Site Investigation Report – Phase 1

Pelham Plaza

Pelham Manor, New York

Site No. V00110-3

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1.0 INTRODUCTION

In 1997, Levin Properties, LP (Levin or the Volunteer) entered into a Voluntary Cleanup Agreement with the New York State Department of Environmental Conservation (NYSDEC) for an investigation program to examine potential contamination at the Pelham Plaza Shopping Center, which is located almost entirely at 847 Pelham Parkway in Pelham Manor, New York, with the southeast portion of the property including the building occupied by New York City Off-Track Betting (OTB) being located in the Bronx, New York (the site). The site formerly consisted of a manufactured gas plant (MGP) and petroleum off-loading and storage until the late 1950's. The site now consists of retail stores and surrounding parking areas. An updated Voluntary Cleanup Agreement (VCA) was entered into between Levin and the Department on July 11, 2002. Site location map and site plans are provided as Figures 1 and 2, respectively.

Aromatic volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, and xylenes (BTEX), aliphatic VOCs, and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs) have been found in site soils and groundwater. Light non-aqueous phase liquids (LNAPL) have also been detected in on-site groundwater monitor wells. On July 30, 2002 a Site Investigation Report (SIR) Work Plan was approved by the NYSDEC. The objectives of the SIR Work Plan were as follows:

- Collection of additional data to further determine the extent of NAPL-affected soils both above and below the water table throughout the site.
- Collection of additional data to further delineate groundwater contamination throughout the site.
- Confirmation of the presumed on-site groundwater flow direction and that NAPL had not migrated to the downgradient perimeter of the site (presumed to be Eastchester Creek).

To accomplish these objectives, the following scope of work was included as part of the SIR Work Plan:

- Installation of soil borings at selected locations to collect soil samples continuously to the soil/bedrock interface.
- Collection of soil samples for quantitative and qualitative (fingerprint) laboratory analysis.
- Delineation of the extent of NAPL in groundwater utilizing existing monitor wells and installation of additional monitor wells.
- Collection of groundwater samples for quantitative and qualitative (fingerprint) laboratory analysis.
- Gauging of existing and newly installed monitor wells for NAPL and depth to water, and development of an updated water table elevation contour map.
- Soil gas sampling from below the main building slab within the former Kmart retail space to evaluate the potential of vapors entering the building.

- Test pitting to determine the presence of former MGP structures and potential NAPL contained therein or adjacent to such structures.

The SIR did not include sampling or evaluation of sediment or surface water in Eastchester Creek that are considered off-site. The Volunteer is considered an innocent owner in the VCP and is not required to conduct this off-site sampling or remediation. However, Levin will perform a qualitative on-site and off-site public health exposure assessment in the Phase II Site Investigation.

The principal tenant of Pelham Plaza, Kmart Corporation (Kmart), vacated their store in June 2002, and the Kmart space currently remains vacant. In August 2002, Kmart provided Levin with limited access rights to conduct the required investigation work outlined in the SIR Work Plan. On January 16, 2003, Kmart rejected their lease with Levin, thus surrendering all rights with respect to the premises. The future reuse of Kmart space may consist of renovating the structure or demolishing and replacing it with a new building for commercial/retail use. Pelham Manor is currently re-zoning the village business district, which includes the project site. The re-zoning accounts for the existing use of the K-mart and adjacent buildings, and also considers demolition of the existing buildings with redevelopment in the western portion of the site adjacent to Eastchester Creek.

The remainder of this SIR is formatted as follows:

- Section 2.0 outlines the site description and history;
- Section 3.0 describes the site investigation field program;
- Section 4.0 summarizes the site investigation results including analytical data, exposure assessment, proposed future site use limitations, proposed remedial action objectives, and data usability summary; and
- Section 5.0 provides an overall summary and conclusions for the SIR.

2.0 SITE DESCRIPTION

2.1 LOCATION AND LEGAL DESCRIPTION OF SITE

The study site is described as the parcel of real property, approximately 20 acres in size, situated along Boston Post Road and Pelham Parkway in the Village of Pelham Manor and known as Block 5655, Lot 300 on the Tax Map of the Town of Pelham, with the southeast portion of the property including the building occupied by New York City Off-Track Betting (OTB) being located in the Bronx, New York (Figure 1). The site is located at 40°53'31" North and 73°49'15" West. As part of the VCA signed in July 2002, the site is divided into three operable units; Operable Unit 2 (OU-2) being the existing main shopping center building and attached retail space, with a footprint of approximately 150,000 square feet, in roughly the middle of the site; Operable Unit 1 (OU-1) being the remainder of the site; while OU-3 represents the Eastchester Creek. The shopping center has been designated as a separate operable unit for purposes of preparing the VCA. However, the Volunteer plans for the contemplated use of the property will include the demolition of the former Kmart building and that future development will occur in the western portion of the site. Figure 2 depicts the general limits of the site, the operable units, and the proposed extent of redevelopment structures.

2.2 SITE AND VICINITY CHARACTERISTICS

Pelham Parkway bound the study site to the north, Boston Post Road to the east, an oil storage terminal to the south, and Eastchester Creek (a.k.a., Hutchinson River) to the west. The site is occupied by retail facilities surrounded by asphalt-paved parking, with entrances provided from both Boston Post Road and Pelham Parkway. The parking lot slopes gently down to the west towards the bulkhead at Eastchester Creek. The bulkhead ends near the property's southwestern corner, where the land slopes steeply from the parking lot to the creek. A natural gas line, supported by a metal framework, crosses the creek just north of where the bulkhead ends.

Properties surrounding the site include a mix of retail, residential and industrial facilities. Warehouses, a vacant large retail store, and two fitness centers are located to the north across Pelham Parkway (Figure 4). Retail gasoline stations and fast-food restaurants are located to the east along Boston Post Road with warehouses and light manufacturing facilities located off Boston Post Road, further to the east. Bulkheads have been constructed along both banks of the Eastchester Creek in the vicinity of the site, with oil terminals and contractor yards occupying the properties along the creek. Eastchester Creek is not used for recreational purposes. A Getty oil storage terminal (formerly known as Sinclair Oil) is located directly south of the subject site and retail gasoline stations (both active and closed) are located east of the site and directly across from the site on Boston Post Road.

2.3 DESCRIPTION OF SITE STRUCTURES

The largest structure on the property is an unoccupied two-story, approximately 226,000 square foot (113,000 square foot footprint) building, which was formerly operated by Kmart and currently occupied by several subtenants, including a Modell's sporting good store, a hair salon, a dentist office, and a Vision World eyeglass store. An approximately 13,000 square foot building is connected to the main shopping center and contains a Dress Barn clothing store, a Hallmark gift store, a jewelry store, and a General Nutrition Center. . The property also contains separate retail buildings including: a bank (Citibank) and a women's clothing store (Mandee) located in the northeastern corner of the property, an Off-Track Betting (OTB) parlor in the southeastern corner of the property, and a retail building located south of the main shopping plaza (currently occupied by A.J. Wright - a discount department store). There are Consolidated Edison substation structures located along Pelham Parkway where access is restricted due to health and safety concerns. To date, there is no information or data available to indicate that this area was impacted from previous MGP activities. Therefore, future investigation of this area will be limited during future investigation (Phase II) tasks.

2.4 SITE GEOLOGY, HYDROGEOLOGY AND SUBSURFACE CHARACTERISTICS

Based on an elevation survey of the site, the site lies at elevations ranging from 8 to 20 feet above the North American Vertical Datum (NAVD) of 1988, which approximates mean sea level (MSL). The site lies within the former flood plain for Eastchester Creek, which is a tidally influenced tributary of Long Island Sound. According to the *Geologic Map of New York State - Lower Hudson Sheet* (Fisher, 1970) the site and surrounding area are underlain by the metamorphic Manhattan and Hartland formations, both consisting of pelitic schist and amphibolite. The *Surficial Geologic Map of New York State - Lower Hudson Sheet* (Cadwell, 1989) indicates that till materials cover the majority of the area surrounding the site with outcropping bedrock also present in the site vicinity. Outcropping bedrock was observed approximately 500 feet north of the site.

The surficial geology at the site consists of fill materials underlain by native soils consisting of organic peat and micaceous sand units. The uppermost fill layer consists of fine to medium sand with brick, gravel, and coal fragments, which is thicker in the central and eastern portions of the site. The organic peat layer, a remnant of a former tidal wetland that once occupied portions of the site, underlies the surficial fill in the western and southwestern portions of the site. The peat layer appears to be absent under the shopping center building and in the eastern portion of the site and was possibly excavated during past construction activities. The micaceous sand layer underlies the peat and is present to bedrock. Based on the limited information obtained during this phase of the remedial investigation, the bedrock ranges in depth from approximately 8 feet below ground surface (bgs) in the northeastern corner of the site to greater than 120 feet bgs in the central portion.

The groundwater table is generally shallower in the western portion of the site and deeper in the east. The peat layer, when present in sufficient thickness, appears to act as a semi-confining unit separating the unconfined fill aquifer and the deeper sand aquifer. However, due to breaches in the peat possibly resulting from past construction activities and/or other natural discontinuities, the two aquifers may be hydraulically connected, allowing contaminants to migrate from the surface into the deeper sand unit. Based on groundwater elevation contours constructed from water table measurements, groundwater flow may be variable, possibly due to tidal influence. This will be further evaluated as part of a future tidal study conducted as part of the Phase II SIR. Groundwater flow direction in the deeper sand aquifer is generally to the west-southwest with an approximate hydraulic gradient of 0.002 feet per feet (ft/ft).

2.5 SITE HISTORY

Pelham Gas Works of Mt. Vernon, New York, owned by Westchester Lighting Company and later Con Edison, occupied the site starting in the late 1800's and operated a manufactured gas plant there until approximately 1951. Until approximately 1947, the plant was capable of producing both water gas and coal gas, but produced water gas almost exclusively. In 1947, a liquid petroleum processing system was installed at the plant and it started producing petroleum gas in addition to water gas. In 1951, MGP operations ended when Con Edison converted its gas supply operations to natural gas. Between 1951 and 1968, Con Edison expanded its liquid petroleum production facilities at the site to provide stand-by gas supply in the event of a natural gas shortage.

In 1965, Barbara Realty Company purchased the property from Con Edison. As part of the purchase agreement, the southern portion of the site was leased to Con Edison for continued operation of the liquid petroleum processing facility. Barbara Realty Company then sold the property to Douglaston Associates in 1966. Later in 1966, John Hancock Mutual Life Insurance Company became the fee owner of the property and entered into a ground lease with Barbara Realty Company, predecessor in interest to Levin, the current ground lessee and operator of the shopping center at the site. The main shopping center that currently occupies the site was constructed by early 1966. Construction of the separate retail facilities located adjacent to the main building and in the northeastern corner of the site was completed in 1967. In September 1998, Hancock Mutual Life Insurance Company sold the site to Janice H. Levin, and the property subsequently passed into her estate; the estate is thus the current owner. Cessation of the liquid petroleum processing operations, demolition of all remaining structures, and lease termination were completed by Con Edison in 1968, as indicated in an internal Con Edison memorandum dated September 30, 1968. Following Con Edison's departure from the site, the southern portion of the property was converted to an asphalt-paved parking lot. A site plan indicating the locations of the former structures at the site, which takes into account the previous site uses, is provided as Figure 3. A more detailed description of historic site operations and property transactions are included in the Site Investigation Report Work Plan (AKRF, July 2002).

2.6 REGULATORY HISTORY

In January 1989, the NYSDEC was notified by Levin's consultant, Clement Associates, of MGP residuals being encountered at the site as part of geotechnical and environmental investigations undertaken for expansion of the shopping center (strip mall area where Citibank is key tenant). At the time, it was proposed that monitoring wells be installed to characterize groundwater and to develop appropriate health and safety protocols for future construction activities.

In May 1989, representatives of NYSDEC and Levin met at the site, where it was agreed that Levin would conduct further research regarding the site history. Subsequently, correspondences between Levin and NYSDEC discussed the investigation and remediation requirements for the site. Beginning in 1992, AKRF developed a site investigation work plan, which was finalized in March 1993 and approved by the NYSDEC in April 1993. The work plan was implemented in May 1993 with findings provided in a Site Investigation report dated February 1995.

In March 1997, Levin entered into a Voluntary Cleanup Agreement (VCA) with the NYSDEC. The VCA included a work plan prepared by AKRF dated September 1995, which outlined the completion of an electromagnetic survey and soil gas sampling. This agreement was subsequently amended in June 1998 to include investigation of a former tire store at the site. During the investigation, soil under the tire store building exhibited evidence of hydrocarbon contamination from at approximately 3 feet below ground surface (bgs) and extending to the water table (approximately 15 feet bgs). Hydrocarbon fingerprinting of two samples collected from depth intervals of 5 to 7 feet bgs and 17 to 19 bgs, indicated a hydrocarbon signature consistent with coal tar or coal tar by-products. The findings of this investigation were contained in a report entitled "Investigation of Former Tire Store" dated October 1998.

The VCA between Levin and the NYSDEC was updated on July 11, 2002. A Final Site Investigation Report (SIR) Work Plan outlining the site history, sampling objectives and methodologies to be used for the work described in this Site Investigation Report was approved by the NYSDEC in August 2002. Field activities were conducted during the period of August to October 2002.

3.0 METHODOLOGY

The field program was completed substantially in compliance with the SIR Work Plan. This section provides a description of work performed, any deviations from the work plan, and the rationale for those deviations.

3.1 SOIL BORINGS

Sixty-one soil borings were completed between August 12, 2002 and October 8, 2002 to characterize subsurface soils and collect soil samples for quantitative and qualitative (fingerprint) laboratory analysis. Figure 3 depicts the soil boring locations as well as the locations of former structures present at the site during operation of the MGP. The majority of the soil borings were sited within or immediately adjacent to these former structures to investigate contamination associated with MGP and other site operations. Four borings (SB-1, SB-41, SB-42, and SB-43) were sited to investigate potential contamination in the vicinity of the Citibank branch and the Mandee Store, located at the northeastern portion of the site. Eleven soil borings (SB-1, SB-2, SB-3, SB-8, SB-9, SB-36, SB-38, SB-41, SB-42, SB-43, and SB-52) were sited to provide area-wide delineation of contamination that would not necessarily be attributable to a specific process or structure. Five borings were added to the soil boring program to provide additional delineation (SB-57, SB-58, SB-59, SB-60, and SB-61).

