SITE CHARACTERIZATION WORK PLAN FOR THE INLAND PARCELS, FORMER PRATT OIL WORKS SITE

Long Island City, New York

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SECTION 1

INTRODUCTION

1.1 PROJECT BACKGROUND

ExxonMobil and the New York State Department of Environmental Conservation (NYSDEC) negotiated a Consent Order (Consent Order No. D2-1002-12-07AM) under which ExxonMobil has voluntarily agreed to perform an investigation of the current environmental conditions of several individual properties which formerly comprised the Former Pratt Oil Works (FPOW). The objective of the investigation is to better understand the origin, nature, and extent of any environmental conditions that may exist on the properties. ExxonMobil has agreed to perform a thorough assessment of these properties even though there were several decades of petroleum-related operations pre- and post- ExxonMobil ownership. ExxonMobil operations ceased in approximately 1949.

The properties that are the subject of this Work Plan are located at 37-88, 38-20, 39-30, 38-98, 38-70, 38-78, 38-60, and 38-50 Review Avenue and 38-54, 38-84, and 38-40 Railroad Avenue in Long Island City, Queens, New York (Figure 1). These properties are referred to hereafter collectively as the “Inland Parcels.” Based on recent tax records, the addresses of these properties are believed to be as follows:

Block	Lot	Owner Name	Assumed Address
312	79	Up From the Ashes Inc.	37-88 Review Avenue, Long Island City, NY 11101
312	89	Review Associates	38-20 Review Avenue, Long Island City, NY 11101
312	330	Pepatoba Corp.	39-30 Review Avenue, Long Island City, NY 11101
312	343	Dg Properties LLC	38-98 Review Avenue, Long Island City, NY 11101
312	348	Keane Realty LLC	38-70 Review Avenue, Long Island City, NY 11101
312	349	Werwaiss Realty Co.	38-78 Review Avenue, Long Island City, NY 11101
312	350	Renari LLC	38-60 Review Avenue, Long Island City, NY 11101
312	362	HP Sherman Co. Inc.	38-50 Review Avenue, Long Island City, NY 11101
312	500	Boro Valve Inc.	38-54 Railroad Avenue, Long Island City, NY 11101
312	1362	A & L Cesspool Ser./Co.	38-84 Railroad Avenue, Long Island City, NY 11101
312	1367	Waste Management	38-40 Railroad Avenue, Long Island City, NY 11101

It has been determined that the Inland Parcels have been owned by a predecessor of ExxonMobil, and are part of the FPOW, which once operated between Review Avenue and Newtown Creek. Figure 2 depicts the current properties comprising the Inland Parcels.

As discussed later in Section 2.4 of this Work Plan, to ExxonMobil’s knowledge, limited subsurface investigations have been conducted on two of the 11 properties comprising the Inland Parcels. This Work Plan has been prepared to obtain additional data and provide a better understanding regarding the origin, nature, and extent of the environmental conditions that may currently exist on the Inland Parcels.

1.2 WORK PLAN ORGANIZATION

This work plan is organized as follows:

- Section 1 describes the project background and objectives;
- Section 2 describes the site background;
- Section 3 describes the scope of work to be conducted during the Site Characterization;
- Section 4 describes the project management;
- Section 5 presents the references used in the work plan preparation;
- Appendix A is the Subsurface Investigation Report for 38-70 Review Avenue;
- Appendix B is the Field Sampling Plan (FSP);
- Appendix C is the Quality Assurance Project Plan (QAPP); and
- Appendix D is the Health and Safety Plan (HASP).

SECTION 2

SITE BACKGROUND

2.1 SITE DESCRIPTION

The Inland Parcels are comprised of 11 separate properties located at 37-88, 38-20, 39-30, 38-98, 38-70, 38-78, 38-60, and 38-50 Review Avenue and 38-54, 38-84, and 38-40 Railroad Avenue in Long Island City, Queens, New York. The properties are located within a highly industrialized area of Queens. The properties are primarily covered with buildings, asphalt, or concrete surfaces.

2.2 ADJOINING AND SURROUNDING PROPERTY DESCRIPTION

As shown on Figure 2, the Inland Parcels are bounded on the northeast by Review Avenue, beyond which is the Calvary Cemetery. To the northwest of the Inland Parcels is the Quanta Resources Superfund Site. The southeast end of the Inland Parcels terminates at the intersection of Review Avenue and Laurel Hill Boulevard. The Southern line of the Long Island Railroad (LIRR) bounds the Inland Parcels to the southwest. Further to the southwest are properties which comprise the Waterfront Parcels of the FPOW Site, which include Parcel A and B (Figure 2). These properties are also the subject of a Site Characterization by ExxonMobil. A *Site Characterization Work Plan for the Waterfront Parcels, Former Pratt Oil Works Site* (revised May 2008) was submitted to the NYSDEC and is currently being reviewed. The Waterfront Parcels are located on the northeast banks of Newtown Creek. Zoning in the area is designated as heavy manufacturing by the New York City Department of Planning and Commission.

2.3 SITE HISTORY

The following Site History has been consolidated from a review of available information regarding Standard Oil's operations at or around the Inland Parcels. The history of post Standard Oil operation is currently under further investigation and will be addressed more fully in the subsequent Site Characterization Report.

Industrial operations at and adjacent to the Inland Parcels appear to have commenced in the early 1850s with the construction of a refinery by the North American Kerosene Gas Lamp Company. Subsequent history indicates that a Queens County Oil Works was present at the property and was acquired by the firm of Charles Pratt & Company on or about July 1, 1876. The property was then operated as an oil refinery under the name of the Pratt Long Island Refinery (Pratt Oil Works). It appears that the Standard Oil Company of New York purchased the Pratt Oil Works in approximately 1892 and operated it as a paraffin plant. Operations may have included the manufacture of candles, parowax, paraffin oils, and the treating, blending and distribution of lubricating oils. Figure 3 shows site operations that existed in 1915.

Standard Oil ceased operations in the area on or around December 29, 1949. A footprint of the facility layout in 1950 is depicted in Figure 4. From approximately 1951 through 1984, the area appears to have been the location for various petroleum/chemical operations by entities associated with the Carey Energy Company. None of these companies were owned by ExxonMobil or its corporate predecessors. Many structures were removed from the Site during this time as new owners altered their properties. Some of these changes can be seen on Figure 5, which shows the layout of the properties in 1970. A layout of the structures as depicted on the 1996 Sanborn map is shown on Figure 6.

2.4 PREVIOUS INVESTIGATIONS

A site investigation has been conducted in connection with the former Quanta Resources Site (State Superfund Site #2-41-005) which included limited investigation on Lot 79. Lots 79 and 89 of the Inland Parcels are known as the Phoenix Beverage properties (an imported beer distributor). The investigation and results are documented in the *Remedial Investigation Report* for the Quanta Resources Site (Golder Associates, June 2005). A limited subsurface investigation was also conducted on Lot 348 which is currently owned by Keane Realty, LLC. The investigation was conducted by EEA, Inc. in 1989. A report documenting this investigation and the results is provided as Appendix A. Appendix A has been included solely to provide relevant background information. The inclusion of this document in no way signifies that ExxonMobil agrees with or endorses any of the findings or conclusions of this report. The results of the limited investigation documented in Appendix A warrant further investigation and have been considered in the development of this Work Plan. No known investigations have been conducted on the remaining properties which comprise the Inland Parcels.

2.5 SITE SETTING

The *Remedial Investigation Report* for the Quanta Resources Site (Golder Associates, June 2005) was used to develop the following information regarding the geology and hydrogeology in the area of the Inland Parcels.

2.5.1 Geology

The Inland Parcels are located in close proximity to Newtown Creek that flows northwest and drains into the East River in the western part of Long Island. The banks of the creek and the surficial materials on the adjacent properties have been largely altered by land reclamation activities that preceded much of the modern history of this part of Long Island. The topography and surficial geology in the vicinity of the Inland Parcels is largely a reflection of man-made urban fill and unconsolidated natural deposits related to the Wisconsin Stage Glaciation.

Based on the remedial investigation (RI) conducted at the Quanta Resources Site, the subsurface stratigraphy of the Inland Parcels is anticipated to consist of the following:

- Urban fill;
- Glacial deposits consisting of an upper and lower sand and gravel unit; and
- Lower clay unit (Raritan Clay).

The urban fill is anticipated to range in thickness from 3 to 16 feet and generally consists of a mixture of heterogeneous soil including angular to sub angular, loose to compact, silty fine sand and gravel intermixed with various debris, including but not limited to, brick fragments, asphalt, wire, and plastic.

Interbedded horizons of fine to coarse sand and fine to coarse gravel comprise the glacial deposits which underlay the urban fill in the vicinity of the Inland Parcels. These glacial deposits can be subdivided into two distinct units (an “upper unit” and a “lower unit”) based largely on their lateral extent and natural color. Some silt, silty clay and clay are also present within the upper unit of the glacial deposits.

A laterally continuous, finely laminated to thinly bedded, silty clay, silt, or clay is present beneath the lower glacial deposits. This lower clay unit has been identified as the Raritan Formation of Late Cretaceous Age. The clay encountered at the Quanta Resources Site has been described as dark gray silty clay and white to light gray clay. The lower clay unit was encountered at depths ranging from 71 to 85 feet below ground surface (bgs) and is believed to be continuous across the area.

2.5.2 Hydrogeology

The Inland Parcels are located between a local topographic high located in the northeast (local groundwater recharge area) and Newtown Creek (believed to be a regional groundwater discharge area). Groundwater in the relatively flat area of the Inland Parcels and surrounding properties is anticipated to generally flow horizontally south-southwest with the glacial deposits towards Newtown Creek. Depths to groundwater ranged from approximately 10 to 20 feet bgs and tidally influenced groundwater fluctuations on the order of approximately 0.05 feet to 0.1 feet were observed during the remedial investigation at the Quanta Resources property.

SECTION 3

SCOPE OF WORK

The following sections present the scope of work to be conducted during the Site Characterization. The scope of the field investigation activities includes the installation of test pits, soil borings, and monitoring wells. Samples of soil, groundwater, and free product (if present) will be collected for laboratory analysis. All proposed sampling locations are shown on Figure 7, which also shows the layout of current buildings/structures, and structures that appeared to be present around 1950 when most refinery-related buildings existed. Table 1 provides a summary of the anticipated number of samples and chemical analyses.

Quanta Resources is currently conducting an investigation at parcels 79 and 89, and as such, those parcels will not be addressed in this Work Plan. The data from the Quanta Resources investigation will be evaluated when it becomes available.

Sampling procedures are described in detail in Appendix B, the FSP. Quality assurance/quality control (QA/QC) procedures are described in Appendix C, the QAPP.

3.1 SITE INSPECTION AND PRELIMINARY INVESTIGATION ACTIVITIES

ExxonMobil is currently negotiating with the current property owners to obtain access to the Inland Parcels properties in order to implement the Site Characterization.

Upon NYSDEC approval of this Work Plan and prior to the start of work, a kick-off meeting will be held with each of the property owners. Available as-built diagrams will be reviewed for access, feasibility, occupant health and safety, worker health and safety, and traffic/crowd control. Subsurface utility locations will be reviewed once more with respect to known subsurface utilities, disruption to operations, and potential work hour restrictions. The kick-off meeting will allow the most efficient and effective methods to be employed during the Site Characterization. Proposed locations and proposed methods may be altered in the field based on site conditions, access, utilities, and public safety issues raised during the kick-off meeting.

3.2 UNDERGROUND UTILITY CLEARANCE

Prior to the start of intrusive work, an electro magnetic (EM) and/or ground-penetrating radar (GPR) survey of the Inland Parcels will be conducted. The purpose of the geophysical survey is to attempt to provide information regarding the presence of underground structures including pipelines related to former refinery operations. The survey will be conducted on a grid interval of approximately five feet established relative to permanent landmarks (roads, fences, buildings, etc.). Additionally, each of the proposed drilling and test pit locations will be scanned with the EM and/or GPR instruments individually to assess the potential presence of underground utilities. A report and CAD drawing presenting the results of the geophysical survey will be prepared and included in the Site Characterization Report.

In addition to the geophysical survey, the Dig Safely New York One-Call Center will be contacted for a Code 753 utility mark-out. No drilling or excavation activities will be conducted until the following minimum requirements have been met:

- The Parsons Project Manager and/or Field Team Leader have thoroughly inspected the drilling and test pit locations and surrounding area for the Code 753 mark-out and the location is clear of marked utilities;
- A private utility locating contractor has conducted a geophysical survey of the proposed sampling locations to locate potential underground utilities or obstructions;
- All drilling locations have been cleared with a metal detector by Parsons;
- Parsons has met with and reviewed all of the drilling and test pit locations with a facility representative and ExxonMobil's representative, and verified that all locations have been marked; and
- Each drilling location and test pit has been hand-cleared or vacuum excavated to a minimum depth of four feet.

3.3 AIR MONITORING

The proposed investigation and sampling activities may generate fugitive dust or organic vapors. Worker breathing zone air monitoring will be conducted as described in Section 3.3.1. A community air monitoring program will also be implemented as described in Section 3.3.2. The HASP (Appendix D) provides the air monitoring action levels and corresponding response actions. Background air monitoring will be used to distinguish between odors resulting from the waste transfer operations and the site investigation activities, as appropriate.

