FORMER UNIFORMS FOR INDUSTRY SITE

QUEENS, NEW YORK

REMEDIAL DESIGN WORK PLAN

NYSDEC Site Number: C-241103

Prepared for:

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TABLE OF CONTENTS
REMEDIAL DESIGN WORK PLAN
FORMER UNIFORMS FOR INDUSTRY SITE

TABLES

FIGURES

ATTACHMENTS

REMEDIAL DESIGN WORK PLAN
FORMER UNIFORMS FOR INDUSTRY SITE

LIST OF ACRONYMS

Acronym	Definition
AMC	AMC Engineering
AWQS	Ambient Water Quality Standards
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CQMP	Construction Quality Management Plan
DUSR	Data Usability Statement Report
EBC	Environmental Business Consultants
FER	Final Engineering Report
HDPE	High Density Polyethylene
IRM	Interim Remedial Measure
NYC	New York City
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PS	Public School
PVC	Polyvinyl Chloride
RAO	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RSCOs	Recommended Site Cleanup Objectives
SCG	Standards, Criteria, and Guidelines
SMMP	Soil/Materials Management Plan
SSDS	Sub-slab Depressurization System
SWPPP	Stormwater Pollution Prevention Plan
SVOCs	Semi-Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

REMEDIAL DESIGN WORK PLAN

1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 INTRODUCTION

This document was prepared as an element of the remedial program at the Uniforms for Industry Site (hereinafter referred to as the "Site") under the New York State (NYS) Brownfield Cleanup Program (BCP) administered by New York State Department of Environmental Conservation (NYSDEC). The site is being remediated in accordance with Brownfield Cleanup Agreement (BCA) Index # C-241103, which was executed on June 17, 2007 and last amended on December 7, 2009.

1.1.1 General

Union Jamaica LLC entered into a BCA with the NYSDEC to remediate a 1.72 acre property located in Richmond Hill, Queens, New York. This BCA required the Remedial Party, Union Jamaica LLC to investigate and remediate contaminated media at the site. A figure showing the site location and boundaries of this 1.72-acre "site" is provided in **Figure 1**. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Environmental Easement.

The Remedial program approved for the Site, as specified in the UFI Decision Document completed by the NYSDEC in January 2011, includes the excavation and off-site disposal of contaminated soils to a depth of 15 feet, chemical oxidant treatment of residual contamination in soil and groundwater at the water table, installation and operation of a subslab depressurization system (SSDS) and capping of the site.

This Remedial Design Work Plan (RDWP) was prepared to provide design specifics of the chemical oxidant treatment program to be implemented at the Site. This RDWP was prepared by Environmental Business Consultants, on behalf of Union Jamaica LLC, in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010.

1.2 SITE BACKGROUND

1.2.1 Site Location and Description

The Site is located in the County of the Queens, New York, and is identified as Block 9281, and Lot 44 on the Queens Borough Tax Map (see **Figure 1** - Location Map). The Site is situated on an approximate 75,230 square foot (1.72-acre) area bounded by residential properties and 127th Street to the west, a residential lot to the north, Jamaica Avenue to the south and the Long Island Railroad-Ronkonkoma Line to the east (**Figure 2**).

1.2.2 Site History

Sanborn Maps dating back to 1901 show the property to be developed with a 2-story residential building in the south-central portion of the site. By 1911, three 1-story commercial buildings are shown in the western area of the property and are labeled as stores. The 1925 map shows the addition of two 1-story and one 2-story residential buildings in the southeastern portion of the site. In 1929, the main building was constructed in the central portion of the site and operated as a commercial laundry. By 1942, only the 2-story residence remains. A small 1-story building labeled as a store is now present east of the residence and a larger 1-story building labeled "auto collision" is shown north of the residences. Four gasoline tanks are shown near the store in the southeast corner of the property.

According to the Phase I prepared by GCE (10/04), UFI has occupied the Site since at least 1957. By 1963, the 2-story residential building is being utilized as a filling station. By 1981, the filling station building is labeled as an office building. The auto collision building, 2-story office building, and the commercial laundry building remain unchanged through 1988. In the 1990 map the auto collision building and office building are gone and a large addition is added to the laundry building in the southeast area of the site. According to the GCE Phase I, UFI ceased operations at the Site in 2002.

Previous environmental reports indicate that fuel oil, mop oil, mineral spirits, Stoddard solvent, and Varsol solvent have been historically stored on the Site. According to the Remedial Investigation Report prepared by Environmental Liability Management, LLC (12/09), UFI used tetrachloroethene (PCE) in a dry cleaning machine from 1992 and 1997.

According to the NYSDEC Spills Database, two spill numbers are associated with the Site. Spill No. 91-01477 (reported on May 6, 1991), was related to the tank test failure of a 3,000 gallon underground storage tank. The database indicates that the spill was closed on March 7, 2003, as a result of no new information. The spill file references a second spill, No. 02-08119. The second spill is related to a tank test failure of a 6,000 gallon fuel oil underground storage tank. Contaminated soil was later discovered around the fill lines of a mineral oil underground storage tank and a diesel underground storage tank. This spill remains open.

1.2.3 Geologic Conditions

Based upon the results of previous investigations conducted at the site and upon recent soil borings advanced at the site for geotechnical analysis and during the Supplemental Investigation, subsurface materials at the site are as follows:

Historic fill materials in the upper 6 inches to 2 feet of the soil column. Historic fill contains fragments of asphalt, brick and wood, with some ash materials in a silty-sand matrix.

Non-native backfill materials to a depth of 15 feet within the former UST area in the western parking area and to a depth of 20 feet within the former UST area in the east central part of the Site. Non-native backfill consists of poorly sorted sand and silt with fine gravel and small to large cobbles. Native soils are present directly beneath the historic fill layer. Native soils are composed of fine to coarse sand with varying amounts of fine to coarse gravel and cobbles. According to the RIR, cobbles and boulders appear to be more commonly encountered between 19 and 25 feet below the surface.

The RIR also describes soils below approximately 42 to 45 feet as fine to coarse sand, with small amounts of fine gravel present to approximately 50 feet. These sands generally become finer and better sorted with depth, and extend to a depth of approximately 115 feet. The RIR reports a clay layer from 115 to at least 120 feet.

Groundwater at the Site is present at a depth of 38 to 40 feet below the surface and generally flows in a southwesterly direction. A groundwater flow figure is shown in **Figure 3**.

1.3 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

A Remedial Investigation (RI) was performed to characterize the nature and extent of contamination at the site. The Remedial Investigation (RI) of the Site was performed by Environmental Liability Management, LLC (ELM) on behalf of the former property owner, UFI. The field work portion of the RI was performed from November 2008 through February, 2009. ELM documented the results of the RI in a Remedial Investigation Report (RIR) dated April 16, 2010 (revised August 13, 2010). The RIR was accepted and approved by the NYSDEC in a letter dated August 30, 2010.

Summary tables of contamination remaining in soil and groundwater above clean up objectives are provided in **Tables 1** and **2**.

1.3.1 Soil

The soil boring program did not identify primary (PCE and TCE) compounds of concern (COCs) in vadose zone or saturated zone soils above Part 375 Restricted Residential Soil Cleanup Objectives (RRSCOs) during the investigation. Primary COCs were detected in vadose zone above unrestricted objectives in a single boring (B13) at a depth of 18 feet below surface. Primary COCs were not detected in saturated soils during the investigation.

Secondary (petroleum-VOC) Petroleum VOCs were detected above Restricted Residential SCOs in saturated zone soils in the former north-central UST area and in the northeastern portions of the site. The VOCs detected above RRSCOs were limited to 1,2,4-Trimethylbenzene in three borings (B13, B15, B19) within the former UST area and 1,2,4-Trimethylbenzene and 1,3,5-Trimethylbenzene in one boring (B16) in the vicinity of the former DW4 drywell in the northern part of the Site.

1.3.2 Groundwater

The sampling of existing monitoring wells identified groundwater VOC concentrations in both on-site and off-site wells above NYSDEC Technical and Operational Guidance Series Ambient Water Quality Standards for groundwater (AWQS). Two of the on-site wells, MW8 and MW11, contained liquid phase hydrocarbons (LPH) at the time of the sampling event and, as such, groundwater samples were not obtained from these locations. Primary COCs were detected above standards in all 10 of the wells sampled. Total primary COC concentrations ranged from 9 µg/L in MW7 in the northern corner of the

site to 1,474 µg/L in MW1 within the former central UST area. Secondary COCs were reported above standards in 7 of the 10 wells sampled with total concentrations ranging from 12 µg/L in MW4 near the southwest property line to 2,381 µg/L in MW1.

Secondary COCs above standards were also reported in the temporary vertical profile borings at a depth of 67 feet in the northeastern area of the site, with concentrations dropping vertically with depth, yet still exceeding standards at a depth of 78 feet.

1.3.3 Soil Vapor

The soil vapor sampling program included the collection of 4 sub-slab samples within the building and 8 soil gas samples collected around the building exterior within the east and west parking areas and near the north loading dock area. Sub-slab samples were collected directly beneath the slab while exterior soil gas samples were collected from implants installed to a depth of 5 feet below the surface. Chlorinated VOCs (CVOCs) were detected in all 4 subslab samples and in all 8 soil gas samples. Petroleum VOCs (PVOCs) were not detected in any of the samples. CVOC concentrations ranged from 115.9 in the southwest corner of the property to a high of 5,290,000 in the vicinity of the former central area USTs. Elevated CVOC concentrations were also reported in the vicinity of the drainage structures in the eastern parking area, beneath the building slab in the southeastern corner of the building, and in the northern corner of the site.

1.3.4 Underground Storage Tanks

The property is identified in the NYSDEC Petroleum Bulk Storage database as Facility Site No. 2-248541. The facility status is listed as unregulated. The database lists thirteen tanks registered for the Uniforms for Industry facility. The tanks listed include: two 6,300 gallon underground storage tank (UST) (one fuel oil, one "other"), one 7,500 gallon UST (fuel oil), three 2,000 gallon UST ("other"), three 3,000 gallon USTs (2 "other", 1 "invalid material"), one 6,000 gallon UST ("empty") and three 1,500 gallon USTs ("empty"). Eleven of the thirteen tanks are listed as closed - removed. Two of the 3,000 gallon tanks are listed as "closed prior to 3/1991".

1.4 SUMMARY OF REMEDIAL PROGRAM

The Site is subject to remediation in accordance with the remedy selected by the NYSDEC in the RAWP dated December 2010 and RAWP amendment dated January 26, 2011.

The factors considered during the selection of the remedy are those listed in 6NYCRR 375-1.8. The following are the components of the selected remedy:

1. Excavation of the upper 15 to 20 ft of soil exceeding Restricted Residential SCOs in three identified CVOC hot-spot areas.
2. Additional horizontal excavation of the three identified CVOC hot-spot areas to remove all PVOC/CVOC impacted soil above Restricted Residential SCOs in the upper 15 ft of the soil column. Additional excavation of CVOC impacted soil below Restricted Residential SCOs to reduce CVOC's in soil gas. Segregation and classification for off-Site disposal of residual petroleum, PVOC or CVOC affected soil encountered during excavation of the basement areas.
3. Additional excavation if post-excavation soil sampling demonstrates that Restricted Residential SCOs have not been met.
4. Excavation and off-Site disposal of historic fill materials above Restricted Residential SCOs within the top 2 feet of soil, if removed during construction excavation/site grading or if present in planned landscaped/exposed soil areas.
5. Screening for indications of contamination (by visual means, odor, and monitoring with PID) of all excavated soil during all intrusive Site work.
6. Site Monitoring of airborne VOCs and particulates in accordance with a NYSDEC and NYSDOH approved CAMP and HASP during all intrusive and soil handling activities.
7. Implementation of proper dust and odor suppression techniques during all intrusive and soil handling activities. Appropriate off-Site disposal of all material removed from the Site in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal.
8. Import of materials to be used for backfill and cover in compliance with: (1) the Sub-part 375-6.7(d), (2) all Federal, State and local rules and regulations for handling and transport of material.

9. Collection and analysis of confirmation soil samples to evaluate the performance of the remedy with respect to attainment of Restricted Residential SCOs .
10. Investigation and removal of drainage structures, surface drains and related piping and proper closure in accordance with the USEPA UIC regulations.
11. The injection of a chemical oxidant solution to remediate the contaminated groundwater beneath the Site. Chemical oxidants will be injected through pvc injection points installed into the water table. Oxidant injection wells to be registered with the USEPA.
12. The collection and analysis of additional information as needed to finalize the design of the chemical oxidant injection program.
13. Installation of a vapor barrier and SSDS beneath all basement areas which will not be required to have continuous mechanical ventilation.
14. Post-remediation groundwater monitoring for a minimum of two years.
15. Post-remediation evaluation of potential soil vapor intrusion concerns.
16. Recording of an Environmental Easement, including Institutional Controls, to prevent future exposure to any residual contamination remaining at the Site.
17. Publication of a Site Management Plan for long term management of residual contamination as required by the Environmental Easement, including plans for: (1) Institutional and Engineering Controls, (2) monitoring, (3) operation and maintenance and (4) reporting.
18. All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable Federal, State and local rules and regulations.
19. Remedial activities to be performed at the Site in accordance with this NYSDEC-approved RAWP.

Remedial activities including the excavation and removal of drainage structures, underground storage tanks, hot-spot areas and historic fill were completed at the site in October 2011. Installation of the vapor barrier and venting system was completed in November 2012. Installation of the monitoring network and chemical oxidant injection points will be completed in December 2012. Oxidant injections and groundwater monitoring are expected to continue for a two year period.