Forty of the outdoor soil borings were advanced to bedrock using a Hurricane™ rig, which is a direct push probe (DPP) drill rig. The Hurricane™ rig was equipped with 4-inch solid stem auger drilling capabilities to advance through concrete and other subsurface obstacles that normally preclude the use of standard direct push rigs. Eight borings (SB-1, SB-3, SB-9, SB-16, SB-25, SB-26, SB-31, and SB-37X) were installed using a truck-mounted drill rig equipped with 6.25-inch outside diameter hollow stem augers (HSA). Shallow refusal on metal or concrete was encountered using the Hurricane rig at borings SB-24, SB-25, SB-27, SB-37, SB-39, SB-56, SB-57, and SB-58. Therefore, boring SB-39 was installed outside of the corresponding target MGP structure and borings SB-25 and SB-37 were installed using the hollow stem auger rig. Each of these replacement borings (designated SB-25, SB-37X, and SB-39X) was successfully advanced to the target depth. Based on equipment limitations and discussions with the on-site NYSDEC Project Manager, borings SB-24, SB-27, SB-56, SB-57, and SB-58 were not completed beyond approximately 3 to 16 feet bgs.

Thirteen soil borings (SB-11, SB-12, SB-13, SB-14, SB-15, SB-17, SB-19, SB-22, SB-23, SB-46, SB-47, SB-48, and SB-55) were advanced inside of the former K-mart building using a remote-access DPP rig. Due to the lack of proper ventilation in the building, problems were encountered with venting carbon monoxide exhaust from the drill rig. To address the carbon monoxide issue, an enclosure was built around the drill rig, and blowers, fans, and exhaust ductwork were used to direct exhaust away from the work zone to the building exterior. Loading bay doors were also opened when possible. Shallow refusal, apparently on concrete, was encountered using the DPP rig at borings SB-11, SB-12 and SB-15. Based on equipment limitations, these borings were not completed beyond approximately 8 feet bgs.

DPP soil samples were collected using a four-foot long, 2-inch diameter, macrocore piston rod sampler fitted with an acetate liner. HSA samples were collected using two-foot split spoon samplers advanced ahead of the auger. Each sample was split lengthwise and logged by AKRF field personnel. Logging consisted of: describing the soil according to the modified Burmister Classification System; describing any evidence of contamination (e.g., NAPL, staining, sheens, odors); and screening for organic vapors in one-foot intervals using a Thermo 580B Organic Vapor Meter (OVM) equipped with a photoionization detector (PID) calibrated with 100 parts per million (ppb) isobutylene.

When drilling, continuous samples were collected from ground surface to a minimum of 32 feet bgs, with a final sample collected from just above the bedrock interface when possible. Continuous sampling was conducted until no evidence of contamination was observed for at least three consecutive four-foot sampling intervals below the deepest point of contamination. In the interest of efficiency, non-discrete samples were collected until NAPL or slough from soils above the sampling interval were encountered in the sampler. Once this occurred, continuous discrete soil samples were collected. In general, two soil samples from each boring, one from the vadose zone and one from below the groundwater table were selected for laboratory analysis based on PID response and visual indications of contamination. The depth intervals of samples collected was determined based on trends observed in the field, including contamination limited to vadose/saturated zone, no contamination observed, and contamination observed in a particular depth layer. In the absence of contamination, soil samples from the vadose and saturated zones were collected immediately above and below the water table, respectively. More than two samples were collected at some locations (SB-3, SB-10, SB-16, SB-18, SB-29, SB-36 and SB-49) to investigate shallower or deeper intervals. Although bedrock coring was not performed as a part of this investigation, soil samples were collected for analysis from near the apparent bedrock surface in borings SB-1, SB-16, SB-18, SB-30, SB-36, SB-49 and SB-52 to determine the lower extent of contamination and potential for the presence of dense NAPL (DNAPL). Selected soil samples observed to contain NAPL, a sheen, or high PID readings, including SB-26 (12 to 13 feet bgs), SB-17 (18 feet bgs), SB-36 (12 to 13 feet bgs), SB-53 (16 to 20 feet bgs), SB-35 (24.5 to 25 feet bgs), SB-29 (14 to 16 feet bgs), SB-30 (9.5 to 10.5 feet bgs), SB-7 (4 feet 8 inches to 4 feet 11 inches bgs), SB-3 (14 to 16 feet bgs), and SB-25 (25 to 26 feet bgs) were collected for forensic hydrocarbon fingerprint analysis.

Soil samples collected for laboratory analysis were transferred directly from the sampling spoon into appropriately labeled laboratory-supplied sample jars and placed into ice-filled coolers. Throughout the workday, the sample jars were transferred into on-site refrigerators located in a secure field office. [Note: All samples held in the field were stored in a secured refrigerator and were analyzed within 14 days of collection as per EPA SW-846 protocol therefore, the accumulation of samples in the field did not impact sample integrity.] At the end of each workweek, the sample containers were placed into sealable plastic bags, surrounded by plastic bubble wrap, and transferred into ice-filled coolers. The coolers were sealed for shipment and delivered to the laboratory via courier. All soil samples were analyzed for Target Compound List (TCL) VOCs by EPA Method 8260, TCL SVOCs by EPA Method 8270, TAL metals by EPA Method 6000/7000 series, and cyanide by EPA

Method 9012. Selected soil samples collected from locations near existing or former transformers were also analyzed for PCBs by EPA method 8082. One soil sample per shipment or per 20 samples (whichever was fewer) was selected for waste characterization analysis. These samples were analyzed for TCL VOCs, TCL SVOCs and TAL metals using the toxicity characteristic leaching procedure (TCLP), as well as polychlorinated biphenyls (PCBs) by EPA method 8082, ignitibility, reactivity, corrosivity, and total petroleum hydrocarbons (TPH) by EPA method 418.1. All soil samples and waste characterization samples were analyzed at Toxikon Corporation (Toxikon) in Bedford, Massachusetts, a New York State Department of Health (NYSDOH) and Environmental Laboratory Accreditation Program (ELAP) certified laboratory certified to perform NYSDEC Analytical Services Protocol (ASP). Soil samples slated for forensic hydrocarbon fingerprint analysis were submitted to Meta Environmental, Inc. (Meta) in Watertown, MA to be analyzed by modified EPA Method 8100. One of the sample jars for soil sample SB-21 (9-10) was broken in transit to the laboratory, therefore, this sample was analyzed for TCL VOCs, but not for TCL SVOCs, TAL metals, or cyanide due to insufficient sample volume. In some instances when samples were held in the field for greater than 48 hours, the holding times specified under NYS CLP protocol were exceeded for VOCs. These samples were qualified as "J", estimated, for the positive results and "UJ", estimated, for the non-detected results. (See Section 4.10 for further details – Data Usability Summary Report)

During soil boring activities on September 16, 2002, drill rods were advanced to 122 feet bgs in soil boring SB-45 without encountering refusal; however, the rods broke off in the boring before the depth to bedrock could be determined. Based on this occurrence and consultation with the drilling contractor and the NYSDEC Project Manager, it was determined that the limitation of the Hurricane rig at the site would need to be restricted to 70 to 75 feet bgs. Therefore, for the remainder of the work where deep sampling was conducted (SB-2, SB-5, and SB-8), if bedrock was not encountered before 70 to 76 feet bgs, the boring was terminated and a sample was not collected at the bedrock surface. Based on discussions with the NYSDEC Project Manager, 10 soil borings (SB-4, SB-7, SB-9, SB-25, SB-37X, SB-43, SB-44, SB-54, SB-60, and SB-61) were completed to depths between 32 and 40 feet bgs without advancing to bedrock/refusal. Table 1 provides a summary of soil boring locations, depths, sampling intervals and observations. Soil boring logs are provided in Appendix A. Handling and disposal of soil cuttings, sampling materials, and decontamination-related wastes are described in Section 3.9.

3.2 SOIL GAS SAMPLING

Soil gas samples were collected on August 27, 2002 from below the ground floor concrete slab of the former Kmart retail space to characterize the vapors present in the subsurface of the building. Soil gas samples were collected from six soil borings, SG-1 through SG-6, as indicated on Figure 3. The soil gas sample locations were adjacent to (within two to five feet) soil boring locations within the building, which were biased towards the former MGP structures where subsurface contamination was expected to be greatest. The adjacent soil borings were grouted prior to completion of the soil gas sampling to prevent the potential of a preferred pathway for vapor migration. A representative of the New York State

Department of Health (NYSDOH) was present during soil gas sampling activities, and granted verbal approval of the sampling procedures implemented.

Soil gas samples were collected using direct push probe (DPP) samplers equipped with a disposable tip and internal sampling port connected to new, clean 1/8-inch inside diameter polyethylene sampling tubing. The sampling tubing extended from the tip of the drive point to above grade. Collectively, the disposable tip, sampling port and sampling tube are hereby referred to as the "soil gas sampler".

During sampling, the soil gas sampler and attached DPP were advanced to approximately 15.5 to 18.5 inches below the bottom of the concrete slab. The soil gas sampler and DPP were then retracted approximately one foot to create a void approximately 2.5 to 6.5 inches below the concrete slab to collect the soil gas sample. Following advancement of the sampling assembly, the annulus at the surface (between the concrete and probe) was sealed by placement and hydration of bentonite chips.

Tubing was connected to the sampling tip, which extended aboveground via the interior of the DPP. The tubing was then connected to a gauge to measure the differential pressure between the subsurface soil and the building. After recording the pressure measurement, the gauge was disconnected and a peristaltic pump was connected to the tubing to facilitate withdrawal of the soil gas sample. Prior to collecting the sample, the sampling assembly was purged of at least 0.6 liters of air by pumping at an approximate flow rate of 0.2 liters per minute for at least three minutes. This process ensured that a minimum of one volume of the overall sampling train, including the one-foot void created by withdrawing the sampling tip prior to sample collection, was purged and a representative sample collected. After purging, a representative sample of soil gas was collected in three Tedlar sample bags filled two-thirds full and appropriately labeled. Two of the filled sample bags were collected for laboratory analysis, while the third sample bag was screened for VOCs in the field using a Thermo 580B PID calibrated to a 100-ppm isobutylene standard. A field blank sample was collected by drawing ambient air through the soil gas sampling assembly into Tedlar bags using the peristaltic pump. Samples slated for laboratory analysis were placed in a cooler (not containing ice), sealed for shipment, and delivered to the Severn Trent Laboratories in Burlington, VT to be analyzed for VOCs using EPA Method TO-14A. This included a library search of non-polar compounds to provide concentrations of tentatively identified compounds (TICs) as requested by the NYSDOH.

Table 2 provides a summary of soil gas sampling locations and depths. Soil gas sampling logs are provided in Appendix B.

3.3 MONITORING WELLS

Groundwater monitoring wells MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14 and MW-15 were installed at eight of the soil boring locations to supplement data from the eleven existing monitoring wells for use in delineating groundwater flow and quality. An inspection of the eleven existing monitoring wells was conducted to determine their integrity. Based on this survey, monitoring wells B-102AW (shallow), B-102W (deep), and MW-3 were determined to be damaged or paved over and therefore could not be used. Two new shallow wells were installed with screens set across the water table to replace B-102AW (shallow) and MW-3. A deep well was installed with the screen set above the bedrock surface to replace B-102W (deep). An additional monitoring well, MW-2D, was installed with the screen set immediately above the bedrock surface at the location depicted in Figure 3. This monitoring well was added to the field program based on discussions with the NYSDEC Project Manager.

Monitoring wells were installed between September 30, 2002 and October 9, 2002. Borings for the new wells were installed using 6.25-inch outside diameter HSAs and a truck-mounted drill rig. The wells were constructed with two-inch diameter PVC with 0.02 slotted screens. In general, the shallow wells were installed to depths of 17 to 26 feet bgs with 15 feet of screen straddling the groundwater table (with generally seven feet of screen above the groundwater table and eight feet of screen below the groundwater table). The two deep wells [MW-2D and B-102W (Deep)] were installed to the bedrock interface to depths of 55 and 51, feet bgs respectively. A two-foot sump was provided at the bottom of both of these deep wells to provide a reservoir for DNAPL accumulation with 10 feet of screen extending above the sump. The annular space around the well screens were backfilled with sand filter pack extending from the bottom of the well to one to two feet above the screen. The annular space around the well riser was sealed with bentonite pellets extending one to two feet above the sand filter pack and completed with a non-shrinking cement grout to approximately one foot bgs. Monitoring wells were completed using locking, flush-mount gate boxes, with a cement apron set around each gate box to prevent drainage of surface runoff impacts to the wellhead. During installation of replacement well MW-3, a soil sample was collected from approximately 15 to 17 feet bgs for forensic hydrocarbon fingerprint analysis due to the presence of staining. This sample was submitted to Meta to be analyzed using modified EPA Method 8100. Table 3 provides a summary of monitoring well details. Monitoring well construction logs are provided in Appendix C.

Following well installation, each newly installed and pre-existing monitoring well was properly developed via over-pumping in accordance with the SIR work plan. A 3L8 Moyno progressive cavity pump was used during development to induce flow rates of approximately 1 to 3 gallons per minute. The extracted water stream was monitored for turbidity and water quality indicators (i.e., pH, dissolved oxygen, oxidation-reduction potential, temperature, and specific conductivity) with measurements collected approximately every five minutes. Development continued until the turbidity reading was less than 10 nephelometric turbidity units (NTUs) for three successive readings or until water quality indicators stabilized, whichever occurred first. The criteria for stabilization were three successive readings within plus or minus 10 percent for pH, temperature, and specific conductivity. During well development, evidence of NAPL was observed in the development water from wells MW-2S, MW-2D, MW-3, MW-7D, MW-9, MW-14, and MW-102AW (Shallow). Monitoring wells MW-1, MW-2S, MW-7D, MW-7S, and MW-14 failed to stabilize during well development due to the presence of NAPL and slow recharge in these wells. Further development was not considered practicable at that time. Monitoring well development logs are provided in Appendix C. Handling and disposal of soil cutting, development water, and decontamination wastes are described in Section 3.9.

3.4 TEST PITS

Test pits were excavated at ten (10) locations between October 14 and 22, 2002. The purpose of this work was to supplement the information gained from the soil borings and monitoring wells to determine the presence of MGP structures and the presence of NAPL. The completed test pits included five test pits proposed in the Final Site Investigation Work Plan (TP-2 through TP-6) and four additional test pits proposed after soil boring work was underway (TP-7 through TP-11). Several utility lines were present at the proposed location of test pit TP-1. Following consultation with the NYSDEC Project Manager, this test pit was deferred at that time. Completion of test pit TP-10 was terminated upon encountering a high-pressure natural gas service line at this location. Test pit locations are depicted in Figure 3. The approximate location of the gas line encountered during excavation of TP-10 is also depicted in Figure 3.

The test pit locations were selected to investigate former MGP structures that were suspected to be wholly or partially underground based on typical MGP practices and a review of historical aerial photos. The test pits were excavated from one to 12 feet bgs using a rubber-tired excavator. The test pits measured approximately five to 32 feet long and approximately four to 10 feet wide. During excavation activities, the test pit walls and floor were investigated for evidence of contamination (e.g., odors, staining, sheens, NAPL, elevated PID readings) and the presence of remnant structures. Soil from the test pits was described according to the modified Burmister soil classification system. Details of test pits are summarized in Table 4. Test pit logs are provided as Appendix D.

