SUPPLEMENTAL INVESTIGATION WORK PLAN
PETROLEUM SPILL NOS. 89-08760 and 09-08574
AT THE
MTA LONG ISLAND RAIL ROAD
RICHMOND HILL YARD
RICHMOND HILL, QUEENS
NEW YORK

Prepared for:

MTA Long Island Rail Road
Jamaica, New York

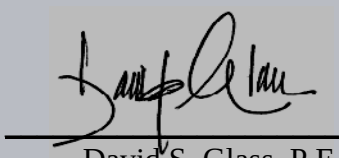
Prepared by:

TRC Engineers, Inc.
1430 Broadway
New York, New York

TRC Project No. 178983-0000-00000
LIRR Contract No. 5973-B

March 2011

I, David S. Glass, certify that I am currently a New York State registered professional engineer and that this Supplemental Investigation Work Plan was prepared in substantial conformance with DER Technical Guidance for Site Investigation and Remediation (DER-10).



David S. Glass, P.E.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

The purpose of this Supplemental Investigation Work Plan is to present to the New York State Department of Environmental Conservation (NYSDEC) for review and approval the proposed plan for further investigation of soil and groundwater at the MTA Long Island Rail Road (LIRR) Richmond Hill Yard. The primary uses of the LIRR Richmond Hill Yard are inspection, maintenance, fueling, and storage of diesel train locomotives. The Richmond Hill Yard ("the Site") is bordered by 89th and 91st Avenues to the north, the Morris Park Yard to the south and west, and 126th and 132nd Streets to the east in the Richmond Hill section of Queens, New York. The focus of this work plan is petroleum spills, resulting from railroad operations, which have occurred at the Site in the vicinity of the Storage Yard, near the western terminus of Track 9, and in the vicinity of the McGurl Building. A Site Location Map is presented in Figure 1.

According to the "Findings Report for the Groundwater Investigation of Petroleum Contamination at Richmond Hill and Morris Park Facilities" (Revision 3 - February 2008) ("Findings Report") prepared by Gannett Fleming Engineers and Architects, P.C. of Locust Valley, New York (Gannet Fleming), for the LIRR, approximately ten petroleum spills of diesel fuel have been reported to the NYSDEC in the vicinity of the Storage Yard and McGurl Building. In October 2003, the petroleum spills were consolidated by the NYSDEC into one spill case (No. 89-08760). In addition, in October 2009, a diesel fuel spill occurred on the south side of Track 9, near the western terminus of the track. The spill, which was the result of a fuel line rupture, was reported to NYSDEC and Spill Case No. 09-08574 was assigned. Detailed information regarding Site history, previous investigations, and remedial actions are presented in Sections 2 and 3 of this Work Plan.

This Supplemental Investigation Work Plan presents an approach for investigation of petroleum contamination consistent with NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation dated May 2010. Following completion of the investigation, TRC will prepare and submit a Supplemental Investigation (SI) Report documenting the findings and conclusions of the investigation. A remedial alternatives analysis will also be presented in the Report, as appropriate.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Location and Setting

The Site, located in the Richmond Hill section of Queens, New York, is bordered by 89th and 91st Avenues to the north, the Morris Park Yard to the south and west, and 126th and 132nd Streets to the east. Figure 1 shows the project Site location. Surrounding properties have been developed primarily for residential and commercial uses. The portions of the Richmond Hill Yard that are the subject of this Work Plan are the Storage Yard, the area near the western terminus of Track 9, and the area adjacent to the McGurl Building. A Site Plan showing Site features and locations of the Storage Yard, Track 9, and McGurl Building is provided in Figure 2.

2.2 Site Use

The LIRR primarily has utilized the Site as a storage and maintenance yard for diesel train locomotives. Typical activities include inspection, maintenance, fueling, and storage of locomotives. Historically, fueling of diesel train locomotives occurred at several different locations throughout the Site. Currently locomotive fueling is performed east of the McGurl Building.

2.3 Site History

The Site has been utilized as a railroad yard since the 1890s. In 1995, approximately 2,450 tons of petroleum-impacted material were excavated and disposed of off-Site during the removal of four (4) 20,000-gallon diesel underground storage tanks (USTs) located east of the McGurl Building. In 1997, approximately 1,180 tons of petroleum-impacted material were excavated and disposed of off-Site during construction of an addition to the Sheridan Shop locomotive maintenance facility in the western portion of the Site. In 2006, approximately 4,200 tons of petroleum-impacted material were excavated and disposed of off-Site during the construction of a retaining wall east of the McGurl Building. The activities associated with the UST and petroleum-impacted soil removal actions, including the results of sampling, are documented in waste receipts and reports titled "Richmond Hill Storage Yard – UST Removal" and "PN-39 Richmond Hill/Morris Park Improvements – CR-04 Removal of Contaminated Soil – Back-Up Information" (refer to Appendix A for waste receipts and pertinent excerpts of these reports).

On October 30, 2009, a diesel fuel line that runs within a containment trough ruptured, releasing several gallons of diesel fuel onto the adjacent surface soil. The incident occurred along the south side of Track 9, near the western terminus of the track (near the bumper block). Initially it was reported that 5 to 10 gallons had been released, but based on initial cleanup activities, the release is thought to be of a larger quantity.

Upon notification when the spill occurred, the LIRR's contractor responded to the scene and performed an emergency cleanup. Five 55-gallon drums of diesel-contaminated soil were excavated from the spill area. Due to the congested nature of the location where the spill occurred, excavation was performed by hand. As such, most of the cleanup excavation could only extend to a depth of 3.5 feet below grade without undermining the adjacent track or platform. The center of the excavation was extended to 5 feet below grade. At the termination of cleanup activities on October 30, plastic sheeting was placed over the spill excavation, until the LIRR could return to excavate further. A more intrusive cleanup was coordinated by the LIRR and conducted on November 5, 2009. On this day, the LIRR's contractor utilized a Vactor truck with over 200 feet of flex hose to remove an additional five cubic yards of diesel impacted soil. The dimensions of the excavation were approximately 12' by 6' by 3.5' to 5' below grade. An endpoint sample collected from the base of the excavation exhibited elevated concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX) compounds. The endpoint sampling data and a spill location diagram are provided in Appendix A.

2.4 Site Geology and Hydrogeology

The geology of Queens consists primarily of unconsolidated glacial deposits overlying crystalline bedrock. Based on the findings of previous investigations and available literature (Buxton, Soren, Posner, and Shernoff, 1981), the subsurface geology in the area of the Site likely includes the following formations:

- Pleistocene upper glacial deposits (aquifer),
- Pleistocene Gardiners Clay (confining unit),
- Pleistocene Jameco Gravel (aquifer),
- Possibly the Cretaceous Magothy Formation and Matwan Group (confining unit and aquifer),
- Cretaceous Raritan Formation (confining unit and aquifer), and
- Precambrian/Paleozoic metamorphic and igneous bedrock.

Based on the results of investigations performed by TRC on the adjacent Morris Park Yard, the upper glacial deposits at the Site consist of outwash gravels, sands and silty sands extending from land surface to the Gardiners Clay. Groundwater in the unconsolidated glacial deposits at the Site (the "Unconsolidated Upper Aquifer") is encountered at approximately 40 to 50 feet below ground surface (bgs), and local groundwater flow direction is predominantly to the southwest, towards Jamaica Bay.

The Gardiners Clay underlying the Unconsolidated Upper Aquifer consists of greenish-gray clays and silts, with some interbedded sands, and represents a confining layer. The Gardiners Clay at the Site is generally encountered at about 140 to 160 feet bgs. The hydraulic conductivity of this geologic unit is very low.