3.3.1 Worker Air Monitoring

Air monitoring of the worker breathing zone will be conducted continuously during all intrusive activities to assure proper health and safety protection for the team and any occupants of the facilities. Readings will be taken prior to start of intrusive work at the Site to establish background conditions. Initially, air monitoring will be conducted at the site of the investigation (potential source area). If air monitoring identifies the presence of volatile organic compounds (VOCs) in the worker breathing zone, guidelines in the HASP (Appendix D) will be followed regarding action levels, permissible exposure, engineering controls, and personal protective equipment. The following equipment will be used to conduct air monitoring:

- A photoionization detector (PID) [RaeSystems MiniRae 2000 or equivalent] will be used to monitor for organic vapors and benzene;
- A MiniRAM Portable Aerosol Monitor will be used to monitor particulate dust and aerosolized vapors; and
- A multi-gas meter (VRae) calibrated to detect lower explosive limit (LEL) of the compounds anticipated at the Inland Parcels, ethylbenzene has the lowest LEL (0.8%); therefore, this compound will drive the monitoring requirements for LEL in the exclusion zone.

Air monitoring results will be recorded in the field log book during investigation activities and made available for review at any time.

3.3.2 Community Air Monitoring

Community air monitoring will be conducted using the New York State Department of Health's (NYSDOH's) Generic Community Air Monitoring Plan (NYSDOH, 2000) as a guidance document. Real-time air monitoring for volatile compounds and particulates at the perimeter of the work area will be performed as described below.

VOC Monitoring

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of groundwater samples. Periodic monitoring may include obtaining measurements upon arrival at a location, while opening a monitoring well cap, when bailing/purging a well, and upon leaving the location. In some instances, depending on the proximity of exposed individuals, continuous monitoring may be conducted during these activities.

Continuous monitoring for VOCs will be conducted during all ground intrusive activities (i.e., test pitting, soil boring installation, and monitoring well installation). Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored continuously at the downwind perimeter of the hot zone. Monitoring will be conducted with a PID equipped with a 10.6 eV lamp calibrated relative to benzene and capable of calculating 15-minute running average concentrations. The following actions will be taken based on organic vapor levels measured:

- If total organic vapor levels exceed 5 parts per million (ppm) above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring;
- If total organic vapor levels at the downwind perimeter of the work area persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm above background for the 15-minute average; and
- If the total organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown.

All 15-minute readings will be recorded and available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, will also be recorded.

Particulate Monitoring

During ground intrusive activities, particulate concentrations will be monitored continuously at the downwind perimeter of the work area with a portable real-time particulate monitor capable of measuring particulate matter less than 10 micrometers in size and capable of integrating over a period of 15 minutes (or less). The equipment will include an audible alarm to indicate exceedence of the action level. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. The following actions will be taken based on particulate concentrations measured:

- If the downwind particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) above background for the 15-minute period or if dust is observed leaving the work area, then dust suppression techniques will be employed. It is anticipated that adequate dust suppression can be achieved using a water mist or spray. Work will continue with dust suppression provided that the downwind particulate level does not exceed 150 $\mu g/m^3$ above background, and no visible dust is migrating from the work area; and
- If, after implementation of dust suppression techniques, the downwind particulate level is greater than 150 $\mu g/m^3$ above background, work will be stopped and a re-evaluation of activities will be initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate level to within 150 $\mu g/m^3$ of the background (upwind) level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel for review.

3.4 TEST PIT EXCAVATION

Test pits will be excavated at four locations (TP-1 through TP-4) to determine the presence of former structure remnants and/or impacted subsurface materials. Proposed test pit locations are depicted on Figure 7. The test pits will be excavated using a rubber-tired or tracked excavator or backhoe to groundwater, bedrock, or limits of the excavator, whichever is encountered first. Generally, test pits will measure approximately 10 feet long (or more) and will be the width of the excavator bucket (2 to 3 feet). During excavation activities, the test pit walls and floor will be investigated for evidence of impacts, (odors, staining, sheens, non-aqueous-phase liquid [NAPL], elevated PID readings) and remnant structures. Soil retrieved from test pits will be visually classified for soil type, grain size, texture, moisture content, and visible evidence of staining or impacts, and screened for the presence of VOCs with a PID. All test pits will be photographed.

If impacted materials are encountered in a test pit, one sample will be collected from the test pit sidewalls from the impacted zone. A second sample will be collected from the 2-foot interval beneath the impacted zone to define the vertical extent of impacts. If the vertical extent of impacts cannot be confirmed due to the limitation in test pit depth, samples will not be collected from the test pit, and the vertical extent of impacts in that area will be evaluated during the soil boring program. If no impacted materials are encountered in a test pit, two samples will be collected, one from the bottom and the second from the sidewalls of the test pit to confirm no impacts are present. Multiple samples may be collected from larger test pits, if necessary. The samples will be submitted for laboratory analysis for Target Compound List (TCL) VOCs, TCL semivolatile organic compounds (SVOCs), Target Analyte List (TAL) metals, polychlorinated biphenyls (PCBs), and pesticides using methods identified in Table 1.

In the event that subsurface piping of a historical nature is encountered and found to contain liquids, these liquids will be removed from the piping for subsequent characterization and off-site disposal. ExxonMobil will utilize best available technology to cap or plug any piping prior to backfilling the location and surveying for future reference.

3.5 SOIL BORINGS

A total of six soil borings (SB-6 through SB-11) will be advanced to characterize subsurface conditions. Historic soil borings SB-1 through SB-5 were installed during a limited subsurface investigation on Lot 348 by EEA, Inc. in 1989. Figure 7 depicts the proposed boring locations. All boring locations are subject to change based on accessibility, utility clearance, and site conditions encountered during the site inspection and field activities. Additional soil borings may also be added during the course of the field investigation based on subsurface conditions encountered.

Each soil boring location will be cleared for utilities as described above in Section 3.2. Soil borings will be advanced using either a truck-mounted or a track-mounted drill rig, and 4.25-inch inner diameter hollow-stem augers (HSAs) or direct-push methods. The access to soil boring locations will govern the drilling techniques used. Soil borings will be drilled to a depth of approximately 25 feet or refusal, whichever is less, unless visually-impacted materials are observed. If visually-impacted materials are observed at the bottom of the boring, the boring will be continued until unimpacted soils are observed, bedrock is encountered, or the limit of the drilling equipment is reached.

Soil samples will be collected continuously to the bottom of the borings using a 2-foot long, 2-inch diameter stainless steel split spoon sampler, or a 4-foot long 2-inch diameter macrocore sampler. Soil samples retrieved from each boring will be visually classified for soil type, grain size, texture, moisture content, and visible evidence of staining or impacts. Each sample will also be screened for the presence of VOCs with a PID. In addition, one sample from each 2-foot interval will be collected in a sealed plastic bag and the sample headspace will be screened for the presence of VOCs with a PID. Each soil boring will be grouted to the surface when complete.

Two soil samples will be selected from each boring location and submitted to a laboratory for chemical analysis (see Table 1). The two samples will be collected as follows:

- One sample will be collected from the zone with the highest PID readings or visual impacts from the boring. If no visual impacts or elevated PID readings are observed, a sample will be collected from directly above the water table; and
- One sample will be collected below the impacted zone or near the base of the boring to define the vertical extent of impacts at that location.

Additional soil samples may be collected based on field observations. The soil samples will be analyzed for TCL VOCs, SVOCs, TAL metals, PCBs, and pesticides. In addition, if NAPL-saturated soils are encountered, one representative sample will be submitted for forensic fingerprinting analysis to a lab that specializes in analyzing and determining the origin of NAPL samples as described in Section 3.9.

Borings that are not converted into monitoring wells will be grouted to the surface following completion. Holes in asphalt or concrete will be repaired and patched with similar materials. Drilling equipment will be decontaminated between each boring in accordance with procedures specified in Appendix B, the FSP. Drill cuttings and decontamination water will be containerized in accordance with procedures also specified in the FSP.

3.6 MONITORING WELL INSTALLATION

Ten 4-inch diameter overburden monitoring wells (MW-9 through MW-18) will be installed at the proposed locations shown on Figure 7. Groundwater is anticipated to be approximately 10 to 20 feet bgs; therefore, overburden monitoring wells will be installed to depths of approximately 15 to 30 feet bgs. The data collected from the overburden monitoring wells will be used to: characterize upgradient groundwater conditions, assess groundwater flow direction, evaluate the presence of NAPL, and ascertain the potential impact of constituents on groundwater quality.

Overburden monitoring well borings will be advanced using 6.25-inch inner diameter HSAs. Soil samples will be collected continuously to the bottom of the borings using 2-foot long discrete split-spoon samplers. Soil samples retrieved from each overburden monitoring well boring will be visually characterized for soil type, grain size, texture, moisture content, and visible evidence of staining or impacts. Each sample will also be screened for the presence of VOCs with a PID. In addition, a sample from each 2-foot interval will be collected in a sealed plastic bag and the sample headspace will be screened for the presence of VOCs with a PID.

Two soil samples will be selected from each overburden monitoring well boring location and submitted to the laboratory for chemical analysis. The two samples will be collected as follows:

- One sample will be collected from the zone with the highest PID readings or visual impacts from either the test pit (hand auger) or boring. If no visual impacts or elevated PID readings are observed, a sample will be collected from directly above the water table; and
- One sample will be collected below the impacted zone or near the base of the boring to define the vertical extent of impacts at that location.

Additional soil samples may be collected based on field observations. The soil samples will be analyzed for TCL VOCs, SVOCs, TAL metals, PCBs, and pesticides (see Table 1).

The overburden monitoring wells will be constructed with 4-inch ID, threaded, flush-joint, Schedule 40 PVC casing and approximately 10 feet of 0.02-inch slot screens. The annulus around the screens will be backfilled with silica sand having appropriate size for the subsurface conditions (e.g., Morie No. 2). The screens will be placed across the water table interface to allow for the monitoring of LNAPL, if present. The wells will be contained in flush-mounted vaults to maintain accessibility to the area after completion.

After a minimum of 24 hours, the monitoring wells will be developed until the well is reasonably free of sediment (less than 50 NTU if possible) or until the pH, temperature, and conductivity stabilize. Monitoring well installation, construction, development, decontamination, and investigation-derived waste handling procedures are specified in the FSP (Appendix B).

3.7 SITE SURVEY

The locations and elevations of the test pits, soil borings, and monitoring wells will be surveyed by a licensed surveyor. Vertical control of elevations for soil borings and monitoring wells will be established to the nearest 0.01-foot and will be based on a USGS datum and benchmarks established on the Site. Horizontal control will be based on New York State Plane coordinate system with established and referenced control points.

3.8 GROUNDWATER SAMPLING AND ANALYSIS

Groundwater samples will be collected from the 10 new monitoring wells (MW-9 through MW-18) to characterize groundwater quality. In addition to the new wells, ExxonMobil will attempt to obtain permission from the property owners to sample existing monitoring wells that may exist. A decision will be made to sample existing wells if the condition and construction of the wells can be verified and are consistent with the objectives of the Site Characterization (e.g., similar screened interval). Prior to sampling, the headspace within each well will be measured with a PID. An oil/water level interface probe and/or a water level indicator will be used to measure the depths to the water table and thickness of any free product in the wells. The monitoring wells will be purged to remove a minimum of three times the volume of standing water in the well to allow for collection of a representative sample. Groundwater samples will then be collected using dedicated sampling equipment (e.g., bailer or pump tubing).

Prior to filling the sample bottles, the turbidity, pH, temperature, and conductivity of the sample will be measured and recorded. The groundwater samples will be analyzed for TCL VOCs and SVOCs, TAL metals, PCBs, and pesticides. Sampling procedures are described in detail in the FSP (Appendix B). QA/QC procedures are described in the QAPP (Appendix C). In addition, if NAPL is encountered in a well, a representative sample will be submitted for forensic fingerprinting analysis to a lab specialized in analyzing and determining the origin of NAPL samples as described below.

3.9 FORENSIC FINGERPRINTING ANALYSIS

If NAPL or grossly contaminated soil is observed in any of the test pits, soil borings, or monitoring wells, a representative sample(s) of the product or soil will be collected and submitted for detailed hydrocarbon compositional analysis. Chemical measurements will be conducted in a tiered fashion, using published methods of forensic hydrocarbon analysis (Douglas et al. 2007). The analyses will include high resolution chromatographic fingerprints and quantitative measurement of C8-C40 n-alkanes and isoprenoids using a modified EPA Method 8015; analysis of volatile C5 to C15 paraffin, isoparaffin, aromatics, naphthenes and olefins (PIANO) using a modified EPA Method 8260, measurement of parent and C1-C4 alkylated polycyclic aromatic hydrocarbons and biomarkers using a modified EPA Method 8270, and organic lead speciation using modified EPA Method 8270. These analyses will be used to help determine the character and source(s) of hydrocarbons present in the samples.