During test pit activities, excavated soil was monitored for contamination using a PID and visual/olfactory inspection. The test pits were backfilled with the native soils and compacted with the excavator bucket and/or a hand-operated vibrating tamper. Excess soil remaining after backfilling was stockpiled on-site and disposed of as described in Section 3.9. Following inspection, the surface was prepared with a three-inch base coat or recycled concrete aggregate (RCA) and paved with a 2-inch top coat of hot patch asphalt.

3.5 GROUNDWATER MONITORING

3.5.1 Water Level Monitoring

The depth to water was measured in the on-site monitor wells on October 8, October 18, October 23, and November 11, 2002. The measurements were conducted using an oil/water interface probe or a water level indicator with measuring tapes accurate to 0.01 feet. Measurements were collected by lowering the probe into the well and noting the depth at which the water indicator alarm sounded. Attempts were made to measure the depth to any NAPL present in the wells, however, the oil/water interface probe was often "blinded" by the product at the site and accurate measurements could not be obtained. Therefore, only the presence of LNAPL or DNAPL was noted in some cases. Not all wells were recorded during each event due to accessibility problems and/or concerns about damage to the oil/water interface probe. Top of casing elevations (Section 3.6) were used to calculate the elevations of the water table in the monitoring wells. Table 5 summarizes the water table elevation calculations and observations regarding the presence of NAPL.

3.5.2 Groundwater Sampling

Between October 17 and 22, 2002, groundwater samples were collected from monitoring wells MW-1, MW-1A, MW-2S, MW-2D, MW-5, MW-6, MW-8, MW-9, MW-10, MW-12, MW-13, and MW-15. A groundwater sample was collected from MW-11 on November 4, 2002. All samples were analyzed for TCL VOCs using EPA Method 8260, TCL SVOCs using EPA Method 8270; dissolved TAL metals using EPA Method 6000/7000 series and cyanide using EPA Method 9012 at Toxikon. Prior to sampling each well, the wellhead was monitored for VOCs by placing the PID probe inside the well immediately after removing the well cap and noting the measurement. The depth to groundwater then was measured using an electronic oil/water interface probe or water level indicator. After measuring the depth to water, the probe tip was examined for the presence of LNAPL. The probe was then lowered to the bottom of the well to check for the presence of DNAPL. Samples were not collected from wells containing LNAPL [MW-3, MW-7S, MW-7D, MW-14 and B-102AW (Shallow)]. Groundwater samples were collected from wells that displayed only a sheen (MW-2S) at the time of sampling as directed by the NYSDEC Project Manager.

The groundwater level data and well geometry were used to calculate the volume of water in each well. Groundwater samples were collected using low-flow sampling methods according to procedures described in *Groundwater Sampling Guidelines for Superfund and RCRA Project Managers* (USEPA, May 2002). Polyethylene tubing was lowered to approximately the center of the screened interval. The tubing then was connected to a peristaltic pump, the pump was activated, and the flow rate was adjusted to create a water level drawdown in the well of no greater than 0.3 feet. Water quality parameters (i.e., pH, temperature, dissolved oxygen, reduction-oxidation potential, specific conductivity, and turbidity) of the extracted water were measured approximately every five minutes using a Hydrolab Quanta G multi-parameter probe equipped with a flow-through cell and a Lamotte 2020 turbidity meter. Purging of the well continued until water quality parameters stabilized or purging was conducted for four hours without stabilization. Stabilization criteria were as shown in the following table:

Parameter	**pH**	**Specific Conductance**	**ORP/Eh**	**Turbidity**	**Dissolved Oxygen**
Stabilization Criteria	+/- 0.1 pH units	+/- 3% siemens per centimeter (S/cm)	+/- 10 millivolts (mV)	+/- 10% nephelometric turbidity units (NTUs) for values greater than 1 NTU	+/- 0.3 milligrams per liter (mg/l)

Following purging, the discharge end of the tubing was disconnected from the flow-through cell for sample collection. Groundwater samples to be analyzed for SVOCs and cyanide were collected in laboratory supplied sample bottles directly from the tubing. Samples to be analyzed for dissolved metals were collected by filling a plastic filter chamber from the tubing; sealing the chamber, and using a hand pump to draw the sample through a disposable, dedicated filter into the laboratory supplied sample container. Samples to be analyzed for VOCs were collected using a disposable bailer equipped with a low-flow sampling tip. Following sample collection, sample bottles were then placed into ice-filled coolers. Throughout the workday, the sample containers were transferred into on-site refrigerators located in a secure field office. At the end of each workweek, the sample containers were placed into sealable plastic bags, surrounded by plastic bubble wrap, and transferred into ice-filled coolers for shipment to the laboratory. Handling and disposal of purge water and decontamination-related wastes are described in Section 3.9. All water quality parameter readings were recorded on Monitoring Well Sampling Logs. Copies of the logs are provided in Appendix C.

On September 5, 2002, a sample of LNAPL was collected from monitoring well MW-2S using a disposable bailer. This sample was transferred to a laboratory-supplied container and submitted to Meta for forensic hydrocarbon fingerprint analysis by modified U.S. EPA Method 8100.

3.6 SURVEYING

Prior to initiating subsurface investigation activities, the horizontal location of all sampling points were staked out by In-Site Engineering, P.C. (In-Site), a New York State-licensed surveyor, to ensure their accuracy in relation to the former MGP structure locations. During this survey, the elevations of the soil borings were also determined to an accuracy of 0.1 feet. At the completion of sampling activities, In-Site surveyed all monitoring well and test pit locations. Three elevation measurements were taken at each well location: the elevation of the ground beside the well; the elevation on the rim of the gate box or protective casing; and the elevation of the top of PVC casing. Ground elevations were determined to an accuracy of 0.1 feet. Top of casing elevations were determined to an accuracy of 0.01 feet. All elevations were referenced to the NAVD of 1988.

3.7 RECEPTOR SURVEY

Pelham Parkway to the north, Boston Post Road to the east, an oil storage terminal to the south, and Eastchester Creek bound the study site to the west. The site is occupied by retail facilities surrounded by asphalt-paved parking, with entrances provided from both Boston Post Road and Pelham Parkway. Properties surrounding the site include a mix of retail, residential and industrial facilities.

Warehouses, a large retail store, and two fitness centers are located to the north across Pelham Parkway. Gas stations and fast-food restaurants are located to the east along Boston Post Road. Bulkheads have been constructed along both banks of the Eastchester Creek in the vicinity of the site, with oil terminals and contractor yards occupying the properties along the creek. The closest residential dwelling to the subject site is located at 44-10 Boston Post Road in Pelham Manor, which is approximately one-eighth mile to the east-northeast. The next closest residential property consists of multi-family buildings located on Flint Avenue in the Bronx, which are located one-eighth mile to the southeast of the subject site. Another residential dwelling is located at 52 Secor Lane in Pelham Manor, which is less than one-quarter mile to the north. Identification of occupants and uses of properties on and immediately surrounding the subject site is summarized in Figure 4.

Groundwater in the vicinity of the site is not used for consumptive purposes, with water to Pelham Manor and the City of New York being supplied via the upstate New York reservoir system operated by the New York City Department of Environmental Protection. A Freedom of Information Law request was submitted to the following state, county, and local agencies to ascertain any information regarding public and private supply wells within a one-half-mile radius of the subject site:

- New York State Department of Environmental Conservation;
- New York State Department of Health;
- Westchester County Department of Health;
- Village of Pelham Manor;
- City of Mount Vernon Department of Public Works;
- City of Mount Vernon Board of Water Supply;
- New York City Department of Health; and
- New York City Department of Environmental Protection.

Responses to the requests were received from the New York Stated Department of Environmental Conservation, the Westchester County Health Department and the Village of Pelham Manor. The information gathered did not indicate the presence of any public or private supply wells located within a one-half mile radius of the subject site. A review of surrounding land uses did not indicate any documented schools, hospitals or public parks within a one-quarter mile radius of the subject site. Information requested from the New York City Department of Health, New York City Department of Environmental Protection and New York Stated Department of Health was not received. Any information from these agencies will be included in subsequent reports.

As a tributary of the Hutchinson River, the Eastchester Creek is classified by the NYSDEC as a Class B water body. While the Eastchester Creek is not currently used for recreational purposes, the Hutchinson River is identified as a high priority for total maximum daily load development (TMDL) by the NYSDEC under the 2002 Section 303d List of Impaired Waters Requiring a TMDL. Specifically, the Hutchinson River is reported to be impaired by oxygen demand, oil and grease, and pathogens from urban and storm runoff and industrial sources.

The surrounding area has a history of industrial and commercial use. A Getty oil storage terminal (formerly known as Sinclair Oil) is located directly south of the subject site and retail gasoline stations (both active and closed) are located east of the site and directly across from the site on Boston Post Road.

3.8 COMMUNITY AIR MONITORING

Perimeter community air monitoring for VOCs was conducted during soil boring, monitor well installation, and test pitting activities. Community air monitoring for dust particulates was conducted during test pit excavation activities. At the start of work, air-monitoring stations were established upwind of the work activities and at the downwind perimeter of the work zone.

3.8.1 VOC Monitoring

Monitoring for VOCs was conducted using a Thermo 580B PID. Monitoring for VOCs at the upwind station was conducted at the start of each workday to establish background conditions, and subsequently conducted each time the wind direction changed significantly. Monitoring for VOCs at the downwind station was conducted at a minimum frequency of once every two hours during soil boring and monitoring well installation and on a continuous basis during test pitting activities. Background readings and any readings that triggered response actions were recorded in the project logbook, which was continually available on-site for NYSDEC/NYSDOH review. No exceedances of the 5-ppm action level for VOCs occurred during field activities.

3.8.2 Dust Monitoring

Community air monitoring for dust particulates was conducted using a real time particulate monitor that measures the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}). Monitoring for particulates at the upwind location was conducted at the start of each workday to establish background conditions and measured each time the wind direction changed significantly. Monitoring at the downwind station was conducted at a minimum frequency of once every two hours. Background readings and any readings that triggered response actions were recorded in the project logbook, which was continually available on-site for NYSDEC/NYSDOH review. No exceedances of the 100 microgram per cubic meter (ug/m^3) action level occurred during field activities.

3.9 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

All investigation-derived waste (IDW) was containerized in DOT-approved 55-gallon drums as it was generated. The drums were sealed at the end of each workday and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, test pit soil, development water or purge water) and the telephone number of an AKRF point-of-contact. All drums were labeled "pending analysis" until laboratory data were available.

On October 8, 2002, a composite sample was collected from the drums containing liquids for analysis of TCL VOCs using EPA Method 8260, TCL SVOCs using EPA Method 8270, TAL metals using EPA method 6000/7000 series, PCBs using EPA method 8082, ignitibility, corrosivity, reactivity and TPH using EPA method 418.1 at Toxikon. On October 21, 2002, a vacuum truck was used to empty 55-gallon drums containing decontamination water and well development and purge water. Based on waste-characterization results, the liquid was disposed of as non-hazardous, industrial waste at Clean Water of New York, Inc. in Staten Island, New York. The non-hazardous waste manifest is included in Appendix E.

On October 17, 2002, drummed soil cuttings were transferred into a roll-off container and a composite soil sample was collected to be analyzed for waste characterization. The samples were analyzed for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, TAL metals using EPA method 6000/7000 series, PCBs using EPA Method 8082, TPH using EPA method 8015B, total cyanide using EPA method 9012, sulfur using ASTM method 4239, and total organic carbon. On November 1 and 4, 2002, the drill cuttings and excess soil from backfilling of the test pits were transported off-site and disposed of at EMSI in Fort Edward, New York. Based on waste characterization results, the soil was disposed of as non-hazardous waste. Non-hazardous waste manifests are included in Appendix E.

3.10 QUALITY ASSURANCE/QUALITY CONTROL

In addition to the laboratory analysis of the field soil and groundwater samples, additional analysis was included for quality control measures. The quality control samples included one equipment rinseate blank, one trip blank, one matrix spike/matrix spike duplicate (MS/MSD), and one set of duplicate samples per twenty field samples or per sample shipment, whichever included fewer samples. The equipment blank, MS/MSD, and duplicate samples were analyzed for TCL VOCs using EPA Method 8260, TCL SVOCs using EPA Method 8270, TAL metals using EPA Method 6000/7000 series, and cyanide using EPA Method 9012. The trip blank was analyzed for TCL VOCs using EPA Method 8260. One field duplicate and one field blank were collected during soil gas sampling activities and analyzed for VOCs using EPA method TO-14A.

3.11 CITIZENS PARTICIPATION

Citizen participation activities for the site investigation were conducted by the NYSDEC and NYSDOH in cooperation with the Volunteer. These activities included preparing a fact sheet that described the site, which provided a summary of the purpose and goals of the investigation, included a project schedule and milestones, and listed sources of additional information. The fact sheet was sent to persons on a mailing list, including adjacent property owners, elected officials, relevant community groups, and local media, prior to the start of fieldwork. A copy of the SIR Work Plan and the Fact Sheet was also placed in the public repository at the Town of Pelham Public Library.

4.0 SITE INVESTIGATION RESULTS

4.1 TOPOGRAPHY

Based on the site survey, the site lies at elevations ranging from 20 feet above MSL in the eastern portion of the property to eight feet above MSL in the western portion. The ground surface of the site slopes towards Eastchester Creek, with an approximate east-west gradient of 0.01 feet/feet.

4.2 GEOLOGY

Logging of soil samples collected during soil boring installation indicate that subsurface materials generally consisted of sandy fill material underlain by gray-brown native sand, containing occasional fine gravel lenses. A silty peat layer separates the fill material and native sand at some locations. Fill materials generally gave way to native soils at 10 to 20 feet bgs in borings where peat was not encountered. The native sand was underlain by dark gray to black schistose bedrock at depths ranging from between eight and 30 feet bgs in the northeastern and northwestern portions of the site to greater that 120 feet in the center portion. A site plan indicating the location of four geologic cross sections is provided as Figure 5. Geologic cross sections A-A', B-B', C-C', and D-D', constructed from the soil boring logs, are depicted in Figures 6, 7, 8, and 9, respectively.

The fill materials consisted of a well-sorted brown to orange-brown sand and contained construction debris such as brick, concrete, wood, wooden railroad ties, slag, and coal. Large remnants of subsurface structures, such as concrete slab, and concrete and brick walls were encountered in various areas at depths of one to eight feet bgs. Pipes ranging from one-inch to 36 inches in diameter were encountered during boring and test pitting activities. In general, the pipes disturbed during this site investigation were found to be empty with the exception of an approximately 2-inch diameter pipe in TP-8North, which was observed to contain a thick tar-like substance. Intact pipes (i.e., those pipes not disturbed by the investigation) were not accessed to determine their contents. The fill layer was thickest in the central and eastern portions of the site, extending up to approximately 20 feet bgs. In the northeastern most portion of the site, it appears that the fill materials extend all the way to bedrock, which indicates that native soils were likely removed during prior construction activities. The source of the fill material is not known, but may originate from regional grading and construction and/or demolition of the former MGP.