3.0 PREVIOUS INVESTIGATIONS

In 1997 STV Incorporated of New York ("STV") performed a subsurface soil investigation south of the Sheridan Shop in the Storage Yard as part of planning for the construction of an addition to the shop. In 2007 Gannet Fleming conducted a subsurface soil and groundwater investigation, which included the advancement of soil borings and installation of groundwater monitoring wells, in the Block End of the Storage Yard and an area south of the McGurl Building. In addition, in 2009 LIRR conducted a subsurface soil and groundwater investigation, which included the advancement of soil borings and installation of groundwater monitoring wells in the vicinity of the McGurl Building. Presented below are brief summaries of the results of these prior investigations as well as the results of quarterly groundwater sampling performed by TRC between July 2008 and June 2010.

3.1 STV Soil Investigation

In 1997 STV conducted a subsurface soil investigation at the Site for the LIRR, including the advancement of soil borings south of the Sheridan Shop. The purpose of the investigation was to determine the extent of petroleum impacted soils within the areas of planned construction of an addition to the Sheridan Shop.

The STV "Soils Investigation Report for Planned Locomotive Shop and Electric Substation at Richmond Hill and Morris Park Yards," dated October 1997, reports observation of black staining of soil in the 0 to 2 foot interval below the overlying ballast. Results of laboratory analyses revealed several NYSDEC Spill Technology and Remediation Series (STARS)-listed semi-volatile organic compounds (SVOCs) at concentrations greater than NYSDEC STARS Guidance Values in soil samples collected from 0 to 8 feet below overlying ballast.

3.2 Gannet Fleming Subsurface Soil and Groundwater Investigation

The 2008 Gannett Fleming Findings Report identifies ten historic petroleum spills in the areas of the "Storage Yard" and the McGurl Building. Eight of the petroleum spills occurred on or near the "Block End" portion of the Storage Yard. One petroleum spill reportedly occurred in the former "East Fueling Yard" portion of the Storage Yard. The tenth petroleum spill occurred south of 91st Avenue near the McGurl Building. The locations of the Block End and former East Fueling Yard portions of the Storage Yard, and the McGurl Building, are shown on the Site Plan presented as Figure 2. Based on a review of the Gannett Fleming Findings Report and information available on the NYSDEC Spill Incidents Database a summary of the reported

petroleum spills at the Site in the areas of the Storage Yard and the McGurl Building has been compiled in Table 1 below:

Table 1: Summary of NYSDEC Spill Cases in the Areas of the Storage Yard and the McGurl Building

Spill Number	Location	Spill Cause	Amount
89-08760	Storage Yard Block End Track #10	Not Reported	Unknown
90-05491	Old Turntable/ South of 91st Avenue	Tank Overfill	Unknown
90-08461	Block End – Track #10	Unknown	Unknown
93-10347	Block End – Track #10	Line Leak	1,800 Gallons
94-01535	Block End (Exact Location Unknown)	Equipment Failure	1 Gallon
97-04724	Block End Tracks 1 & 2 Fueling Station	Line Leak	2,400 Gallons
98-05610	Block End Storage Yard (Pipe Elbow)	Line Leak	100 Gallons
98-10288	East Fueling Yard	Line Leak	100 Gallons
99-01518	Near Monitoring Well MW-1 South of 89th Avenue	Line Leak	8,000 Gallons
05-50364	Block End (Fuel Line – Exact Location Unknown)	Line Leak	40,000 Gallons

In 2007 Gannet Fleming conducted a subsurface soil and groundwater investigation at the Site for the LIRR, including the advancement of soil borings and installation of groundwater monitoring wells in the vicinity of the Block End (MW-GF-2, MW-GF-4 and MW-GF-5) and McGurl Building (MW-GF-6, MW-GF-7, MW-GF-8, MW-GF-9 and MW-GF-18). The purpose of the investigation was to investigate impacts to soil and groundwater due to historic operations and spills at the Site and to recommend actions to obtain spill case closure.

In soil samples collected from MW-GF-2, MW-GF-4 and MW-GF-5 (located in the vicinity of the Block End), several VOCs and/or SVOCs were detected, all at concentrations less than NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 Recommended Soil Cleanup Objectives (RSCOs). No visual or olfactory indications of contamination (i.e., no

staining or odor) were observed in the soil samples collected from borings MW-GF-2 and MW-GF-5. Slight odors were recorded in soil samples collected from boring MW-GF-4 at depths of 25 to 27 feet below ground surface (bgs) and 40 to 42 feet bgs. Elevated PID readings and slight odors were also recorded at depths of 9 to 11 feet bgs and 45 to 47 feet bgs in soil samples collected from boring MW-GF-4. No staining was observed in soil samples collected from boring MW-GF4.

In the vicinity of the McGurl Building, in soil samples collected from soil borings MW-GF-6, MW-GF-9 and MW-GF-18 several SVOCs were detected at concentrations above the NYSDEC RSCOs. The highest concentration of total SVOCs detected (in a sample collected from soil boring MW-GF-18 at 9 to 11 feet bgs) was 18,269 µg/kg. No visual or olfactory indications of contamination (i.e., no staining or odor) were observed in the soil samples collected from borings MW-GF-6 and MW-GF-9. Elevated PID readings, staining and/or odors were recorded in soil samples collected from borings MW-GF-7, MW-GF-8, and MW-GF-18.

In groundwater samples collected from monitoring wells MW-GF-2, MW-GF-4 and MW-GF-5 (located in the vicinity of the Block End) in April 2007 and July 2007 VOCs and SVOCs were not detected. In groundwater samples collected from the monitoring well MW-GF-8 (located in the vicinity of the McGurl Building) in April 2007 several VOCs and SVOCs were detected at concentrations above New York State Class GA Groundwater Quality Standards and Guidance Values ("Class GA Values"). Light non-aqueous phase liquid (LNAPL) was detected in April 2007 in monitoring well MW-GF-18. In groundwater samples collected from monitoring wells MW-GF-7 and MW-GF-8 in July 2007 several VOCs were detected at concentrations above Class GA Values. The highest concentration of total VOCs (27.5 µg/L) was detected in the sample collected from MW-GF-8 in July 2007. The highest concentration of total SVOCs (162.4 µg/L) was detected in the sample collected from MW-GF-8 in April 2007.

3.3 LIRR Subsurface Soil and Groundwater Investigation

In 2009 the LIRR conducted a subsurface soil and groundwater investigation at the Site, including the advancement of soil borings and installation of groundwater monitoring wells (MW-34S, MW-35S, and MW-36S) in the vicinity of the McGurl Building. The purpose of the investigation was to supplement the Gannet Fleming Findings Report. The findings of the investigation are reported in the LIRR "Phase I Supplemental Investigation of Petroleum Contamination at the Richmond Hill and Morris Park Facilities," dated June 2, 2009.

Olfactory indications of contamination and "high" PID readings were observed in the soil samples collected from borings MW-34S and MW-36S. VOCs and SVOCs were detected in soil samples collected in the vicinity of the McGurl Building at concentrations below NYSDEC TAGM 4046 RSCOs. The results of the analyses of groundwater samples collected from monitoring wells MW-34S, MW-35S and MW-36S showed VOCs and SVOCs at concentrations less than Class GA Values. Only the SVOC phenanthrene was detected at a concentration (66.5 µg/L) greater than the corresponding Class GA Value (50 µg/L) in the sample collected from monitoring well MW-36S.