3.10 WELL GAUGING/GROUNDWATER LEVEL MEASUREMENTS

Following installation of the 10 new monitoring wells proposed herein, groundwater level measurements from each new well will be obtained to facilitate development of a groundwater contour map showing groundwater flow direction. An oil/water level interface probe will also be used to measure the depths to and thickness of any free product in the wells. As discussed in Section 3.8, existing wells previously installed by others on the Inland Parcels and found to be in good condition may also be included in the gauging/groundwater level measurement event.

In the event that free product is encountered in any of the monitoring wells installed on the Inland Parcels during the Site Characterization, the product will be bailed from the well(s), contained, and properly characterized and disposed of off site. Periodic (e.g., biweekly) gauging/bailing of the wells will be implemented to further assess the volume present and recoverability of free product. Gauging/bailing activities will be the responsibility of ExxonMobil until the source of free product is addressed or the source, through forensic analysis, is determined not to be associated with the FPOW operations.

3.11 WASTE MANAGEMENT

All investigation-derived wastes (IDW) generated during the site investigation will be containerized. Soils will be segregated by boring or location and placed in 55-gallon Department of Transportation-(DOT) approved drums which are labeled appropriately. Plastic sheeting and personal protective equipment will be consolidated in DOT-approved drum(s). Fluids will be placed in DOT-approved fluid drums with closed tops. The drums will be staged in a secure area as determined by ExxonMobil and facility representatives prior to proper characterization and disposal. A drum inventory will be kept to document the number of drums being stored and transported, the contents of the drums, drum identification information, and the hazardous or non-hazardous nature of the contents. Characterized wastes will be properly disposed of off site in accordance with local, state, and federal regulations.

3.12 LABORATORY ANALYSIS AND DATA VALIDATION

Laboratory analyses of soil and groundwater samples will be conducted by a NYSDOH Environmental Laboratory Analysis Program (ELAP) approved laboratory certified for analyses using the most recent Analytical Services Protocol (ASP). Laboratory analyses will be conducted in accordance with USEPA SW-846 methods and Category B deliverable format. Sample Data deliverables will meet the requirements of the July 2005 NYSDEC ASP for Category B deliverables.

Table 1 summarizes the anticipated analytical methods and quality control samples required. QA/QC procedures required by the SW-846 methods will be followed, including initial and continuing instrument calibrations, standard compound spikes, surrogate compound spikes, and analysis of other samples (blanks, laboratory control samples, matrix spikes/matrix spike duplicates, etc.). The laboratory will provide sample bottles, which have been pre-cleaned and preserved in accordance with the SW-846 methods. NYSDEC ASP holding times will be adhered to. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP shall take precedence.

Data validation will be performed in accordance with USEPA Region II standard operating procedures (SOPs) for organic and inorganic data review. These validation guidelines are regional modifications to the National Functional Guidelines for organic and inorganic data review (USEPA 1999 and 2004). Validation will be conducted by the Quality Assurance Officer (QAO) and will include the following:

- Verification of 100% of all quality control (QC) sample results (both qualitative and quantitative);
- Verification of the identification of 100% of all sample results (both positive hits and non-detects);
- Re-calculation of 10% of all investigative sample results; and
- Preparation of a Data Usability Summary Report (DUSR) by the QAO.

Data reduction, validation, and reporting procedures are provided in the QAPP (Appendix C).

3.13 SITE CHARACTERIZATION REPORT

Upon completion of all fieldwork and receipt of laboratory analytical results, a Site Characterization Report (SCR) will be prepared. The general outline of the SCR will be as follows:

- Section 1 (Introduction) will include a site overview and history;
- Section 2 (Site Characterization Activities) will describe the investigation activities completed and any deviations from this work plan;
- Section 3 (Site Characterization Results) will present the results of the investigation, including extent of impacts and a qualitative human health exposure assessment; and
- Section 4 (Conclusions and Recommendations) will summarize the results of the investigation and present any conclusions and recommendations for future investigation or remediation.

SECTION 4

PROJECT MANAGEMENT

4.1 ORGANIZATION AND STAFFING

This Site Characterization will be completed for ExxonMobil by Parsons. Key members of the project team and their responsibilities are described below:

Key Position	Contact Name	Responsibilities
ExxonMobil		
Project Manager	Frank Messina Telephone: (732) 850-4009 E-mail: frank.j.messina@exxonmobil.com	ExxonMobil's Project Manager is responsible for managing the project within ExxonMobil and for ensuring the consultant completes the work in accordance with the Work Plan.
ExxonMobil's Consultant (Parsons)		
Project Manager	Chris Del Monico Telephone: (732) 537-3533 Fax: (732) 868-3110 E-mail: christopher.delmonico@parsons.com	The Parsons Project Manager is responsible for project execution and will be the primary contact with ExxonMobil on all technical and scheduling issues.
Field Supervisor	Allyson Kriney Telephone: (732) 537-3524 Fax: (732) 868-3110 E-mail: allyson.kriney@parsons.com	The Field Supervisor will be responsible for working with the Project Manager to coordinate, oversee, and ensure that all requirements are strictly adhered to on field activities.
Technical Director	Marlene Lindhardt Telephone: (732) 537-3525 Fax: (732) 868-3110 E-mail: marlene.lindhardt@parsons.com	The Technical Director will provide technical support and overall quality assurance for the project. The primary objective of the Technical Director is to ensure compliance with all regulatory guidance and regulations.
Quality Assurance Officer	Brendan Baranek-Olmstead Telephone: (617) 449-1404 Fax: (617) 249-0459 E-mail: Brendan.Baranek-Olmstead@parsons.com	The Quality Assurance Officer will perform data validation, prepare the DUSR, and ensure that the QAPP is properly implemented.
Health and Safety Officer	Gregory Beck Telephone: (732) 537-3502 Fax: (732) 868-3110 E-mail: gregory.beck@parsons.com	The Health and Safety Officer will ensure that the health and safety plan is properly implemented and that all personnel and subcontractor site personnel are trained in the site-specific project health and safety requirements, as well as those of ExxonMobil.

Key Position	Contact Name	Responsibilities
Subcontractors		
Drilling/Well Installation/ Excavation	To Be Determined	Installation of soil borings and monitoring wells and test pit excavation.
Surveyor	To Be Determined	Survey sampling locations.
Laboratory	Accutest Laboratories Dayton, New Jersey NYSDOH Lab ID No.: 10983	Conduct laboratory analyses of soil and water samples in accordance with the QAPP.
Laboratory	NewFields Rockland MA, 02370 NYSDOH Lab ID No.: 11672	Conduct laboratory analyses of free product samples in accordance with the QAPP.

4.2 PROJECT SCHEDULE

The anticipated project schedule for the Site Characterization is shown on Figure 8.

SECTION 5

REFERENCES

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New York State Department of Health (NYSDOH), 2000. *New York State Department of Health Generic Community Air Monitoring Plan.* Revised June 2000.

Parsons. 2008. *Site Characterization Work Plan for the Waterfront Parcels, Former Pratt Oil Works Site.* May 2008.

United States Environmental Protection Agency (USEPA), 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review.* October 1999.

United States Environmental Protection Agency (USEPA), 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* October 2004.

TABLES

TABLE 1

SUMMARY OF SAMPLES AND ANALYSES

Matrix	Parameter	Analytical Method	Field Samples: Field Samples	Field Samples: Field Duplicate	Field Samples: MS/MSD[(a)] (Total)	Field Samples: Sub-Total	QC Blanks: Rinse Blanks[(b)]	QC Blanks: Trip Blank[(c)]	Total
Soil Samples (from soil borings, test pits, and monitoring well borings)	TCL VOCs	EPA SW 8260	40	2	2/2	46	2	0	48
	TCL SVOCs	EPA SW 8270B	40	2	2/2	46	2	0	48
	TAL Metals	EPA SW 6010, 7470/7471, 7841, 9010	40	2	2/2	46	2	0	48
	PCBs	EPA SW 8082	40	2	2/2	46	2	0	48
	Pesticides	EPA SW 8081	40	2	2/2	46	2	0	48
Groundwater Samples	TCL VOCs	EPA SW 8260	10	1	1/1	13	1	2[(c)]	16
	TCL SVOCs	EPA SW 8270	10	1	1/1	13	1	-	14
	TAL Metals	EPA SW 6010, 7470/7471, 7841, 9010	10	1	1/1	13	1	-	14
	PCBs	EPA SW 8082	10	1	1/1	13	1	-	14
	Pesticides	EPA SW 8081	10	1	1/1	13	1	-	14
Free Product Samples	Hydrocarbon Fingerprinting	Modified Methods 8015, 8260, 8270	TBD[(d)]	-		-	-	-	TBD

(a) Matrix spike / matrix spike duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analysis.

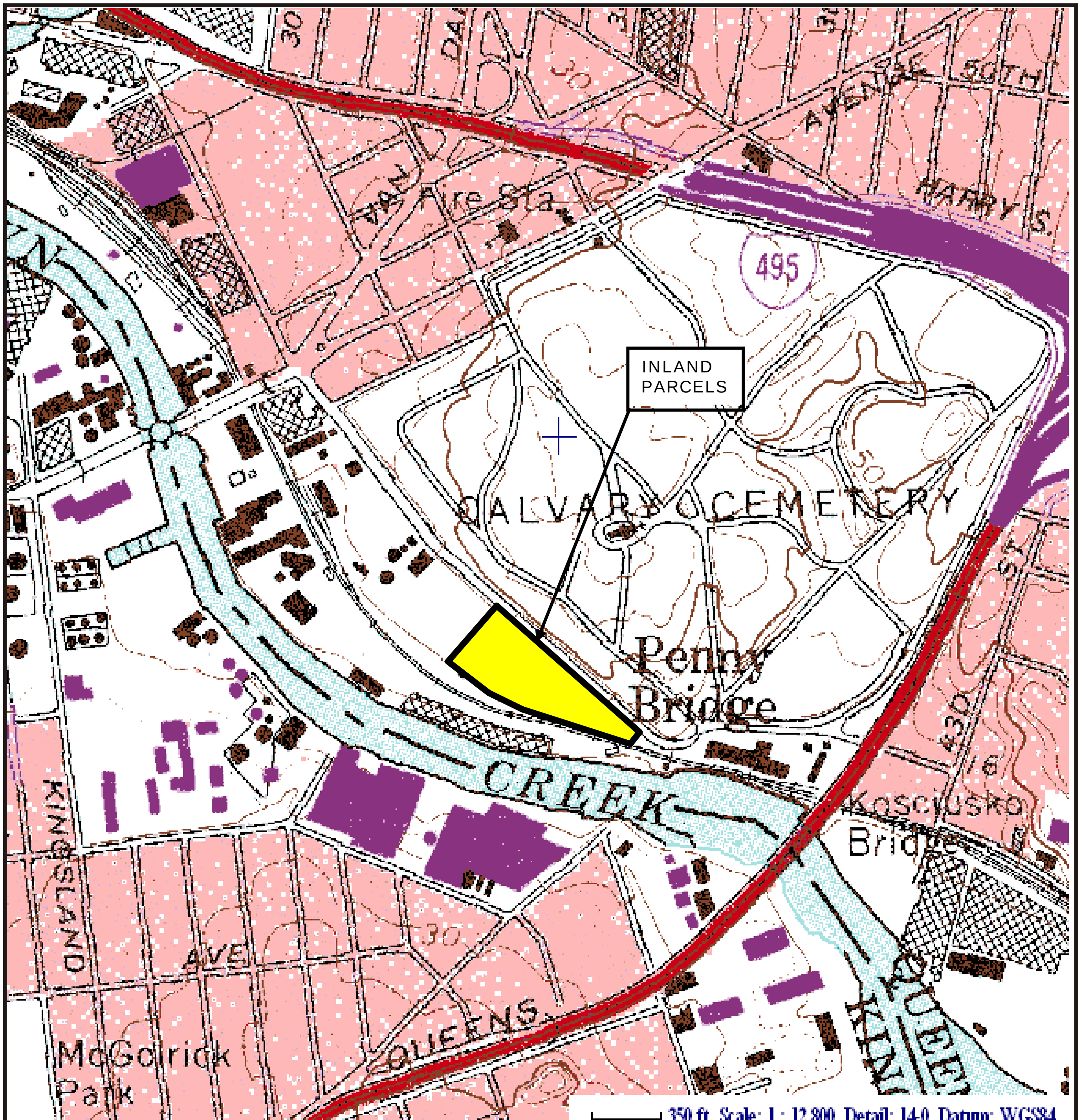
(b) One rinse blank per 20 samples will be collected when non-disposable (decontaminated) sampling equipment is used.

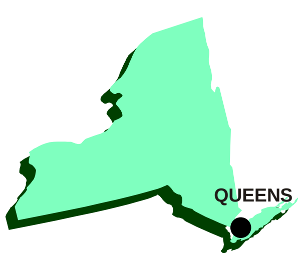
(c) Trip blanks will be collected for each day a groundwater VOCs sample is sent to the laboratory.

(d) Number of free product samples collected for analysis (if any) will be determined in the field.