2.0 DESIGN SCOPE

2.1 IN-SITU CHEMICAL OXIDANT INJECTION PROGRAM OVERVIEW

The remedial plan for the Site includes the injection of a chemical oxidant solution to address affected groundwater and residual petroleum VOC contamination in soil at the water table. Chemical oxidant injection is intended to significantly reduce the CVOCs and PVOCs in the high concentration areas, and thereby accelerate improvements in groundwater quality. The area of injection is within, and upgradient of, the former central UST area which was the primary source of PVOC contamination at the Site. Injections at this location will deliver oxidant through residual soil contamination in this area, allowing it to flow southwest with groundwater treating both the CVOC and PVOC plume. A second injection area is located approximately 150 ft southwest of the central tank area and is designed to treat the downgradient portion of the plume. Both injection areas are located outside of the new buildings allowing injections to proceed during and after building construction as necessary.

The oxidant selected for this project is high pH-activated sodium persulfate. Sodium persulfate is a robust oxidant which has a long residence time (anion lifetime) in the subsurface. Persulfate activation through high pH provides fast contaminant reaction kinetics capable of destroying a wide range of organics including the PVOCs and CVOCs present at the Site.

Sodium persulfate will be delivered to the site as a dry powder which will be mixed with water on-site to provide a 20% solution. Sodium hydroxide (NaOH) will be delivered to the site as a 25% solution and added to the persulfate solution at a rate of 0.4 gallons of 25% NaOH solution per gallon of 20% persulfate solution.

The initial injection consisted of approximately 100 gallons of activated persulfate solution per injection point. The need for subsequent injections and the number and location of injection points to be utilized for subsequent injections will be determined following the collection and analysis of performance monitoring samples.

Chemical oxidant treatment will continue as needed to achieve further significant reduction of VOCs in groundwater at the site. The decision to perform subsequent oxidant applications will be based on performance sampling results and will be made in concurrence with the NYSDEC project manager.

2.2 INJECTION WELL SPECIFICATIONS

Twenty-two injection points will be installed upgradient of the primary source areas and in the downgradient plume area as shown on **Figure 4.** Injection points will be constructed of 2-inch diameter schedule 40 pvc with a 10 ft, 0.050-inch slot screened section installed 8 ft below the water table, and 2 ft above the water table. A No. 2 morie gravel back will be placed around the screen to a depth of approximately 1 ft above the screen followed by a 1 ft hydrated bentonite pellet seal. The injection wells were then finished at grade with an 8-inch bolt down manhole to protect the wells.

2.3 CHEMICAL OXIDANT DEMAND CALCULATIONS

The overall oxidant demand, in pounds of activated persulfate, needed to complete the remediation of the Site, requires an estimate of contaminant mass in soil and groundwater. The estimate of contaminant mass for each VOC parameter in groundwater prior was performed by dividing the site into 5 groundwater zones and assigning an average concentration for each parameter within that zone. The total contaminant mass for each parameter was then calculated by multiplying the area of the zone by the depth of impact, porosity and stoichiometric demand. The total contaminant demand to remediate the VOCs in groundwater was calculated at 501.66 pounds of activated persulfate.

The contaminant demand for soil was calculated by multiplying average concentrations for each parameter within the identified source area, the volume of soil impacted with residual contamination and the soil density. The total contaminant demand to remediate the VOCs in soil was calculated at 68,141.54 pounds of activated persulfate. Total combined contaminant demand for soil and groundwater at the site is estimated at 68,643.20 pounds of activated persulfate.

2.4 PERFORMANCE MONITORING

Quarterly monitoring of the performance of the chemical oxidant treatment program through groundwater sampling will be conducted while chemical oxidant treatment continues and for up to eight additional quarters after the treatment program has been completed. The frequency thereafter will be determined by NYSDEC.

Groundwater monitoring will be performed on a periodic basis to assess the performance of the remedy. The network of monitoring wells has been installed to monitor both up-gradient and down-gradient groundwater conditions at the site. The network of on-site wells has been designed based on the following criteria:

- The pattern of groundwater flow from the northeast area of the site to the southwest. (See **Figure 5**);
- Provide downgradient coverage of the chemical injection well network;
- Provide downgradient coverage of the former location of identified source areas (i.e. central USY and hotspot areas);
- The concentration distribution of VOCs in groundwater across the site; and
- To provide coverage of upgradient areas, downgradient areas and former source areas as previously defined.

The monitoring well network consists of nine wells including three upgradient wells located along the northeast property line, four interior area wells downgradient of the source area to monitor the performance of the chemical injections and two wells located at the downgradient property line along Jamaica avenue and 129th Street.

All monitoring wells will be constructed of 2-inch pvc with a 15-foot 0.010 screened section set with approximately 5 feet above and 10 feet below the water table. A No. 00 morie gravel pack was placed around the screen to a depth of approximately 1 foot above the screen followed by a 1 foot hydrated bentonite pellet seal. The wells are completed at the surface with a locking compression-style cap and an 8-inch bolt down manhole cover.

Groundwater samples will be collected from the nine monitoring wells on a quarterly basis. Changes in the sampling frequency or number and location of wells included in the program will not be made without written approval from NYSDEC.

Sampling Protocol

All well sampling activities will be recorded in a field book and a groundwater-sampling log. Other observations (e.g., well integrity, etc.) will be noted on the well sampling log. The well sampling log will serve as the inspection form for the groundwater monitoring well network.

This should include a description of:

- Well gauging;
- Well purging;
- Sampling methodology;
- Analytical methodology:
    - Lab certification;
    - Analytical methods;
    - Analytes.

Groundwater samples will be collected using a peristaltic pump or check valve and oscillation method and dedicated polyethylene tubing in accordance with the following:

- Record pump make & model on sampling form.
- Wear appropriate health and safety equipment as outlined in the Health and Safety Plan
- Inspect each well for any damage or evidence of tampering and note condition in field logbook.
- Remove the well cap.
- Lay out plastic sheeting and place the monitoring, purging and sampling equipment on the sheeting.
- To avoid cross-contamination, do not let any downhole equipment touch the ground.
- Measure well headspace with a PID or FID and record the reading in the field logbook.
- A synoptic water level measurement round should be performed (in the shortest possible time)

before any purging and sampling activities begin. Measure and record the depth to water using a water level meter or interface probe to the nearest 0.01 ft. Record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or soil boring logs.

- Collect samples in order from wells with lowest contaminant concentration to highest concentration.
- Fit the polyethylene tubing with a check valve, connect the tubing to the peristaltic pump and lower the tubing into the well to approximately the middle of the screen. Tubing should be a minimum of 2 feet above the bottom of the well as this may cause mobilization of any sediment present in the bottom of the well.
- Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.
- There should be at least 1 foot of water over the end of the tubing so there is no risk of entrapment of air in the sample. Pumping rates should, if needed, and reduced to the minimum capabilities of the pump to avoid purging the well dry. However, if the recharge rate of the well is very low and the well is purged dry, then wait until the well has recharged to a sufficient level and collect the appropriate volume of sample. During well purging, monitor indicator field parameters (turbidity, temperature and pH) every three to five minutes until the parameters stabilize.
- VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.
- Use pre-preserved 40 ml glass vials and non-acidified 100 ml nalgene bottles as provided by the contract laboratory. Fill the VOA vials first, and then fill the remaining containers for persulfate and ferrous iron analysis. Fill each container with sample to just overflowing so that no air bubbles are entrapped inside. Fill all sample bottles by allowing the pump discharge to flow gently down the inside of the bottle with minimal turbulence. Cap each bottle as it is filled.

- Label the samples, and record them on the chain of custody form. Place immediately into a cooler for shipment and maintain at 4^{o}C.
- Remove the tubing from the well. The polyethylene tubing must either be dedicated to each well or discarded. If dedicated the tubing should be placed in a large plastic garbage bag, sealed, and labeled with the appropriate well identification number.
- Close and lock the well.
- Decontaminate pump either by changing the surgical pump tubing between wells or as follows:
    - Flush the equipment/pump with potable water.
    - Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.
    - Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.
    - Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.
    - Flush with distilled/deionized water. The final water rinse must not be recycled.

Samples will be collected in pre-cleaned laboratory supplied glassware, stored in a cooler with ice and submitted to Phoenix Environmental Laboratories, Inc., a New York State ELAP certified environmental laboratory (NY Lab ID # 11.01). All purging and sampling data will be recorded on dedicated well sampling forms.

2.4.1 Monitoring Quality Assurance/Quality Control

All sampling and analyses will be performed in accordance with the requirements of the Quality Assurance Project Plan (QAPP) prepared for the site. Main Components of the QAPP include:

- QA/QC Objectives for Data Measurement;
- Sampling Program:
    - Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.
    - Sample holding times will be in accordance with the NYSDEC ASP requirements.

  - Field QC samples (e.g., trip blanks, coded field duplicates, and matrix spike/matrix spike duplicates) will be collected as necessary.
- Sample Tracking and Custody;
- Calibration Procedures:
  - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
  - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.
- Analytical Procedures;
- Preparation of a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.
- Internal QC and Checks;
- QA Performance and System Audits;
- Preventative Maintenance Procedures and Schedules;
- Corrective Action Measures.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or “cold-paks” to maintain a temperature of 4oC.

Dedicated disposable sampling materials will be used for both soil and groundwater samples, eliminating the need to prepare field equipment (rinsate) blanks. However, if non-disposable equipment is used, (stainless steel scoop, etc.) field rinsate blanks will be prepared at the rate of 1 for every eight samples collected.

Decontamination of non-dedicated sampling equipment will consist of the following:

  - Flush the equipment/pump with potable water.

- Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.
- Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.
- Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.
- Flush with distilled/deionized water. The final water rinse must not be recycled.

Field blanks, if used, will be prepared by poring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers. Trip blanks will accompany samples each time they are transported to the laboratory. Matrix spike and matrix spike duplicates (MS/MSD) will be collected at the rate of one per 20 samples submitted to the laboratory. Laboratory reports will be upgradeable to ASP category B deliverables for use in the preparation of a data usability report (DUSR). In accordance with DER-10, the final round of confirmatory (post remediation) samples will include Category B laboratory data deliverables and a Data Usability Summary Report will be prepared by a party independent from the laboratory performing the analysis.

Monitoring Reporting Requirements

Forms and any other information generated during regular monitoring events and inspections will be kept on file on-site. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be (1) subject to approval by NYSDEC and (2) submitted at the time of the Periodic Review Report, as specified in the Reporting Plan of this SMP.

All monitoring results will be reported to NYSDEC on a periodic basis in the Periodic Review Report. A letter report will also be prepared subsequent to each quarterly groundwater sampling sampling event.

The report (or letter) will include, at a minimum:

- Date of event;
- Personnel conducting sampling;

- Description of the activities performed;
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (o be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether groundwater conditions have changed since the last reporting event.

3.0 PERMITS / AUTHORIZATION

Remediation injection points for chemical oxidation are considered Class V UIC wells and are regulated through the USEPA UIC program. EPA will be notified of the construction of the injection trench by filing form OMB No. 2040-0042 with the Region 1 USEPA office prior to performing any oxidant injection into oxidant injection wells.

4.0 SCHEDULE

The chemical oxidant injection program is anticipated to begin on December 29th. Injection well installation began the week of December 10th, 2012 and will continue for 1-2 weeks. Oxidant injections will begin immediately after well installation. The estimated duration of the chemical oxidant program is 2 years. The anticipated schedule of milestone events is as follows:

Schedule Milestone	Estimated Completion Date
Submittal of RDD	November 26, 2012
Begin Installation of Chemical Inj. Wells	Week of December 10, 2012
Complete Installation Chemical Inj. Wells	Week of December 24, 2012
Begin Oxidant Injections	Week of December 24, 2012

TABLES

TABLE 1
Former Uniforms For Industry Site
129-09 Jamaica Avenue, Richmond Hill, NY
Contamination Remaining in Soil Above Unrestricted / Restricted Residential Soil Cleanup Objectives

Vertex and GCE Samples

COMPOUND	Track 1 Unrestricted Cleanup Objectives	Restricted Residential Cleanup Objectives	Mop Oil Room (30-32FT)	Filter Room (32-34FT)	MW1 (30-31.5FT)	MW1 (45FT)	B1 (30 32FT)	B2 (35 37FT)
Sample Results in µg/kg	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*
1,2,4-trimethylbenzene	3,600	52,000	ND	ND	**10,000**	**2,600**	**4,800**	**83,000**
1,3,5-trimethylbenzene	8,400	52,000	ND	ND	ND	ND	ND	**21,000**
Acetone	50	100,000	ND	ND	**460**	**470**	**290**	**7,600**
Cis-DCE	250	59,000	ND	ND	ND	ND	ND	ND
Ethylbenzene	1,000	41,000	**1,460**	**1,560**	ND	ND	ND	**3,600**
m/p-Xylenes	260	100,000	**2,750**	**9,190**	ND	ND	**470**	**11,000**
Napthalene	12,000	NS	ND	ND	ND	ND	ND	ND
n-butylbenzene	3,900	100,000	ND	**8,010**	ND	ND	ND	**14,000**
n-propylbenzene	12,000	100,000	ND	ND	ND	ND	ND	ND
o-Xylene	260	100,000	**2,270**	ND	ND	ND	**310**	**8,300**
sec-butylbenzene	11,000	100,000	ND	ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	1,300	19,000	ND	ND	ND	ND	ND	ND
Toluene	700	100,000	ND	ND	ND	ND	ND	ND
4,4-DDD	3.3	13,000.0	ND	ND	ND	ND	ND	ND

BOLD Exceedence of Track 1 Unrestricted Residential Cleanup Objective
BOLD Exceedence of Restricted Residential Cleanup Objective