3.4 Quarterly Groundwater Sampling (July 2008 through June 2010)

Between July 2008 and June 2010, TRC performed quarterly groundwater sampling of existing wells located on-site and off-site in the vicinity of the Block End and the McGurl Building. The following wells were sampled: MW-GF-2, MW-GF-4, MW-GF-5 and MW-28S (located on-site and off-site upgradient of the Block End along 89th Avenue and 126th Street); and MW-GF-6, MW-GF-7, MW-GF-8, MW-GF-18, MW-34S, MW-35S and MW-36S (located in vicinity of the McGurl Building). Groundwater samples were analyzed for TCL VOCs, and TCL SVOCs.

There were no compounds detected at concentrations above Class GA Values in the groundwater samples collected from monitoring wells in the vicinity of the Block End during the nine (9) quarterly sampling events. Monitoring wells MW-GF-2, MW-GF-4, and MW-GF-5 located on-site and off-site near the Block End were abandoned with NYSDEC approval in March 2010.

VOCs and/or SVOCs were detected at concentrations greater than Class GA Values in samples collected from monitoring wells MW-GF-7, MW-GF-8, MW-GF-18 and/or MW-36S, in the vicinity of the McGurl Building, during the nine (9) quarterly groundwater sampling events. Additionally, LNAPL has been detected intermittently during quarterly groundwater sampling events in monitoring wells MW-GF-8, MW-GF-18 and MW-34S. A summary of the results of the nine (9) quarterly groundwater sampling events is presented in Table 2 below.

Table 2: Summary of Groundwater Sampling Results Above Class GA Values and LNAPL Thickness Measurements near the McGurl Building			
Date	**Monitoring Well ID**	**Measured LNAPL (ft)[1]**	**Groundwater Sampling Results[2]**
July 2008	MW-GF-7	Not detected	sec-Butylbenzene at 5.8 µg/L
	MW-GF-8	Not detected	Isopropylbenzene at 7.0 µg/L n-Propylbenzene at 7.4 µg/L
	MW-GF-18	Detected, not measurable	Not sampled
October 2008	MW-GF-7	Not detected	sec-Butylbenzene at 7.5 µg/L Isopropylbenzene at 6.4 µg/L Naphthalene at 13.5 µg/L
	MW-GF-8	0.29	Not sampled
	MW-GF-18	0.01	Not sampled
January 2009	MW-GF-7	Not detected	sec-Butylbenzene at 5.4 µg/L Naphthalene at 13.4 µg/L
	MW-GF-8	Not detected	Isopropylbenzene at 6.1 µg/L n-Propylbenzene at 6.1 µg/L
	MW-GF-18	Not detected	Phenanthrene at 72.1 µg/L
April 2009	MW-36S	Not detected	Phenanthrene at 66.5 µg/L
	MW-GF-8	0.40	Not sampled
	MW-GF-18	Detected, not measurable	Not sampled
July 2009	MW-34S	0.01	Not sampled
	MW-GF-7	Not detected	Naphthalene at 10.2 µg/L
	MW-GF-8	Not detected	n-Butylbenzene at 12.1 µg/L sec-Butylbenzene at 10.1 µg/L Isopropylbenzene at 9.2 µg/L n-Propylbenzene at 10.9 µg/L Naphthalene at 12.6 µg/L
	MW-GF-18	Not detected	n-Butylbenzene at 13.5 µg/L
October 2009	MW-36S	Not detected	sec-Butylbenzene at 5.6 µg/L
	MW-GF-7	Not detected	sec-Butylbenzene at 6.7 µg/L Isopropylbenzene at 7.3 µg/L
	MW-GF-8	Not detected	Isopropylbenzene at 6.0 µg/L n-Propylbenzene at 5.8 µg/L Naphthalene at 19 µg/L
	MW-GF-18	Not detected	sec-Butylbenzene at 5.5 µg/L
January 2010	MW-GF-7	Not detected	sec-Butylbenzene at 6.4 µg/L Isopropylbenzene at 6.5 µg/L
	MW-GF-18	Not detected	sec-Butylbenzene at 5.3 µg/L

Table 2: Summary of Groundwater Sampling Results Above Class GA Values and LNAPL Thickness Measurements near the McGurl Building

Date	Monitoring Well ID	Measured LNAPL (ft)[1]	Groundwater Sampling Results[2]
April 2010	MW-GF-7	Not detected	sec-Butylbenzene at 5.1 µg/L
	MW-GF-8	Not detected	Isopropylbenzene at 8.7 µg/L n-Propylbenzene at 8.8 µg/L
	MW-GF-18	Not detected	sec-Butylbenzene at 5.3 µg/L Acenaphthene at 30 µg/L Fluorene at 62 µg/L Phenanthrene at 100 µg/L
July 2010	MW-36S	Not detected	sec-Butylbenzene at 6.0 µg/L
	MW-GF-7	Not detected	sec-Butylbenzene at 5.3 µg/L
	MW-GF-8	0.02	Not sampled
	MW-GF-18	Not detected	n-Butylbenzene at 6.6 µg/L sec-Butylbenzene at 7.4 µg/L

Notes:

1. Periodic passive recovery of LNAPL has been performed by LIRR in the monitoring wells near the McGurl Building.
2. Class GA Values: acenaphthene – 20 µg/L, fluorene – 50 µg/L, isopropylbenzene – 5 µg/L, n-butylbenzene – 5 µg/L, n-propylbenzene –5 µg/L, naphthalene – 10 µg/L, phenanthrene – 50 µg/L, and sec-butylbenzene – 5 µg/L.

Based on the results of the 2007 Gannet Fleming investigations (described in Section 3.2 above), the 2009 LIRR investigation (described in Section 3.3 above), and nine (9) quarters of sampling of the groundwater monitoring wells (summarized in the table above), in the vicinity of the McGurl Building the extent of petroleum-related impacts have been delineated. Marginal exceedances of Class GA Values and/or LNAPL have only consistently been detected in monitoring wells MW-GF-7, MW-GF-8, and MW-GF-18. LNAPL has not been detected in the downgradient wells, MW-35S and MW-36S. Also, during the most recent year of sampling events (October 2009 through July 2010), only on two occasions was an exceedance of a Class GA Value detected in a sample collected from the downgradient wells MW-35S and MW-36S. Sec-butylbenzene was detected at concentrations of 5.6 µg/L and 6.0 µg/L in the samples collected from MW-36S in October 2009 and July 2010, respectively. The Class GA Value for sec-butylbenzene is 5 µg/L.

4.0 SUPPLEMENTAL INVESTIGATION OBJECTIVES AND METHODS

This section of the Work Plan presents the objectives and methods for the proposed additional investigation in connection with Spill Nos. 89-08760 and 09-08574, and follows the guidance for an investigative work plan in NYSDEC Division of Environmental Remediation DER-10 Technical Guidance for Site Investigation and Remediation. The Work Plan has been prepared in consideration of the Site history and findings of previous investigations (refer to Sections 2.0 and 3.0).

The Quality Assurance Project Plan (QAPP) detailing the organization, data objectives, and specific quality assurance/quality control (QA/QC) procedures to be implemented as part of the Supplemental Investigation is in Appendix B. A site-specific Health and Safety Plan (HASP) for implementing the Supplemental Investigation is included in Appendix C.

4.1 Recognized Environmental Conditions

Previous reports and investigations conducted by STV, Gannett Fleming, LIRR and TRC document the known or potential presence of elevated levels of petroleum-related VOCs and SVOCs in soil and/or groundwater in the vicinity of the McGurl Building, the former East Fueling Yard and the area near the western terminus of Track 9. Based on a review of the findings of the previous investigations the recognized environmental conditions (RECs) associated with the area in the vicinity of the McGurl Building have been characterized and delineated (refer to Section 3.4). Additional investigation of the former East Fueling Yard and the area near the western terminus of Track 9 is the focus of this section of the Work Plan, to characterize the related RECs.