A layer of dark brown to black silty organic peat was encountered in the western portion of the site behind the main shopping center building (SB-21, SB-25, SB-26, SB-29, SB-30, SB-50, SB-59, and SB-60) and in the southwestern portion of the site, near Eastchester Creek (SB-36, SB-37 and SB-38). Contours of the peat surface elevations are illustrated in Figure 10. In the southwest, the top of the peat appears to slope gently toward the creek from an elevation of approximately 1.7 feet at SB-36 and 1.9 feet at SB-38 to approximately 0.2 feet at SB-37X. Behind the shopping center building, the peat is present at elevations ranging from approximately three feet at SB-59 to –3.5 feet at SB-29/29X. The peat surface appears to form a slight, north-south trending depression in the area between SB-25 to SB-28/29X, and slopes upward toward SB-50 to the west, SB-30 to the south, and SB-21 to the east. The peat layer is thickest behind the shopping center building, ranging from approximately two to seven feet thick, and appears to thin towards the Creek where it is approximately 1.5 to 2.5 feet thick. Peat was not encountered in any borings advanced under the shopping center floor slab, indicating that it decreases in thickness to the east and/or was excavated from this area during previous construction activities. The peat is not necessarily continuous between all borings in which it was encountered, and may contain intermittent layers of sand in the center of the site. It is not known whether the peat is continuous from the area behind the shopping center building to the southwestern portion of the site near the Creek. A thick layer of peat was encountered at 16 to 28 feet bgs in soil boring SB-8, located along the northern property boundary, near Pelham Parkway, but was not present in nearby borings SB-9 or SB-54. It is not known whether this peat layer was at one time connected to the more continuous peat layer located behind the shopping center building. Due to discontinuities, the peat may serve as a lens to retain NAPL in certain areas of the site, but it is unlikely to act as an aquiclude across the site.

The native fine-medium size micaceous sand was generally gray-brown in color, and contained occasional medium and medium-coarse sand and fine gravel lenses. Gravel was frequently encountered near the bedrock interface, within the micaceous sand matrix. In most borings this gravel consisted of decomposed schistose bedrock. However in borings SB-5 and SB-6 (located in the eastern portion of the site), SB-33, SB-34 and SB-36 (located near the southern property boundary), and SB-59 (located behind the shopping center building) a distinctive gravel was encountered on the bedrock surface. This gravel was composed of quartz and possibly calcite pebbles, different in appearance, composition and competency than the native bedrock, and is considered a possible streambed deposit.

Dark gray to black schistose bedrock was encountered at depths ranging from eight to greater than 122 feet bgs across the site. Contours of the bedrock elevations are illustrated in Figure 11. As indicated by the contours, bedrock appears closest to the ground surface in the northeastern and northwestern corners of the site and slopes toward a trough that runs through the center of the site in a north-south orientation. The configuration and character of the bedrock in this area of the site cannot be known for certain without additional investigation. This has been identified as a data gap and will be further investigated in Phase II of site investigation work.

4.3 HYDROGEOLOGY

Groundwater was encountered in soil borings at depths ranging from 0.5 to 22 feet bgs, and in wells at depths from 3 to 18 feet bgs, and was generally shallowest in the western portion of the site adjacent to Eastchester Creek. Groundwater elevations in each of the monitoring wells were calculated based on top of well casing elevations and water level monitoring data. The calculated elevations are summarized in Table 5. Higher groundwater elevations in shallow wells in the western portion of the site correlate with the presence of peat in the subsurface, with markedly lower groundwater elevations in wells MW-13 and MW-15, located east of where the peat layer appears to decrease in thickness (Section 4.2). In addition, the groundwater elevation in deep wells MW-2D and B-102W (Deep), both screened below the peat layer, displayed groundwater elevations above the top of the peat surface. These features indicate that the peat layer is acting as a semi-confining unit, separating the western portion of the site into two aquifers, with the shallow fill material comprising a shallow water table (unconfined) aquifer and the deeper native sand unit comprising a semi-confined aquifer. Groundwater levels in the shallow wells in well nests B-102W (Deep)/B-102AW (Shallow), MW-2D/MW-2S, and MW-7D/MW-7S were consistently at higher elevations than levels measured in the corresponding deep well, indicating a downward gradient exists between the two aquifers. The peat layer does not act as a competent aquiclude and the two aquifers appear to be hydraulically connected, as evidenced by the presence of NAPL below the peat layer in several borings (e.g., SB-25, SB-26, SB-37, SB-38, and SB-50). Communication between the two aquifers also occurs in the eastern portion of the site, where the sand aquifer is unconfined (i.e., the peat layer is absent).

Groundwater contour maps constructed from water level monitoring data for wells screened above the peat layer (i.e., in the shallow fill aquifer) are depicted in Figures 12a and 12b. Groundwater contour maps constructed from water level data for wells screened below the peat layer and at locations where the peat is absent (i.e., in the deeper sand aquifer) are depicted in Figure 13a and 13b. Figure 12a (October 8, 2002) and Figure 12b (November 11, 2002) indicate differing flow directions in the shallow fill aquifer, with flow away from the Creek on October 8, 2002 and toward the Creek on November 11, 2002. Groundwater level measurements for each date were collected over a relatively long time period (i.e., 3-5 hours) and therefore cannot be correlated with available tidal data. On October 18, 2002, the hydraulic gradient away from the Creek was relatively flat (approximately 0.001 ft/ft), with a steeper gradient (approximately 0.009 ft/ft) observed toward the Creek on November 11, 2002. Figures 13a (October 8, 2002) and 13b (November 11, 2002) both indicate an overall westerly to southwesterly flow direction in the deeper sand aquifer with a relatively flat hydraulic gradient (approximately 0.002 ft/ft) in the eastern portion of the site. The hydraulic gradient is steeper (approximately 0.008 ft/ft) in the western portion of the site on November 11, 2002; whereas, the gradient appears more uniformly flat on October 8, 2002, with a depression present in the vicinity of MW-10. These differences might be due to tidal influence in the deeper aquifer, with low tide conditions inducing the steeper hydraulic gradient in the western portion of the site on November 11, 2002. The next phase of investigation work will include a tidal survey in wells screened above and below the peat to determine tidal influence on the fill and sand aquifers.

4.4 SUBSURFACE STRUCTURES

As indicated in Section 3.4, test pits were completed at selected locations to investigate former MGP structures that were suspected to be wholly or partially underground. During test pit activities, evidence of underground structure remnants was encountered at three locations (TP-2, TP-3 or TP-7). A concrete chamber, believed to be the former underground tar separator, was observed in TP-2. This chamber measured approximately five by 10 feet and contained a concrete bottom at approximately seven feet bgs. A concrete and brick chamber measuring approximately five feet by seven feet was encountered in TP-7; this structure is assumed to be the former brick underground tar tank located adjacent to Eastchester Creek, as depicted in Figure 3. DNAPL was observed in soils within and outside of the structure in this test pit. A third concrete structure was encountered in TP-3. This structure consisted of a concrete slab just below ground surface connected to a subsurface concrete wall that extended to approximately five feet bgs. This structure is assumed to be the former drip separator pit as indicated on Figure 3.

Although complete or partial underground structures were not encountered in the remaining test pits, evidence of subsurface concrete slabs was encountered in TP-5, TP-8 and TP-11 and in nearby soil borings at depths of less than five feet bgs. An uneven surface of concrete was encountered from 2.5 to 5 feet bgs in TP-5, located behind the southern end of the main shopping center building. The concrete observed at this location is likely the foundation of the former 287,000 gallon oil tank. A concrete slab, assumed to be the foundation of a former tar or oil tank, was encountered at approximately four feet bgs in TP-8, located behind the shopping center building. A concrete slab was also observed at approximately five feet bgs in TP-11, located in the eastern portion of the site in front of the shopping center building. This concrete is likely the foundation of the former three million cubic foot gas holder. During soil boring activities, concrete was also encountered in soil borings located along the perimeter (SB-5 and SB-54) and in the center of the gas holder footprint (SB-6), indicating that the majority of the foundation still may be present in the site subsurface. NAPL was encountered in one structure only and near the creek. However, historical spills or releases from these structures may have occurred and created associated impacts to soil and groundwater.

A test pit could not be completed within the footprint of the former 350,000 cubic foot relief holder located under the current shopping center, however, refusal on concrete or metal was encountered at 5 to 8 feet bgs in borings SB-12, SB-15 and SB-56. The refusal may represent the relief holder foundation, but also may be construction debris. Therefore, it is not known whether an underground portion of the relief holder remains in the site subsurface.

4.5 SOIL CONTAMINATION

Analytical results for soil samples are included in Appendix F. Summaries of detected VOCs, SVOCs, and inorganic compounds in soils are provided in Tables 6, 7, and 8, respectively. A summary of analytical results for PCBs in selected soil samples is provided in Table 9. Total VOC and SVOC concentrations in soil are depicted in Figure 14. Summaries of detected TCLP VOCs, TCLP SVOCs, and TCLP inorganics in selected soil samples are summarized in Tables 10, 11, 12. Results from additional waste characterization analyses, including PCBs, TPH, ignitibility, corrosivity, and reactivity are summarized in Table 13. The waste characterization summary tables also list hazardous waste thresholds given in CFR Title 40 Part 261. Soils are divided into two categories: shallow soil and subsurface soil. For the purposes of this report, shallow soils are defined as soil encountered from the ground surface to approximately 10 feet bgs. Contaminated soils at these depths are expected to pose a potential exposure pathway to construction workers during future excavation, utility, landscaping and maintenance activities. Subsurface soils are those soils encountered at depths greater than 10 feet bgs.

4.5.1 Shallow Soil

Field evidence of contamination (i.e., NAPL, sheen, odors, staining, elevated PID readings) was detected in shallow soil in a total of 41 of 61 borings, with 19 of these borings located in the eastern portion of the site (including under the Kmart building footprint), and 23 located in the western portion of the site. The shallow soil in the eastern borings exhibited elevated PID readings and tar-like solvent-like and petroleum-like odors. In addition, coal tar-like material was observed at 0.5 to 1 feet bgs in SB-44 and 9 to 10 feet bgs in SB-17, and a narrow band of NAPL was observed at 1.5 to 1.8 feet in SB-43. The shallow soil in the western borings exhibited relatively higher PID readings and tar-like and petroleum-like odors, with NAPL present in borings SB-29 (7 to 8 feet bgs), SB-30 (at 8 to 10 feet bgs), SB-36 (at 4 to 6 feet bgs), SB-37 (at 8 to 10 feet bgs), and SB-38 (4 to 4.5 feet bgs).

A total of 59 shallow soil samples were collected for laboratory analysis, based on PID response and visual/olfactory inspection. One of the sample jars for soil sample SB-21 (9 to10 feet bgs) was broken in transit to the laboratory, resulting in insufficient sample volume for the entire set of analyses, therefore, this sample was analyzed for VOCs only. Forty-six of these samples were collected from borings that exhibited field evidence of contamination. The remaining 13 samples did not exhibit field evidence of contamination, but were selected as vadose zone samples for laboratory analysis based on the sampling protocol described in Section 3.1.

Thirteen shallow soil samples [SB-02 (0.5 to 1 feet bgs), SB-03 (5 to 6 feet bgs), SB-07 (7 to 8 feet bgs), SB-17 (9.5 to 10 feet bgs) SB-21 (9 to 10 feet bgs), SB-29 (3 to 3.5 feet bgs), SB-30 (9.5 to 10.5 feet bgs), SB-36 (8 to 9 feet bgs), SB-37X (4 to 6 feet bgs), SB-37X (8 to 9 feet bgs), SB-38 (4 to 4.5 feet bgs), SB-59 (9.5 to 10 feet bgs), and SB-60 (2.5 to 3.5 feet bgs)] contained total VOC concentrations exceeding 10 ppm, with a maximum total VOC concentration of 1,690 ppm detected in SB-03 (5 to 6 feet bgs). The primary compounds detected in these samples were benzene, toluene, ethylbenzene and xylenes (BTEX), isopropylbenzene, and styrene. Tetrachloroethylene was detected in two shallow soil samples [SB-38 (4 to 4.5 feet bgs) and SB-44 (7 to 8 feet bgs)] at concentrations of 3.2 ppm and 1.6 ppm, respectively. Trichloroethlyene was detected in SB-44 (7 to 8 feet bgs) at 0.62 ppm. Additional VOCs detected in the shallow soil samples included 2-butanone, acetone, 1,1,2,2-tetrachlorethane, 1,2,4-trichlorobenzene, carbon disulfide, methylene chloride, and carbon tetrachloride. These compounds were generally detected at concentrations of less than 0.1 ppm. Acetone and methylene chloride are common laboratory contaminants.

Fourteen shallow soil samples [SB-03 (5 to 6 feet bgs), SB-17 (9.5 to 10 feet bgs), SB-29 (3 to 3.5 feet bgs), SB-30 (9.5-10.5 feet bgs), SB-36 (8 to 9 feet bgs), SB-37X (8 to 9 feet bgs), SB-38 (4 to 4.5 feet bgs), SB-43 (2 to 3 feet bgs), SB-46 (6.5 to 7.5 feet bgs), SB-59 (4.5 to 5.5 feet bgs), SB-59 (9.5 to 10 feet bgs), SB-60 (2.5 to 3.5 feet bgs), SB-61 (3 to 4 feet bgs)] exhibited total SVOC concentrations exceeding 500 ppm. The primary compounds detected in these samples included polycyclic aromatic hydrocarbons (PAHs) and dibenzofuran. Additional SVOCs detected in the shallow soil samples included 2,4-dinitrotoluene, 2,6-dinitrotoluene, 4,6-dinitro-2-methylphenol, bis(2-ethylhexyl)phthalate, 2-chloronaphthalene, di-n-octylphthalate, carbazole, 2,4-dimethylphenol, 2-chloronaphthalene, isophrone, hexachlorobenzene, hexachlorobutadiene, 4-bromophenyl phenylether, 4-chlorophenyl phenylether, 4-nitroaniline, 2-nitroaniline, 4-chloroaniline, pentachlorophenol, n-nitrosodiphenylamine, and dimethylphthalate.