ELM Samples

COMPOUND	Track 1 Unrestricted Cleanup Objectives	Restricted Residential Cleanup Objectives	B13 (18 ft)	B13 (42 ft)	B13 (63 ft)	B15 (38 ft)	B15 (52.5 ft)	B15 (67.5 ft)	B16 (52.5 ft)	B19 (44 ft)	B19 (64.5 ft)	B19 (74 ft)
Sample Results in µg/kg	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*
1,2,4-trimethylbenzene	3,600	52,000	**4,600**	**140,000**	**52,000**	**8,900**	**140,000**	**26,000**	**170,000**	**110,000**	**7,500**	ND
1,3,5-trimethylbenzene	8,400	52,000	ND	**53,000**	ND	ND	**46,000**	ND	**56,000**	**34,000**	ND	ND
Acetone	50	100,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-DCE	250	59,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1,000	41,000	ND	ND	ND	ND	ND	ND	ND	**13,000**	**6,700**	**2,000**
m/p-Xylenes	260	100,000	ND	**13,000**	**1,200**	ND	**2,100**	ND	ND	**20,000**	ND	ND
Napthalene	12,000	NS	ND	**17,000**		ND	**1,300**	ND	ND	**48,000**	**19,000**	**19,000**
n-butylbenzene	3,900	100,000	ND	**28,000**	**22,000**	ND	**41,000**	**11,000**	**54,000**	**27,000**	**11,000**	**5,600**
n-propylbenzene	12,000	100,000	ND	**17,000**	ND	ND	**19,000**	ND	**25,000**	ND	ND	ND
o-Xylene	260	100,000	ND	ND	ND	ND	ND	ND	ND	**8,700**	ND	ND
sec-butylbenzene	11,000	100,000	ND	**13,000**	**11,000**	ND	**19,000**	ND	**29,000**	**24,000**	ND	ND
Tetrachloroethylene (PCE)	1,300	19,000	**6,300**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	700	100,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4-DDD	3.3	13,000.0	ND	ND	**4.9**	**17**	**7.5**	ND	ND	ND	ND	ND

BOLD Exceedence of Track 1 Unrestricted Residential Cleanup Objective
BOLD Exceedence of Restricted Residential Cleanup Objective

EBC Samples Supplemental Investigation 9/2010 and Endpoint Samples 9/20:

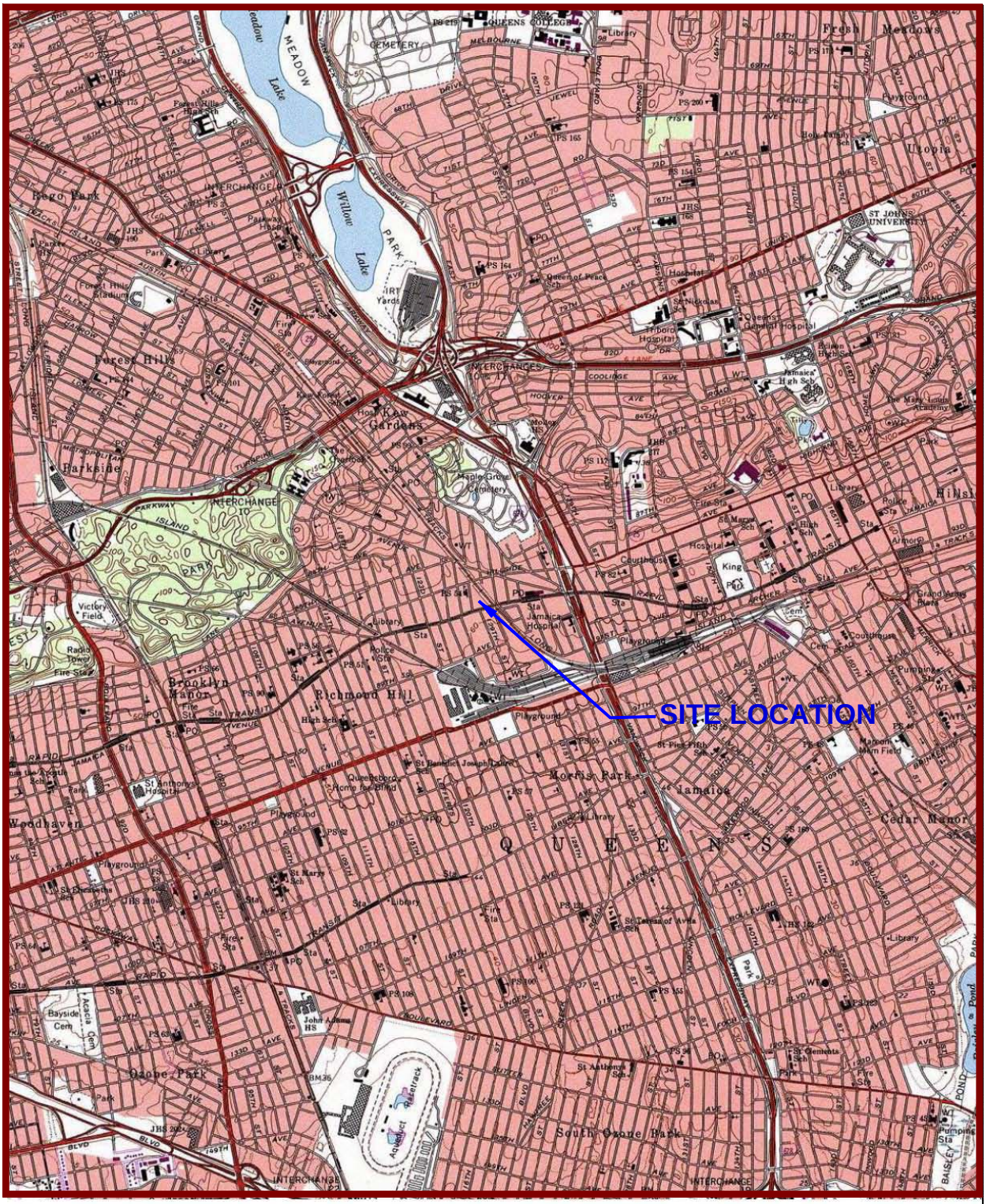
COMPOUND	Track 1 Unrestricted Cleanup Objectives	Restricted Residential Cleanup Objectives	10B-02 (15-20 ft)	10B-03 (15-20 ft)	Hotspot 5 Bottom Endpoint (18 ft)
Sample Results in µg/kg	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*
1,2,4-trimethylbenzene	3,600	52,000	**7,600**	**8,200**	ND
1,3,5-trimethylbenzene	8,400	52,000	ND	ND	ND
Acetone	50	100,000	ND	ND	ND
Cis-DCE	250	59,000	ND	ND	ND
Ethylbenzene	1,000	41,000	ND	ND	ND
m/p-Xylenes	260	100,000	**430**	**330**	ND
Napthalene	12,000	NS	ND	ND	ND
n-butylbenzene	3,900	100,000	ND	ND	ND
n-propylbenzene	12,000	100,000	ND	ND	ND
o-Xylene	260	100,000	**460**	**370**	ND
sec-butylbenzene	11,000	100,000	ND	ND	ND
Tetrachloroethylene (PCE)	1,300	19,000	ND	ND	**25,000**
Toluene	700	100,000	ND	ND	ND
Trichloroethene (TCE)	470	21,000	ND	ND	ND
4,4-DDD	3.3	13,000	ND	ND	ND

BOLD Exceedence of Track 1 Unrestricted Residential Cleanup Objective
BOLD Exceedence of Restricted Residential Cleanup Objective

TABLE 2
Former Uniforms for Industry Site
129-09 Jamaica Avenue, Richmond Hill, NY
Groundwater Contamination Above Standards

Parameter	NYSDEC Ambient Water Quality Standards	MW1	MW1	MW3	MW4	MW4	MW5	MW6
ug/L	*ug/L*	9/20/2010	11/30/2010	9/20/2010	9/20/2010	11/30/2010	9/20/2010	9/20/2010
1,2,4-trimethylbenzene	5	1900	1900				5.1	
1,3,5-trimethylbenzene	5	530	530					
1-1 Dichloroethene	5							
2-Butanone	50							
2-Hexanone	50							
4-Isopropyltoluene	-							
4-Methyl 2-Pentanone								
Acetone	50							
Benzene	1							
Chloroethane	5							
Cis 1-2 DCE	5	1400	93		140	93	210	76
Ethylbenzene	5	62						
Isopropylbenzene	5	64						
m/p - xylene	5							
Methylene Chloride	5	6.1	5.3			5.3		
MTBE	10							
Napthalene	5	250						
n-butylbenzene	5	120						
n-propylbenzene	5	140						
o-xylenes	5							
p-diethylbenzene								
p-ethyltoluene								
p-isopropyltoluene		90	7.7					
sec-butylbenzene		74			7.4	7.7		
tert-butylbenzene			11					
tetrachloroethene	5			6.4	19	11	32	100
toluene	5	45						
Trans 1-2 DCE	5							
trichloroethene	5		21		5.7		24	7.6
vinyl chloride	2	74	74		7.6	21	12	11
Xylenes (total)		410	410					

FIGURES



USGS Jamaica Quadrangle 1994, Contour Interval = 10 feet

0 .5 1 MILES

1000 0 1000 2000 3000 4000 5000 FEET

1 .5 0 KILOMETERS 1

1000 0 METERS 1000

MN
13°
10/19/10

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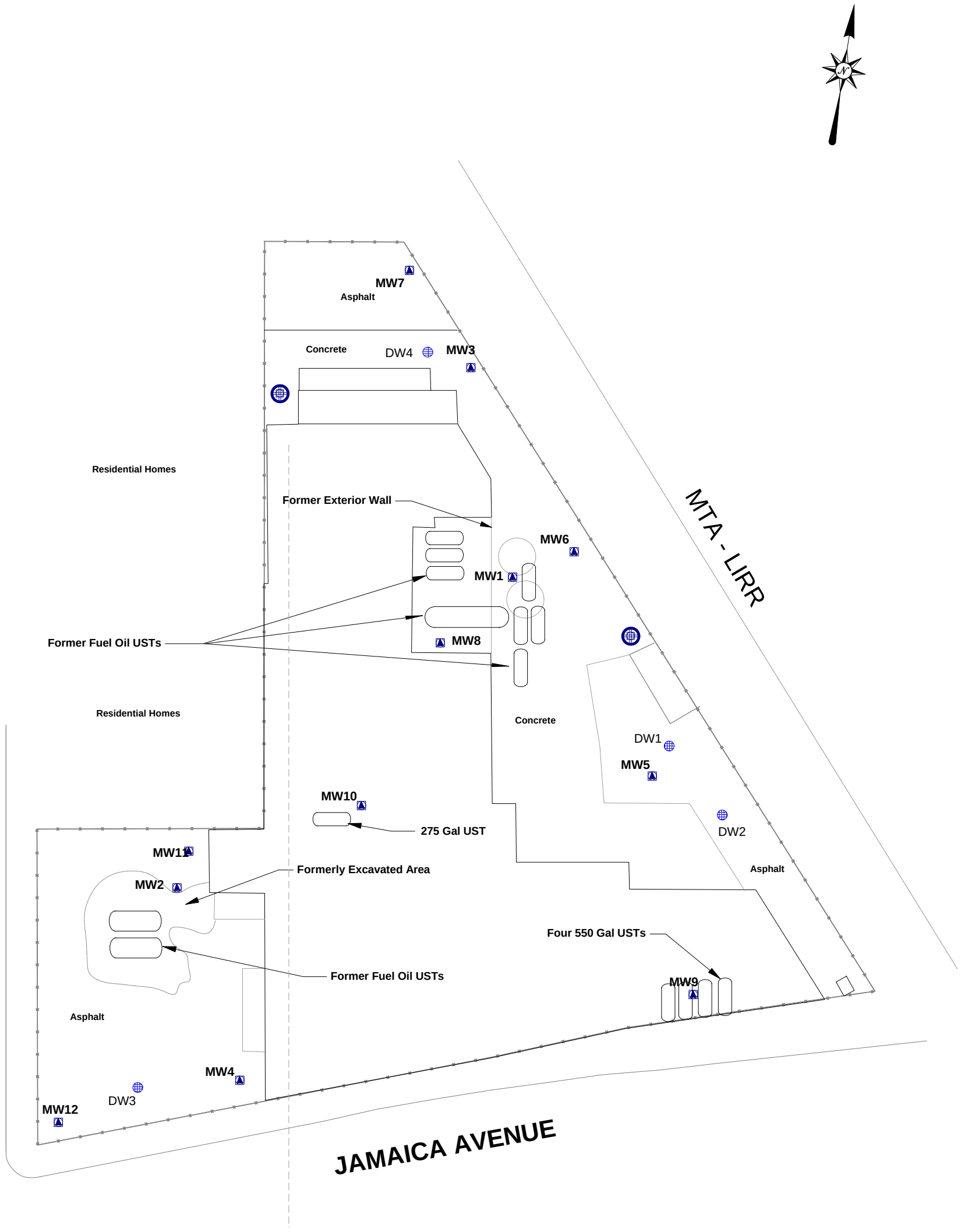
FORMER UNIFORMS FOR INDUSTRY SITE

129-09 JAMAICA AVENUE, RICHMOND HILL, NY

FIGURE 1 SITE LOCATION MAP



KEY:

MWX Monitoring Well

Surface Drain Drywell

Water Supply Well

0 25 50 100

1 Inch = 50 feet

Notes:

The locations of DW4, MW6, MW9 and MW10 not field verified

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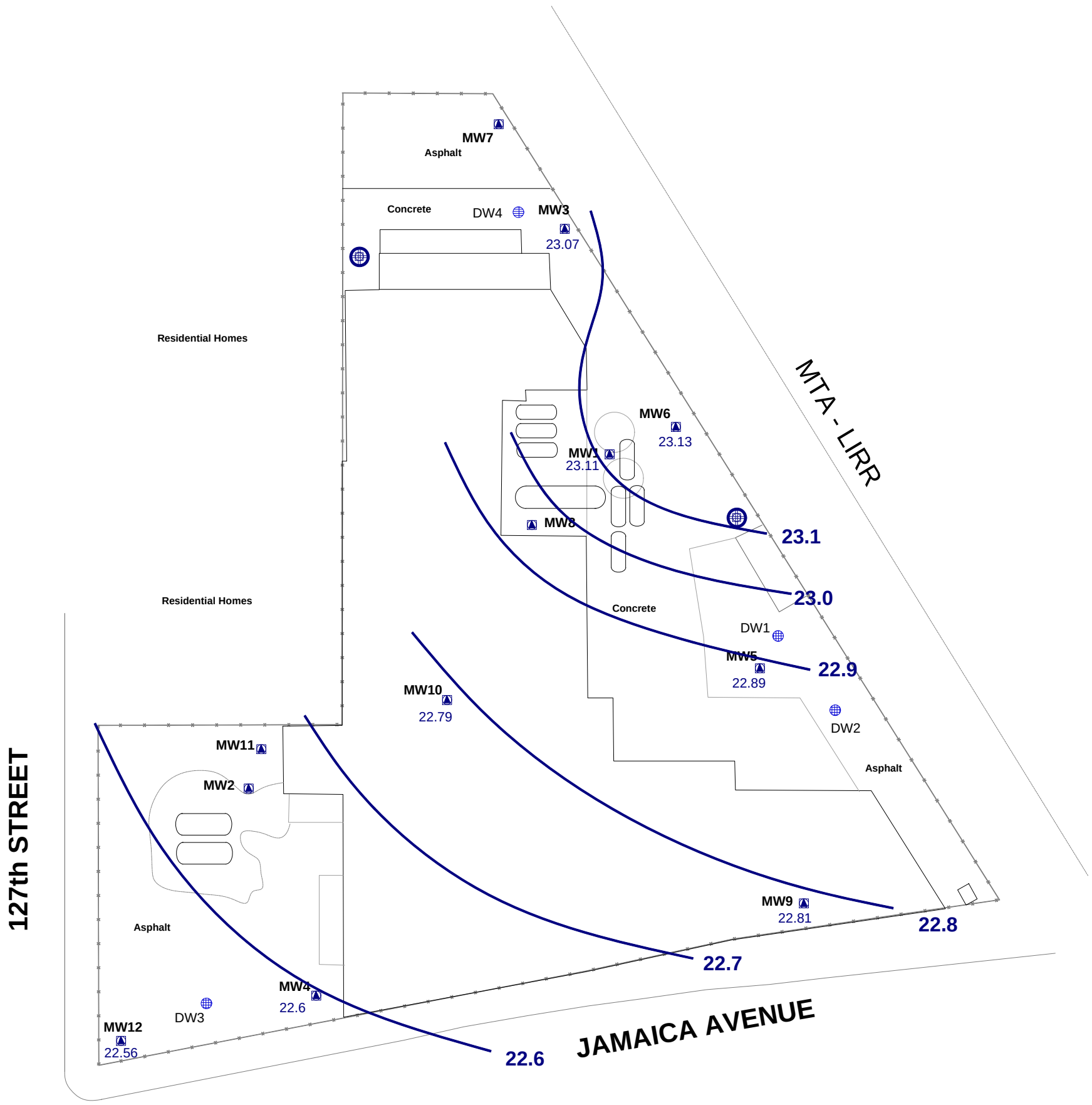
Figure No. **2**

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE

Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY

Drawing Title: SITE PLAN



KEY:

MWX Monitoring Well

Surface Drain Drywell

Water Supply Well

0 25 50 100

1 Inch = 50 feet

Notes:

The locations of DW4, MW6, MW9 and MW10 not field verified

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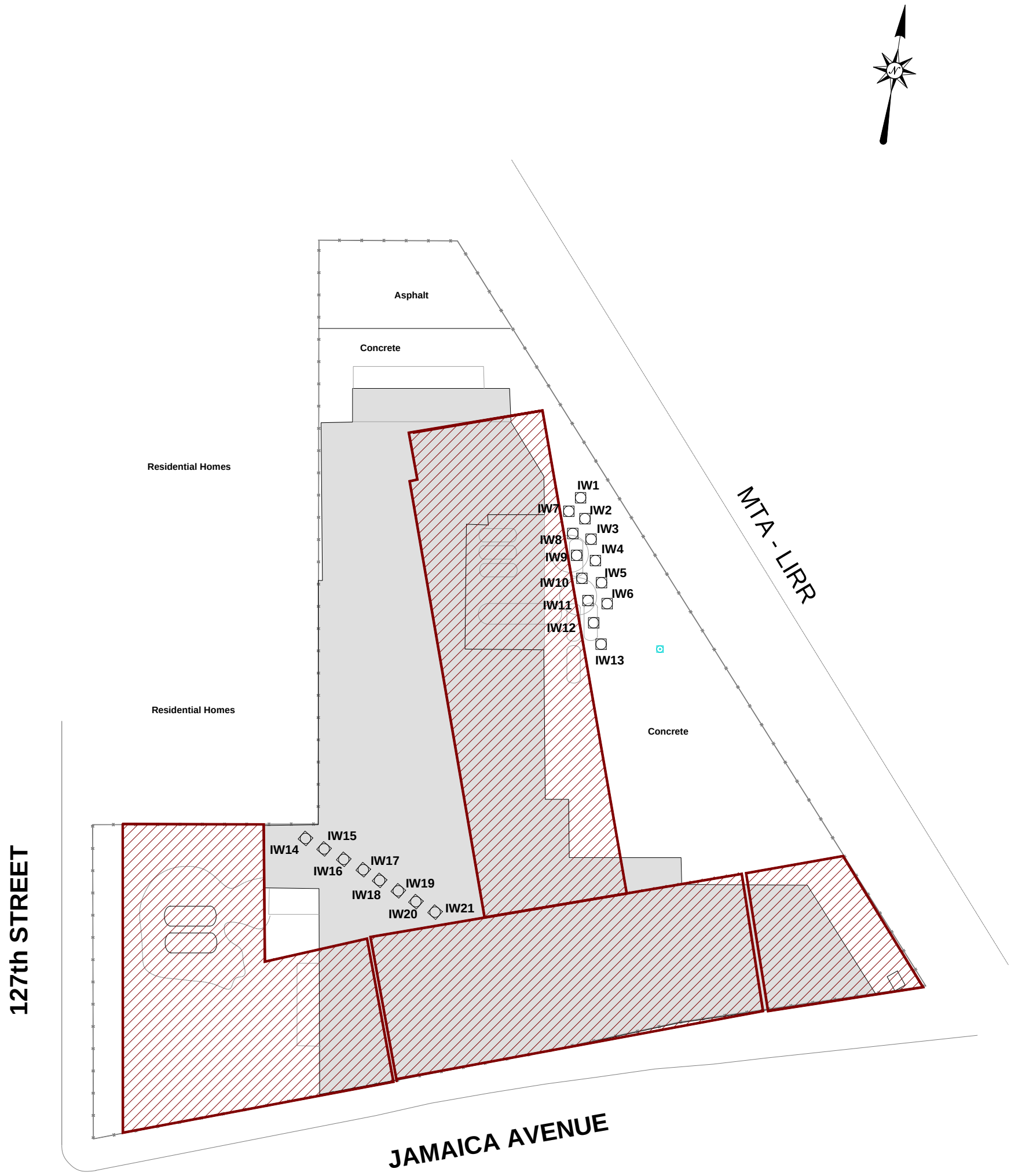
Figure No. **3**

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE

Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY

Drawing Title: GROUNDWATER ELEVATION (5/21/09)



KEY:

IWx ○ Chemical Oxidant Injection Well

0 25 50 100

1 Inch = 50 feet

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Figure No. **4**

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE

Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY

Drawing Title: CHEMICAL OXIDANT INJECTION WELL LOCATIONS

KEY:

MW12xx
Monitoring Well Locations

0 25 50 100

1 Inch = 50 feet

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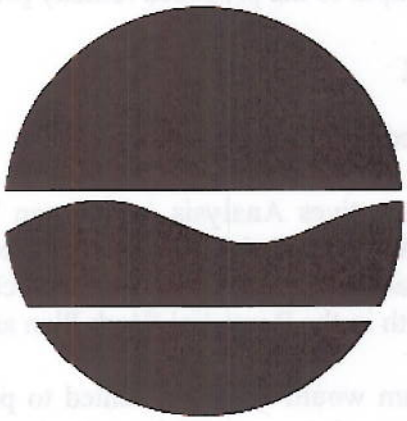
Figure No.
5

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE
Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY
Drawing Title: ROUNDWATER MONITORING WELL NETWORK

ATTACHMENT A
Decision Document

DECISION DOCUMENT

Uniforms for Industry
Operable Unit Number: 01
Brownfield Cleanup Program
Richmond Hill, Queens County
Site No. C241103
January 2011



Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - DECISION DOCUMENT

Uniforms for Industry
Operable Unit Number: 01
Brownfield Cleanup Program
Richmond Hill, Queens County
Site No. C241103
January 2011

Statement of Purpose and Basis

This document presents the remedy for Operable Unit Number: 01 of the Uniforms for Industry site, a brownfield cleanup site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law, Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for Operable Unit Number: 01 of the Uniforms for Industry site and the public's input to the proposed remedy presented by the Department.

Description of Selected Remedy

The elements of the selected remedy are as follows:

Based on the results of the Alternatives Analysis, which can be found in Section 3.0 of the Remedial Action Work Plan (RAWP), and the criteria identified for evaluation of alternatives, the NYSDEC has selected a Track 4 Restricted Residential cleanup for this BCP site. The components of the remedy set forth in the Remedial Work Plan are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.

2. All on-site soils located in the vadose zone (above the water table) in the former UST area in the central portion of the site, and in the east parking lot drainage system distribution box and line repair area which exceed the Part 375 Restricted Residential Soil Cleanup Objectives would be excavated down to a maximum depth of 20 feet and transported off-site for disposal. Approximately 944 cubic yards of soil would be removed. In addition, any soils encountered during any future development or construction work which exhibits visual or olfactory signs of contamination, or if field screening results of the soil are positive for the presence of contamination, will be removed down to a maximum depth of 20 feet. The proposed excavation areas are shown on the attached Figure 7 from the RAWP.

3. Backfilling excavated areas, as needed, with clean soil. Clean soil is soil that is tested

and meets the Division of Environmental Remediation's criteria for backfill and meets the requirements of Part 375-6.7(d).

4. The removal of the top two (2) feet of soil in any "green" or landscaped areas, and covering these areas with 2 feet of soil cover. The two-foot thick cover will consist of clean soil underlain by a demarcation layer to delineate the cover soil from the subsurface soil. The top six inches of soil will be of sufficient quality to support vegetation. Non-vegetated areas (buildings, parking lots, etc.) will be covered by either a paving system or concrete at least 6 inches thick.

5. In-situ treatment of contaminated soil and on-site and off-site groundwater via chemical oxidation. The proposed injection points are shown on the attached Figure 8 from the RAWP.

6. Installation of a vapor barrier and active soil vapor mitigation systems, or basement-level mechanical ventilation systems (if the new construction includes a basement-level garage), as part of any new construction to mitigate the potential for soil vapor intrusion.

7. Imposition of an institutional control in the form of an Environmental Easement for the controlled property that:

   (a) requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).
   (b) land use is subject to local zoning laws, the remedy allows the use and development of the controlled property for: restricted residential use;
   (c) restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH;
   (d) prohibits agriculture or vegetable gardens on the controlled property;
   (e) requires compliance with the Department approved Site Management Plan;

8. Since the remedy results in contamination remaining at the site that does not allow for unrestricted use, a Site Management Plan is required, which includes the following:

   (a) an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to assure the following institutional and/or engineering controls remain in place and effective:

   Institutional Controls: The Environmental Easement discussed in bullet #7 above.

   Engineering Controls: The soil cover discussed in bullet #4 above and the soil vapor mitigation system (sub-slab depressurization system) discussed in bullet #6 above.

This plan includes, but may not be limited to:

(i) Soil Management Plan which details the provisions for management of future excavations in areas of remaining contamination;
(ii) descriptions of the provisions of the environmental easement including any land use, and groundwater use restrictions;
(iii) provisions for the management and inspection of the identified engineering controls;
(iv) maintaining site access controls and Department notification; and
(v) the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls;

(b) a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

(i) monitoring of groundwater to assess the performance and effectiveness of the remedy;
(ii) a schedule of monitoring and frequency of submittals to the Department;
(iii) provision to evaluate the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified;
(iv) provision to evaluate the potential for soil vapor intrusion for existing buildings if building use changes significantly or if a vacant building become occupied.

9. To maximize the net environmental benefit, Green remediation and sustainability efforts are considered in the design and implementation of the remedy to the extent practicable, including;

- Energy efficiency and green building design
- Using renewable energy sources
- Reducing green house gas emissions
- Encouraging low carbon technologies
- Conserve natural resources
- Increase recycling and reuse of clean materials
- Design storm water management systems to recharge aquifers

Declaration

The remedy conforms with promulgated standards and criteria that are directly applicable, or that are relevant and appropriate and takes into consideration Department guidance, as appropriate. The remedy is protective of public health and the environment.

1/27/11
Date

Robert Cozzy, Director
Remedial Bureau B

DECISION DOCUMENT

Uniforms for Industry
Richmond Hill, Queens County
Site No. C241103
January 2011

SECTION 1: SUMMARY AND PURPOSE

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), has selected a remedy for the above referenced site. The disposal of contaminants at the site has resulted in threats to public health and the environment that would be addressed by the remedy. The disposal or release of contaminants at this site, as more fully described in this document, has contaminated various environmental media. Contaminants include hazardous waste and/or petroleum.

The New York State Brownfield Cleanup Program (BCP) is a voluntary program. The goal of the BCP is to enhance private-sector cleanups of brownfields and to reduce development pressure on "greenfields." A brownfield site is real property, the redevelopment or reuse of which may be complicated by the presence or potential presence of a contaminant.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and (6 NYCRR) Part 375. This document is a summary of the information that can be found in the site-related reports and documents.

SECTION 2: SITE DESCRIPTION AND HISTORY

Location:

The Uniforms for Industry (UFI) site is a 1.72 acre parcel located at 129-09 Jamaica Avenue, Richmond Hill, Queens.