4.2 Current Conceptual Site Model

The Site has been utilized as a train locomotive yard for over 100 years. Periodic and routine maintenance as well as fueling has been performed on diesel locomotives at the Site. Documented historic and existing petroleum-related impacts (particularly compounds associated with diesel fuel) in and around the Storage Yard and McGurl Building, in soil and groundwater, can be attributed to historic releases at the Site. Significant investigation as well as removal of petroleum-impacted material has been performed in connection with these areas. An important

consideration is that the Storage Yard is an active LIRR operations area which encompasses a complex arrangement of tightly spaced tracks, buried utilities and other railroad infrastructure, representing difficult conditions for subsurface investigation.

Groundwater surface in the unconsolidated glacial deposits at the Site (the "Unconsolidated Upper Aquifer") is present at approximately 40 to 50 feet bgs, and predominant local groundwater flow direction is to the southwest, towards Jamaica Bay. Based on the results of investigations performed by TRC on the adjacent Morris Park Yard the upper glacial deposits at the Site consist of outwash gravels, sands and silty sands extending from land surface to the Gardiners Clay. The Gardiners Clay underlying the Unconsolidated Upper Aquifer consists of greenish-gray clays and silts, with some interbedded sands, and represents a confining layer. The Gardiners Clay at the Site is generally encountered at about 140 to 160 feet bgs. The hydraulic conductivity of this geologic unit is very low.

There were no compounds detected at concentrations above Class GA Values in the groundwater samples collected from monitoring wells in the vicinity of the Block End during quarterly sampling events over the past two (2) years. MW-GF-2, MW-GF-4, and MW-GF-5 located on-site and off-site near the Block End were abandoned with NYSDEC approval in March 2010. Therefore, no further investigation is warranted in this portion of the Site.

The results of analyses of groundwater samples collected during quarterly sampling of monitoring wells between 2008 and 2010 in the vicinity of the McGurl Building indicate the intermittent presence of a thin layer of highly localized LNAPL and dissolved phase petroleum-related compounds at concentrations generally within an order of magnitude of Class GA Values. The extent of LNAPL and dissolved phase contamination in the vicinity of the McGurl Building has been delineated. Additional sampling data in the vicinity of the former East Fueling Yard and near the western terminus of Track 9 is required to characterize these areas. Therefore, the scope of the planned Supplemental Investigation activities which are the subject of this Work Plan is limited to the former East Fueling Yard and near the western terminus of Track 9.

4.3 Objectives

The principal objectives of this Supplemental Investigation is to complete the characterization of impacts related to petroleum releases associated with Spill Case Nos. 89-08760 and 09-08574 as

well as to collect data necessary for selection of an appropriate remedial action, to the extent required.

4.4 Scope of Investigation

The scope of the planned investigation activities are as follows:

- Soil sampling,
- Monitoring well installation,
- Groundwater sampling, and
- Sample location surveying.

The site-specific sampling techniques and analytical methods to be used in implementing the Supplemental Investigation are presented in the QAPP in Appendix B. The investigation activities will be performed in accordance with the site-specific HASP in Appendix C. Community air monitoring requirements to be performed during implementation of the Work Plan are described in the HASP.

A summary of the sampling program is presented in Table 3 below and each component of the Supplemental Investigation scope is described in the following subsections.

Table 3: Supplemental Investigation Work Plan Sampling Summary[1]

Program Element	Environmental Media	Sample Type	Equipment	Number of Samples for Analysis	Parameters[2]
Soil Sampling	Soil	Grab sample	Soil sampler	19	VOCs and SVOCs
Groundwater Sampling	Groundwater	Water in well after purging well	Low-flow pump, flow-through cell	Up to 5	VOCs and SVOCs
Groundwater Sampling	Groundwater	Water in well after purging well	Low-flow pump, flow-through cell	2	Iron and manganese[3]

Table 3: Supplemental Investigation Work Plan Sampling Summary[1]					
Program Element	**Environmental Media**	**Sample Type**	**Equipment**	**Number of Samples for Analysis**	**Parameters[2]**
Field Duplicates	Groundwater	Water in well after purging well	Low-flow pump, flow-through cell	1 per 20 soil and groundwater samples	VOCs and SVOCs
Trip Blanks	Distilled Water	Distilled water in laboratory glassware	Sample supplied by laboratory	1 per cooler with soil or groundwater VOC samples	VOCs
Equipment Blanks	Distilled Water	Sampling equipment rinsate	Soil sampler and bladder pump	1 per 20 soil and groundwater samples	VOCs and SVOCs

[1]Does not include analysis of soil for grain size and fingerprint analysis of LNAPL if encountered.

[2]Analyses for VOCs and SVOCs will consist of the contaminants listed in Table 3 of the "Commissioner Policy 51 - Soil Cleanup Guidance (CP – 51)" in accordance with paragraph 2.1(a)(3) of DER-10.

[3]Analysis for iron and manganese is for the purpose of remedial alternatives analysis only.

4.5 Task 1 – Soil Sampling

The overall objective of Task 1 will be to characterize impacts to soil from petroleum releases. Seven (7) borings will be advanced. As shown on Figure 3, soil borings MW-38S and MW-39S will be installed in the former East Fueling Yard between Tracks 7 and 8. As shown on Figure 4, soil borings SB-1 through SB-5 will be installed in the vicinity of the western terminus of Track 9. Prior to intrusive investigation work, boring locations will be evaluated for the potential presence of underground utilities as described in the site-specific HASP and locations will be adjusted, if appropriate.

Borings MW-38S and MW-39S will be advanced in the vicinity of the former East Fueling Yard, utilizing a hollow-stem auger drill rig, and continuously sampled from approximately five (5) feet below ground surface to approximately five (5) feet below the water table (anticipated to be 40 to 50 feet bgs) or approximately five (5) feet below the deepest evidence of petroleum-impacted material, whichever is deeper. A trained and experienced TRC geologist or project scientist will screen soils for VOCs utilizing a PID properly calibrated for detection of petroleum-type contamination. Field observations, including evidence of contamination (i.e.,

odors, staining, NAPL, etc.), PID readings, and geological descriptions of each soil sample will be recorded in a field log book. Drill cuttings will be contained in drums.

From each boring (MW-38S and MW-39S), samples will be selected for laboratory analysis as follows:

- The most apparently impacted soil sample collected (i.e., interval exhibiting highest PID readings, strongest odor, and/or greatest staining), and
- The soil interval at the groundwater table interface.

If in the boreholes of MW-38S or MW-39S evidence of contamination is not encountered, the sample interval at the groundwater table interface will be submitted for laboratory analysis.

Boring SB-1 will be advanced near the center of the area of impact associated with Spill Case No. 0908574, utilizing direct push methods, and continuously sampled from approximately five (5) feet below ground surface to approximately five (5) feet below the deepest apparent diesel-impacted soil interval (based on visual and olfactory indications and PID measurements). If five (5) consecutive feet of non-impacted soil are observed above the groundwater table, the boring will be terminated. If impacted soil is encountered within five (5) feet of the groundwater table the boring will be advanced at least five (5) feet below the groundwater interface or approximately five (5) feet below the deepest evidence of petroleum-impacted material, whichever is deeper, and completed as a groundwater monitoring well as described in Section 4.6. SB-2 through SB-5 will be advanced following the same protocol to delineate the horizontal and vertical extent of diesel-impacted material (up to two of the boreholes will be converted to groundwater monitoring wells). A trained and experienced TRC geologist or project scientist will screen soils for VOCs utilizing a PID properly calibrated for detection of petroleum-type contamination. Field observations, including evidence of contamination (i.e., odors, staining, NAPL, etc.), PID readings, and geological descriptions of each soil sample will be recorded in a field log book. Drill cuttings will be contained in drums.