Four shallow soil samples were analyzed for forensic hydrocarbon fingerprint analysis. These samples included SB-30 (9.5 to 10.5 feet bgs) collected from behind (west of) the shopping center building; SB-7 (4 feet 8 inches to 4 feet 11 inches bgs), collected from in front (east) of the shopping center building; SB-8 (8 to 12 feet bgs), collected from near the northern property boundary; and SB-52 (6.5 to 7 feet bgs) collected from near the northwestern corner of the site. Environmental forensic reports for these samples are included as Appendix G. Fingerprint analyses indicated that all of these samples contained pyrogenic or petrogenic substances and were characterized as being consistent with MGP tar.

The inorganics concentrations detected in soil samples were compared with the upper limit of the Eastern United States background range for metals listed in NYSDEC Technical and Administrative Guidance Memorandum (TAGM): Determination of Soil Cleanup Objectives and Cleanup Levels (HWR-94-4046). The Eastern United States background levels are not necessarily representative of site-specific background levels, which may be higher due to the historical use of the site vicinity for industrial purposes. Forty-four of the shallow soil samples contained one or more metal at concentrations exceeding their respective Eastern United States background levels. Cadmium, mercury, and zinc exceeded Eastern United States background levels in the majority of the shallow samples. In general, the detected cadmium concentrations were less than two times the Eastern United States background level of 1 ppm, with the exception of four samples [SB-37X (4 to 6 feet bgs), SB-37X (8 to 9 feet bgs), SB-44 (2 to 4 feet bgs) and SB-49R2 (6.5 to 7.5 feet bgs)], which exhibited concentrations ranging from 2.4 to 7.1 ppm. The detected zinc concentrations were generally less than 10 times the Eastern US background level of 50 ppm, with the exception of SB-37X (4 to 6 feet bgs) and SB-49R2 (6.5 to 7.5 feet bgs), which exhibited concentrations of 567 ppm and 5,430 ppm, respectively. The detected mercury concentrations ranged from 0.04 to 264 ppm, with concentrations greater than 10 times the Eastern United States background level of 0.2 ppm in six samples [SB-04 (2.5 to 3.5 feet bgs), SB-7 (7 to 8 feet bgs), SB-27 (2 to 3 feet bgs), SB-30 (1 to 2 feet bgs), SB-44 (7 to 8 feet bgs), and SB-47 (9 to 10 feet bgs)], and greater than 1000 times the Eastern United States background in one sample [SB-49R2 (6.5 to 7.5 feet bgs)].

Arsenic exceeded the Eastern United States background level of 12 ppm in ten shallow soil samples at concentrations ranging from 15.6 ppm in SB-01 (0 to 2 feet bgs) to 160 ppm in SB-30 (1 to 2 feet bgs). Copper exceeded the Eastern United States background level of 50 ppm in six shallow soil samples at concentrations ranging from 67.7 ppm in SB-6 (4 to 4.5 feet bgs) to 203 ppm in SB-49R2 (6.5 to 7.5 feet bgs). Magnesium concentrations were greater that the Eastern United States background level of 5,000 ppm in seven shallow soil samples, with concentrations ranging from 5,030 ppm in SB-6 (4 to 4.5 feet bgs) to 21,400 ppm in SB-39R3 (4 to 5 feet bgs). Lead concentrations were greater than the Eastern United States background level of 500 ppm in three shallow soil samples, with concentrations ranging from 549 ppm in SB-37X (4 to 6 feet bgs) to 4,090 ppm in SB-49R2 (6.5 to 7.5 feet bgs). All other metals concentrations in shallow soil samples were within the respective Eastern US background range. Waste characterization analysis of shallow soil samples SB-01 (0 to 2 feet bgs) and SB-47 (9 to 10 feet bgs) using TCLP indicated that no metals were present at levels exceeding hazardous waste thresholds (Table 12).

Cyanide was detected in 40 of the 59 shallow samples at concentrations ranging from 0.57 ppm in SB-16 (9 to 10 feet bgs) to 175 ppm in SB-49R2 (6.5 to 7.5 feet bgs). TAGM 4046 does not list an Eastern United States background level for cyanide. Therefore, background cyanide concentrations will be generated using this and future site investigation data. Waste characterization analysis of shallow soil sample SB-01 (0 to 2 feet bgs) and SB-47 (9 to 10 feet bgs) indicated that the cyanide present in these samples is not reactive and, therefore, not characteristic of hazardous waste (Table 13).

Four of the surface soil samples submitted for laboratory analysis were analyzed for PCBs. These samples included: SB-31 (5 to 6 feet bgs) and SB-32 (2 to 3 feet bgs), collected near an existing electrical transformer at the southwestern corner of the shopping center building; SB-43 (2 to 3 feet bgs), collected near the Con Edison substation in the northeastern corner of the site; and SB-53 (7 to 8 feet bgs), collected near the former transformers in the northwestern portion of the site. PCBs were not detected in these surface samples.

4.5.2 Subsurface Soil

Field evidence of contamination was observed in 42 of the 61 soil borings located throughout the site. In general, logging of soil samples and PID screening indicated shallower contamination in the northeastern portion of the site (i.e., contamination was observed only above the water table in borings SB-4, SB-6 and SB-43); whereas deeper contamination, including sheens on soil and NAPL, was observed at and below the water table in the western portion of the site. Field screening did not indicate significant subsurface soil contamination in nine soil borings, including SB-5, SB-10, and SB-45 located in the eastern portion of the site; SB-32, located in the southwestern portion; SB-14, SB-19, and SB-48, located within the shopping center footprint; and SB-9, SB-41 and SB-42, located along the northern property boundary. Soil borings SB-11, SB-15, SB-24, and SB-58 also did not exhibit significant field evidence of contamination; however, shallow refusal (less than 7 feet bgs) was encountered in these borings and soil conditions below the refusal depth are not known. Deeper conditions within the relief holder footprint will be investigated by excavation of test pits inside the Kmart building during Phase II site investigation activities. Conditions under the boiler house footprint (near SB-24) will be investigated with a soil boring (advanced using HSA or rotosonic).

A total of 62 subsurface soil samples were collected for laboratory analysis based on PID response and visual/olfactory inspection. Fourteen of the 62 samples analyzed for VOCs [SB-3 (18 to 19 feet bgs), SB-7 (13 to 14 feet bgs), SB-8 (16 to 17 feet bgs), SB-17 (16.5 to 17 feet bgs), SB-22 (15 to 16 feet bgs), SB-25 (15 to 16 feet bgs), SB-26 (10 to 13 feet bgs), SB-26 (13 to 14 feet bgs), SB-50 (14 to 15 feet bgs), SB-51 (12 to 13 feet bgs), SB-53 (10.5 to 11.5 feet bgs), SB-54 (10 to 11 feet bgs), SB-54 (13 to 14 feet bgs), and SB-60 (14 to 16 feet bgs)] contained total VOC concentrations exceeding 10 ppm, with the detected concentrations ranging from 13.9 ppm in sample SB-51 (12 to 13 feet bgs) to 1,744 ppm in sample SB-50 (14 to 15 feet bgs). Compounds detected in these samples included BTEX, isopropylbenzene, and styrene. 1,2-dichloroethane was also detected in one of these samples [SB-50 (14 to 15 feet bgs)]. Methyl-tert-butyl-ether (MTBE) was detected in 10 subsurface soil samples at concentrations ranging from 0.0022 ppm in SB-30 (37 to 38 feet bgs) to 0.15 ppm in SB-02 (16 to 16.5 feet bgs). Additional VOCs detected in the subsurface samples (at concentrations of less than 0.1 ppm) included acetone, 2-butanone, and carbon disulfide. [Note: A review of records for all past tenants at the property indicated that no dry cleaning facility or other chlorinated solvent user ever operated on the premises.] Methylene chloride and acetone are common laboratory contaminants.

Thirteen of the 62 subsurface soil samples analyzed for SVOCs [SB-7 (13 to 14 feet bgs), SB-8 (16 to 17 feet bgs), SB-16 (18 to 19 feet bgs), SB-17 (16.5 to 17 feet bgs), SB-22 (15 to 16 feet bgs), SB-24 (15 to 16 feet bgs), SB-26 (10 to 13 feet bgs), SB-26 (13 to 14 feet bgs), SB-46 (17.5 to 18.5 feet bgs), SB-50 (14 to 15 feet bgs), SB-51 (12 to 13 feet bgs), SB-53 (10.5 to 11.5 feet bgs), and SB-54 (10 to 11 feet bgs)] contained total SVOC concentrations exceeding 500 ppm, with concentrations ranging from 579 ppm at SB-16 (18 to 19 feet bgs) to 5,048 ppm at SB-25 (15 to 16 feet bgs). Compounds detected in these samples consisted primarily of PAHs, 2.4-dinitrotoluene, and dibenzofuran. Phenol, 2-methylphenol, 4-methylphenol, 4-nitrophenol, bis(2-ethylhexyl)phthalate, and bis(2-chloroethoxy)methane were also detected in these samples. PAHs, nitrobenzene, 2,4-dinitrotoluene, 2-chloronaphthalene, aniline, 2-nitrophenol 4-nitrophenol, bis(2-chloroethoxy)methane, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, diethylphthalate, dimethylphthalate, hexachloroethande, isophrone, and/or n-nitroso-di-propylamine were detected in an additional 50 samples that contained total SVOCs of less than 500 ppm.

Ten subsurface soil samples were analyzed for forensic hydrocarbon fingerprint analysis. These samples included SB-25 (25 to 26 feet bgs), SB-26 (12 to 13 feet bgs), SB-29 (14 to 16 feet bgs), collected from behind (west of) the shopping center building; SB-17 (18 feet bgs), collected from under the shopping center building slab; SB-36 (12 to 13 feet bgs), SB-35 (24.5 to 25 feet bgs), MW-3 (15 to 17 feet bgs); collected from near the southwestern property boundary; and SB-53 (16 to 20 feet bgs), SB-54 (13 to 14 feet bgs) and SB-3 (14 to 16 feet bgs), collected from in front (east) of the shopping center building. Environmental forensic reports for these samples are included as Appendix G. With the exception of SB-54 (13 to 14 feet bgs), all of the samples contained pyrogenic or petrogenic substances and were characterized as being indicative of MGP tar. The fingerprint of sample SB-54 (13 to 14 feet bgs), collected from in front of the shopping center building within the footprint of the 3 million cubic foot gas holder, was dominated by naphthalene and was characterized as a light oil or distillate of tar possibly related to MGP processes.

Twenty-two of the 62 subsurface soil samples analyzed for inorganics contained one or more metals at concentrations exceeding Eastern United States background ranges. Magnesium and zinc were the most common exceedances in these samples. Eight samples exhibited elevated (above background) magnesium concentrations ranging from 5,810 ppm in SB-25 (15 to 16 bgs) to 46,800 ppm in SB-1 (28 to 30 feet bgs), compared to the 5,000-ppm background level. Elevated zinc concentrations greater than the Eastern United States background level of 50 ppm were detected in eight samples and ranged from 50.3 ppm in sample SB-22 (15 to 16 feet bgs) to 111 ppm in sample SB-29 (44 to 45 feet bgs).

Elevated cadmium concentrations at or slightly above the Eastern US background level of 1 ppm were detected in five subsurface soil samples and ranged from 1 ppm in samples SB-14 (15 to 16 feet bgs) to 1.3 ppm in samples SB-03 (18 to 19 feet bgs) and SB-29 (44 to 45 feet bgs). Elevated mercury concentrations at or above the Eastern United States background level of 0.2 ppm were detected in five subsurface samples, and ranged from 0.2 ppm in sample SB-26 (10 to 13 feet bgs) to 8.3 ppm in sample SB-49R2 (12 to 13 feet bgs). Only one of these samples [SB-49R2 (12 to 13 feet bgs)] exhibited a mercury concentration of greater than 10 times the background level. Elevated nickel concentrations above the Eastern United State background level of 25 ppm were detected in five samples with concentrations ranging from 26.1 ppm in SB-30 (40 to 41 feet bgs) to 378 ppm in SB-01 (28 to 30 feet bgs). Only one of these samples [SB-30 (40 to 41 feet bgs)] exhibited a nickel concentration of greater than ten times the background level.

A chromium concentration of 86.4 ppm, above the Eastern United States background level of 40 ppm, was detected in one subsurface soil sample [SB-01 (28 to 30 feet bgs)]. Copper was detected above the Eastern United States background of 50 ppm in two samples [SB-03 (18 to 19 feet bgs) and SB-29 (44 to 45 feet bgs)] at concentrations of 51.6 ppm and 66 ppm, respectively.

Cyanide was present in 16 of the subsurface soil samples at concentrations ranging from 0.60 ppm in SB-22 (15 to 16 feet bgs) to 76.7 ppm in SB-26 (10 to 13 feet bgs). Waste characterization analysis indicated that the cyanide present in the soil is not reactive and, therefore, not characteristic of hazardous waste (Table 13).

Four subsurface soil samples were analyzed for PCBs. These samples included: SB-31 (18 to 20 feet bgs) and SB-32 (15 to 16 feet bgs), collected near the existing transformer at the southwestern corner of the shopping center; SB-53 (10.5 to 11.5 feet bgs) collected near the former transformers located near the northwestern corner of the site; and SB-43 (29 to 30 feet bgs), collected near the Con Edison substation. PCBs were not detected in any of these subsurface soil samples.

4.6 SOIL GAS

A total of six soil gas samples were collected from the interior of the former Kmart shopping center building for the purpose of assessing the potential vapor intrusion if the building was reused as part of the site redevelopment. Laboratory analytical results are provided in Appendix F and summarized in Table 14. Benzene, toluene and m&p xylenes were detected in all soil gas samples. Benzene soil gas concentrations ranged from 5.5 parts per billion-volume (ppbv) in SG-5 to 27 ppbv in SB-1. The toluene soil gas concentrations ranged from 27 ppbv in SB-3 to 250 ppbv in SB-6. The m&p-xylenes soil gas concentrations ranged from 5.5 ppbv in SG-5 to 160 ppbv in SG-6. Other VOCs detected in one or more soil gas samples at lower concentrations included chloromethane, chloroform, tetrachloroethene, trifluorochloromethane, trichloroethene, ethylbenzene, styrene, o-xylene, styrene, and 1,2,4-trimethylbenzene. Of these detected compounds, styrene, xylenes, 1,2,4-trimethylbenzene, toluene and methylene-chloride were detected in the field blank sample. Unknown alkanes and non-alkanes were detected in all soil gas samples and in the field blank sample. Based on these results and if the existing Kmart shopping center building were redeveloped, the NYSDEC and NYSDOH would require the installation and activation of an engineering control (sub-surface depressurizations system) to reduce vapor intrusion from the site subsurface.

4.7 GROUNDWATER CONTAMINATION

Groundwater samples were collected at fourteen wells. Wells were not sampled if they contained measurable NAPL as described in Section 3.5. Laboratory analytical results for groundwater samples are provided in Appendix F. Results for VOCs, SVOCs and inorganic compounds are summarized in Tables 15, 16 and 17, respectively. Total VOC and SVOC concentrations in groundwater are depicted in Figure 15.