TBD - To Be Determined

FIGURES





New York
Quadrangle

LATITUDE: N40° 43' 49"
LONGITUDE: W73° 56' 12"

N

SOURCE:
DeLORME 3-D TOPOQUADS PROGRAM

FIGURE 1

ExxonMobil

FORMER PRATT OIL WORKS
QUEENS, NEW YORK

SITE LOCATION MAP

PARSONS
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, NY 13088 PHONE: (315) 451-9560

Block 312 - Long Island City, NY 11101	
Lot	**Address**
79	37-88 Review Avenue
89	38-20 Review Avenue
330	39-30 Review Avenue
343	38-98 Review Avenue
348	38-70 Review Avenue
349	38-78 Review Avenue
350	38-60 Review Avenue
362	38-50 Review Avenue
500	38-54 Railroad Avenue
1362	38-84 Railroad Avenue
1367	38-40 Railroad Avenue

89 Lot Line and Number

Inland Parcels

Waterfront Parcels

Waterfront Parcel A

Waterfront Parcel B

Approximate Limits of Former Pratt Oil Works (1892 Sanborn Maps)

Feet

0 95 190 380 570 760

FIGURE 2

ExxonMobil Former Pratt Oil Works

Inland Parcels and Surrounding Properties

PARSONS

290 ELWOOD DAVIS RD, SUITE 312, LIVERPOOL, NY 13088 PHONE:(315)451-9560

05/27/2008

Q:\GIS\Projects\ExxonMobil\inland_andprops-table.mxd

FIGURE 3

ExxonMobil

Former Pratt Oil Works

1915 SITE PLAN

PARSONS

290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

FILE NAME: P:\444111 – XOM QUEENS INLAND PARCEL\CAD\1915 SITE PLAN.DWG
PLOT DATE: 8/13/2008 3:41 PM PLOTTED BY: WINTERS, CHRIS

FIGURE 4

ExxonMobil

Former Pratt Oil Works

1950 SITE PLAN

PARSONS

290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

FILE NAME: P:\444111 – XOM QUEENS INLAND PARCEL\CAD\1950 SITE PLAN.DWG
PLOT DATE: 8/13/2008 3:23 PM PLOTTED BY: WINTERS, CHRIS

FIGURE 5

ExxonMobil

Former Pratt Oil Works

1970 SITE PLAN

PARSONS

290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

FILE NAME: P:\444111 – XOM QUEENS INLAND PARCEL\CAD\1970 SITE PLAN.DWG
PLOT DATE: 8/13/2008 3:22 PM PLOTTED BY: WINTERS, CHRIS

LEGEND:

STRUCTURE LAYOUT (1996)

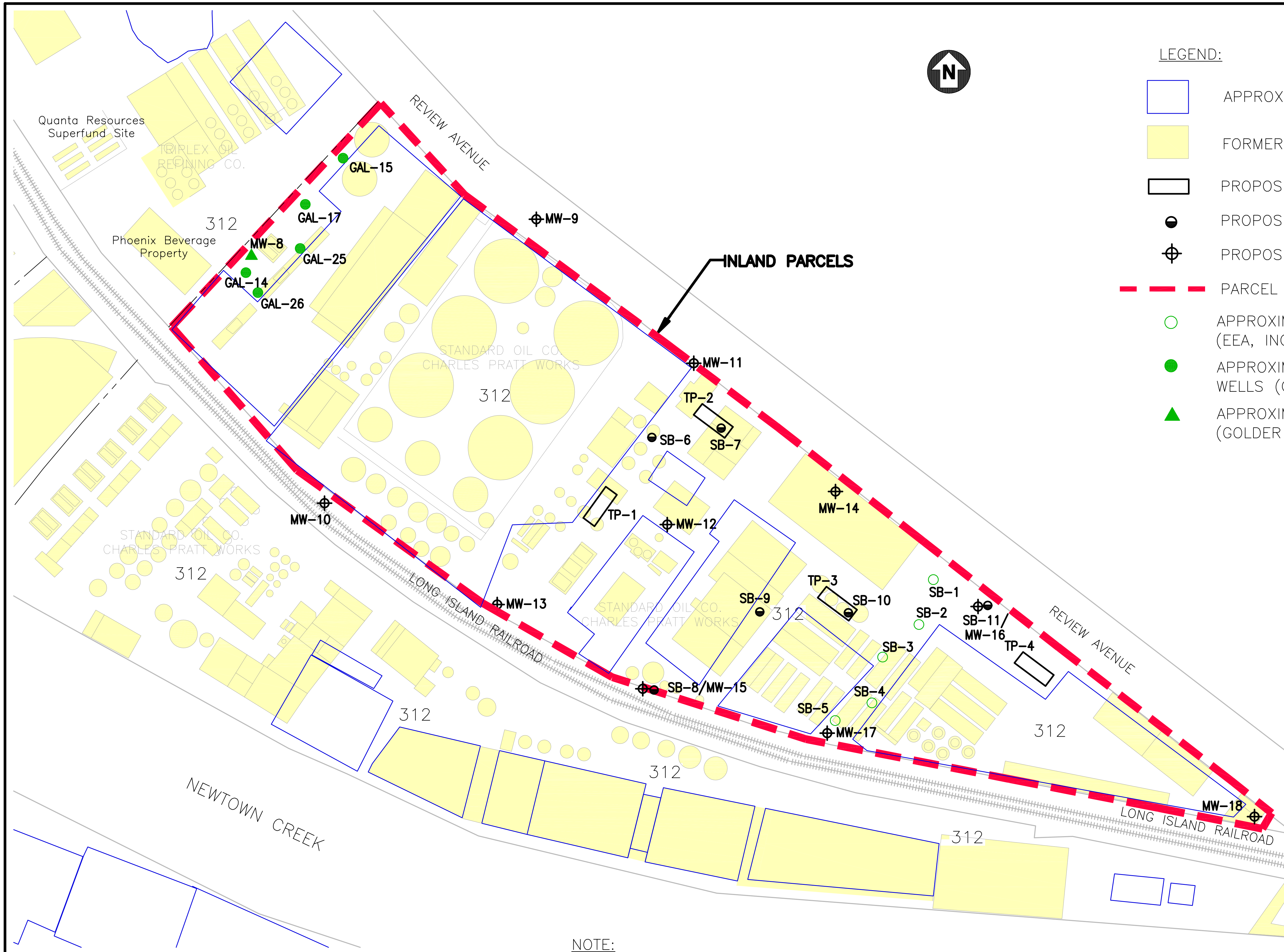
FILE NAME: P:\444111 – XOM QUEENS INLAND PARCEL\CAD\1996 SITE PLAN.DWG
PLOT DATE: 8/13/2008 3:23 PM PLOTTED BY: WINTERS, CHRIS

FIGURE 6

ExxonMobil — Former Pratt Oil Works

1996 SITE PLAN

PARSONS
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560



LEGEND:

- APPROXIMATE CURRENT STRUCTURE LAYOUT
- FORMER STRUCTURE LAYOUT (1950)
- PROPOSED TEST PIT LOCATION
- PROPOSED SOIL BORING LOCATION
- PROPOSED MONITORING WELL LOCATION
- PARCEL OUTLINE
- APPROXIMATE HISTORICAL SOIL BORING (EEA, INC., 1989)
- APPROXIMATE HISTORICAL LNAPL MONITORING WELLS (GOLDER ASSOCIATES, 2005)
- APPROXIMATE HISTORICAL MONITORING WELLS (GOLDER ASSOCIATES, 2005)

NOTE:

BASE MAP TAKEN FROM SANBORN & AERIAL MAPS.

FIGURE NOT TO SCALE.

ALL PROPOSED SAMPLING LOCATIONS ARE SUBJECT TO CHANGE BASED ON ACCESSIBILITY AND SITE CONDITIONS AT TIME OF FIELD CHARACTERIZATION.

FILE NAME: P:\444111 – XOM QUEENS INLAND PARCEL\CAD\444111-SK005.DWG
PLOT DATE: 8/13/2008 3:08 PM PLOTTED BY: WINTERS, CHRIS

FIGURE 7

ExxonMobil Former Pratt Oil Works

PROPOSED SAMPLING LOCATIONS

PARSONS
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

APPENDIX A

Subsurface Investigation of 37-80 Review Avenue (EEA, 1989)

SUBSURFACE INVESTIGATION OF PROPERTY VACANT PROPERTY LOCATED ON REVIEW AVENUE MASPETH, QUEENS, NEW YORK

Prepared for:

FONTANELLA, INC.
56-22 58th STREET
MASPETH, NEW YORK

Prepared by:

EEA, *Inc.*

55 Hilton Avenue
Garden City, New York 11530
(516) 746-4400

DECEMBER 1989

89117.00

INTRODUCTION

A subsurface investigation was conducted on November 10, 1989 at vacant property located on Review Avenue in Maspeth, Queens, New York. Figure 1 shows the location of the property.

The investigation was initiated based upon a Phase I Audit performed by EEA in October of this year. The Audit revealed that past operations at the subject property included copper shops, machine shops, press houses, bleaching tanks and wax sweating houses of the Charles Pratt Works of Standard Oil Company. Several oil tanks were also used at the site but have since been removed.

It was suggested that due to the nature of these operations, a detailed investigation of the subsurface soils would be necessary to adequately access the environmental status of the property.

At the request of Fontanella, Inc., a work plan was developed which would adequately define the nature, extent, and implications of possible contamination in the subsurface environment.

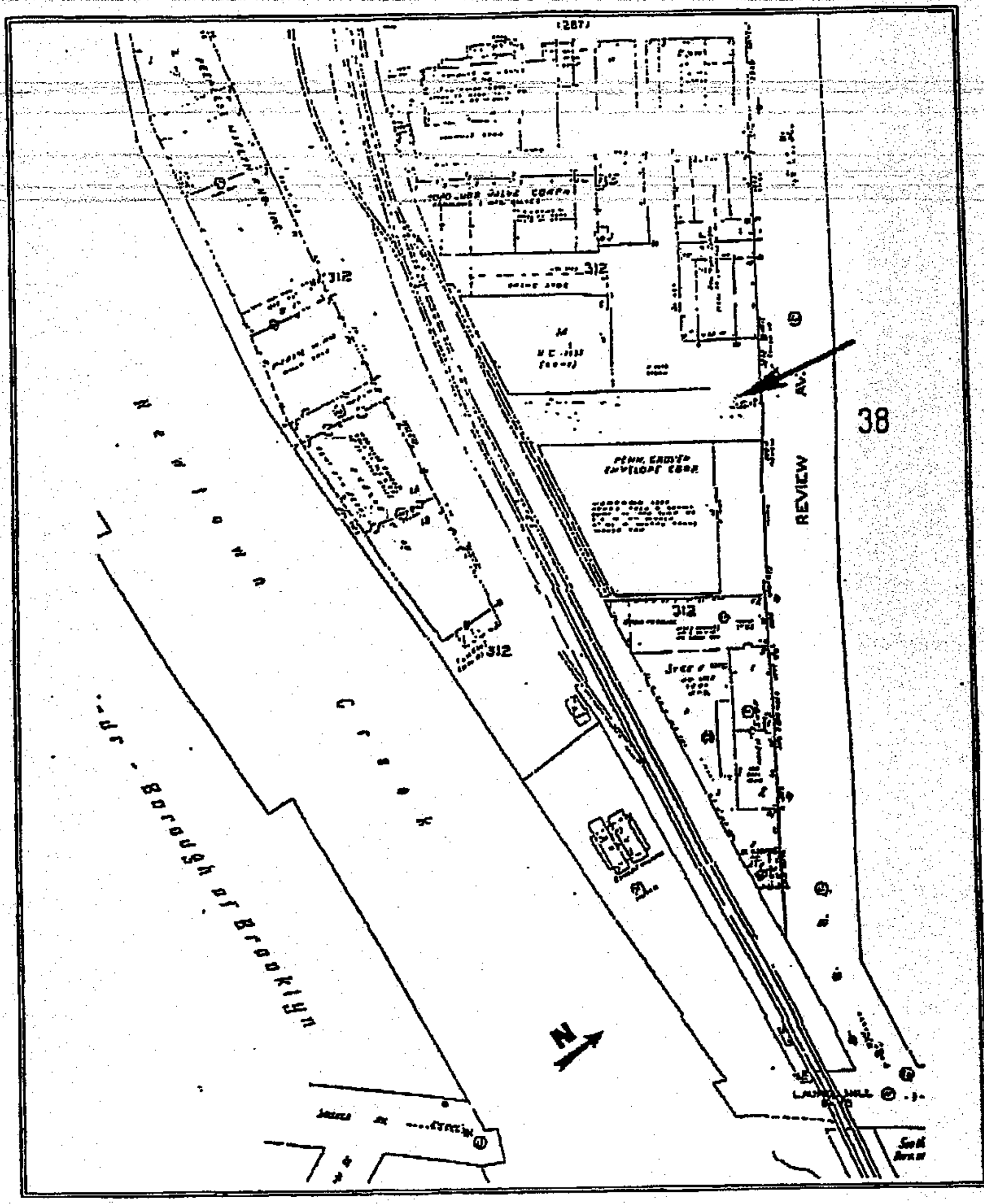
SCOPE OF WORK

The investigation included the collection of ten soil samples from five soil borings. The specific sample collection locations are shown on Figure 2.