Site Features:

Two interconnected buildings make up approximately 2/3 of the site. The remaining area is covered predominantly by pavement. The site is bounded by 127th St. to the west, Jamaica Ave. to the south, residential properties to the north, and a railroad to the east.

Current Zoning/Use:

The surrounding parcels are mainly residential with some first floor commercial and light industrial properties. The site is currently inactive, but was previously used for commercial laundering services.

Historical Uses:

The site was formerly owned and operated by Ideal Vortex Laundry, which utilized a petroleum-based dry-cleaning machine during the 1930s through the 1950s. UFI acquired the property in the 1950s and continued laundry operations through November 2002, when all operations ceased. A number of spills from machinery and underground storage tanks (USTs) have led to soil and groundwater contamination. In June 2007, the Department entered into a Brownfield Cleanup Agreement (BCA) with UFI. Fieldwork associated with the BCA commenced in November 2008, and was performed by Environmental Liability Management, LLC. The Department received the Remedial Investigation Report (RIR) on January 15, 2010. The revised RIR, dated April 16, 2010, was approved for placement in the document repository on August 30, 2010. The RIR found that the on-site soil was contaminated with elevated levels of petroleum-based compounds, and the on-site soil vapor was contaminated with elevated levels of chlorinated volatile organic compounds (CVOCs). In addition, the on-site and off-site groundwater was found to be contaminated with volatile organic compounds (VOCs), including CVOCs such as tetrachloroethylene (PCE). Based on the results of the RIR, an off-site Soil Vapor Intrusion Investigation (SVI) will be performed as part of remedy to determine whether contaminated soil vapor has migrated off-site, and to assess the potential for off-site soil vapor intrusion. The off-site SVI will be managed as a separate operable unit, and is currently underway. The public comment period for the proposed Remedial Action Work Plan to address the on-site contamination ended on December 6, 2010.

Operable Units:

As alluded to above, the site was divided into two operable units. An operable unit represents a portion of the a remedial program for a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

Operable unit 1 (OU1) is the on-site source area. OU2 consists of the off-site soil vapor plume.

Site Geology and Hydrogeology:

The site overlies the Upper Glacial Aquifer of Long Island. The Upper Glacial Aquifer is approximately 115 feet thick at this location and is underlain by the Gardiners Clay which is approximately 75 to 100 feet thick beneath the site area and is a major confining unit. Underlying the Gardiners Clay lies approximately 125 feet of the Magothy Aquifer, followed by 180 feet of clay, which forms the Raritan confining unit. The Lloyd Aquifer, which is approximately 195 feet thick, underlies the Raritan confining unit. Bedrock below the site is located at approximately 650 feet.

The groundwater table surface lies approximately 38 to 40 feet below ground surface and flows to the southwest.

Operable Unit (OU) Number 01 is the subject of this document.

A Decision Document has yet to be issued for OU 02.

A site location map is attached as Figure 1.

SECTION 3: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, alternatives (or an alternative) that restrict(s) the use of the site to restricted-residential use (which allows for commercial use and industrial use) as described in Part 375-1.8(g) is/are being evaluated in addition to an alternative which would allow for unrestricted use of the site.

A comparison of the results of the investigation to the appropriate standards, criteria and guidance values (SCGs) for the identified land use and the unrestricted use SCGs for the site contaminants is available in the RI Report.

SECTION 4: ENFORCEMENT STATUS

The cleanup agreement is with a Volunteer. The Volunteer does not have an obligation to address off-site contamination. The Department has determined that this site poses a significant threat to human health and the environment and there are off-site impacts that require remedial activities; accordingly, enforcement actions are necessary.

One of the Applicants under the Brownfield Cleanup Agreement is a Participant. As such, the Participant (UFI) has an obligation to address on-site and off-site contamination. Accordingly, no enforcement actions are necessary.

SECTION 5: SITE CONTAMINATION

5.1: Summary of the Remedial Investigation

A remedial investigation (RI) serves as the mechanism for collecting data to:

- characterize site conditions;
- determine the nature of the contamination; and
- assess risk to human health and the environment.

The RI is intended to identify the nature (or type) of contamination which may be present at a site and the extent of that contamination in the environment on the site, or leaving the site. The RI reports on data gathered to determine if the soil, groundwater, soil vapor, indoor air, surface water or sediments may have been contaminated. Monitoring wells are installed to assess groundwater and soil borings or test pits are installed to sample soil and/or waste(s) identified. If other natural resources are present, such as surface water bodies or wetlands, the water and sediment may be sampled as well. Based on the presence of contaminants in soil and groundwater, soil vapor will also be sampled for the presence of contamination. Data collected in the RI influence the development of remedial alternatives. The RI report is available for review in the site document repository and the results are summarized in section 5.4.

5.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. For a full listing of all SCGs see: http://www.dec.ny.gov/regulations/61794.html

5.1.2: RI Information

The analytical data collected on this site includes data for:

- groundwater
- soil
- soil vapor

The data have identified contaminants of concern. A "contaminant of concern" is a contaminant that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized below. Additionally, the RI Report contains a full discussion of the data. The contaminant(s) of concern identified for this Operable Unit at this site is/are:

tetrachloroethylene (pce)	dichloroethylene
vinyl chloride	1,2,4-trimethylbenzene

The contaminant(s) of concern exceed the applicable standards, criteria and guidance for:

- groundwater
- soil
- soil vapor

While there are currently no SCGs for soil vapor, the observed soil vapor concentrations were elevated enough to warrant mitigation.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Decision Document.

There were no IRMs performed at this site during the RI.

5.3: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

Exposure to site contaminants in drinking water is unlikely since the area is served with public water. Contact with potentially contaminated soil is not likely since the site is covered by buildings and pavement. If the on-site building is occupied in the future the inhalation of site contaminants in the indoor air from vapor intrusion is possible. The indoor air and vapor beneath nearby residences will be tested to determine if site contaminants are entering homes through vapor intrusion.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water. The RI report presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

Contamination was identified by the Remedial Investigation of this site, which represents a significant threat to public health and the environment, requiring a remedial program for the site to address the contamination identified below.

Nature of contamination: Based on previous investigations, the primary contaminants of concern (COCs) at the site include chlorinated organic compounds, primarily perchloroethylene (PCE) and its breakdown products including 1,2-dichloroethylene (1,2-DCE) and vinyl chloride, and secondary COCs, primarily petroleum-based compounds, including 1,2,4-trimethylbenzene (1,2,4-TMB) and 1,3,5-TMB. Significant contamination was not detected in the on-site shallow soils. However, up to 170 ppm of 1,2,4-TMB was detected in the central portion of the site in the deeper saturated zone, i.e. 52.5 feet below ground surface (bgs). The soil cleanup objectives (SCOs) for restricted residential use for 1,2,4-TMB is 52 ppm.

Volatile organic compounds (VOCs) including petroleum-based compounds were detected in on-site groundwater at concentrations up to 4,200 ppb total VOCs. This also included PCE and its breakdown products (PCE up to 81 ppb; 1,2-DCE up to 980 ppb; and vinyl chloride up to 580 ppb. The groundwater standard for these compounds is 5 ppb, 5 ppb, and 2 ppb, respectively. Semi-volatile organic compounds (SVOCs) were also detected in on-site groundwater at concentrations up to 11,337 ppb total SVOCs. The highest SVOC concentrations were detected in the southwest portion of site and included the following constituents: acenaphthene (540 ppb); anthracene (200 ppb); fluorene (740 ppb); pyrene (240 ppb); and 2-methynaphthalene, naphthalene, and phenanthrene at 5,700 ppb, 2,500 ppb, and 1,300 ppb, respectively. Off-site groundwater is also contaminated with chlorinated VOCs above groundwater standards, including PCE up to 40 ppb. Free product (petroleum) which was encountered in a number of the on-site wells appears to be stable within the boundaries of the site. Groundwater grab

samples were also collected at various depths while advancing soil borings. In the central portion of the site PCE was detected at 5 ppb at 112 feet bgs. TCE was detected at 15 ppb and 22 ppb at 93 feet bgs and 112 feet bgs, respectively. Ethylbenzene, total xylenes and naphthalene were detected at 620 ppb, 700 ppb and 130 ppb at 67 feet bgs; however concentrations of these fuel-related compounds declined by more than one order of magnitude in the 78-foot bgs sample. The soil boring and groundwater sample results are summarized in Figure 5 and Figure 6 from the draft Remedial Action Work Plan (attached).

On-site soil vapor is contaminated with site-related VOCs, mainly PCE, at concentrations up to 4,200,000 µg/m3. The soil vapor sample results are summarized in Figure 4-F (attached).

Extent of contamination:

Source areas/Waste disposal – The former UST area located in the central portion of the site has been identified as a primary source area which has led to soil and groundwater contamination. All known USTs have previously been removed from the site. In addition, the site was previously owned and operated by Vortex Laundry which utilized a petroleum solvent dry-cleaning machine during the 1930s through the 1950s. It is believed spills from these machines may have also contributed to the observed soil and groundwater contamination. The remedy must address soil, soil vapor and groundwater contamination in this area.

Surface soil – Most of the site is covered with either structures or pavement. However, any areas not covered by buildings or pavement must be addressed by the remedy.

Subsurface soil – Petroleum-based organic compounds, including 1,2,4-TMB were identified at levels exceeding restricted residential SCOs in an area surrounding the former UST area located in the central portion of the site. The remedy must address the area of identified subsurface soil contamination in the central portion of the site.

Groundwater - Both on-site and off-site groundwater has been impacted by VOCs, primarily PCE. Exposure to contaminated groundwater is not expected since the area is served by public water. However, the remedy must address the existing groundwater contamination.

Soil Vapor – Elevated levels of VOCs, primarily PCE were identified in on-site soil vapor. An off-site soil vapor investigation has also been proposed. The remedy must address the on-site soil vapor contamination. The off-site soil vapor will be handled under Operable Unit No. 2.

More information regarding the site can be found in the documents placed in the Site Document Repository: QUEENS BOROUGH PUBLIC LIBRARY in RICHMOND HILL, NY.

Significant Threat:

Based on the findings of the RIR, the Department in consultation with the New York State Department of Health has determined that the site poses a significant threat due to elevated concentrations of contaminants in soil vapor.

SECTION 6: ELEMENTS OF THE SELECTED REMEDY

The alternatives developed for the site and evaluation of the remedial criteria are present in the Alternative Analysis. The remedy is selected pursuant to the remedy selection criteria set forth in DER-10, Technical Guidance for Site Investigation and Remediation and 6 NYCRR Part 375.

The selected remedy is a Track 4: Restricted use with site-specific soil cleanup objectives remedy.

The elements of the selected remedy, as shown in Figure 2, are as follows:

Based on the results of the Alternatives Analysis, which can be found in Section 3.0 of the Remedial Action Work Plan (RAWP), and the criteria identified for evaluation of alternatives, the NYSDEC has selected a Track 4 Restricted Residential cleanup for this BCP site. The components of the remedy set forth in the Remedial Work Plan are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.

2. All on-site soils located in the vadose zone (above the water table) in the former UST area in the central portion of the site, and in the east parking lot drainage system distribution box and line repair area which exceed the Part 375 Restricted Residential Soil Cleanup Objectives would be excavated down to a maximum depth of 20 feet and transported off-site for disposal. Approximately 944 cubic yards of soil would be removed. In addition, any soils encountered during any future development or construction work which exhibits visual or olfactory signs of contamination, or if field screening results of the soil are positive for the presence of contamination, will be removed down to a maximum depth of 20 feet. The proposed excavation areas are shown on the attached Figure 7 from the RAWP.

3. Backfilling excavated areas, as needed, with clean soil. Clean soil is soil that is tested and meets the Division of Environmental Remediation's criteria for backfill or local site background, and meets the requirements of Part 375-6.7(d).

4. The removal of the top two (2) feet of soil in any "green" or landscaped areas, and covering these areas with 2 feet of soil cover. The two-foot thick cover will consist of clean soil underlain by a demarcation layer to delineate the cover soil from the subsurface soil. The top six inches of soil will be of sufficient quality to support vegetation. Non-vegetated areas (buildings, parking lots, etc.) will be covered by either a paving system or concrete at least 6 inches thick.

5. In-situ treatment of contaminated soil and on-site and off-site groundwater via chemical oxidation. The proposed injection points are shown on the attached Figure 8 from the RAWP.

6. Installation of a vapor barrier and active soil vapor mitigation systems, or basement-level mechanical ventilation systems (if the new construction includes a basement-level garage), as part of any new construction to mitigate the potential for soil vapor intrusion.

7. Imposition of an institutional control in the form of an Environmental Easement for the controlled property that:

(a) requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).
(b) land use is subject to local zoning laws, the remedy allows the use and development of the controlled property for: restricted residential use
(c) restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH;
(d) prohibits agriculture or vegetable gardens on the controlled property;
(e) requires compliance with the Department approved Site Management Plan;

8. Since the remedy results in contamination remaining at the site that does not allow for unrestricted use, a Site Management Plan is required, which includes the following:

(a) an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to assure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in bullet #7 above.

Engineering Controls: The soil cover discussed in bullet #4 above and the soil vapor mitigation system (sub-slab depressurization system) discussed in bullet #6 above.