Individual VOCs were detected at levels exceeding NYSDEC Class "GA" (Groundwater) Ambient Water Quality Standards in all groundwater samples other than those from MW-12 and MW-8. No VOCs were detected in the sample collected from MW-8, in the northeastern corner of the study site. The highest total VOC concentration of 12,490 micrograms per liter (ug/L) was detected in the groundwater sample collected at MW-9, located in front of the southern end of the main shopping center building. The primary VOCs detected in this sample were benzene, ethylbenzene, and xylenes. A total VOC concentration of 882 ug/L was detected in the sample collected from MW-6, in the western portion of the site adjacent to Eastchester Creek, with benzene being the primary compound detected. MW-10, directly in front of the main shopping center building, displayed a total VOC concentration of 720 ug/L, comprised of ethylbenzene and xylenes. Levels of benzene exceeding the GA Standard were also detected in samples collected from MW-1, MW-2S, MW-2D, MW-5, MW-11, MW-15 and B102W Deep. Other VOCs detected in one or more sample at concentrations exceeding the applicable GA Standard included isopropylbenzene, MTBE, cis-1,2-dichloroethene, ethylbenzene, toluene, chloroform, and xylenes. Based on known utilization of the site, there were no known sources of MTBE or chlorinated solvents such as recent (since 1980's) gasoline storage or dry cleaning operations. Therefore, the presence of MTBE and chlorinated solvents in groundwater is most likely attributable to undocumented off-site gasoline spills or other industrial facilities surrounding the site.

Individual SVOCs were detected at concentrations exceeding their GA Standards in groundwater samples from wells MW-2D and MW-2S, MW-5, MW-6, MW-9, MW-10, MW-11, MW-13, MW-15 and B102W Deep. No SVOCs were detected in the sample collected from MW-8, in the northeastern corner of the site. Total SVOC concentrations were greater than 1,000 ug/L in samples from the following wells: MW-9 (9,480 ug/L), located along the northern property boundary; MW-10 (2,250 ug/L), located directly in front (east) of the main shopping center building; MW-2S (1,057 ug/L), located in the southeastern portion of the site; and MW-13 (1,450 ug/L), located behind (west of) the shopping center building. The primary SVOC detected above GA Standards was naphthalene, with a maximum concentration of 8,000 ug/L in MW-9. Other SVOCs detected in one or more sample at concentrations exceeding the applicable GA Standard included acenaphthene, 4-chloroaniline, and 2,6-dinitrotoluene.

All 14 filtered groundwater samples contained one or more metals at concentrations exceeding their respective GA Standards. Aluminum, manganese, sodium, and iron exceeded GA Standards in most of the samples. Antimony and magnesium were also detected at concentrations exceeding their respective GA Standards in one or more samples. These metals are often found naturally in saline waters. Sodium and magnesium in particular may be present in groundwater at the site due to the close proximity of Eastchester Creek, which is variably saline depending on tidal cycles. Thallium was present above the GA Standard of 0.5 ug/L in five groundwater samples, at concentrations ranging from 4.7 to 23 ug/L. This GA value is a guidance value rather than a true groundwater quality standard. Thallium was not detected in any soil samples or in any TCLP waste characterization samples, therefore, the dissolved thallium detected in groundwater does not appear related to soil contamination at the Pelham site.

Cyanide was detected in 10 of the 14 groundwater samples. The NYSDEC has developed a standard concentration for cyanide in groundwater of 200 ug/L which is listed in the document entitled *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* dated June 1998. In samples from MW-6, MW-9, MW-10, and MW-12, cyanide concentrations exceeded the GA standard of 0.2 milligram per liter (mg/L), with a maximum detected concentration of 1.0 mg/L in both MW-10 and MW-12, both in the north-central portion of the study site, immediately in front (east) of the shopping center building.

4.8 EXTENT OF CONTAMINATION

4.8.1 Non-Aqueous Phase Liquid

Non-aqueous phase liquid was observed in 17 of the 61 borings advanced at the site. The NAPL was generally present across wider intervals (i.e., 1 to 9.5 feet) in borings located behind the shopping center buildings (SB-25, SB-26, SB-29/29X, SB-30, SB-50and SB-61) and adjacent to Eastchester Creek (SB-36, SB-37X, SB-38 and SB-51). With the exception of SB-25, the top of the NAPL interval was encountered within 3 feet of the observed water table in these borings (below the water table in SB-26, SB-30, SB-36, SB-37X, SB-50, SB-51, and SB-61; and above the water table in SB-29/29X and SB-38). DNAPL was encountered at greater than 10 feet below the water table in SB-25, however, soil samples collected in this boring from just below the water table to approximately 24 feet bgs displayed a sheen. The organic peat layer was encountered in most all of these borings except SB-51 and SB-61. These observations indicate that the surface of the low permeability peat likely is acting as a preferential pathway for lateral DNAPL migration. At most locations, however, DNAPL has also migrated vertically into the peat, and at some locations, such as SB-25, SB-26, SB-36, SB-38 and SB-50, into the underlying sand unit. NAPL was also present within 3 feet of the water table in borings SB-17 and SB-47 and approximately 11 feet below the water table in SB-16 located just north and east of where the peat layer decreases in thickness. NAPL was present at the water table and down to approximately 12 feet below the water table in SB-53, located near the northwestern property boundary. Fingerprint analysis of soil samples from borings SB-17, SB-25, SB-26, SB-29 and SB-30 indicated that the NAPL contained in the western and southwestern portions of the site most likely consists of MGP tar.

Relatively narrow bands (less than 1 foot thick) of NAPL were encountered at shallower depths (less than 2 feet bgs) 4 to 10 feet above the water table in borings SB-43 and SB-44 located in the northeastern portion of the site. DNAPL was observed well below the water table (at 24.5 feet below ground surface) in boring SB-35, located behind the A.J. Wright building (southern portion of the site). Fingerprint analysis of a soil sample from SB-35 indicated that the DNAPL at this boring is most likely an MGP-related tar.

During water level monitoring, evidence of floating or LNAPL was observed in monitoring wells MW-7S and MW-7D (located next to the Creek), and MW-14 and B-102AW Shallow (located behind the shopping center building) (Table 5). During well development, evidence of NAPL was also observed in MW-2S, MW-2D, and MW-3 (located near the southwest property boundary). LNAPL was encountered on the water table in TP-7, located adjacent to Eastchester Creek, near the northwestern corner of the site. These observations confirm the presence of separate-phase product observed near the water table in soil borings located behind (west of) the shopping center building and near Eastchester Creek.

Evidence of DNAPL was observed just above the bedrock surface in boring SB-53 (as a tar-like material) and in SB-36 (as a sheen on the soil). DNAPL was also encountered in monitoring wells MW-7D, MW-13 and MW-102AW Shallow at thicknesses ranging from 0.5 to 1.4 feet on October 18, 2002 (Table 5); however, the presence of DNAPL in these wells was not detected during previous or subsequent water level monitoring.

4.8.2 Volatile and Semivolatile Organic Compounds

Laboratory and field evidence indicate that VOCs and SVOCs are present in soil and groundwater throughout the site, with the greatest concentrations in the western portion (within or near the footprints of former MGP structures), further southwest and west (adjacent to Eastchester Creek), and in the eastern portion (immediately in front of the shopping center building). The contaminant distributions in soil and groundwater are illustrated in Figures 14 and 15, respectively, which indicate total VOC and SVOC concentrations.

Soil contamination was generally shallower near the front (east) of the shopping center building where field evidence of contamination was observed in soils collected from above the water table. Fingerprint analysis of soil samples collected from in front of the shopping center indicated that the contamination in this area is indicative of a probable MGP-related tar, as in SB-3 (14 to 16 feet bgs) and SB-7 (4 feet 8 inches to 4 feet 11 inches bgs), or a light oil or distillate of tar possibly related to MGP processes, as in SB-54 (13 to 14 feet bgs). Shallow soil and soils above the water table also exhibited field and/or laboratory evidence of contamination in SB-2, located further to the south and east, near the Off-Track Betting building. Contamination was detected in groundwater in the eastern portion of the site, with total VOC or SVOC concentrations exceeding 1,000 ug/L detected in MW-9 and MW-10.

Contamination was deeper in the western and southwestern portion of the site, where field and/or laboratory evidence of VOCs and/or SVOCs was not encountered in a majority of the soil borings until just above or below the water table. However, laboratory and field screening did indicate shallower contamination above the water table in soil borings: SB-26, SB-29/29X, SB-59, SB-60 and SB-61, located behind the main shopping center building; and SB-36, located along the southwestern property boundary near Eastchester Creek. Groundwater contamination and/or NAPL were detected in water table wells in these areas. The dissolved total VOC and SVOC concentrations detected in wells located in the western portion of the site were relatively low compared to wells in the eastern portion of the site; however, total SVOC concentrations exceeded 1,000 ug/L in MW-2S and MW-13. In addition, groundwater samples were not collected from the wells containing NAPL (MW-3, MW-7S, MW-7D, B-102AW Shallow, and MW-14); these wells likely contain detectable concentrations of dissolved contaminants.

SB-53, SB-29/29X, and SB-36 were the only deep borings that exhibited petroleum-like or tar-like odors and/or a sheen at depth (i.e., just above the bedrock surface) during this phase of the remedial investigation. Laboratory analysis of deep soils samples from these borings, however, detected relatively low VOC and SVOC concentrations. Additional work will be conducted during the Phase II site investigation in order to delineate NAPL at deeper intervals in the western portion of the site and to determine if NAPL is present in the eastern section of the site.

Relatively lower concentrations of VOCs and SVOCs were detected in soil samples collected from both above and below the water table in the northeastern and northwestern portions of the site, and SVOC and VOC concentrations were negligible in groundwater samples collected in the northeastern portion. However, soil and groundwater contamination (total SVOC and VOC) was observed along the central portion of the northern property boundary in soil samples collected from below the water table in SB-53 and SB-8. A total SVOC concentration of 9,480 ug/L was detected in monitoring well MW-9. Fingerprint analysis of soil samples from SB-53 and SB-8 indicated that the contamination in these borings is consistent with an MGP-related tar.

4.8.3 Inorganic Compounds

Elevated concentrations of mercury and/or zinc greater than 10 times the Eastern United States background levels were present in soil samples SB-37X (4-6) located near the southwestern corner of the site; SB-7 (7-8), SB-44 (7-8), and SB-4 (2.5-3.5), located in front (east) of the shopping center building; SB-47 (9-10) located under the shopping center building slab; SB-25 (15-16), SB-25 (25-26), SB-27 (2-3), and SB-30 (1-2), located behind (west of) the shopping center building; and SB-49R2, located behind the A.J. Wright building. An elevated lead concentration greater than five times the Eastern United States background level was also present in SB-49R2. The elevated metals concentrations detected in samples from borings SB-25 and SB-44 appear to correlate with the presence of NAPL and/or high VOC/SVOC concentrations; whereas, the elevated metals concentrations in samples from borings SB-4, SB-7, SB-30, SB-47 and SB-49R2 appear to correlate with the presence of coal and/or slag in the sample interval. The areas exhibiting these elevated metals concentrations do not necessarily correlate with the areas containing NAPL and/or the greatest VOC and SVOC contamination. Therefore, the mercury, lead and/or zinc are instead, likely associated with other MGP wastes other than NAPL, such as coal and/or metal slag contained in most of these soil samples. Cyanide was detected in soil samples throughout the site, including locations not associated with former MGP structures such as SB-2 and SB-3. The heavy metals detected in soil (lead, mercury, and zinc) were not present above GA water quality standards in filtered groundwater samples. Cyanide exceeded the 0.2 mg/L GA standard in the eastern portion of the site (in MW-9, MW-10 and MW-12) near soil borings where elevated cyanide levels were detected in soil. Cyanide also exceeded the groundwater standard in MW-6, located adjacent to Eastchester Creek.

4.9 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

4.9.1 Potentially Exposed Human Populations

As outlined in Section 3.7, a receptor survey was completed to identify potential sensitive receptors that could be adversely affected by contamination originating from the study site. There are no schools or public parks within one-quarter mile and no supply wells located within one-half mile of the study site. The remaining sensitive environmental receptor would be the Eastchester Creek and its biota located west-adjacent to the site.

There are four groups of potentially exposed human populations: site workers, employees of site tenants, customers, and other human populations (e.g., passersby). Based upon the distance, hydrogeology, and extent of contamination, nearby residents are not considered potentially exposed populations.

Site Workers

Site workers are considered those persons, who would be involved with excavation or foundation work associated with future remediation or development of the site. It is assumed that the most exposed worker might work on all the excavation and foundation activities through final grading for a period of one year. For remediation or maintenance activities requiring excavation, it is assumed that the most exposed worker might be involved with excavation or trenching for relatively shorter periods of time (e.g., one week to a few months).

Tenant Employees

Tenant employees would potentially be exposed to contaminants during occupancy of the premises prior to, during, and following any future development.

Customers

A customer would potentially be exposed to contaminants while visiting the premises prior to, during, and following any future development. The potential exposure to customers would be appreciably less compared to tenants due to the shorter duration and frequency of visiting the site.

Other Human Populations

Individuals such as occupants of neighboring properties, and drivers and pedestrians on Pelham Parkway and Boston Post Road, are also considered potential receptors. However, due to the limited time of exposure, their total exposure would be much lower than that of a tenant or customer. Furthermore, a number of sources including roadways, industrial, retail gasoline, and other operations may also adversely affect background conditions. The only other group potentially of concern is trespassers who might intentionally breach security fencing or accidentally come into contact with contaminated soil resulting in ingestion, dermal contact, or exposure via inhalation of VOCs. With adequate security to restrict access, the relatively low frequency of trespassing would therefore mean that the potential exposure to this group would be lower than that of construction workers in the excavation, tenants, or customers.

An environmental easement will be prepared for the site and this document will require the preparation of a Site Management Plan (SMP). The plan will document procedures for soil management during future excavation activities and address health and safety concerns for site workers, tenant employees, customers, and other human populations frequenting the site.

4.9.2 Future Use Limitations

The site is currently a retail shopping center. The exposure assessment described in this section is based upon the implementation of activity and use limitations for the site, including institutional and engineering controls, as defined below. Any controls would be further defined as part of the final remedy and recorded with the deed in accordance with NYSDEC requirements.