From each boring (SB-1 through SB-5), up to three (3) soil samples will be selected for laboratory analysis. The following depth intervals will be selected for laboratory analysis from each boring:

- The most apparently impacted soil sample collected (i.e., interval exhibiting highest PID reading, strongest odor, and/or greatest staining),
- The soil interval free of diesel impacts (based on field observations) immediately underlying the impacted interval, and
- The deepest soil interval.

If there are no samples which exhibit evidence of contamination in a boring, only two samples from the boring will be submitted for analysis. Specifically, the shallowest and deepest samples will be selected for analysis.

Soil samples will be shipped to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory and analyzed for VOCs and SVOCs listed in Table 3 of NYSDEC Commissioner Policy 51 – Soil Cleanup Guidance (CP-51). Samples will be submitted to the laboratory for petroleum "fingerprint" analysis if separate-phase liquid is observed. In addition one sample of each distinct subsurface material encountered (i.e., fill material, sand, etc.) will be collected and analyzed for grain size, for future use in evaluating potential remedial alternatives, to the extent required.

4.6 Task 2 – Monitoring Well Installation

The overall objective of this task will be to install two (2) groundwater monitoring wells in the former East Fueling Yard and up to three (3) groundwater monitoring wells near the western terminus of Track 9. As shown on Figure 3, two (2) permanent groundwater monitoring wells, MW-38S and MW-39S, will be installed in the Former East Fueling Yard. The two (2) groundwater monitoring wells in the Former East Fueling Yard will be installed in the boreholes advanced as part of Task 1 described above. As shown on Figure 4, up to three (3) permanent groundwater monitoring wells, MW-40S through MW-42S, will be installed near the western terminus of Track 9. Groundwater monitoring wells MW-40S through MW-42S, near the western terminus of Track 9, will only be installed if the diesel-impacted soil encountered in SB-1, SB-2, SB-3, SB-4 or SB-5 extends to within five (5) feet of the water table interface. The boreholes for groundwater monitoring wells MW-40S through MW-42S will be advanced by hollow stem auger drilling methods (no soil samples will be collected, since the soil will have already been sampled as part of Task 1). The actual locations of MW-40S through MW-42S may be adjusted based on the results of the soil sampling described under Task 1 above.

Well construction procedures are described in detail in the QAPP. The groundwater surface is expected to be approximately 40 to 50 feet bgs based on information from prior investigations. It is anticipated the monitoring wells will be constructed with 20-foot long screens (five feet above the water table and fifteen feet below).

Once drilling and soil sampling are complete, well construction will proceed as follows:

- Casing and screen will be inserted and set to the desired depth described above. Each well will be constructed using 4-inch diameter Schedule 40 PVC casing and an approximately 20-foot length of 10-slot (0.010-inch) PVC screen;
- The annular space between each well screen and the borehole wall will be filled with clean silica sand to one foot above the top of the screen;
- A 2-foot thick layer of bentonite pellets or chips will be installed above the sand pack and hydrated with potable water;
- The remainder of each borehole annulus will be filled with cement or cement-bentonite grout to within 2 feet of grade; and
- After the grout has been allowed to settle each well will be completed with a concrete pad, secure locking plug and flush-mounted protective manhole.

The new monitoring wells will be developed after construction, by pumping and/or bailing. The purpose of development is to create a hydraulic connection between the well and the surrounding formation by removing fine-grained sediments from the screened interval and sand-pack. The goal will be to produce a sediment-free discharge, although this may not be practical in extremely fine-grained materials. Observations of well yield, sediment content, odors/sheens, etc. will be recorded in the field log book. Water will not be added to facilitate development. Purged groundwater during development will be contained in drums.

4.7 Task 3 – Groundwater Sampling

The overall purpose of this task will be to determine the quality of groundwater in the new wells. Groundwater samples will be collected from each of the new monitoring wells installed approximately one (1) week following completion of installation. Groundwater sampling will proceed from upgradient to downgradient locations to lessen the possibility of cross contamination, and will be performed utilizing low-flow groundwater sampling techniques in accordance with the procedures in the QAPP.

Prior to purging each well the head space will be measured with a PID and the well will be gauged with an oil/water interface probe. If LNAPL is encountered in a well the thickness will be measured and recorded, and a groundwater sample will not be collected for analysis. LNAPL, if encountered, will be sampled and submitted to the laboratory for fingerprint analysis.

During purging, prior to sampling of each monitoring well, the following field parameters will be measured: pH, temperature, conductivity, dissolved oxygen, turbidity and oxidation-reduction potential. A discrete sample will be collected by positioning the bladder pump in the new wells at the mid-point of the saturated well screen interval during sample collection using low-flow techniques.

The groundwater samples collected will be submitted to a NYSDOH accredited laboratory and analyzed for the VOCs and SVOCs listed in Table 3 of CP-51. Up to two of the five groundwater samples will additionally be analyzed for iron and manganese for use in analysis of remedial alternatives only. Purged groundwater will be contained in drums.

4.8 Task 4 – Sample Location Survey

The purpose of this task will be to establish the locations of the new soil borings and groundwater monitoring wells. The locations of new borings and wells will be surveyed and mapped by a land surveyor licensed to practice in the State of New York. Also, the elevations of the tops of casing of the new wells will be surveyed. A to-scale map will be prepared showing the locations and elevations of the tops of casings of the new and the existing wells.

4.9 Task 5 – Management of Investigation Derived Waste

Drilling cuttings, development water, purge water and decontamination water generated during the investigation will be contained in 55-gallon steel drums. Drums will be labeled after use and staged in a secure on site location to be selected in consultation with LIRR. Drums will be transported off site for disposal following receipt of analytical data and disposal facility approval. It is likely that waste will be accepted by the selected disposal facility on the basis of the analytical data collected during the soil and groundwater investigation. As such, no additional waste characterization sampling and analysis is planned.

5.0 PROJECT PERSONNEL

Key project personnel and contact information are identified in Table 4 below. Resumes of key TRC project personnel are in Appendix D.