This plan includes, but may not be limited to:

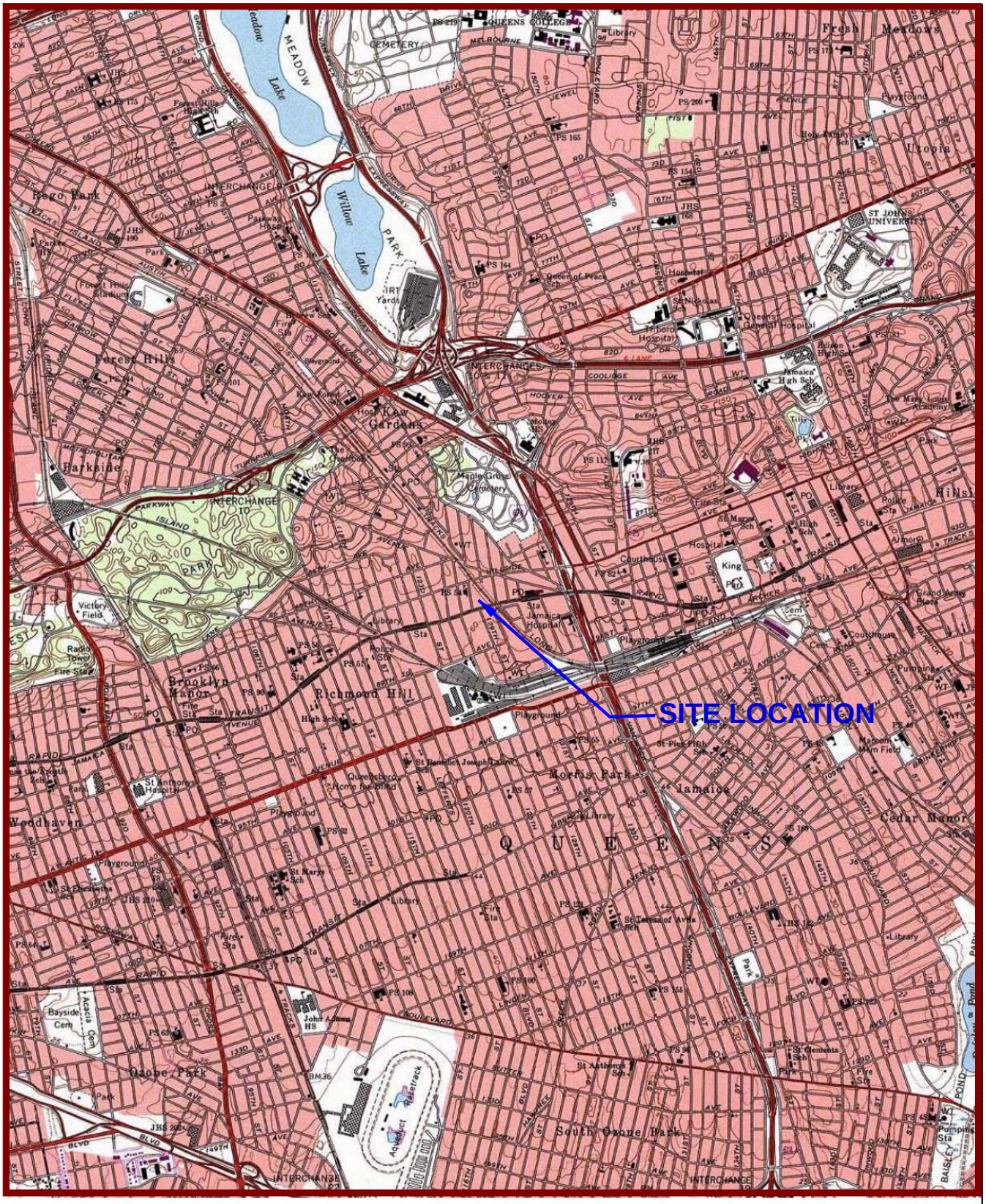
(i) Soil Management Plan which details the provisions for management of future excavations in areas of remaining contamination;
(ii) descriptions of the provisions of the environmental easement including any land use, and groundwater use restrictions;
(iii) provisions for the management and inspection of the identified engineering controls;
(iv) maintaining site access controls and Department notification; and
(v) the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls;

(b) a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but not be limited to:

(i) monitoring of groundwater to assess the performance and effectiveness of the remedy;
(ii) a schedule of monitoring and frequency of submittals to the Department;
(iii) provision to evaluate the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified;
(iv) provision to evaluate the potential for soil vapor intrusion for existing buildings if building use changes significantly or if a vacant building become occupied.

9. To maximize the net environmental benefit, Green remediation and sustainability efforts are considered in the design and implementation of the remedy to the extent practicable, including;

- Energy efficiency and green building design
- Using renewable energy sources
- Reducing green house gas emissions
- Encouraging low carbon technologies
- Conserve natural resources
- Increase recycling and reuse of clean materials
- Design storm water management systems to recharge aquifers



USGS Jamaica Quadrangle 1994, Contour Interval = 10 feet

0 .5 1 MILES

1000 0 1000 2000 3000 4000 5000 FEET

1 .5 0 KILOMETERS 1

1000 0 METERS 1000

MN 13° 10/19/10

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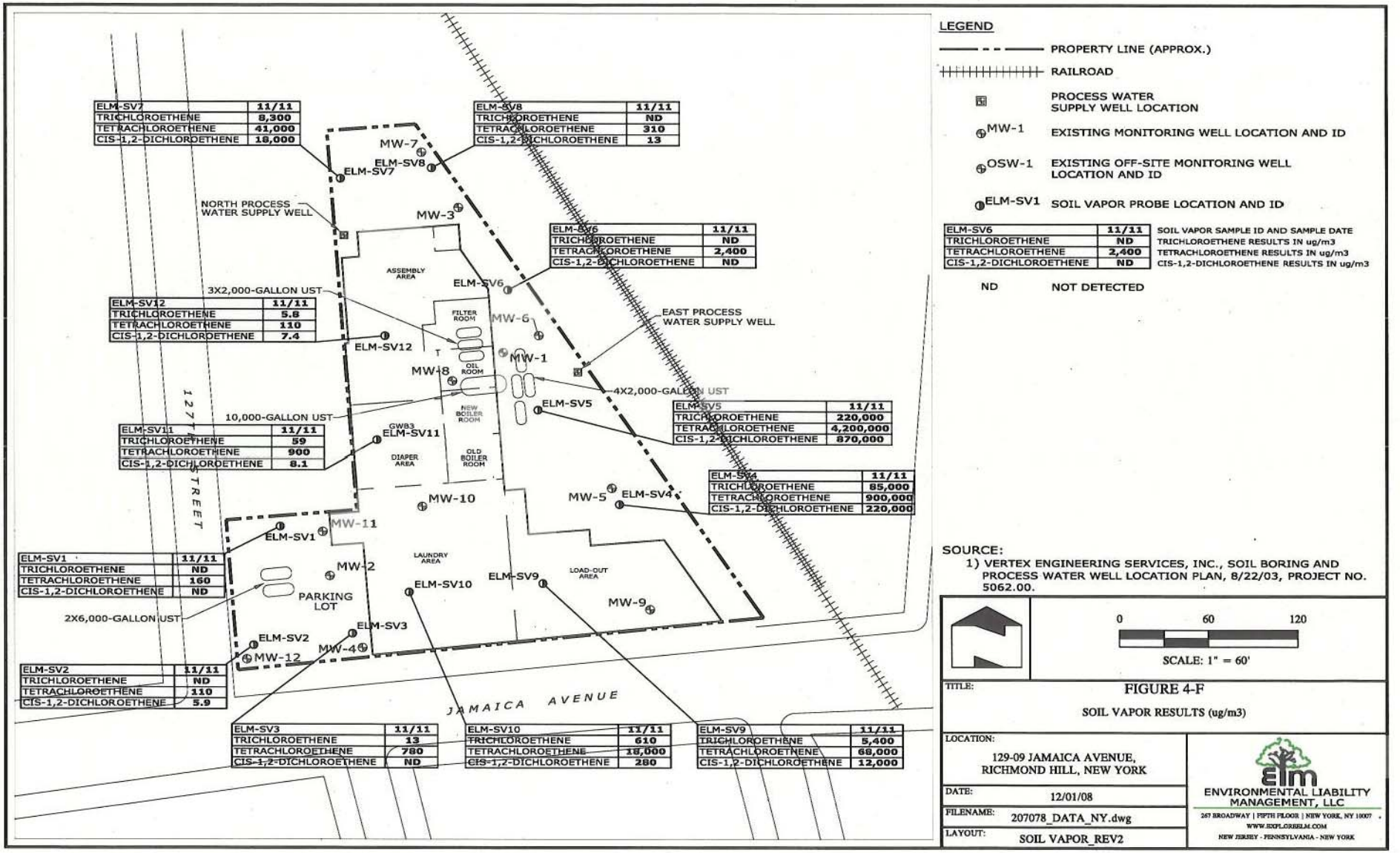
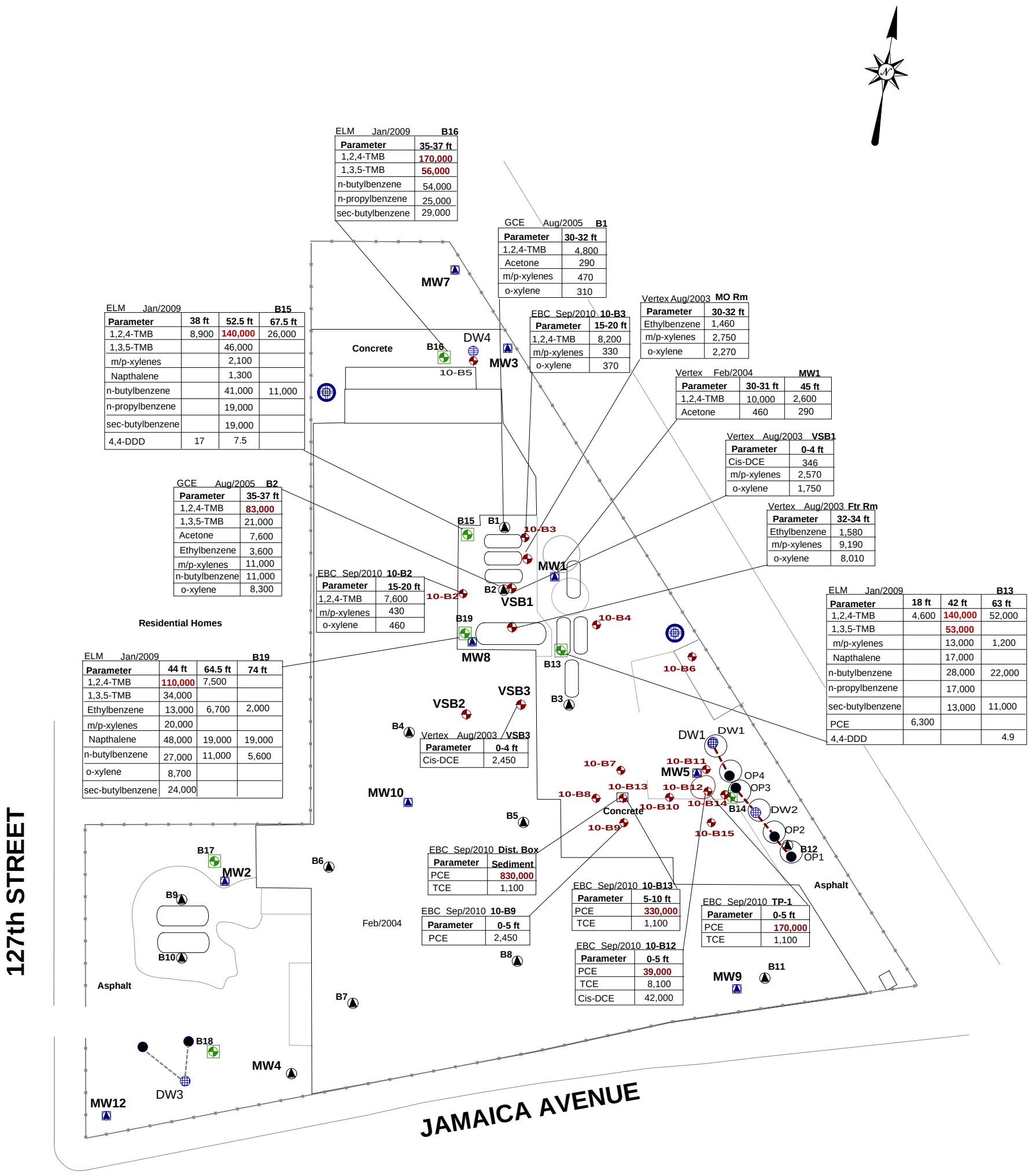
FORMER UNIFORMS FOR INDUSTRY SITE

129-09 JAMAICA AVENUE, RICHMOND HILL, NY

FIGURE 1 SITE LOCATION MAP

VOCs in Soil Gas





Notes:

* Samples not analyzed for full suite of petroleum VOCs during this round

All results in ug/kg

All Values indicate exceedance in Unrestricted SCOs

Values in Red indicate exceedance in Restricted Residential SCOs

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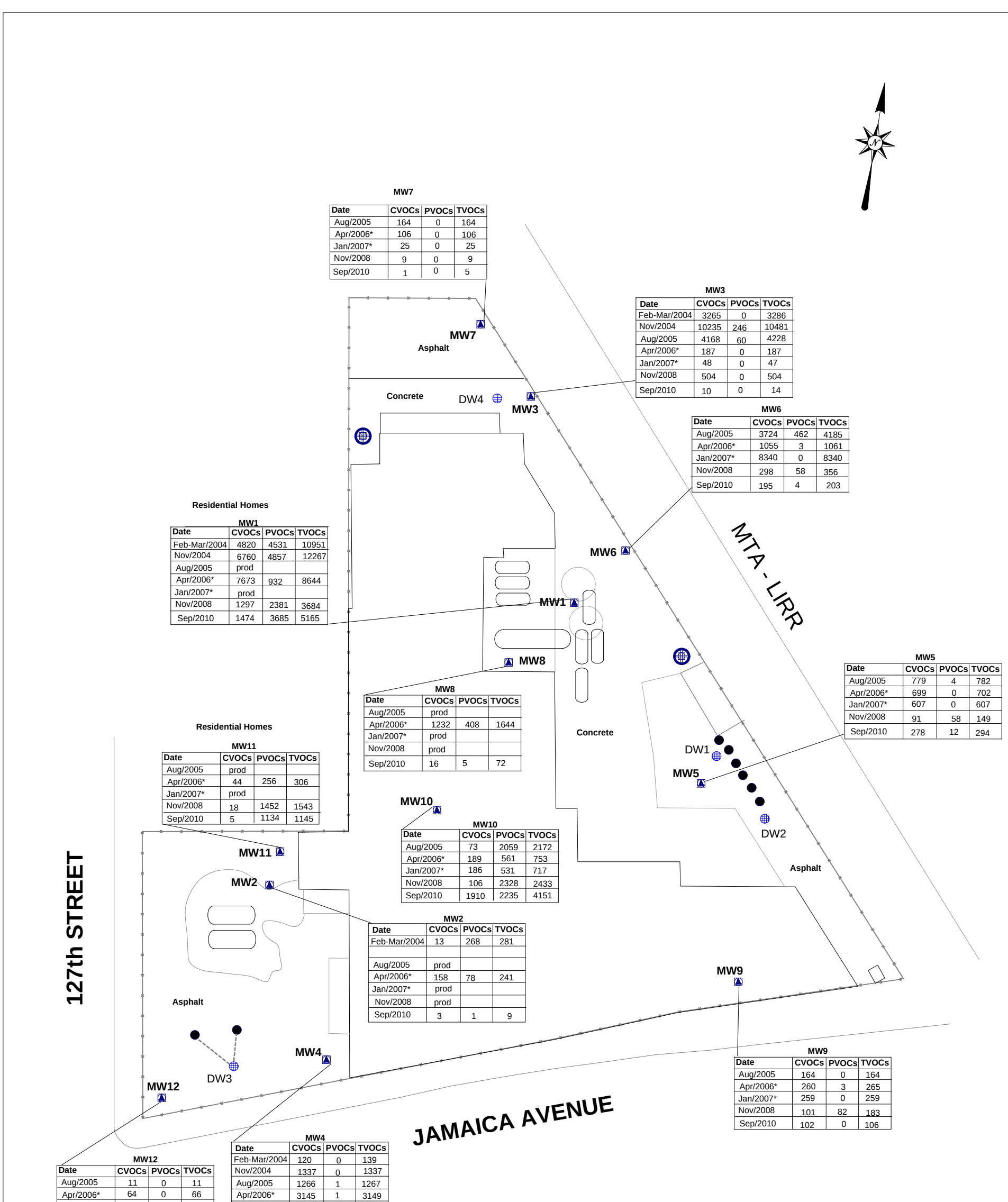
Figure No. 5

Site Name: Former Uniforms For Industry Site

Site Address: 129-09 Jamaica Avenue, Richmond Hill, NY

Drawing Title: Exceedance of Track 1 & Track 4 SCOs



MW7

Date	CVOCs	PVOCs	TVOCs
Aug/2005	164	0	164
Apr/2006*	106	0	106
Jan/2007*	25	0	25
Nov/2008	9	0	9
Sep/2010	1	0	5

MW3

Date	CVOCs	PVOCs	TVOCs
Feb-Mar/2004	3265	0	3286
Nov/2004	10235	246	10481
Aug/2005	4168	60	4228
Apr/2006*	187	0	187
Jan/2007*	48	0	47
Nov/2008	504	0	504
Sep/2010	10	0	14

MW6

Date	CVOCs	PVOCs	TVOCs
Aug/2005	3724	462	4185
Apr/2006*	1055	3	1061
Jan/2007*	8340	0	8340
Nov/2008	298	58	356
Sep/2010	195	4	203

MW1

Date	CVOCs	PVOCs	TVOCs
Feb-Mar/2004	4820	4531	10951
Nov/2004	6760	4857	12267
Aug/2005	prod		
Apr/2006*	7673	932	8644
Jan/2007*	prod		
Nov/2008	1297	2381	3684
Sep/2010	1474	3685	5165

MW8

Date	CVOCs	PVOCs	TVOCs
Aug/2005	prod		
Apr/2006*	1232	408	1644
Jan/2007*	prod		
Nov/2008	prod		
Sep/2010	16	5	72

MW5

Date	CVOCs	PVOCs	TVOCs
Aug/2005	779	4	782
Apr/2006*	699	0	702
Jan/2007*	607	0	607
Nov/2008	91	58	149
Sep/2010	278	12	294

MW11

Date	CVOCs	PVOCs	TVOCs
Aug/2005	prod		
Apr/2006*	44	256	306
Jan/2007*	prod		
Nov/2008	18	1452	1543
Sep/2010	5	1134	1145

MW10

Date	CVOCs	PVOCs	TVOCs
Aug/2005	73	2059	2172
Apr/2006*	189	561	753
Jan/2007*	186	531	717
Nov/2008	106	2328	2433
Sep/2010	1910	2235	4151

MW2

Date	CVOCs	PVOCs	TVOCs
Feb-Mar/2004	13	268	281
Aug/2005	prod		
Apr/2006*	158	78	241
Jan/2007*	prod		
Nov/2008	prod		
Sep/2010	3	1	9

MW9

Date	CVOCs	PVOCs	TVOCs
Aug/2005	164	0	164
Apr/2006*	260	3	265
Jan/2007*	259	0	259
Nov/2008	101	82	183
Sep/2010	102	0	106

MW12

Date	CVOCs	PVOCs	TVOCs
Aug/2005	11	0	11
Apr/2006*	64	0	66
Jan/2007*	47	0	47
Nov/2008	109	0	115
Sep/2010	29	5	38

MW4

Date	CVOCs	PVOCs	TVOCs
Feb-Mar/2004	120	0	139
Nov/2004	1337	0	1337
Aug/2005	1266	1	1267
Apr/2006*	3145	1	3149
Jan/2007*	1387	0	1387
Nov/2008	953	12	965
Sep/2010	176	9	190

KEY:

MWX Monitoring Well

Surface Drain Drywell

Suspect Overflow Drywell - No Surface Access

Water Supply Well

0 25 50 100

1 Inch = 50 feet

Notes:

* Samples not analyzed for full suite of petroleum VOCs during this round

All results in ug/L

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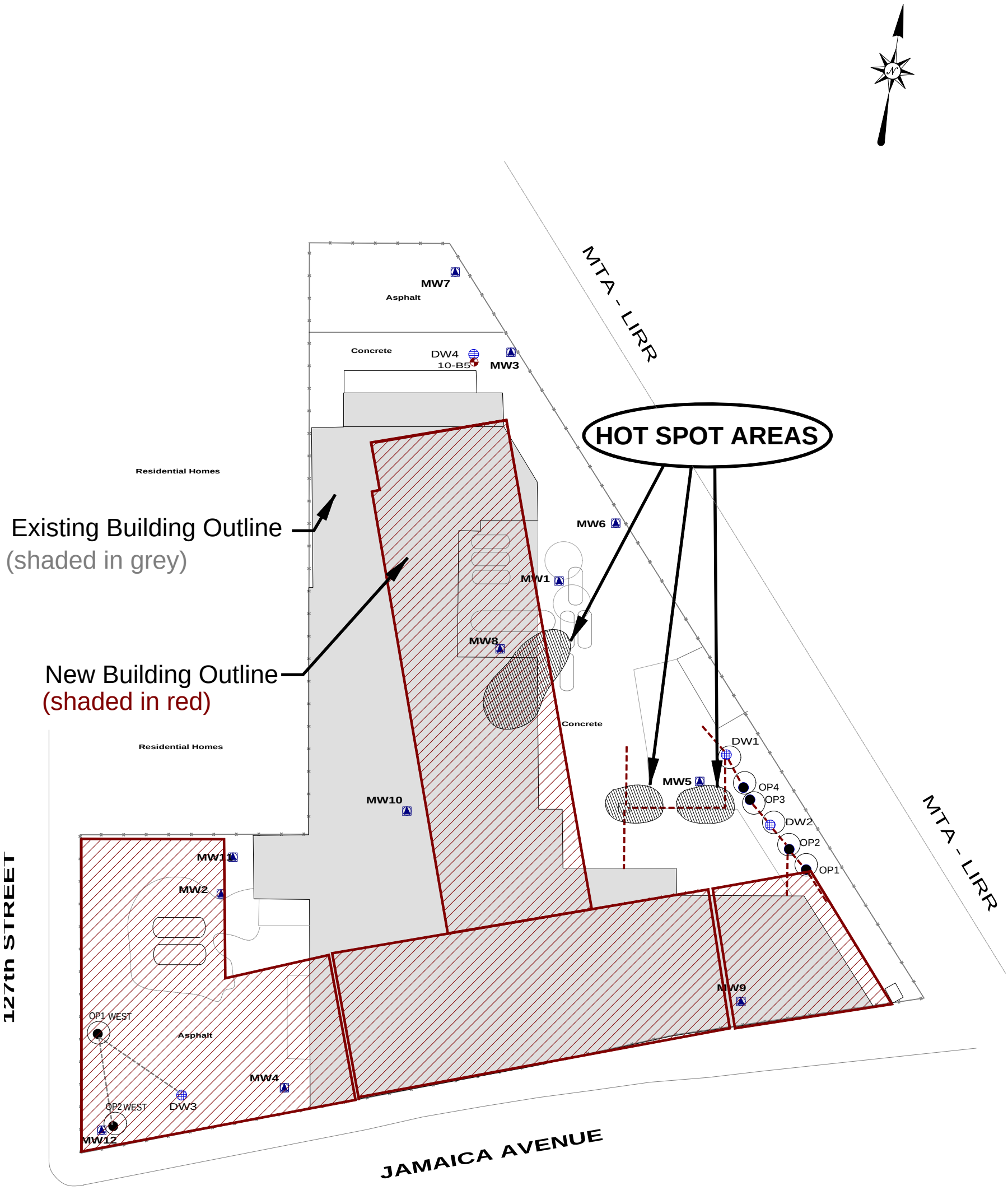
Figure No. **6**

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE

Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY

Drawing Title: HISTORIC GROUNDWATER RESULTS



Notes:

The locations of DW4, MW6, MW9 and MW10 not field verified

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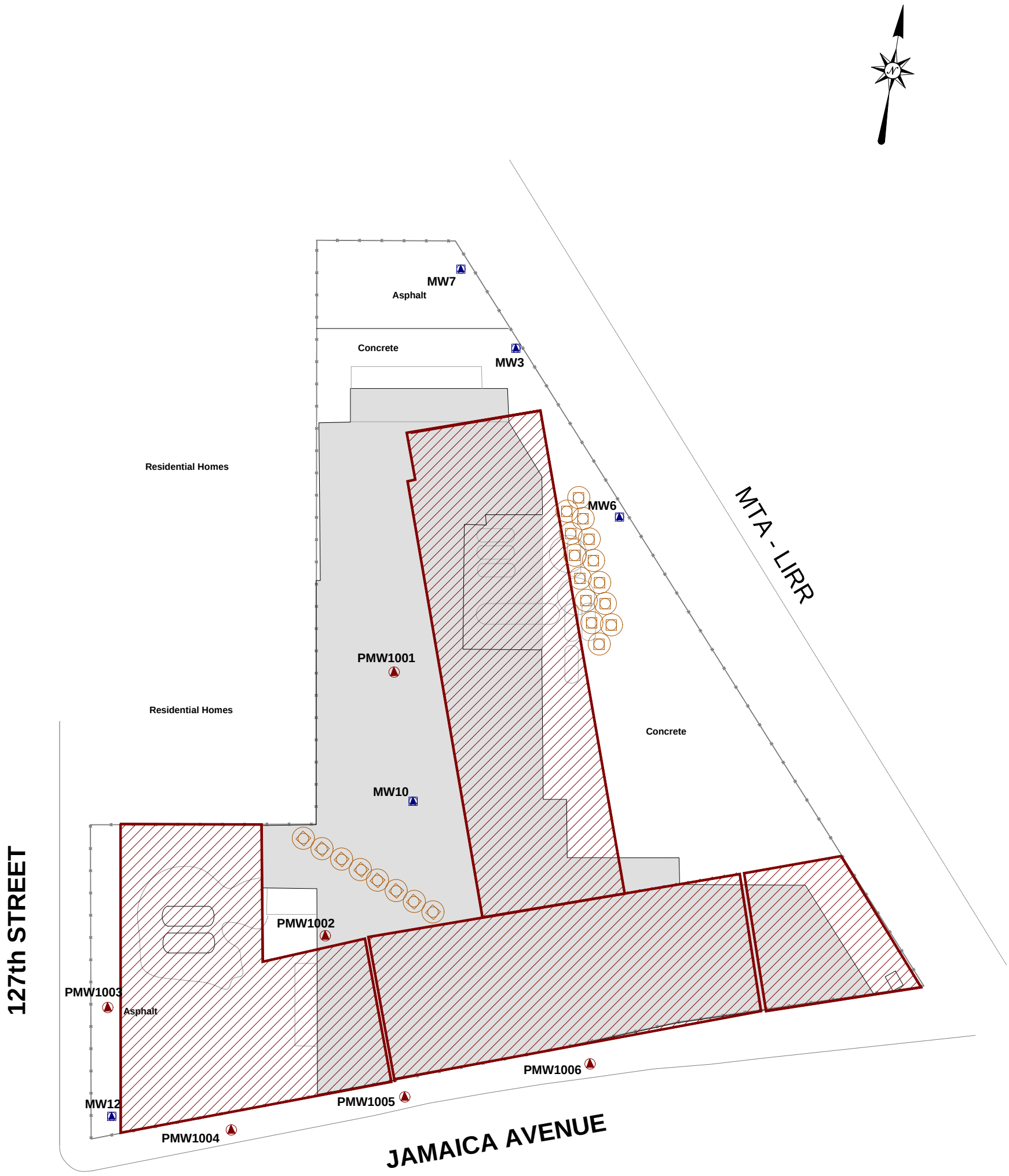
Figure No. 7

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE

Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY

Drawing Title: HOT SPOT EXCAVATION PLAN



KEY:

MWX Existing Monitoring Well

PMW10XX Proposed Monitoring Well

Chemical Oxidant Injection Well (5 ft inj. radius)

Surface Drain Drywell

0 25 50 100

1 Inch = 50 feet

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Figure No. **8**

Site Name: FORMER UNIFORMS FOR INDUSTRY SITE

Site Address: 129-09 JAMAICA AVENUE, RICHMOND HILL, NY

Drawing Title: CHEMICAL OXIDANT INJECTION PLAN

ATTACHMENT B
Oxidant Demand Calculations

FORMER UNIFORMS FOR INDUSTRY SITE
CALCULATED OXIDANT DEMAND

	Surface Area of Zone (ft^2)	Height of Water Column Contamination (ft)	Height of Soil Contamination Layer (ft)	Soil Density (lb/ft^3)	Total Mass of Contaminants in Groundwater (lb)	Amount of Klozur Required to Treat Groundwater (lb)	Total Mass of Contaminants in Soil (lb)	Amount of Klozur Required to Treat Soil (lb)	Total Amount of Klozur Required for Site (lb)
Zone 1	4832	12	12	108	6.77	196.49	0.00	0.00	68,643.20
Zone 2	6305	12	12	108	0.11	3.64	0.00	0.00	
Zone 3	8863	12	12	108	10.14	242.15	0.00	0.00	
Zone 4	4631	12	12	108	1.45	55.92	0.00	0.00	
Zone 5	10238	12	12	108	0.49	3.46	0.00	0.00	
Zone 6	5500	12	12	108	0.00	0.00	1,766.02	68,141.54	
Zone 7	0	12	12	108	0.00	0.00	0.00	0.00	

Total Amount of Closure to Treat Groundwater	501.66	1766.02
Total Amount of Closure to Treat Soil		

ZONE 1

														Enter Data			Enter Data			Enter Data												
														4832			15			0.30												
Contaminant	Groundwater Concentration (µg/L)		Conversion (µg to g)		Conversion (g to lb)		Groundwater Concentration (lb/L)		Converstion (ft^3 to L)		Area (ft^2)		Height of Water Column Contamination (ft)		Porosity		Mass of Contaminant (lb)		Klozur Required (lb)	Total Klozur Required (lb)
1,2,4-Trimethylbenzene	1,900	(X)	1.E-06	(X)	0.0022	=	0.00000418	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	2.573711687	(X)	=	91.88151	196.4853
1,3,5-Trimethylbenzene	530	(X)	1.E-06	(X)	0.0022	=	0.000001166	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.717930102	(X)	=	25.6301	
2-Butanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
2-Chlorotoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
2-Hexanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
4-Methyl-2-Pentanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Acetone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Bromobenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Ethyl Benzene	62	(X)	1.E-06	(X)	0.0022	=	1.364E-07	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.083984276	(X)	=	3.57773	
Hexachlorobutadiene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Isopropylbenzene	64	(X)	1.E-06	(X)	0.0022	=	1.408E-07	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.086693446	(X)	=	3.788504	
m/p-Xylenes	410	(X)	1.E-06	(X)	0.0022	=	0.000000902	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.55537989	(X)	=	26.15839	
Methyl Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
methyl tert-butyl Ether		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Naphthalene	250	(X)	1.E-06	(X)	0.0022	=	0.00000055	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.338646275	(X)	=	13.44426	
n-Butylbenzene	120	(X)	1.E-06	(X)	0.0022	=	0.000000264	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.162550212	(X)	=	7.217229	
n-Propylbenzene	140	(X)	1.E-06	(X)	0.0022	=	0.000000308	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.189641914	(X)	=	8.287352	
o-Xylene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
p-Isopropyltoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
sec-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Styrene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
tert-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0	(X)	=	0	
Toluene	45	(X)	1.E-06	(X)	0.0022	=	0.000000099	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	0.060956329	(X)	=	2.523592	
Toluene	1,474	(X)	1.E-06	(X)	0.0022	=	3.2428E-06	(X)	28.3168	(X)	4832	(X)	15	(X)	0.30	=	1.996658435	(X)	=	13.97661	
															Total	=	6.766152566				

ZONE 2

												Enter Data			Enter Data			Enter Data												
												6305			15			0.30												
Contaminant	Groundwater Concentration (µg/L)		Conversion (µg to g)		Conversion (g to lb)		Groundwater Concentration (lb/L)		Conversion (ft^3 to L)		Area (ft^2)		Height of Water Column Contamination (ft)		Porosity		Mass of Contaminant (lb)			Klozur Required (lb)		Total Klozur Required (lb)
1,2,4-Trimethylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		3.640385
1,3,5-Trimethylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
2-Butanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
2-Chlorotoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
2-Hexanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
4-Methyl-2-Pentanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Acetone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Benzene	17	(X)	1.E-06	(X)	0.0022	=	3.74E-08	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0.030047848	(X)	=	1.376191		
Bromobenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Ethyl Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Hexachlorobutadiene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Isopropylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
m/p-Xylenes		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Methyl Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
methyl tert-butyl Ether	29	(X)	1.E-06	(X)	0.0022	=	6.38E-08	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0.051258094	(X)	=	2.081079		
Naphthalene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
n-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
n-Propylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
o-Xylene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
p-Isopropyltoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
sec-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Styrene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
tert-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
Toluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0	(X)	=	0		
CVOCs	15	(X)	1.E-06	(X)	0.0022	=	3.256E-08	(X)	28.3168	(X)	6305	(X)	15	(X)	0.30	=	0.026159303	(X)	=	0.183115		
															Total	=	0.107465246					

ZONE 3

													Enter Data			Enter Data			Enter Data												
													8863			15			0.30												
Contaminant	Groundwater Concentration (µg/L)		Conversion (µg to g)		Conversion (g to lb)		Groundwater Concentration (lb/L)		Converstion (ft^3 to L)		Area (ft^2)		Height of Water Column Contamination (ft)		Porosity		Mass of Contaminant (lb)			Klozur Required (lb)	Total Klozur Required (lb)
1,2,4-Trimethylbenzene	1,000	(X)	1.E-06	(X)	0.0022	=	0.0000022	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	2.484620804	(X)	=	88.70096	242.1519
1,3,5-Trimethylbenzene	350	(X)	1.E-06	(X)	0.0022	=	0.00000077	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.869617281	(X)	=	31.04534	
2-Butanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
2-Chlorotoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
2-Hexanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
4-Methyl-2-Pentanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Acetone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Bromobenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Ethyl Benzene	74	(X)	1.E-06	(X)	0.0022	=	1.628E-07	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.18386194	(X)	=	7.832519	
Hexachlorobutadiene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Isopropylbenzene	67	(X)	1.E-06	(X)	0.0022	=	1.474E-07	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.166469594	(X)	=	7.274721	
m/p-Xylenes	290	(X)	1.E-06	(X)	0.0022	=	0.000000638	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.720540033	(X)	=	33.93744	
Methyl Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
methyl tert-butyl Ether		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Naphthalene	200	(X)	1.E-06	(X)	0.0022	=	0.00000044	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.496924161	(X)	=	19.72789	
n-Butylbenzene	40	(X)	1.E-06	(X)	0.0022	=	0.000000088	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.099384832	(X)	=	4.412687	
n-Propylbenzene	100	(X)	1.E-06	(X)	0.0022	=	0.00000022	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.24846208	(X)	=	10.85779	
o-Xylene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
p-Isopropyltoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
sec-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Styrene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
tert-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0	(X)	=	0	
Toluene	50	(X)	1.E-06	(X)	0.0022	=	0.00000011	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	0.12423104	(X)	=	5.143165	
CVOCs	1,910	(X)	1.E-06	(X)	0.0022	=	0.000004202	(X)	28.3168	(X)	8863	(X)	15	(X)	0.30	=	4.745625736	(X)	=	33.21938	
															Total	=	10.1397375				

ZONE 4

																		Enter Data			Enter Data			Enter Data								
																		4631			15			0.30								
Contaminant	Groundwater Concentration (µg/L)		Conversion (µg to g)		Conversion (g to lb)		Groundwater Concentration (lb/L)		Converstion (ft^3 to L)		Area (ft^2)		Height of Water Column Contamination (ft)		Porosity		Mass of Contaminant (lb)		Klozur Required (lb)	Total Klozur Required (lb)
1,2,4-Trimethylbenzene	490	(X)	1.E-06	(X)	0.0022	=	0.000001078	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.636136374	(X)	=	22.71007	55.92327
1,3,5-Trimethylbenzene	46	(X)	1.E-06	(X)	0.0022	=	1.012E-07	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.059718925	(X)	=	2.131966	
2-Butanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
2-Chlorotoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
2-Hexanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
4-Methyl-2-Pentanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Acetone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Bromobenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Ethyl Benzene	68	(X)	1.E-06	(X)	0.0022	=	1.496E-07	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.08828015	(X)	=	3.760734	
Hexachlorobutadiene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Isopropylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
m/p-Xylenes	51	(X)	1.E-06	(X)	0.0022	=	1.122E-07	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.066210112	(X)	=	3.118496	
Methyl Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
methyl tert-butyl Ether		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Naphthalene	400	(X)	1.E-06	(X)	0.0022	=	0.00000088	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.519294999	(X)	=	20.61601	
n-Butylbenzene	13	(X)	1.E-06	(X)	0.0022	=	2.86E-08	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.016877087	(X)	=	0.749343	
n-Propylbenzene	50	(X)	1.E-06	(X)	0.0022	=	0.00000011	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0.064911875	(X)	=	2.836649	
o-Xylene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
p-Isopropyltoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
sec-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Styrene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
tert-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
Toluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	4631	(X)	15	(X)	0.30	=	0	(X)	=	0	
															Total	=	1.451429523				

ZONE 5

										Enter Data		Enter Data		Enter Data														
										10238		15		0.30														
Contaminant	Groundwater Concentration (µg/L)		Conversion (µg to g)		Conversion (g to lb)		Groundwater Concentration (lb/L)		Converstion (ft^3 to L)		Area (ft^2)		Height of Water Column Contamination (ft)		0.3		Mass of Contaminant (lb)		lb Klozur / lb contaminant		Klozur Required (lb)	Total Klozur Required (lb)
1,2,4-Trimethylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	35.7	=	0	3.461607
1,3,5-Trimethylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	35.7	=	0	
2-Butanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	33.1	=	0	
2-Chlorotoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)		=	0	
2-Hexanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)		=	0	
4-Methyl-2-Pentanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	38.0	=	0	
Acetone		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	28.7	=	0	
Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	45.8	=	0	
Bromobenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	29.6	=	0	
Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)		=	0	
Ethyl Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	42.6	=	0	
Hexachlorobutadiene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	4.6	=	0	
Isopropylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	43.7	=	0	
m/p-Xylenes		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	47.1	=	0	
Methyl Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)		=	0	
methyl tert-butyl Ether		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	40.6	=	0	
Naphthalene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	39.7	=	0	
n-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	44.4	=	0	
n-Propylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	43.7	=	0	
o-Xylene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	47.1	=	0	
p-Isopropyltoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)		=	0	
sec-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	44.4	=	0	
Styrene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	41.4	=	0	
tert-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	44.4	=	0	
Toluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0	(X)	41.4	=	0	
CVOCs	172	(X)	1.E-06	(X)	0.0022	=	3.7906E-07	(X)	28.3168	(X)	10238	(X)	15	(X)	0.30	=	0.494515343	(X)	7.0	=	3.461607	
															Total	=	0.494515343					

SOIL ZONE 6

										Enter Data			Enter Data			Enter Data														
										5500			12			108.00														
Contaminant	Soil Concentration (µg/kg)		Conversion (µg to g)		Conversion (g to lb)		Soil Concentration (lb/kg soil)		Contaminated Area (ft^2)		Height of Soil Contamination Layer		(ft)		Soil Density (lb/ft^3)		Conversion (lb to kg)		Mass of Contaminant (lb)			Klozur Required (lb)	Total Klozur Required (lb)
1,2,4-Trimethylbenzene	118,250	(X)	1.E-06	(X)	0.0022	=	0.00026015	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	841.1327971	(X)	=	30028.44	68141.54
1,3,5-Trimethylbenzene	38,500	(X)	1.E-06	(X)	0.0022	=	0.0000847	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	273.8571898	(X)	=	9776.702	
2-Butanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
2-Chlorotoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
2-Hexanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
4-Methyl-2-Pentanone		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Acetone	1,900	(X)	1.E-06	(X)	0.0022	=	0.00000418	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	13.51503014	(X)	=	387.8814	
Benzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Bromobenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Ethyl Benzene	4,275	(X)	1.E-06	(X)	0.0022	=	0.000009405	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	30.40881782	(X)	=	1295.416	
Hexachlorobutadiene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Isopropylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
m/p-Xylenes	11,525	(X)	1.E-06	(X)	0.0022	=	0.000025355	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	81.97932758	(X)	=	3861.226	
Methyl Cyclohexane		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
methyl tert-butyl Ether		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Naphthalene	16,825	(X)	1.E-06	(X)	0.0022	=	0.000037015	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	119.6791485	(X)	=	4751.262	
n-Butylbenzene	26,750	(X)	1.E-06	(X)	0.0022	=	0.00005885	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	190.2773981	(X)	=	8448.316	
n-Propylbenzene	9,125	(X)	1.E-06	(X)	0.0022	=	0.000020075	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	64.90771056	(X)	=	2836.467	
o-Xylene	4,375	(X)	1.E-06	(X)	0.0022	=	0.000009625	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	31.1201352	(X)	=	1465.758	
p-Isopropyltoluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
sec-Butylbenzene	16,750	(X)	1.E-06	(X)	0.0022	=	0.00003685	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	119.1456605	(X)	=	5290.067	
Styrene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
tert-Butylbenzene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
Toluene		(X)	1.E-06	(X)	0.0022	=	0	(X)	5500	(X)	12	(X)		(X)	108.00	(X)	0.4536	=	0	(X)	=	0	
																	Total	=	1766.023215				