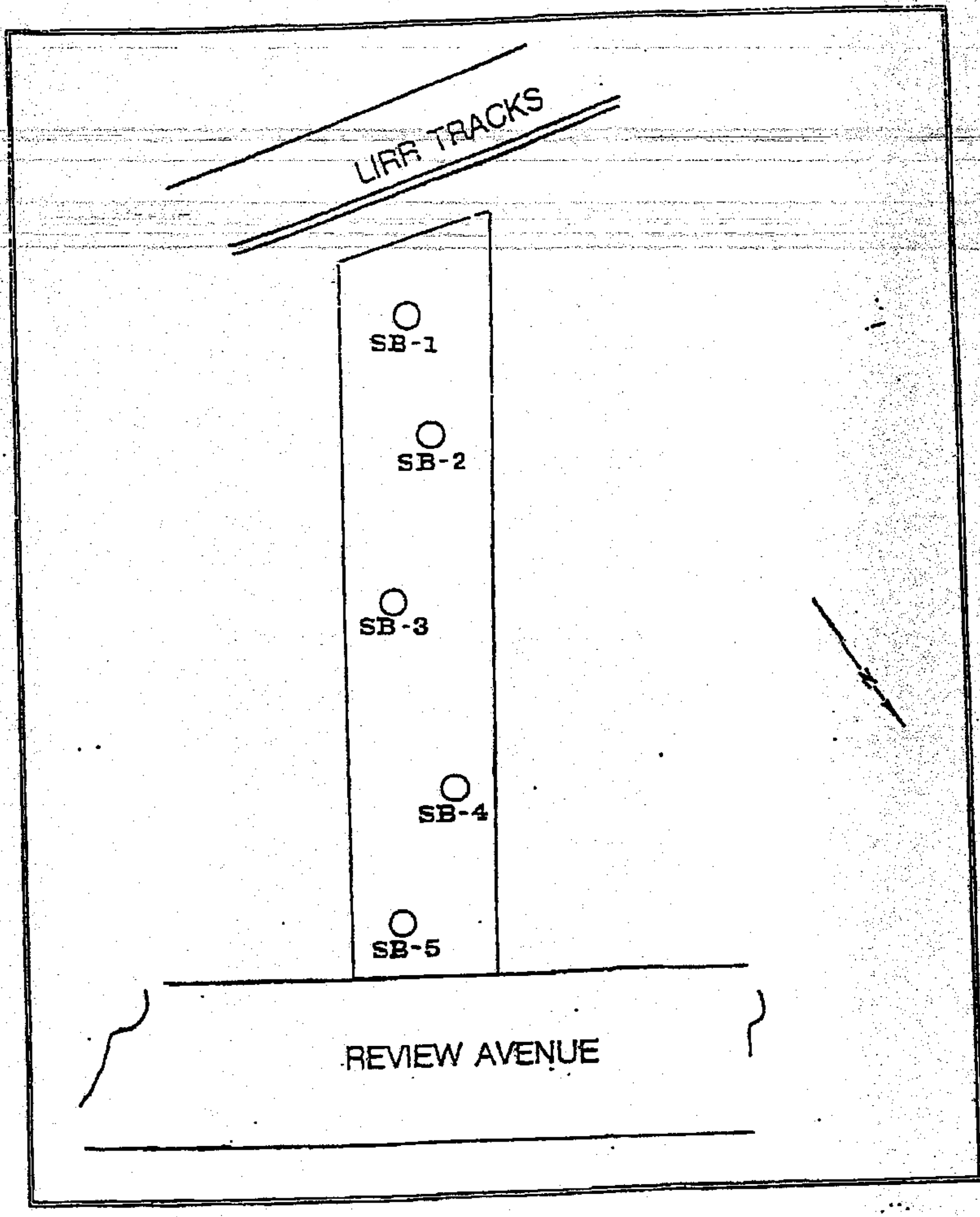
The samples were collected using a two-foot long split spoon sampler through hollow stem augers. Samples were collected continuously from the ground surface to the interception with groundwater. Each sample was screened for volatile organic contaminants (VOCs) using a HNu Systems Inc. photoionizer.

A sample from the 0-2 foot surface interval and an intermediate-depth sample were selected for detailed laboratory analyses. The specific laboratory analytical parameters are shown in Table 1. Only where the HNu instrument indicated high levels of organic contaminants was a volatile organic compound analysis conducted.

One boring, SB1, was completed to the top of the water table which was encountered at a depth of 26 feet below grade.



LOCATION OF THE PROPERTY *FIGURE 1*



SOIL SAMPLE LOCATION

Figure 2

TABLE 1

Analytical Parameters

Total Petroleum Hydrocarbons
Volatile Organic Compounds[1]
Cadmium
Copper
Chromium
Lead
Mercury
Zinc

1 - Specific organic compounds listed Table 4

RESULTS OF LABORATORY ANALYSES

Tables 2, 3, and 4 are a summary of the laboratory analyses for soil samples collected at the property.

The laboratory data sheets are presented as an Appendix to this report.

DISCUSSION OF THE RESULTS

Petroleum Hydrocarbons - Table 2

Petroleum Hydrocarbons (PHC) were found in the soils of the property in soil borings SB1, SB2, and SB3. In SB1, the soils were found to be "saturated" with oil from eight (8) feet below grade to sixteen (16) feet below grade. Sample S-1B, which was collected from 14-16 feet below grade, contained 100,000 ppm (parts per million) of petroleum hydrocarbons. This represents 10 percent by weight of petroleum hydrocarbons in the soil. Lesser amounts were found in borings SB2 and SB3; however, the concentrations here are also considered high.

Soil boring SB1 was continued to the water table which was encountered at 26 feet below grade. Samples collected below 20 feet did not show as high a level of contamination as the above layers and the groundwater did not reveal the presence of significant petroleum hydrocarbon contamination. The New York State Department of Environmental Conservation (NYSDEC) does not presently have specific guidelines regulating petroleum hydrocarbon contamination of soils. However, the New Jersey DEP (Department

TABLE 2

TOTAL PETROLEUM HYDROCARBONS

SAMPLE IDENTIFICATION NUMBER	SAMPLE LOCATION	COLLECTION DEPTH (FT)	TPH[1] (ppm)
S-1A	SB1	0-2	1900
S-1B	SB1	14-16	100000[2]
S-2A	SB2	0-2	630
S-2B	SB2	14-16	14000
S-3A	SB3	2-4	2200
S-3B	SB3	14-16	260[2]
S-4A	SB4	2-4	50
S-4B	SB4	14-16	<16[3]
S-5A	SB5	2-4	<16[3]
S-5B	SB5	14-16	<16[3]

New Jersey DEP Recommended Cleanup Level (RCL) - 100 ppm
(Industrialized areas) - 200 ppm

Notes:

1 - Total petroleum hydrocarbons, parts per million
2 - Sample also analyzed for volatile organic compounds
3 - Concentration below detection limits

TABLE 3

METALS

SAMPLE IDENTIFICATION NUMBER	SAMPLE LOCATION	SAMPLE DEPTH	ANALYTICAL PARAMETERS (ppm)[1]					
			LEAD	CHROMIUM	CADMIUM	MERCURY	COPPER	ZINC
S-1A	SB-1	0-2	680	56	7.0	2.3	1300	425
S-1B	SB-1	14-16	16	7.0	0.14	0.034	16	23
S-2A	SB-2	0-2	1000	46	7.3	1.2	750	370
S-2B	SB-2	14-16	15	11	0.18	0.011	16	22
S-3A	SB-3	2-4	140	12	2.8	0.20	80	530
S-3B	SB-3	14-16	2.3	6.0	0.024	<0.005	7.0	12
S-4A	SB-4	2-4	70	8.0	0.75	0.060	41	110
S-4B	SB-4	14-16	2.4	4.5	0.028	<0.005	7.5	14
S-5A	SB-5	2-4	7.5	10	0.035	0.020	10	24
S-5B	SB-5	14-16	2.6	8.5	0.038	<0.005	10	15
NJDEP RCLs (ppm)[2]			250-1000	100	3.0	1.0	170	350

1 - parts per million
2 - New Jersey Department of Environmental Protection Recommended Cleanup Levels

TABLE 4

VOLATILE ORGANIC COMPOUNDS
(ppb)[1]

SAMPLE IDENTIFICATION NUMBER

ANALYTICAL PARAMETER	S-1B	S-3B
Chloromethane	<5	<5
Bromomethane	<5	<5
Dichlordifluomethane	<5	<5
Vinyl Chloride	<5	<5
Chloroethane	<5	<5
Methylene Chloride	<10	<10
Trichlorofluomethane	<10	<10
11 Dichloroethene	<10	<10
11 Dichloroethane	<10	<10
12 Dichloroethene	<10	<10
Chloroform	<5	<5
12 Dichloroethane	<10	<10
111 Trichloroethane	<5	<5
Carbon Tetrachloride	<5	<5
Bromodichloromethane	<5	<5
12 Dichloropropane	<10	<10
t 13 Dichloropropene	<10	<10
Trichloroethylene	<5	<5
Chlorodibromomethane	<5	<5
112 Trichloroethane	<10	<10
c 13 Dichloropropene	<10	<10
2 Chloroethvinylether	<10	<10
Bromoform	<10	<10
1122 Tetrachloroethane	<10	<10
Tetrachloroethene	<5	<5
Chlorobenzene	<5	<5
13 Dichlorobenzene	<10	<10
12 Dichlorobenzene	<10	<10
14 Dichlorobenzene	<10	<10

1 - parts per billion

of Environmental Protection) has published "Action" levels under ECRA (Environmental Conservation and Recovery Act). The RCL (Recommended Cleanup Level) for PHC is 100 ppm or 200 ppm for heavily industrialized areas.

Metals - Table 3

Elevated concentrations of metals were found in some samples collected at the property.

Lead was found to be above normal background concentrations in S-1A (680 ppm), S-2A (1,000 ppm), and S-3A (140 ppm). The NJDEP RCL for lead in soil is 250 1000 ppm.

Chromium concentrations were found to be within the range of average background concentrations. The NJDEP RCL for chromium is 100 ppm.

Cadmium was found above the NJDEP RCL in S-1A (7.0 ppm) and in S-2A (7.3 ppm). The RCL is 3.0 ppm.

The RCL for mercury in soils is 1.0 ppm. This was exceeded in samples S-1A and S-2A, but not significantly.

Copper concentrations in S-1A and S-2A were 1,300 ppm and 750 ppm, respectively. This is in excess of the RCL of 170 ppm.

Zinc was found above the RCL of 350 ppm in samples S-1A (425 ppm), S-2A (370 ppm) and S-3A (530 ppm).

The NJDEP RCLs are used as guidelines for cleanup action at New Jersey ECRA sites and do not represent a definitive "Action" level required by any state agency. They are presented here only to indicate and compare potential environmental liabilities.

Volatile Organic Compounds (VOCs) - Table 4

There were no detectable levels of volatile organic compounds in the two samples collected (S-1B and S-3B). These analyses were conducted based on very high HNu meter readings which may indicate the presence of VOCs. The presence of VOCs in soils would be of concern because many of these compounds are considered known/ potential or possible carcinogens and their presence in the environment is strictly enforced by the Regulatory Agencies.

CONCLUSIONS

Contamination of soils has occurred most likely due to past use of the property. Petroleum hydrocarbons were found to exist in the soils centered in the southern half of the property. It does not appear to have migrated significantly into the groundwater. The soils are fine grained and tend to "hold" onto the product inhibiting its transport. Elevated concentrations of metals were also found on the property. The problem area again is the southern half (rear) of the property. The contamination here is limited to the surface soils.

Presently, there appears to be no impact to sensitive receptors (i.e., drinking water wells, wetlands, etc.) The groundwater system (aquifer) underlying the property is not used for industrial or municipal purposes. The conditions do not represent a health or safety problem to the occupants of a new warehouse.

If, however, the soils are disturbed as in the excavation for a foundation of a future building, there would be a problem with the handling and disposal of the contaminated soils.

The only scenario that I can foresee that could cause a problem for the new owner would be as follows:

> A new owner wishes to sell the property for development that would require a change in zoning, such as for residential use. Before the change in zoning, or other actions could be granted, a subsurface investigation would be mandated by the City Department of Environmental Protection to determine if the property is contaminated. If this study shows evidence of contamination, the zoning change would not be granted.

REMEDIAL MEASURES

The remedial action recommendation is dependent upon the future use of the property. If the property is to remain undeveloped or if the subsurface soils are not to be disturbed (i.e., construction of parking lot, etc.), no action is recommended. However, if development includes the construction of a building, it should be noted that the excavated soils would have to be disposed of at an approved landfill. Cost for contaminated soils are in the order of $125 per cubic yard.