Table 4: Key Personnel and Contact Information

Name	Role	Phone Number
Maria Hall, LIRR	LIRR Project Manager	(718) 558-3826
David Glass, TRC	TRC Project Director	(212) 221-7822, ext. 112
Jennifer DiPilato, TRC	TRC Project Manager	(212) 221-7822, ext. 120 cellular: (914) 806-5719
Patrick Narea, TRC	Project Geologist	(212) 221-7822, ext. 133 cellular: (917) 589-4907
Daniel Warren, TRC	Field Team Leader	(212) 221-7822, ext. 138 cellular: (917) 232-9837
Jennifer Miranda, TRC	Health and Safety Officer	(212) 221-7822, ext. 102 cellular: (646) 285-8990
Elizabeth Denly, TRC	Quality Assurance Officer	(978) 970-5600
William Poupis, Aquifer Drilling and Testing, Inc.	Drilling Services	(516) 616-6026
Dorothy Richter, Hager-Richter Geoscience, Inc.	Geophysical Services	(603) 893-9944
Joe Dockery, Chemtech	Laboratory Services	(732) 225-4111
Christopher Caino, Munoz Engineering	Land Surveying Services	(212) 967-6588

6.0 REPORTING

A Supplemental Investigation/Remedial Action Selection (SI/RAS) Report will be prepared after receipt of surveying and laboratory data. The SI/RAS Report will conform to the guidelines set forth in NYSDEC DER-10 Sections 3.14 (Remedial Investigation Report) and 4.4 (Remedy Selection Reporting Requirements) to the extent consistent with the scope of the investigation described above and to the extent necessary and applicable. The SI/RAS Report will include the following:

- Summaries of historic data and the results of prior investigations;
- A description of the scope of the Supplemental Investigation;
- Descriptions of investigation methods;
- Scaled site plan of soil and groundwater sampling locations;
- Field sample screening data and documentation (logs, chain-of-custody forms, etc.);
- Results of the soil and groundwater investigations, including laboratory data packages, and a discussion of the findings;
- Groundwater surface elevation contour map showing apparent gradients and predominant local groundwater flow direction;
- Map summarizing the results of the soil and groundwater sampling, showing locations of LNAPL (if encountered) and highlighting exceedances of relevant regulatory standards, criteria and guidance;
- An analysis and discussion with a supporting drawing showing the estimated overall extent of soil and groundwater contamination and LNAPL, if encountered; and,
- Evaluation of potential remedial alternatives for LNAPL recovery from wells containing LNAPL as well as for petroleum contaminated soil and groundwater.

7.0 SCHEDULE

Presented below are estimated completion dates for key milestones associated with implementation of the Supplemental Investigation.

KEY MILESTONE	WORKING DAYS FROM WORK PLAN APPROVAL
NYSDEC Approval of Work Plan	0
Begin Supplemental Investigation Field Activities	15
Complete Supplemental Investigation (including laboratory analyses)	45
Submit Supplemental Investigation/ Remedial Action Selection (SI/RAS) Report to NYSDEC	95

8.0 REFERENCES

1. *Soils Investigation Report for Planned Locomotive Shop & Electric Substation at Richmond Hill and Morris Park Yards*, STV Incorporated, October 1997.

2. *Phase I Supplemental Investigation of Petroleum Contamination at the Richmond Hill and Morris Park Facilities,* Long Island Rail Road, June 2009.

3. *Findings Report of the Groundwater Investigation of Petroleum Contamination at Richmond Hill and Morris Park Facilities,* Gannet Fleming Engineers and Architects, P.C., September 2007 – revised February 2008.

4. *Progress Report – August, 2008, Spills #92-12990 and #89-08760,* LIRR, August 2008.

5. *Progress Report – November 1, 2008, Spills #92-12990 and #89-08760*, LIRR, November 2008.

6. *Progress Report – February 1, 2008, Spills #92-12990 and #89-08760*, LIRR, February 2009.

7. *Progress Report – May 1, 2009, Spills #92-12990 and #89-08760,* LIRR, May 2009.

8. *Progress Report – August 1, 2009, Spills #92-12990 and #89-08760*, LIRR, August 2009.

9. *Progress Report – November 1, 2009, Spills #92-12990 and #89-08760,* LIRR, November 2009.

10. *Progress Report – February 1, 2010, Spills #92-12990 and #89-08760*, LIRR, February 2010.

11. *Progress Report – May 1, 2010, Spills #92-12990 and #89-08760,* LIRR, May 2010.

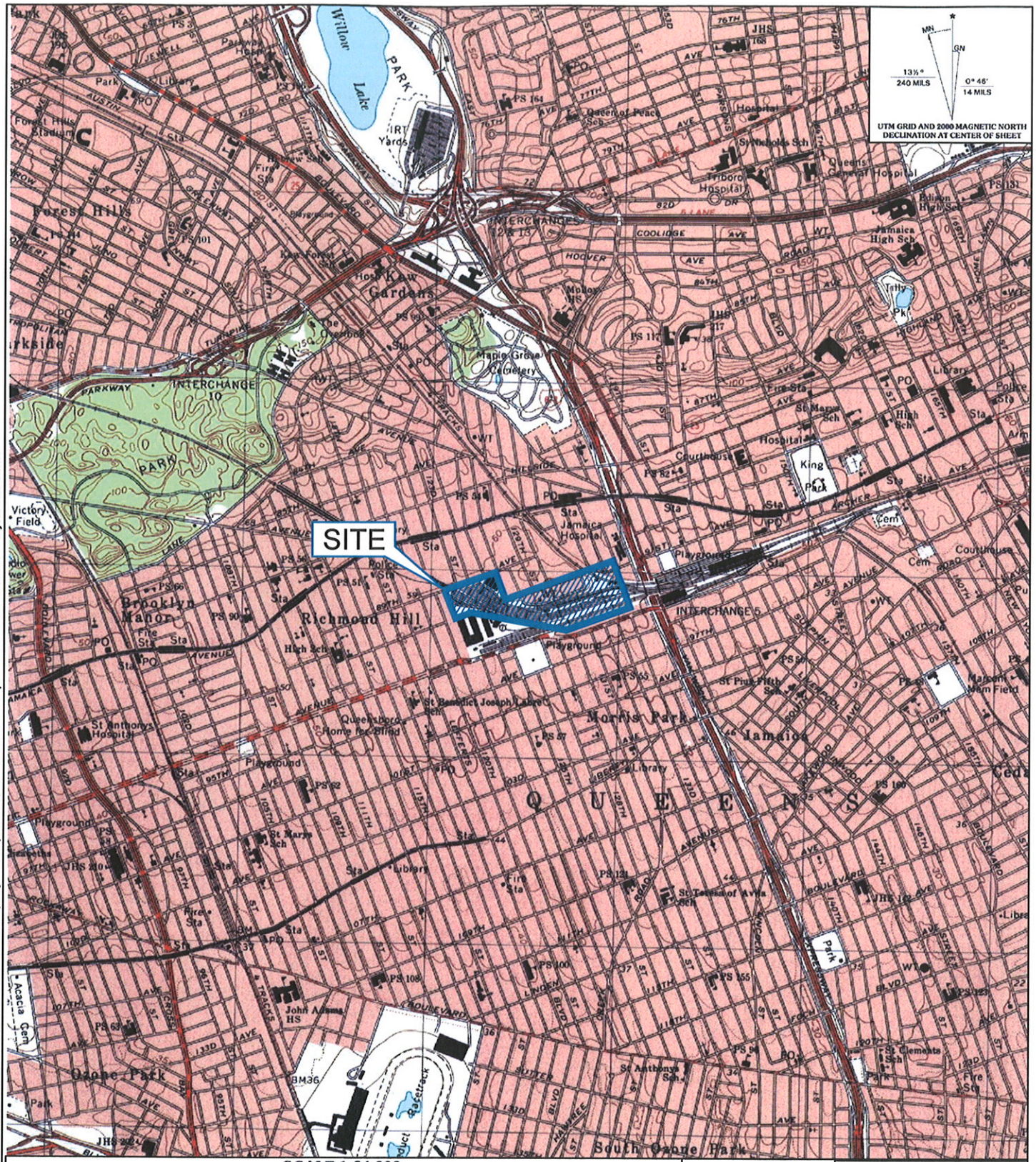
12. *Progress Report – August 1, 2010, Spills #92-12990 and #89-08760*, LIRR, August 2010.

13. *Bedrock and Engineering Geologic Maps of New York County and Parts of Kings and Queens Counties, New York, and Parts of Bergen and Hudson Counties, New Jersey,* Charles A. Baskerville, 1994.