- Site restricted to commercial and industrial use as established in the VCA. The Village zoning department will become involved when the environmental easement is executed for the site by the Volunteer.
- Prohibition of day care, childcare, or medical care uses.
- Construction of any new buildings with a vapor barrier to prevent sub-slab vapor migration to the enclosed space and any other engineering control as specified by the NYSDOH (i.e. subsurface depressurization system).
- Prohibition of the installation of water supply wells for potable or non-potable uses of groundwater. Current Westchester County code (Article VII. Section 873.707.3.) prohibits installation of potable water wells in areas where municipal water supply is available. An environmental easement will be implemented to prohibit the installation/use of non-potable supply wells at the property.
- Requirement that all future construction or maintenance activities which require subsurface excavation be conducted in accordance with NYSDEC/DOH-approved, site-specific health and safety, community air monitoring, and soil excavation management plans. This requirement would be specified in the Remedial Action Work Plan (RAWP) and, associated Site Management Plan (SMP). Such plans would specify appropriate air monitoring, personal protective equipment, engineering controls for dust and volatilization, erosion and sediment controls, security, and soil characterization and disposal requirements. The NYSDEC would be notified prior to any activities requiring subsurface excavation.
- Any future development would maintain a cap of impervious material such as asphalt or concrete. In small landscaped areas, at least two feet of clean would be provided as a cover. This would minimize infiltration, volatilization to ambient air, and direct contact with contaminants in soil.
- Recreational access to Eastchester Creek to be limited to viewing purposes only; fishing or swimming would be prohibited by use of signage and fencing

4.9.3 Exposure Pathway Screening

Potentially exposed populations and potential exposure pathways are evaluated below. Exposure can only occur if there is a complete pathway from a specific chemical of concern contained in one of the on-site media (i.e., soil, soil gas, or groundwater) to an exposure point. The mere presence of a chemical at a site is not in itself evidence that a complete exposure pathway will exist. The following pathways are, therefore, considered incomplete at the site and do not require further consideration:

Groundwater Ingestion/Inhalation

Public water is available at the site, in the Village of Pelham Manor and City of New York, and there are no identified groundwater users within a one-half mile radius of the site. Institutional controls will be implemented to prevent groundwater use for potable and non-potable purposes on-site.

Surface Water Ingestion/Inhalation and Dermal Contact

Eastchester Creek is not designated for potable supply, and therefore, would not be used as drinking water. Eastchester Creek is designated for fishing and primary/secondary contact recreation (e.g., swimming). However, on-site access to the water body would be restricted by fencing, signage, and other measures. Additionally, the surrounding land use does not accommodate potential recreational uses where significant ingestion/inhalation or dermal exposure would occur.

Sediment Incidental Ingestion and Dermal Contact

Eastchester Creek is designated for fishing and primary/secondary contact recreation (e.g., swimming). However, access to the water body would be restricted by fencing, signage, and other measures and the surrounding land use does not accommodate potential recreational uses where significant ingestion or dermal exposure would occur.

Ingestion of Fish

Access on-site to Eastchester Creek would prohibit fishing through signs posted near the Creek.

The following on-site pathways are considered potentially complete:

Soil Incidental Ingestion

The site is paved, occupied with buildings, and contains small areas of landscaping. Potential exposure by this pathway would be only exist during future development, remediation, and maintenance activities requiring subsurface excavation, although the duration of any such exposure would be relatively short. Any future development, remediation, or maintenance activities that require subsurface excavation of soil would be conducted in accordance with NYSDEC/DOH-approved, site-specific health and safety plan, community air monitoring plan, and SMP developed as part of the final remedy. These requirements would be specified in the RAWP.

Soil Dermal Contact

The site is paved, occupied with buildings, and contains small areas of landscaping. Potential exposure by this pathway would only exist during future development, remediation, and maintenance activities requiring subsurface excavation, although the duration of any such exposure would be relatively short. Any future development, remediation, or maintenance activities that require subsurface excavation of soil would be conducted in accordance with NYSDEC/DOH-approved site-specific health and safety, community air monitoring, and SMP developed as part of the final remedy.

Groundwater Dermal Contact

Public water is available and groundwater would not be permitted to be used for any consumptive uses. Potential exposure by this pathway would only exist during future development, remediation, and maintenance activities requiring subsurface excavation, although the duration of any such exposure would be relatively short. Any future development, remediation, or maintenance activities that require subsurface excavation where groundwater may be encountered would be conducted in accordance with NYSDEC/DOH-approved site-specific health and safety, community air monitoring, and SMP developed as part of the final remedy.

Inhalation of Vapors

Potential exposure could occur as a result of volatilization of volatile organic compounds from soil or groundwater to soil gas and then eventually to ambient air or an enclosed space (i.e., inside a current or future building). Volatilization to an enclosed space is the pathway of greatest concern. However, soil gas sampling conducted beneath the foundation of the former Kmart building of the site indicated concentrations of VOCs, with the average benzene, toluene, ethylbenzene, and xylenes (total) being 43 ppbv, 72 ppbv, 14 ppbv, and 45 ppbv, respectively. The detected soil gas concentrations do not account for attenuation via mixing within the enclosed space and ventilation. As a result, the actual enclosed space concentrations of the respective VOCs may be lower than the detected soil gas concentrations. The evaluation of any buildings remaining as a component of the overall redevelopment plan for the site will be conducted in the Phase II site investigation (soil gas and indoor air sampling). However, the installation and activation of an engineering control (e.g., sub-surface depressurization system) will serve to reduce vapor intrusion from the subsurface.

Several other off-site sources that could contribute to increased background concentrations of VOCs on-site include various commercial and industrial facilities in the vicinity of the site including the Getty facility to the south, gasoline service stations to the north and east, and heavily traveled roadways to the north and east [Pelham Parkway, Boston Post Road (US Route 1), and Hutchinson River Parkway]. Based upon the soil gas data, documented background indoor air concentrations, and potential contributions from off-site sources, the contamination existing at the site does not appear to currently impact indoor air quality at the former Kmart building. However, as a contingency measure for future development, building foundations would be required to include a subsurface vapor barrier to prevent potential vapor migration into an enclosed space and other engineering control as specified by the NYSDOH (e.g., subsurface depressurization system).

Potential exposure by inhalation of VOCs could also occur during future development, remediation, and maintenance activities requiring subsurface excavation, although any such exposure period would be relatively short. Any future development, remediation, or maintenance activities that require subsurface excavation of soil would be conducted in accordance with NYSDEC/DOH-approved site-specific health and safety, community air monitoring, and SMP developed as part of the final remedy.

Inhalation of particulates

Release of dust and contaminated particles is a potential concern whenever soil is left exposed and especially when excavating or earth moving activities disturbs it. Any future development, remediation, or maintenance activities that require subsurface excavation of soil would be conducted in accordance with approved site-specific health and safety, community air monitoring, and SMP developed as part of the final remedy.

4.9.4 Summary

One of the potential human pathways is for volatilization of volatile organic compounds into an enclosed space. The other potential pathways for human exposure are related to volatilization from soil or direct contact with soil or groundwater during future development, remediation, or maintenance activities requiring subsurface excavation.

Potential exposure to contaminated soil or groundwater does not present a significant threat to human health to current or future receptors based upon implementation of the following site use limitations:

- Site restricted to commercial and industrial use.
- Prohibition of use as day care, childcare, or medical care uses.
- Construction of any new building will include the installation of a vapor barrier, the activation of an engineering control (e.g., subsurface depressurization system), and associated monitoring and maintenance of the system to reduce vapor intrusion from the subsurface.
- Prohibition of the installation of water supply wells for potable or non-potable uses.
- Requirement that all future construction activities that require subsurface excavation be conducted in accordance with NYSDEC/DOH-approved, site-specific health and safety, community air monitoring, and SMP. Such plans would specify appropriate air monitoring, personal protective equipment, engineering controls to control dust and volatilization, erosion and sediment controls, security, and soil characterization and disposal requirements.
- Any future development would maintain a cap of impervious material such as asphalt or concrete. In small landscaped areas, at least two feet of clean would be provided as a cover. This would minimize infiltration, volatilization to ambient air, and direct contact with contaminants in soil.
- Limiting recreational access to Eastchester Creek to viewing purposes only; fishing or swimming would be prohibited.

The Remedial Action Work Plan (RAWP) will address the potential impacts to environmental receptors from contaminant migration via all media (groundwater, soil, subsurface soil, soil gas, and air).

4.10 QA/QC RESULTS AND DATA REVIEW

4.10.1 QA/QC Sample Results

Results from QA/QC samples analyzed for VOCs, SVOCs, and inorganic compounds are summarized in Tables 18, 19, and 20, respectively. The VOC, chloroform, was detected at a concentration of 3.2 ug/L in FB-1, collected during soil sampling activities on August 16, 2002. No other VOCs were detected in any of the field blank samples. Acetone was detected at a concentration of 2.0 ug/L in TB-4, collected during soil sampling activities on September 6, 2002. Acetone and methylene chloride were detected at concentrations of 19 and 200 ug/L, respectively, in TB-6, collected during soil sampling activities on September 20, 2002. Acetone, chloroform and methylene chloride are common laboratory contaminants. No SVOCs were detected in any of field blank samples collected during soil sampling activities. Most or all of the field blank samples collected during soil sampling activities contained aluminum, calcium, magnesium, potassium, and sodium. The metals antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, thallium, and zinc were also detected in field blank samples collected during soil sampling. Cyanide was not detected in any of the field blank samples collected during soil boring activities.

No VOCs were detected in any of the field blank or trip blank samples collected during groundwater sampling activities. The SVOC diethylphthalate was detected at a concentration of 5.8 ug/L in field blank FB-11, collected during groundwater sampling activities on October 24, 2002. Diethylphthalate is a contaminant commonly encountered when plastic tubing is used to obtain samples. The metals aluminum, barium, beryllium, cadmium, calcium, lead, magnesium, manganese, nickel, potassium, silver, sodium, thallium, vanadium, and zinc were detected in one or more field blank samples collected during groundwater sampling activities. The barium, magnesium, manganese, potassium, sodium, and zinc concentrations detected in the field blanks were generally an order of magnitude less than the concentrations detected in the corresponding groundwater samples with the levels detected in the groundwater samples; whereas the aluminum, beryllium, cadmium, lead, nickel, thallium and vanadium concentrations detected in the field blanks were generally on the same order of magnitude as the corresponding groundwater samples. Silver was detected in two field blanks, FB-11 and FB-12, but was not detected in any of the corresponding groundwater samples. Cyanide was detected in one field blank, FB-11, at a concentration of 14.6 μg/L. This concentration is on the same order of magnitude as cyanide concentrations detected in some of the corresponding groundwater samples.

Results from the field blank collected during soil gas sampling are included with the soil gas samples results in Table 14. Several of the compounds detected in the soil gas samples, including benzene, styrene, xylenes, 1,2,4-trimethylbenzene, toluene and methylene-chloride, were also detected in the field blank sample at similar concentrations. The field blank sample was collected by drawing ambient air through the soil gas sampling assembly into Tedlar bags using the peristaltic pump. The detected VOCs in the field blank likely are a result of emissions from the DPP rig. The bentonite seal applied around the annulus of the soil gas sampling assembly is expected to have prevented fugitive vapors from entering the sampling point. Therefore, the quality of the soil gas samples likely was not affected by the DPP rig emissions.

4.10.2 Data Usability Summary Reports

Third-party data usability summary report (DUSR) technical services were performed by Andrea Schuessler of Chemworld Environmental, Inc. in Rockville, MD for the soil and water samples collected during the field program. The analytical data from the various Toxikon Corporation Laboratory Project Numbers (Sample Delivery Groups) were reviewed (screened) for VOCs, SVOCs (Base/Neutral and Acid Extractable Organics), and inorganics. The data screening consisted of a review of the Quality Control (QC) Summary Forms and a brief review of various chromatograms and quantitation reports. The QC Forms were reviewed to determine whether any data required qualification based upon QC deviations noted on the forms. The associated Analytical Data Result Forms were provided to AKRF with the associated data qualifiers. Data qualifiers from the review are reflected in the laboratory results summary tables contained in this report. Copies of the DUSRs and Ms. Schuessler's resume are included in Appendix H. The DUSR review items included the following, as method appropriate:

- Holding Times from Verified Time of Sample Receipt (VTSR)
- Surrogate Recovery
- GC/MS Instrument Performance Check
- Initial and Continuing Calibration
- Matrix Spike/Matrix Spike Duplicates (MS/MSD)
- Matrix Spike Blanks (MSB)
- Internal Standards
- Method and Field Blanks
- CRDL Standards for ICP
- Laboratory Duplicate Samples
- Laboratory Control Samples (LCS)
- ICP Interference Check

- ICP Serial Dilutions

The QC Summary Forms included various deviations based upon the acceptable limits for quality control. The following should be noted regarding qualification of the data set for the review items above.

- In several instances, SVOC samples were found to generate low reported area counts for the internal standards for chrysene and perylene. These samples were qualified as "J", estimated, for positive results and a "UJ", estimated, for non-detected results for the compounds associated with these internal standards. In a few instances, the reported area counts for the internal standards were found to be reported at less than 25 percent of the lower limit, which rendered the associated non-detected results unusable. This commonly occurs when samples contain relatively high concentrations of hydrocarbons. These samples were qualified as "R", unusable, for the compounds associated with these internal standards; however, usable data for these samples was obtained from additional sample runs with greater dilutions.
- During some sample runs, continuing calibrations for the majority of the compounds were found to exceed the 25 percent limit for the percent difference. The associated samples were qualified as "J", estimated, for positive results and "UJ", estimated, for non-detected results for the compounds affected.
- Due to the relatively low number of samples collected per workday, samples were batched in the field for weekly shipment to the laboratory to avoid excessive QA/QC sampling required per shipment. In some instances when samples were held in the field for greater than 48 hours, the holding times specified under NYS CLP protocol were exceeded for VOCs. These samples were qualified as "J", estimated, for the positive results and "UJ", estimated, for the non-detected results. All samples held in the field were stored in a secured refrigerator and were analyzed within 14 days of collection as per EPA SW-846 protocol. Therefore, the integrity of the samples may have been affected but not to any significant extent.
- All of the data qualified a "J" or "UJ" is considered usable for contamination assessment purposes under New York State guidelines. Therefore, the soil and groundwater data from this phase of the investigation is considered to be valid for use in defining the nature and extent of contamination at the site. Additional information on data quality is included in Appendix H.

5.0 SUMMARY AND CONCLUSIONS

The Pelham Plaza Site Investigation program included advancement of 61 soil borings; sampling and analysis of soil samples from above and below the groundwater table; collection of six soil gas samples from beneath the Kmart building slab; installation of 12 monitoring wells; water level gauging of 19 monitoring wells (including seven pre-existing wells); groundwater sampling from the 14 monitoring wells (including five pre-existing wells at the site); and excavation of 10 test pits. A summary of the findings from the investigation and conclusions drawn from those findings is provided in the following paragraphs.