APPENDIX

LABORATORY DATA SHEETS
and
CHAIN OF CUSTODY RECORD

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

12/01/89

LAB NO. C893375/1

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530

ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-1A, 1010, 0-2'

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS
Petrol. Hydrocarbons	mg/Kg	1900	
Lead as Pb	mg/Kg	680	
Chromium as Cr	mg/Kg	56	
Cadmium as Cd	mg/Kg	7.0	
Mercury as Hg	mg/Kg	2.3	
Copper as Cu	mg/Kg	1300	
Zinc as Zn	mg/Kg	425	

CC:

REMARKS:

DIRECTOR ____

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

LAB NO. C893375/2 12/01/89

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-18, 1010, 14-16'

ANALYTICAL PARAMETERS		
Chloromethane	ug/Kg	<5
Bromomethane	ug/Kg	<5
Dichlordifluomethane	ug/Kg	<5
Vinyl Chloride	ug/Kg	<5
Chloroethane	ug/Kg	<5
Methylene Chloride	ug/Kg	<10
Trichlorofluomethane	ug/Kg	<10
11 Dichloroethene	ug/Kg	<10
11 Dichloroethane	ug/Kg	<10
12 Dichloroethene	ug/Kg	<10
Chloroform	ug/Kg	<5
12 Dichloroethane	ug/Kg	<10
111 Trichloroethane	ug/Kg	<5
Carbon Tetrachloride	ug/Kg	<5
Bromodichloromethane	ug/Kg	<5
12 Dichloropropane	ug/Kg	<10
t 13 Dichloropropene	ug/Kg	<10
Trichloroethylene	ug/Kg	<5
Chlorodibromomethane	ug/Kg	<5
112 Trichloroethane	ug/Kg	<10
c 13 Dichloropropene	ug/Kg	<10
2chloroethvinylether	ug/Kg	<10
Bromoform	ug/Kg	<10
1122Tetrachloroethan	ug/Kg	<10
Tetrachloroethene	ug/Kg	<5

ANALYTICAL PARAMETERS		
Chlorobenzene	ug/Kg	<5
13 Dichlorobenzene	ug/Kg	<10
12 Dichlorobenzene	ug/Kg	<10
14 Dichlorobenzene	ug/Kg	<10
Petrol. Hydrocarbons	mg/Kg	100000
Lead as Pb	mg/Kg	16
Chromium as Cr	mg/Kg	7.0
Cadmium as Cd	mg/Kg	0.14
Mercury as Hg	mg/Kg	0.034
Copper as Cu	mg/Kg	16
Zinc as Zn	mg/Kg	23

cc:

REMARKS:

DIRECTOR

crn= 14947 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

LAB NO. C893375/3 12/01/89

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-2A, 1130, 0-2'

ANALYTICAL PARAMETERS ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS		
Petrol. Hydrocarbons	mg/Kg	630
Lead as Pb	mg/Kg	1000
Chromium as Cr	mg/Kg	46
Cadmium as Cd	mg/Kg	7.3
Mercury as Hg	mg/Kg	1.2
Copper as Cu	mg/Kg	750
Zinc as Zn	mg/Kg	370

CC:

REMARKS:

DIRECTOR ____________

rn= 14948 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

12/01/89

LAB NO. C893375/4

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530

ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
DATE COL'D: 11/10/89 RECEIVED: 11/13/89

COLLECTED BY: Client

SAMPLE: Soil sample, S-28, 1130, 14-16'

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS		
Petrol. Hydrocarbons	mg/Kg	14000
Lead as Pb	mg/Kg	15
Chromium as Cr	mg/Kg	11
Cadmium as Cd	mg/Kg	0.18
Mercury as Hg	mg/Kg	0.011
Copper as Cu	mg/Kg	16
Zinc as Zn	mg/Kg	22

cc:

REMARKS:

DIRECTOR

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

12/01/89

LAB NO. C893375/5

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530

ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
DATE COL'D: 11/10/89 RECEIVED: 11/13/89
COLLECTED BY: Client

SAMPLE: Soil sample, S-3A, 1200, 2-4'

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS		
Petrol. Hydrocarbons	mg/Kg	2200
Lead as Pb	mg/Kg	140
Chromium as Cr	mg/Kg	12
Cadmium as Cd	mg/Kg	2.8
Mercury as Hg	mg/Kg	0.20
Copper as Cu	mg/Kg	80
Zinc as Zn	mg/Kg	530

CC:

REMARKS:

DIRECTOR

ECOTEST LABORATORIES, INC.
ENVIRONMENTAL TESTING
377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

12/01/89

LAB NO. C893375/6

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-38, 1200, 14-16'

ANALYTICAL PARAMETERS		
Chloromethane	ug/Kg	<5
Bromomethane	ug/Kg	<5
Dichlordifluomethane	ug/Kg	<5
Vinyl Chloride	ug/Kg	<5
Chloroethane	ug/Kg	<5
Methylene Chloride	ug/Kg	<10
Trichlorofluomethane	ug/Kg	<10
11 Dichloroethene	ug/Kg	<10
11 Dichloroethane	ug/Kg	<10
12 Dichloroethene	ug/Kg	<10
Chloroform	ug/Kg	<5
12 Dichloroethane	ug/Kg	<10
111 Trichloroethane	ug/Kg	<5
Carbon Tetrachloride	ug/Kg	<5
Bromodichloromethane	ug/Kg	<5
12 Dichloropropane	ug/Kg	<10
t 13 Dichloropropene	ug/Kg	<10
Trichloroethylene	ug/Kg	<5
Chlorodibromomethane	ug/Kg	<5
112 Trichloroethane	ug/Kg	<10
c 13 Dichloropropene	ug/Kg	<10
2chloroethvinylether	ug/Kg	<10
Bromoform	ug/Kg	<10
1122Tetrachloroethan	ug/Kg	<10
Tetrachloroethene	ug/Kg	<5

ANALYTICAL PARAMETERS		
Chlorobenzene	ug/Kg	<5
13 Dichlorobenzene	ug/Kg	<10
12 Dichlorobenzene	ug/Kg	<10
14 Dichlorobenzene	ug/Kg	<10
Petrol. Hydrocarbons	mg/Kg	260
Lead as Pb	mg/Kg	2.3
Chromium as Cr	mg/Kg	6.0
Cadmium as Cd	mg/Kg	0.024
Mercury as Hg	mg/Kg	<0.005
Copper as Cu	mg/Kg	7.0
Zinc as Zn	mg/Kg	12

CC:

REMARKS:

DIRECTOR ____________

n= 14951 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

12/01/89

LAB NO. C893375/7

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-4A, 1230, 2-4'

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS		
Petrol. Hydrocarbons	mg/Kg	50
Lead as Pb	mg/Kg	70
Chromium as Cr	mg/Kg	8.0
Cadmium as Cd	mg/Kg	0.75
Mercury as Hg	mg/Kg	0.060
Copper as Cu	mg/Kg	41
Zinc as Zn	mg/Kg	110

cc:

REMARKS:

DIRECTOR ____________

rn= 14952 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

LAB NO. C893375/8

12/01/89

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-4B, 1230, 14-16'

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS		
Petrol. Hydrocarbons	mg/Kg	<16
Lead as Pb	mg/Kg	2.4
Chromium as Cr	mg/Kg	4.5
Cadmium as Cd	mg/Kg	0.028
Mercury as Hg	mg/Kg	<0.005
Copper as Cu	mg/Kg	7.5
Zinc as Zn	mg/Kg	14

cc:

REMARKS:

DIRECTOR

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

LAB NO. C893375/9 12/01/89

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-5A, 1300, 2-4'

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS
Petrol. Hydrocarbons	mg/Kg	<16	
Lead as Pb	mg/Kg	7.5	
Chromium as Cr	mg/Kg	10	
Cadmium as Cd	mg/Kg	0.035	
Mercury as Hg	mg/Kg	0.020	
Copper as Cu	mg/Kg	10	
Zinc as Zn	mg/Kg	24	

cc:

REMARKS:

DIRECTOR

.rn= 14954 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777

LAB NO. C893375/10 12/01/89

Energy & Environmental Analysts, Inc.
55 Hilton Ave.
Garden City, NY 11530
ATTN: Al Serper

SOURCE OF SAMPLE: Review Ave., Project #89117
COLLECTED BY: Client DATE COL'D:11/10/89 RECEIVED:11/13/89

SAMPLE: Soil sample, S-5B, 1300, 14-16'

ANALYTICAL PARAMETERS ANALYTICAL PARAMETERS

Petrol. Hydrocarbons	mg/Kg	<16
Lead as Pb	mg/Kg	2.6
Chromium as Cr	mg/Kg	8.5
Cadmium as Cd	mg/Kg	0.038
Mercury as Hg	mg/Kg	<0.005
Copper as Cu	mg/Kg	10
Zinc as Zn	mg/Kg	15

cc:

REMARKS:

DIRECTOR ____________

rn= 14955 NYSDOH ID# 10320

EEA Inc.

55 Hilton Avenue
Garden City, New York 11530
Telephone (516) 746-4400
(212) 227-3200

CHAIN OF CUSTODY RECORD

PROJECT NO.: 89119

PROJECT NAME: Devay, 559 Atlantic Av, Oceanside

LABORATORY NAME: Ecotest Labs

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION / SAMPLING METHOD	NO. OF CONTAINERS	TPH	EPA 8020	Cr	Ni	Cd	Pb	Zn	Cu	REMARKS: SAMPLE DESCRIPTION, OTHER ANALYSIS
SB-1	11/30/89	1020		✓	4-6 feet	1	✓								soil
SB-2	11/30/89	1045		✓	8-10 feet	1		✓							soil
SB-3	11/30/89	1100		✓	8-10 feet	1		✓							soil
SB-4	11/30/89	1115		✓	8-10 feet	1		✓							soil
SB-5	11/30/89	11:45			8-10 feet	1		✓							soil
Sllop	11/29/89	—		✓	LI PAINT	1			✓	✓	✓	✓	✓	✓	soil

Shipped Via: hand delivered by EEA Personnel

Relinquished by (Signature)	Date/Time	Agent of	Rec'd. by (Signature)	Date/Time	Agent of
Nicholas Recchia	11/30/89 1515	EEA Inc.	Tracy Ripler	1515 11/30	EEA
Printed Name: Nicholas Recchia			Printed Name: Tracy Ripler		
Relinquished by (Signature): [illegible]	11/30/89 1606	[illegible]	Rec'd. by (Signature): Tom Powell	4:06 11/30/89	Ecotest
Printed Name: [illegible]			Printed Name: Tom Powell		
Relinquished by (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time		
Printed Name		Printed Name			

Remarks:
Metals - total
EPA 8020 - Benzene, Toluene, Ethylbenzene, Xylene
TPH - total petroleum hydrocarbons

Sampler (Signature): Nicholas Recchia

Sampler Name (Print): Nicholas Recchia

APPENDIX B

Field Sampling Plan

APPENDIX B

FIELD SAMPLING PLAN FOR THE SITE CHARACTERIZATION OF THE INLAND PARCELS, FORMER PRATT OIL WORKS SITE
Long Island City, New York

AUGUST 2008

Prepared by:

PARSONS

200 Cottontail Lane

Somerset, New Jersey 08873

Prepared for:

ExxonMobil

Exxon Mobil Corporation

100 Walnut Avenue

Clark, New Jersey 07066

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SECTION 1

INTRODUCTION

This Field Sampling Plan (FSP) defines the methods and procedures to be used for conducting the Site Investigation of the Inland Parcels at the Former Pratt Oil Works Site.

1.1 OVERVIEW OF FIELD ACTIVITIES

The following field activities will be performed as part of the investigation:

- **Test Pits –** Four test pits will be excavated to observe subsurface conditions, determine the presence of former structures, and characterize the presence of petroleum-related residues or other constituents that could impact human health and the environment. Soil samples from test pits will be analyzed for volatile (VOCs) and semivolatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs);
- **Soil and Monitoring Well Borings –** Six soil borings and 10 monitoring well borings will be completed to characterize the presence of petroleum-related residues or other constituents that could impact human health and the environment. Two soil samples will be analyzed from each boring for VOCs, SVOCs, metals, and PCBs;
- **Monitoring Well Installation –** Overburden monitoring wells will be installed at 10 boring locations. The objective of the monitoring wells will be to characterize groundwater quality and to determine the potential impact of petroleum-related residuals on human health and the environment;
- **Groundwater Sampling** - Groundwater samples will be collected from the 10 new monitoring wells and will be analyzed for VOCs, SVOCs, metals, PCBs, and pesticides; and
- **Surveying** - The locations of the sampling points will be surveyed. The location and elevation of the well casings will be determined to support assessment of groundwater flow direction.

SECTION 2

GENERAL FIELD GUIDELINES

2.1 SITE HAZARDS

Potential on-site surface hazards, such as sharp objects, overhead power lines, energized areas, and building hazards will be identified prior to initiation of fieldwork. Generally, such hazards will be identified during a site visit prior to the first day of fieldwork.

2.2 UNDERGROUND UTILITIES

Prior to the start of intrusive work, an electro magnetic (EM) and ground-penetrating radar (GPR) survey of the entire Inland Parcels will be conducted. The purpose of the geophysical survey is to attempt to provide information regarding the presence of underground structures at the property including pipelines related to former refinery operations. The survey will be conducted on a grid interval of approximately five feet established relative to permanent landmarks (roads, fences, buildings, etc.). Additionally, each of the proposed drilling and test pit locations will be scanned with the EM and/or GPR instruments individually to assess the potential presence of underground utilities. A report and CAD drawing presenting the results of the geophysical survey will be prepared and included in the Site Investigation Report.