14. *Reconnaissance of the Ground-Water Resources of Kings and Queens Counties, New York*, Herbert Buxton, Julian Soren, Alex Posner, and Peter Shernoff, U.S. Geological Survey, Open File Report 81-1186, 1981.

15. Spill Investigation for the LIRR – Richmond Hill Yard (Spill No. 098574), Richmond Hill, New York 11418

FIGURES



SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2

1000 0 METERS 1000 2000

1 0.5 0 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

QUADRANGLE LOCATION

JAMAICA, NY

1994

NIMA 6265 III NE-SERIES V821

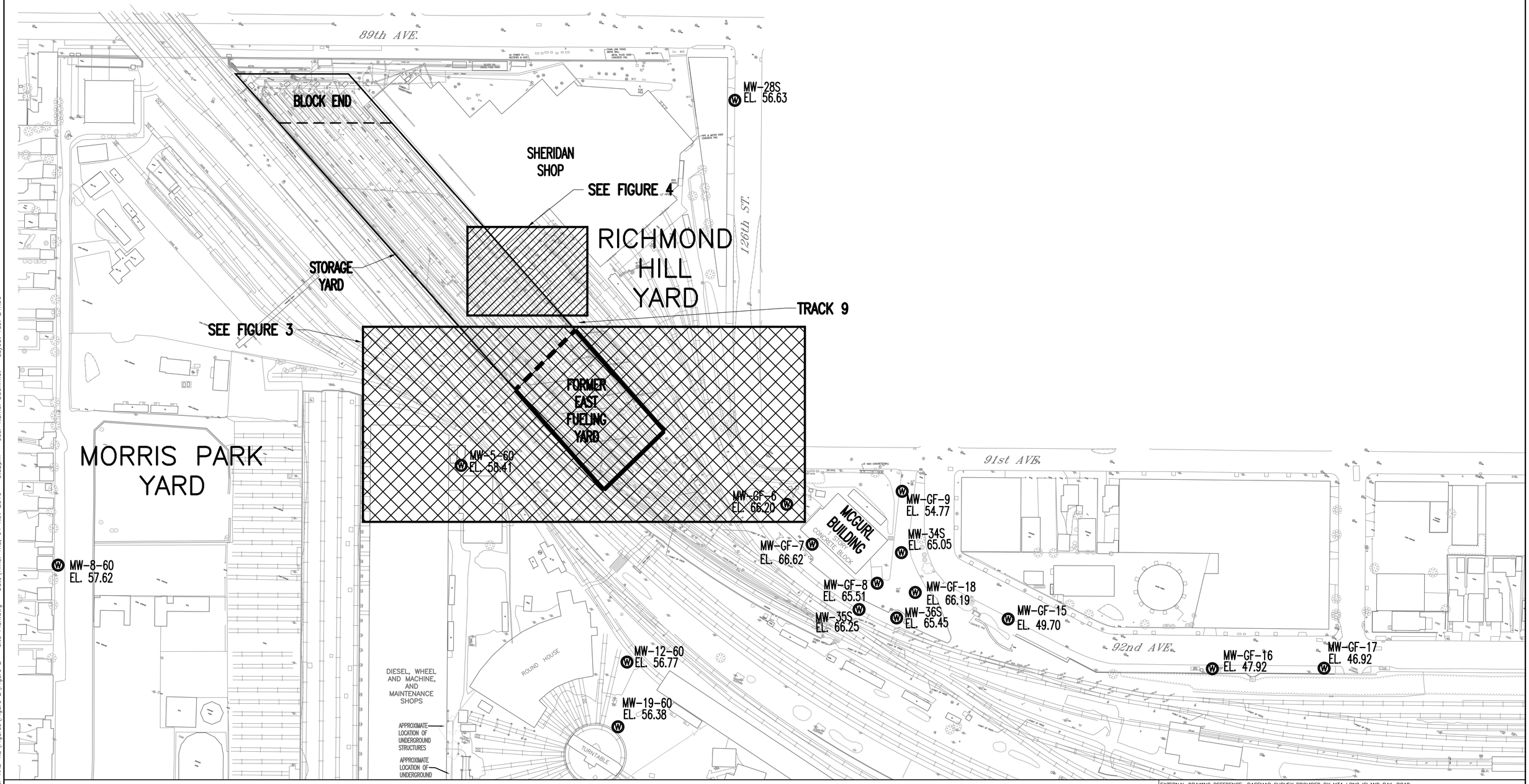
MAP OBTAINED THROUGH USE OF MAPTECH TERRAIN NAVIGATOR PRO SOFTWARE.

TRC
1430 BROADWAY, 10TH FLOOR
NEW YORK, NEW YORK 10018
212-221-7822

DESIGNED BY: DW	PROJECT NAME: MTA LONG ISLAND RAIL ROAD RICHMOND HILL YARD QUEENS, NEW YORK
DRAWN BY: HD	
CHECKED BY: DSG	
DATE: NOVEMBER 2010	DRAWING TITLE: SITE LOCATION
SCALE: AS SHOWN	
PROJECT NUMBER: 178983.0000.0000	

FIGURE 1

Path\Name: i:\Projects\178983 – LIRR Richmond Hill SI-RAS-RD\Figures\Figure 1\Figure 1 – Site Location Map.dwg – Date\Time: Thu, 04 Nov 2010 – 3:29pm – User Name: DSchmidt – Layout Tab: 8.5X11



NOTES:

1. BASE MAP COMPILED BY AIR SURVEY PHOTOGRAMMETRIC MAPPING SERVICES, 45180 BUSINESS COURT, DULLES, VIRGINIA 20166-6706 BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 02-14-04.
2. THE LOCATIONS OF UNDERGROUND STRUCTURES AND UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE.
3. WELLS LABELED MW-GF-XX WERE SURVEYED BY NIK CONSULTING GROUP ON MAY 20 AND 21, 2007.
4. WELLS LABELED MW-34S, MW-35S AND MW-36S WERE SURVEYED BY MUNOZ ENGINEERING P.C. IN OCTOBER 2009.

HORIZONTAL DATUM: NAD 1983
VERTICAL DATUM: NAVD 1988

LEGEND:

MW-GF-6 (W) EL. 66.20 — GROUNDWATER MONITORING WELL LOCATION, IDENTIFICATION NUMBER AND ELEVATION OF TOP OF CASING (SYMBOL NOT TO SCALE)

NORTH

0 60' 120'
GRAPHIC SCALE
SHEET SIZE: 24"X36"

EXTERNAL DRAWING REFERENCE: BASEMAP SURVEY PROVIDED BY MTA LONG ISLAND RAIL ROAD

NUMBER	DATE	REVISIONS	APPROVED

TRC
1430 BROADWAY, 10TH FLOOR
NEW YORK, NEW YORK 10018
212-221-7822

MTA LONG ISLAND RAIL ROAD
RICHMOND HILL YARD
QUEENS, NEW YORK

SITE PLAN

PO# 178983.000003.000000
DRAWN: HD 11/04/10
CHECKED: DSG 11/04/10
SHEET 1 OF 1
SCALE: AS SHOWN

FIG.2

Path\Name: I:\Projects\178983 - LIRR Richmond Hill SI-RAS-RD\Figures\Figure 2\Figure 2 - Site Plan.dwg - Date\Time: Thu, 04 Nov 2010 - 3:32pm - User Name: DSchmidt - Layout Tab: 24X36

MORRIS PARK YARD

RICHMOND HILL YARD

STORAGE YARD

FORMER EAST FUELING YARD

MW-38S

MW-39S

MW-5-60

MW-GF-6

NOTES:

1. BASE MAP COMPILED BY AIR SURVEY PHOTOGRAMMETRIC MAPPING SERVICES, 45180 BUSINESS COURT, DULLES, VIRGINIA 20166-6706 BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 02-14-04.
2. THE LOCATIONS OF UNDERGROUND STRUCTURES AND UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE.
3. WELLS LABELED MW-GF-XX WERE SURVEYED BY NIK CONSULTING GROUP ON MAY 20 AND 21, 2007.
4. WELLS LABELED MW-34S, MW-35S AND MW-36S WERE SURVEYED BY MUNOZ ENGINEERING P.C. IN OCTOBER 2009.
5. HORIZONTAL DATUM: NAD 1983
   VERTICAL DATUM: NAVD 1988

LEGEND (SYMBOLS NOT TO SCALE):

MW-GF-6 (W) — EXISTING GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER

MW-X — PROPOSED SOIL BORING AND GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER

NORTH

0 20' 40'

GRAPHIC SCALE

SHEET SIZE: 24"X36"

EXTERNAL DRAWING REFERENCE: BASEMAP SURVEY PROVIDED BY MTA LONG ISLAND RAIL ROAD

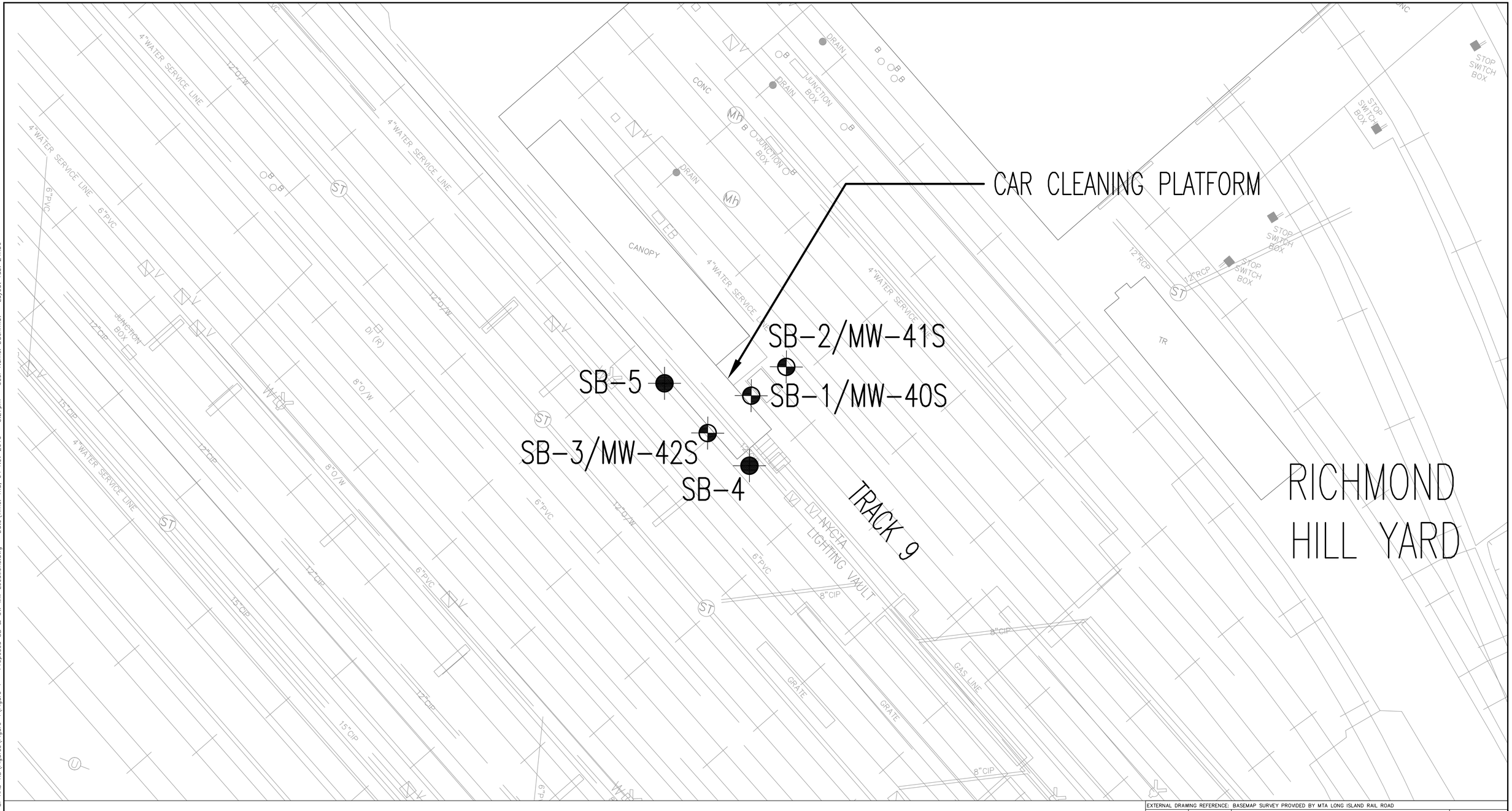
NUMBER	DATE	REVISIONS	APPROVED

TRC
1430 BROADWAY, 10TH FLOOR
NEW YORK, NEW YORK 10018
212-221-7822

MTA LONG ISLAND RAIL ROAD
RICHMOND HILL YARD
QUEENS, NEW YORK

PROPOSED SOIL BORING AND
GROUNDWATER MONITORING WELL LOCATIONS
SPILL CASE NO. 89-08760

PO# 178983.000003.000000		SHEET 1 OF 1	FIG.3
DRAWN: HD	11/04/10	SCALE: AS SHOWN	
CHECKED: DSG	11/04/10		



NOTES:

1. BASE MAP COMPILED BY AIR SURVEY PHOTOGRAMMETRIC MAPPING SERVICES, 45180 BUSINESS COURT, DULLES, VIRGINIA 20166-6706 BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 02-14-04.
2. THE LOCATIONS OF UNDERGROUND STRUCTURES AND UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE.
3. THE ACTUAL LOCATIONS OF MW-40S THROUGH MW-42S MAY BE ADJUSTED BASED ON THE RESULTS OF THE SOIL SAMPLING DESCRIBED UNDER TASK 1.

LEGEND (SYMBOLS NOT TO SCALE):

SB-X/MW-X — PROPOSED SOIL BORING AND GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER. GROUNDWATER MONITORING WELLS WILL ONLY BE INSTALLED AT THESE LOCATIONS IF DIESEL-IMPACTED SOIL IS ENCOUNTERED WITHIN 5 FEET OF THE WATER TABLE.

SB-X — PROPOSED SOIL BORING LOCATION AND IDENTIFICATION NUMBER

SHEET SIZE: 24"X36"

EXTERNAL DRAWING REFERENCE: BASEMAP SURVEY PROVIDED BY MTA LONG ISLAND RAIL ROAD

NUMBER	DATE	REVISIONS	APPROVED

TRC
1430 BROADWAY, 10TH FLOOR
NEW YORK, NEW YORK 10018
212-221-7822

MTA LONG ISLAND RAIL ROAD
RICHMOND HILL YARD
QUEENS, NEW YORK

PROPOSED SOIL BORING AND
GROUNDWATER MONITORING WELL LOCATIONS
SPILL CASE NO. 09-08574

PO# 178983.000003.000000		SHEET 1 OF 1	FIG.4
DRAWN: HD	11/04/10	SCALE: AS SHOWN	
CHECKED: DSG	11/04/10		