Logging of soil samples indicates the geology at the site generally consists of fill materials underlain by native soils including organic peat and micaceous sand units. The uppermost fill layer consists of fine to medium sand with brick, gravel and coal fragments, and is generally thicker in the central and eastern portions of the site. The organic peat layer underlies the surficial fill in the western and southwestern portions of the site (behind the shopping center building and adjacent to Eastchester Creek). The peat layer appears to be absent under the shopping center building and in the eastern portion of the site and was, presumably, excavated during past construction activities or absent due to natural discontinuities. It is not known whether the peat layer is continuous between the western and southwestern portions of the site. The extent of the peat layer will be further evaluated during the Phase II site investigation. A native sand material underlies the fill and peat layers and consists of fine to medium, gray-brown micaceous sand containing some fine to coarse sand and fine gravel lenses at some locations. Dark gray to black schistose bedrock is present under the native sand. Bedrock is closest to the ground surface (8 to 20 feet bgs) in the northwestern and northeastern portions of the site and deepest (greater than 120 feet bgs) in the central portion of the site, where a north-south trending bedrock trough appears to be present. This trough, if present, could act as a sink for accumulation of DNAPL, however, the bedrock surface appears to be highly variable and DNAPL could also accumulate in localized depressions present in the western portion of the site (within the suspected source areas) or migrate in a westerly direction consistent with groundwater flow in the deeper sand aquifer. The configuration of the bedrock and the fate and transport of DNAPL will be investigated further in the Phase II site investigation.

Groundwater was generally shallowest (0.5 to 8 feet bgs) in soil borings and wells closest to Eastchester Creek and deepest (10 to 17 feet bgs) in soil borings and wells located in the northeastern corner of the site. In areas where it is present at sufficient thickness, the peat layer appears to act as a semi-confining unit between with the shallow fill unit and the deeper sand unit. Groundwater level data from shallow/deep monitoring well nests in this portion of the site indicate a downward hydraulic gradient exists between the two aquifers. The peat layer does not act as a competent aquiclude and the two aquifers appear to be hydraulically connected, as evidenced by the presence of DNAPL below the peat layer in several borings. In addition, communication between the two aquifers also occurs in the eastern portion of the site, where the sand unit is unconfined (i.e., the peat layer is absent). Based on groundwater elevation contours constructed from water table measurements, groundwater flow direction in the unconfined fill aquifer fluctuates between easterly and westerly, likely due to tidal influence. Groundwater flow direction in the deeper sand aquifer generally is to the west-southwest with an approximate hydraulic gradient of 0.002 feet per feet (ft/ft), which is within the range of typical hydraulic gradients.

During test pit activities, evidence of underground structure remnants was encountered at three locations including: a concrete chamber, believed to be a former underground tar separator, in TP-2; a concrete and brick chamber, assumed to be the former brick underground tar tank, in TP-7; and a concrete slab just below ground surface connected to a subsurface concrete wall, assumed to be the former drip separator pit, in TP-3. NAPL was observed to be present in soils inside and outside of the structure in TP-7. Test pitting indicated that the other structures appeared to be aboveground. A test pit could not be completed within the footprint of the former 350,000 cubic foot relief holder located under the current shopping center; however, refusal on concrete or metal was encountered at five to eight feet bgs in borings SB-12, SB-15 and SB-56. It is possible that the refusal represents the relief holder foundation, but also may be construction debris. Therefore, it is not known whether an underground portion of the relief holder remains in the site subsurface, however the Phase II portion of the investigation would include supplemental work in this area.

Field examination and laboratory analysis of soil samples collected at the site indicate widespread contamination with volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) in both shallow and subsurface soils. For the purposes of this investigation, shallow soils are defined as those soils that are less than 10 feet bgs, and therefore, present the greatest exposure threat to on-site construction workers during future excavation activities. Field evidence of contamination in shallow soils was observed in 19 soil borings located in front (east) of the shopping center and 23 soil borings located to the west, behind the shopping center. Laboratory results indicated that 13 of the 59 shallow soil samples contained total VOC concentrations greater than 10 ppm. Fourteen of the 59 shallow soil sample contained total SVOC concentrations greater than 500 ppm.

Field evidence of contamination in subsurface soils (those soils greater than ten feet bgs) was observed in 42 soil borings located throughout the site. In general, the field evidence indicated shallower contamination in the northeastern portion of the site; whereas, deeper contamination, including sheens on soil and NAPL, was observed at and below the water table in the western portion of the site. Fourteen of the 62 subsurface soil samples submitted for laboratory analysis contained total VOC concentrations at or exceeding 10 ppm, with the detected concentrations ranging from 13.9 to 1,744 ppm. Thirteen of the subsurface samples contained total SVOC concentrations exceeding 500 ppm with concentrations ranging from 579 to 9,230 ppm. The deeper contamination located behind the shopping center building and in the southeastern portion of the site likely is attributable to former MGP operations.

Laboratory analysis indicated elevated levels of inorganic compounds in shallow and subsurface soils; however, these compounds are not present at concentrations characteristic of hazardous waste. Forty-four of the shallow soil samples collected at the site contained one or more metals (arsenic, copper, cadmium, lead, magnesium, mercury, and/or zinc) at concentrations exceeding their respective Eastern United States background levels. In general, the metals were present at concentrations less than ten times the applicable background level with the exception of zinc and mercury. Zinc concentrations exceeded ten times the background level of 50 ppm in two samples [SB-37X (4 to 6 feet bgs) and SB-49R2 (6.5 to 7.5 feet bgs)] and mercury exceeded ten times the background level of 0.2 ppm in seven samples [SB-04 (2.5 to 3.5 feet bgs), SB-7 (7 to 8 feet bgs), SB-27 (2 to 3 feet bgs), SB-30 (1 to 2 feet bgs), SB-44 (7 to 8 feet bgs), SB-47 (9 to 10 feet bgs), and SB-49R2 (6.5 to 7.5 feet bgs)].

Twenty-two of the subsurface soil samples contained one or metals, including, arsenic, cadmium, chromium, copper, magnesium, mercury, nickel, and/or zinc, at concentrations exceeding Eastern United States background levels. Only two of these samples contained metal concentrations exceeding ten times the applicable background level: SB-49R2 (12 to 13 feet bgs) exhibited a mercury concentration of 8.3 ppm (compared to the 0.2 ppm background level), and SB-30 (40 to 41 feet bgs) exhibited a nickel concentration of 378 ppm (compared to the 25-ppm background level). Elevated metals concentrations were detected in isolated areas throughout the site and do not correlate with the areas containing NAPL and/or the greatest VOC and SVOC contamination, except at borings SB-25 and SB-44. Instead, the mercury, lead, and/or zinc are likely associated with other MGP waste such as coal and/or metal slag contained in most of the soil samples. Waste characterization analysis of select soil samples using the toxicity characteristic leaching procedure (TCLP) indicated that none of the metals were present at levels exceeding hazardous waste thresholds. Cyanide was present in 40 shallow soil samples at concentrations ranging from 0.57 to 175 ppm and in 16 subsurface soil samples at concentrations ranging from 0.60 to 76.7 ppm. Waste characterization analysis indicated that the cyanide present in the soil is not reactive, and therefore, not present at levels characteristic of hazardous waste.

Soil gas sampling conducted beneath the foundation of the Kmart building of the site indicated relatively low concentrations of VOCs, with the average benzene, toluene, ethylbenzene, and xylenes (total) being 43 parts per billion-volume (ppbv), 72 ppbv, 14 ppbv, and 45 ppbv, respectively.

Sampling of the on-site monitoring wells indicated that groundwater at the site has been impacted by VOCs and SVOCs. Individual VOCs, including benzene, isopropylbenzene, MTBE, cis-1,2-dichloroethene, ethylbenzene, toluene, chloroform, and xylenes, were detected at levels exceeding NYSDEC Class "GA" (Groundwater) Ambient Water Quality Standards in 12 of the 14 groundwater samples collected at the site. The benzene concentration exceeded the GA Standard in monitoring wells MW-1, MW-2S and MW-2D, MW-5, MW-11, MW-15 and B102W Deep. The highest total VOC concentration (12,490 ug/L) was detected in MW-9, located in front (east) of the southern end of the main shopping center building. Individual SVOCs were detected at concentrations exceeding their GA Standards in groundwater samples from wells MW-2D, MW-2S, MW-5, MW-6, MW-9, MW-10, MW-11, MW-13, MW-15, and B102W Deep. The primary SVOC detected above GA Standards was naphthalene, with a maximum concentration of 8,000 ug/L in MW-9. Total SVOC concentrations were highest in MW-9 (9,480 ug/L) and MW-10 (2,250 ug/L) located in front (east) of the shopping center building; MW-2S (1,057 ug/L), located in the southwestern corner of the site; and MW-13 (1,450 ug/L) located behind (west of) the shopping center building. No VOCs or SVOCs were detected in MW-8, located in the northeastern corner of the site. VOCs and SVOCs are likely present at detectable levels in monitoring wells that were not sampled due to the presence of LNAPL (MW-3, MW-7S, MW-7D, MW-13, B-102AW Shallow).

Inorganic compounds were detected in filtered groundwater samples throughout the site, with aluminum, antimony, magnesium, manganese, sodium, thallium and iron exceeding GA Standards. Of these metals only magnesium and manganese were detected above background levels in subsurface soil samples. Magnesium and manganese are common components of seawater and brackish water and is likely present in the groundwater due to tidal influence from Eastchester Creek. Other metals present at elevated levels in subsurface soil samples, primarily mercury and zinc, were not detected above GA standards in groundwater. Cyanide was detected in 10 of the 14 groundwater samples. In samples from MW-6, MW-9, MW-10, and MW-12, cyanide concentrations exceeded the GA standard of 0.2 mg/L, with a maximum detected concentration of 1.0 mg/L in both MW-10 and MW-12, both in the north-central portion of the study site, immediately in front (east of) of the shopping center building.

During soil boring installation, non-aqueous phase liquid (NAPL) was observed in 17 of the 61 borings advanced at the site. The NAPL was generally present across wide intervals at and below the water table in borings located immediately behind the shopping center building and adjacent to Eastchester Creek. The organic peat layer was encountered in most of these borings indicating that surface of the low permeability peat may be acting as a preferential pathway for lateral NAPL migration. Evidence of LNAPL was observed in five wells located adjacent to Eastchester Creek (MW-2D, MW-2S, MW-3, MW-7S, and MW-7D), and two wells located behind (west of) the shopping center building (MW-14 and B-102AW Shallow). NAPL was also encountered on the water table in TP-7, located adjacent to Eastchester Creek. These observations confirm the presence of separate-phase product observed at the water table behind (west of) the shopping center building and near Eastchester Creek.

Evidence of DNAPL was observed just above the bedrock surface in boring SB-53 (as a tar-like material) and in SB-36 (as a sheen on the soil). DNAPL was also encountered in monitoring wells MW-7D, MW-13, and MW-102AW. On one occasion during water level monitoring; however, the presence of DNAPL in these wells was not detected during previous or subsequent water level monitoring.

Based on this evaluation of contaminants present at the site and a receptor survey conducted to identify potentially exposed individuals, potentially complete pathways for human exposure to contaminants identified at the site include: volatilization of organic compounds into an enclosed space; volatilization from soil, NAPL, or groundwater during future excavation activities; and direct contact with NAPL, soil or groundwater during future excavation activities. Potential exposure to contaminated soil or groundwater does not present a significant threat to human health to current or future receptors based upon implementation of the following site use limitations:

- Site restricted to commercial and industrial use.
- Prohibition of use as day care, childcare, or medical care uses.
- Construction of any new building with a vapor barrier to prevent sub-slab vapor migration to the enclosed space.
- Prohibition of the installation of water supply wells for potable or non-potable uses.
- Requirement that all future construction activities that require subsurface excavation be

conducted in accordance with NYSDEC/DOH-approved site-specific health and safety, community air monitoring, and SMP. Such plans would specify appropriate air monitoring, personal protective equipment, engineering controls to control dust and volatilization, erosion and sediment controls, security, and soil characterization and disposal requirements.

- Any future development would maintain a cap of impervious material such as asphalt or concrete. In small landscaped areas, at least two feet of clean would be provided as a cover. This would minimize infiltration, volatilization to ambient air, and direct contact with contaminants in soil.
- Limiting recreational access to Eastchester Creek to viewing purposes only; fishing or swimming would be prohibited.

There does not appear to be any significant exposure to potential human receptors, however there may impacts to environmental receptors. Specifically, groundwater contains dissolved phase contaminants above GA standards in all 14 monitoring wells sampled, as well as NAPL being present in eight of the 19 monitoring wells.

A second phase of site investigation is recommended before developing the remedial action work plan to further delineate the hot-spot/NAPL areas in the western portion of the site, to investigate the nature and extent of the contamination beneath the former Kmart building, evaluate the potential for off-site migration of NAPL, and further investigate the eastern section of the site. This site characterization can be accomplished by conducting the following activities:

- Installation of test pits and soil borings to further delineate potential hot-spot removal areas west of former Kmart building in the vicinity of the underground tar separator, along the northwestern portion of site in the vicinity of the brick underground tar tank, and along the southwestern portion of site in the vicinity of the brick storage area.
- Installation of NAPL recovery wells in the western and southwestern portion of the site (along the border with Eastchester Creek and the Getty facility). NAPL recovery tests would be conducted along with measurement of the depth to LNAPL, groundwater, and DNAPL. LNAPL/DNAPL will be removed from recovery/monitoring wells using a bailer, absorbent socks, or other measures to the extent practical.
- Installation of soil borings and monitoring wells in the southwestern portion of the property and between the area immediately west of the main shopping center building and the western and southern property boundaries to further investigate soil contamination and geology. Monitoring wells will be installed at select boring locations to further delineate groundwater quality.
- Installation of soil borings in the vicinity of MW-9, SB-2, and SB-8 to further investigate soil contamination and determine the depth to bedrock in the eastern and northern portions of the site. Monitoring wells will be installed at select boring locations near the southeaster corner of the site to further delineate groundwater contamination.
- Excavation of test pits in the potential source areas near the brick storage area located along in the southwestern property boundary; near the underground tank adjacent to the

Creek in the northwestern portion of the site; and in the vicinity of former oil and tar tanks adjacent to the Creek in the southwestern corner of the site.

- Fluid level monitoring in all on-site monitoring wells to check for the presence of LNAPL and DNAPL.
- A tidal study conducted using pressure transducers in select wells and periodic manual gauging from all wells for a period of 24 hours to ensure collection of data over two full tidal cycles in the adjacent Eastchester Creek.
- While the footprint of the main shopping center building is considered a separate operable unit, additional assessment of the former 350,000 cubic foot relief holder, one million cubic feet gas holder, and purifier house/purifiers is warranted to determine if these structures are present and considered a potential source areas targeted for future remediation. Additional assessment will consist of test pitting within the building to determine the construction and presence of NAPL inside and outside of these structures. An evaluation has been completed to determine that test pitting can be reasonably conducted to a depth of 15 feet bgs, which is below the anticipated depth of groundwater and relief holder bottom.