In addition to the geophysical survey, the Dig Safely New York One-Call Center will be contacted for a Code 753 utility mark-out. No drilling or excavation activities will be conducted until the following minimum requirements have been met:

- The Parsons Project Manager and/or Field Team Leader have thoroughly inspected the drilling and test pit locations and surrounding area for the Code 753 mark-out and the location is clear of marked utilities;
- A private utility locating contractor has conducted a geophysical survey of the proposed sampling locations to locate potential underground utilities or obstructions;
- All drilling locations have been cleared with a metal detector by Parsons;
- Parsons has met with and reviewed all of the drilling and test pit locations with a facility representative and ExxonMobil's representative, and verified that all locations have been marked; and
- Each drilling location and test pit has been hand-cleared or vacuum excavated to a minimum depth of four feet.

2.3 FIELD LOG BOOKS

All field activities will be carefully documented in field log books. Entries will be of sufficient detail that a complete daily record of significant events, observations, and measurements are obtained. The field log book will provide a legal record of the activities conducted at the site and maintained as follows.

- Field books will be bound with consecutively numbered pages;
- Field books will be controlled by the Field Team Leader while field work is in progress;
- Entries will be written with waterproof ink;
- Entries will be signed and dated at the conclusion of each day of fieldwork;
- Erroneous entries made while fieldwork is in progress will be corrected by the person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction; and
- Corrections made after departing the field will be made by the person who made the original entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.

At a minimum, daily field book entries will include the following information:

- Location of field activity;
- Date and time of entry;
- Names and titles of field team members;
- Names and titles of any site visitors and site contacts;
- Weather information, for example: temperature, cloud coverage, wind speed and direction;
- Purpose of field activity;
- A description of the field work conducted;
- Sample media (soil, sediment, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) taken;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;
- Preservatives used;
- Analytical parameters;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- Any field measurements made, such as pH, temperature, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s); and

- Information pertaining to sample documentation such as:
  - Bottle lot numbers;
  - Dates and method of sample shipments; and
  - Chain-of-Custody Record and Federal Express Air Bill numbers.

SECTION 3

FIELD EQUIPMENT DECONTAMINATION AND MANAGEMENT OF INVESTIGATION DERIVED WASTES

3.1 DECONTAMINATION AREA

A temporary decontamination area lined with polyethylene sheeting will be constructed for steam cleaning the drilling equipment. The location of the decontamination area will be coordinated with ExxonMobil and facility representatives. Water collected from the decontamination activities will be collected in 55-gallon drums and managed as described in Section 3.3.

3.2 EQUIPMENT DECONTAMINATION

The following procedures will be used to decontaminate equipment used during the Site Investigation activities.

- All drilling equipment including the drilling rig, augers, bits, rods, tools, split-spoon samplers and tremie pipe will be cleaned with a high-pressure steam cleaning unit before beginning work;
- The bucket of the excavator or backhoe will be cleaned with a high-pressure steam cleaning unit before beginning work, between test pit locations, and prior to leaving the site;
- Tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided;
- All augers, rods, and tools will be decontaminated between each drilling location according to the above procedures; and
- The back of the drill rig and all tools, augers, and rods will be decontaminated at the completion of the work and prior to leaving the site.

3.2.1 Sampling Equipment Decontamination

Suggested Materials:

- Potable water;
- Phosphate-free detergent – ***Alconox*** or ***Simple Green;***
- Distilled water;
- Aluminum foil;
- Plastic/polyethylene sheeting;

- Plastic buckets and brushes; and
- Personal protective equipment in accordance with the Health and Safety Plan.

Procedures:

- Prior to sampling, all non-dedicated sampling equipment (bowls, spoons, interface probes, etc.) will be either steam cleaned or washed with potable water and a phosphate-free detergent (***Alconox*** or ***Simple Green***). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, etc.;
- The sampling equipment will then be rinsed with potable water followed by a deionized water rinse;
- Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground; and
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

3.3 MANAGEMENT OF INVESTIGATION DERIVED WASTES

3.3.1 Decontamination Fluids

Decontamination fluids will be collected in Department of Transportation (DOT) approved 55-gallon drums. The drums will be labeled as investigation-derived wastewater and temporarily stored in a secured area to be determined by ExxonMobil and facility representatives. The drums will be placed on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

3.3.2 Drill Cuttings

Drill cuttings will be contained in 55-gallon drums. The soils will be segregated by drill location to the extent practical. The drums will be labeled as investigation-derived waste soils from the corresponding boring or source area and temporarily stored in a secured area to be determined by ExxonMobil and facility representatives. The drums will be placed on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

3.3.3 Development and Purge Water

All development and purge water will be contained in 55-gallon drums. The drums will be labeled as investigation-derived wastewater from the corresponding well and temporarily stored in a secured area to be determined by ExxonMobil and facility representatives. The drums will be placed on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

3.3.4 Personal Protective Equipment

All personal protective equipment (PPE) will be placed in 55-gallon drums or roll-off containers for proper disposal.

3.3.5 Dedicated Sampling Equipment

All dedicated soil sampling equipment (Macrocore sampler liners and catchers) and groundwater sampling equipment (dedicated disposable polyethylene bailer and dedicated polypropylene line) will be placed in 55-gallon drums for disposal.

SECTION 4

TEST PITTING, DRILLING, AND SOIL SAMPLING

4.1 INTRODUCTION

Investigation activities to be conducted at Inland Parcels of the Former Pratt Oil Works Site include:

- Test pitting;
- Soil borings;
- Monitoring well installations; and
- Collection of subsurface soil samples.

These procedures are described in the following sections. Equipment decontamination procedures are described in Section 3.

4.2 TEST PIT INSTALLATION AND SOIL SAMPLING

The following equipment and methods will be used for installing test pits and collecting subsurface soil samples.

Suggested Equipment

- Field book;
- Project plans;
- Personal protective equipment in accordance with the Project Safety Plan;
- Stakes and flagging;
- Ziploc bags or one-pint containers for lithology samples;
- Tape measure;
- Stainless steel spatula;
- Hand auger with extension handle;
- Decontamination supplies including *Alconox or Simple Green*,
- Photoionization detector (PID);
- Camera;
- Clear tape, duct tape;
- Laboratory sample bottles;

- Coolers and ice; and
- Shipping supplies.

Installation and Soil Sampling Method

- The location and number of test pits to be installed, the frequency of soil samples to be collected, and the associated analytical parameters are summarized in the Site Investigation Work Plan;
- Excavate soil with tracked excavator or backhoe in 1-foot intervals. At each 2-foot interval, examine and classify the soils;
- Soil samples from the test pit to be used for PID screening or visual observation will be collected from the backhoe bucket. If possible, soil samples collected for laboratory analysis will be collected from the sidewalls of the test pit using a dedicated stainless steel spatula or a decontaminated hand auger with an extension handle;
- A representative sample from each depth interval will be placed in a plastic "Ziploc" bag or an 8-ounce sample jar filled approximately half full. The container will be labeled with the boring number and interval sampled. The containers will be closed tightly;
- After a minimum of 10 minutes, the tip of the PID will be inserted under the cap or into the bag to measure the headspace for organic vapors;
- Record observations, test pit dimensions, and PID measurements on the Test Pit Record (Figure 4.1);
- The test pit will be terminated when ground water, bedrock, or the limit of the excavator is reached;
- Following completion of test pit and sample collection, the test pit will be backfilled with the excavated material;
- Each test pit location will be photographed before, during, and after excavation. The number and location of each photograph will be recorded on the test pit record (Figure 4.1); and
- The bucket of the backhoe or excavator will be decontaminated between each test pit location in accordance with methods specified in Section 3.2.

4.3 SOIL BORINGS AND SOIL SAMPLING

The following methods will be used for conducting the soil borings.

Suggested Equipment

- Field book;
- Project plans;
- Personal protective equipment in accordance with the HASP;
- Metal detector;

- Stakes and flagging;
- One pint containers for lithology samples;
- Tape measure;
- Decontamination supplies including *Simple Green*;
- Water level indicator;
- PID;
- Dust Monitor;
- Camera;
- Clear tape, duct tape;
- Aluminum foil;
- Laboratory sample bottles;
- Coolers and ice; and
- Shipping supplies.

Drilling and Geologic Logging Method

- Soil borings will be advanced using direct push or hollow-stem auger drilling methods;
- Soil samples will be collected continuously to the bottom of the borings using 2-foot long, 2-inch diameter discrete samplers, or Macrocore samplers;
- Soil samples retrieved from the borehole will be visually described for:
  1. percent recovery,
  2. soil type,
  3. color,
  4. moisture content,
  5. texture,
  6. grain size and shape,
  7. consistency,
  8. visible evidence of staining, and
  9. any other observations.

  The descriptions will be in accordance with the Unified Soil Classification System (USCS).
- Soil samples will be immediately screened for the evolution of organic vapors with a PID;

- A representative portion of the sample will be placed in a plastic "Ziploc" bag or an 8-ounce sample jar filled approximately half full. The container will be labeled with the boring number and interval sampled. The containers will be closed tightly;
- After a minimum of 10 minutes, the tip of the PID will be inserted under the cap or into the bag to measure the headspace for organic vapors;
- Remaining soil will be disposed of in accordance with methods specified in Section 3.3;
- All borings will be sealed with bentonite or cement/bentonite grout following completion;
- All drilling equipment will be decontaminated between each boring in accordance with methods specified in Section 3.2; and
- The designated field geologist will log borehole geology and headspace measurements in the field book for later transfer to the Drilling Record shown in Figure 4.2, or similar form.

Soil Sampling

- The number and frequency of samples to be collected from each boring and the associated analytical parameters are summarized in the Site Investigation Work Plan;
- Subsurface samples for VOC analyses will be collected directly from the split-spoons or acetate liners, placed into appropriate containers, and compacted to minimize head space and pore space. The remaining sample volume will be homogenized, and placed in appropriate containers for the other analyses;
- The sample containers will be labeled, placed in a laboratory-supplied cooler and packed on ice (to maintain a temperature of 4^{o} C). The coolers will be shipped overnight to the laboratory for analysis;
- Chain-of-custody procedures will be followed as outlined in the Quality Assurance Project Plan (QAPP);
- The sampling equipment will be decontaminated between samples in accordance with procedures described in Section 3;
- Excess soil remaining after sampling will be contained in accordance with methods specified in Section 3.3; and
- The sample locations, descriptions, and depths will be recorded in the field book.

4.4 MONITORING WELL INSTALLATION AND DEVELOPMENT

The following methods will be used for drilling, installing, and developing the monitoring wells.

Suggested Equipment

- Field log book;

- Project plans;
- Personal protective equipment in accordance with the Project Safety Plan;
- Metal detector;
- One pint containers for lithology samples;
- Tape measure;
- Decontamination supplies;
- Water level indicator;
- PID;
- Camera;
- Clear tape, duct tape;
- Aluminum foil;
- Laboratory sample bottles;
- Coolers and ice;
- Shipping supplies;
- Polyethylene disposable bailers (development);
- Polypropylene rope (development);
- Waterra pump or other purge pump (development);
- Stainless steel or glass beakers (development);
- Turbidity meter (development); and
- Temperature, conductivity, pH meter (development).

Overburden Monitoring Well Installation

Figure 4.3 shows a cross-section for a typical overburden monitoring well. The monitoring wells will be installed in accordance with the following specifications:

- The monitoring well borings will be advanced with 6.25-inch inner diameter (ID) hollow stem augers;
- As described above for soil borings, continuous soil samples will be collected from monitoring well borings for visual description and PID screening;
- Wells will be constructed with 4-inch ID, threaded, flush-joint, PVC casings and screens;
- Screens will be 10 feet long with 0.02-inch slot openings. Alternatives may be used at the discretion of the field geologist and approval of ExxonMobil, based on site conditions;

- The annulus around the screens will be backfilled with silica sand having appropriate size (e.g., Morie No. 1) to a minimum height of 2 feet above the top of the screen. Auger flights will be withdrawn as sand is poured in a manner that will minimize hole collapse and bridging;
- A bentonite pellet seal or slurry seal with a minimum thickness of 2 feet will be placed above the sand pack. The bentonite seal (pellets) will be allowed to hydrate before placement of grout above the seal;
- The remainder of the annular space will be filled with a cement-bentonite grout to near the ground surface. The grout will be pumped from the bottom up. The grout will be allowed to set for a minimum of 24 hours before wells are developed;
- Each monitoring well will have a sealed cap (J-plug) and will be contained in a flush-mounted vault. The J-plug will be used to keep surface water from infiltrating into the well during rain events, high water conditions, etc.;
- The concrete seal or pad will be sloped slightly to channel water away from the well, and be deep enough to remain stable during freezing and thawing of the ground. Monitoring wells will be installed so that the vault and concrete pad do not pose a trip hazard when completed;
- The top of the PVC well casing will be marked and surveyed to 0.01 foot, and the elevation will be determined relative to a fixed benchmark or datum;
- The measuring point on all wells will be on the innermost PVC casing; and
- Monitoring well construction details will be recorded in the field book and on the Drilling Record shown in Figure 4.2, or similar form.

Monitoring Well Development

- After approximately 24 hours following completion, the monitoring wells will be developed by surging/bailing, using a centrifugal or peristaltic pump and dedicated polyethylene tubing, a Waterra positive displacement pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist;
- Water levels will be measured in each well to the nearest 0.01 foot prior to development;
- The wells will be developed until the water in the well is reasonably free of visible sediment (50 NTU if possible) or until pH, temperature and specific conductivity stabilize;
- Development water will be contained in accordance with methods specified in Section 3.3; and
- Following development, wells will be allowed to recover for at least seven days before groundwater is purged and sampled. All monitoring well development will be overseen by a field geologist and recorded in the field book.

Figure 4.1 Test Pit Record

FIGURE 4.1

PARSONS
TEST PIT RECORD

PROJECT NAME:		**TEST PIT ID:**
PROJECT NUMBER:		**LOCATION:**
WEATHER		Approximate L X W X D
DATE/TIME START:		=
DATE/TIME FINISH:		
CONTRACTOR:		
INSPECTOR:		

DEPTH (feet bgs)	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Figure 4.2 Drilling Record

FIGURE 4-2

PARSONS

DRILLING RECORD

BORING/ WELL NO. Sheet ___ of ___

Contractor: ____________
Driller: ____________
Inspector: ____________
Rig Type: ____________

PROJECT NAME: ____________
PROJECT NUMBER: ____________

Location Description:

Location Plan

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather: ____________

Date/Time Start: ____________

Date/Time Finish: ____________

Sample Depth	Sample I.D.	SPT	% Rec.	PID (ppm)	FIELD IDENTIFICATION OF MATERIAL	SCHEMATIC	COMMENTS
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SAMPLING METHOD
SS = SPLIT SPOON
A = AUGER CUTTINGS
GP = GEOPROBE - DIRECT PUSH

COMMENTS:

PARSONS

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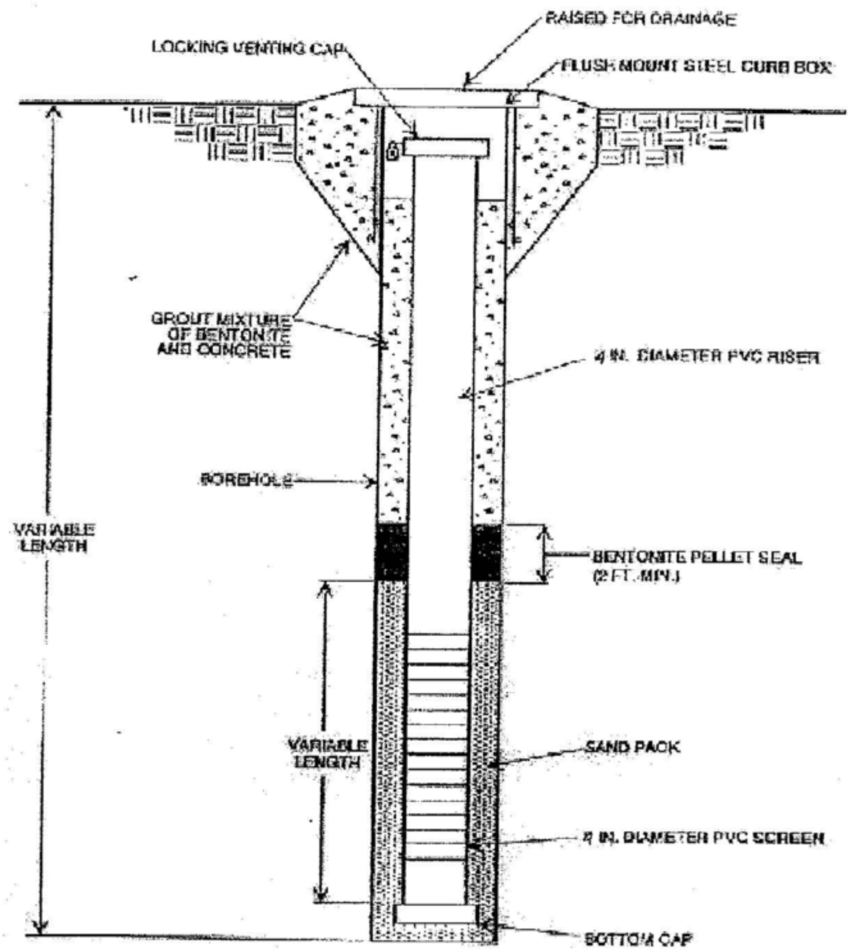
4-8

Figure 4.3 Monitoring Well Cross Section

FIGURE 4-3

TYPICAL MONITORING WELL CROSS SECTION



NOT TO SCALE

PARSONS

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4-9

SECTION 5

GROUNDWATER SAMPLING PROCEDURES

5.1 INTRODUCTION

Procedures for obtaining groundwater samples are described in this section. Sample handling procedures are described in Section 8.

5.2 GROUNDWATER SAMPLING

The following method will be used to collect groundwater samples from monitoring wells.

Suggested Equipment and Supplies

- Field book;
- Project plans;
- Personal protective equipment in accordance with the HASP;
- Oil/Water Interface Probe;
- Temp, conductivity, pH meters;
- Turbidity meter;
- 250-mL glass beaker;
- Decontamination supplies
- Peristaltic or other low-flow purge pump;
- Plastic tubing;
- Plastic sheeting;
- 5-gallon buckets;
- PID;
- Clear tape, duct tape;
- Coolers and ice;
- Laboratory sample bottles; and
- Federal Express labels.

Groundwater Sampling Method

<u>Purging</u>

- The number and frequency of groundwater samples to be collected and the associated analytical parameters are summarized in the Site Investigation Work Plan;
- Prior to sampling, the static water level and thickness of any free product will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the PVC casing with a decontaminated oil/water interface probe. The measurement will be recorded in the field book;
- The probe will be decontaminated according to procedures outlined in Section 3;
- The well will be purged by removing a minimum of three well volumes of water. Purging will be conducted using low-flow sampling methods such as a peristaltic pump;
- If a well goes dry before the required volumes are removed, it will be allowed to recover, purged a second time until dry or the required volumes are removed, and sampled when it recovers sufficiently; and
- Purge water will be managed and disposed of in accordance with procedures described in Section 3.

<u>Sampling</u>

- Samples will be collected using low-flow sampling methods such as a peristaltic pump and dedicated tubing;
- Prior to filling the sample bottles, one “clean” container will be filled with water. The temperature, pH, and conductivity will be measured with a pre-calibrated probe and recorded in the field log book;
- Sample containers for VOCs will be filled first. Sample containers for the other analytes will follow. If turbidity is less than 50 NTU, the sample for metals analysis will not be filtered. If turbidity is greater than 50 NTU, one filtered and one unfiltered sample for metals analysis will be collected and placed in bottles provided by the laboratory;
- The sample containers will be labeled, placed in a laboratory-supplied cooler and packed on ice (to maintain a temperature of 4^{o} C). The cooler will be shipped overnight or delivered to the laboratory for analysis;
- Chain-of-custody procedures will be followed as outlined in the QAPP;
- After all samples are collected, dedicated sampling equipment (i.e., polypropylene rope and bailer) will be disposed of in accordance with methods described in Section 3.3; and
- Well sampling data will be recorded in the field log book and on the Groundwater Sampling Record shown in Figure 5.1, or similar form.

Figure 5.1 Groundwater Sampling Record

PARSONS

GROUNDWATER SAMPLING RECORD

SITE NAME: ____________________

PROJECT NUMBER: ____________________

Purge Date: ____________________

Sampling Date: ____________________

Samplers: __________ of __________ Parsons __________

SAMPLE ID: ____________________

Sampling Method: ____________________

WELL PURGING

Static Water Level (TOC): __________

Depth to Well Bottom (TOC): __________

CALCULATIONS: Ft. of Water in Well __________ X (GAL / FT) = __________ Gallons

2-inch Casing: Ft. of Water in Well __________ x 0.16 = __________ Gallons

3-inch Casing: Ft. of Water in Well __________ x 0.32 = __________ Gallons

4-inch Casing: Ft. of Water in Well __________ x 0.64 = __________ Gallons

Method: ____________________

SAMPLE DESCRIPTION

Odor : ____________________

Other : ____________________

FIELD TESTS

	PURGE	PURGE	PURGE	PURGE	PURGE	PURGE	PURGE	SAMPLE
Time								
Depth To Water (TOC) (ft)								
Depth To Pump (TOC) (ft)								
Flow Rate (ml/min)								
Volume of Water Purged								
Temperature (Degrees C)								
Conductivity (umhos)								
pH (s.u.)								
Dissolved Oxygen (mg/L)								
ORP (eV)								
Turbidity (NTUs)								

SAMPLE ANALYSIS / LABORATORY

Analyze For: ____________________

Shipped Via: ____________________

Laboratory ____________________

Other Notes: ____________________

P:\XOM - Queens Site\Work Plan\FSP\Fig 5-1.xls 5-3 PARSONS

SECTION 6

AIR MONITORING

Air monitoring of the breathing zone will be conducted during all intrusive activities in accordance with the Site Investigation Work Plan and Health and Safety Plan to assure proper health and safety protection for the team and nearby occupants and workers.

- A RaeSystems MiniRae 2000 PID or equivalent will be used to monitor for organic vapors in the breathing zone and to screen the samples;
- A MiniRAM Portable Aerosol Monitor will be used to monitor particulate dust and aerosolized vapors in the breathing zone;
- A multi-gas meter (VRae) calibrated to detect lower explosive limit (LEL). Of the compounds anticipated to be found at the Inland Parcels, ethylbenzene has the lowest LEL (0.8%); therefore, this compound will drive the monitoring requirements for LEL in the exclusion zone; and
- Additional air monitoring may be required as specified in the Health and Safety Plan.

The PID readings will be recorded in the field log book during drilling activities and later transferred to the boring log form. The procedure for the PID operation and calibration is included in Section 7.

SECTION 7

FIELD INSTRUMENTS AND CALIBRATION

Field analytical equipment will be calibrated immediately prior to each day's use and more frequently, if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. All instrument calibrations will be documented in the project field log book and in an instrument calibration log. Records of all instrument calibration will be maintained by the Field Team Leader and will be subject to audit by the Project Quality Assurance Manager (PQAM). Copies of all of the instrument manuals and/or instruction sheets will be maintained on-site by the Field Team Leader.

The following field instruments will be used during the investigation:

- PID;
- MiniRAM real-time aerosol monitor;
- pH Meter;
- Multi-gas meter;
- Specific Conductivity Meter and Temperature Probe; and
- Turbidity Meter.

7.1 PORTABLE PHOTOIONIZATION DETECTOR

- The PID will be a RaeSystems MiniRae 2000 (or equivalent), equipped with a 10.6 eV lamp. The MiniRae is capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the Target Compound List;
- Calibration must be performed at the beginning of each day of use with a standard calibration gas having an approximate concentration of 100 parts per million of isobutylene. Calibration will be performed relative to benzene in accordance with the instrument manufacturer’s instructions. If the unit experiences abnormal perturbation or erratic readings, additional calibration will be required;
- All calibration data must be recorded in the field log book; and
- A battery check must be completed at the beginning and end of each working day.

7.2 MINIRAM

- The operator shall ensure that the instruments respond properly to the substances that they are designed to monitor. Real time aerosol monitors, such as the MiniRAM, must be zeroed at the beginning of each sampling period. The specific instructions for calibration and maintenance provided for each instrument should be followed;

- All calibration data must be recorded in field log books or on calibration log sheets to be maintained on-site; and
- A battery check must be completed at the beginning and end of each working day.

7.3 pH METER

- Calibration of the pH meter must be performed at the start of each day of use, and after very high or low readings as required by this plan, according to manufacturer's instructions;
- National Institute of Standards and Technology - traceable standard buffer solutions which bracket the expected pH range will be used. The standards will be pH of 4.0, 7.0 and 10.0 standard units;
- The pH calibration must be used to set the meter to display the value of the standard being checked; and
- The calibration data must be recorded on calibration sheets maintained on-site or with the piece of equipment.

7.4 MULTI-GAS METER

- Calibration checks using the multi-gas meter must be performed at the start of each day of use, after five to ten readings or after very high or low readings as required by this plan, according to manufacturer's instructions.

7.5 SPECIFIC CONDUCTIVITY METER AND TEMPERATURE PROBE

- Calibration checks using the conductivity standard must be performed at the start of each day of use, after five to 10 readings or after very high or low readings as required by this plan, according to manufacturer's instructions;
- The portable conductivity meter must be calibrated using a reference solution of 200 uohms/cm on a daily basis. Readings must be within five percent to be acceptable; and
- The thermometer of the meter must be calibrated against the field thermometer on a weekly basis.

7.6 TURBIDITY METER

- The turbidity meter must be checked at the start of each day of use and at the end of the day, according to manufacturer's instructions.

SECTION 8

FIELD SAMPLE IDENTIFICATION AND CUSTODY

8.1 SAMPLE LOCATION NUMBERING SYSTEM

- Test pits will be numbered consecutively beginning with TP-1. Individual samples will also be designated with a depth code (see below);
- Subsurface soil borings will be numbered consecutively beginning with SB-6 (soil borings) or MW-9 (monitoring well borings). Sample nomenclatures do not begin with SB-1 or MW-1 in order to distinguish the samples from historical on-site soil borings or monitoring well borings from the Inland Parcels. Individual samples will also be designated with a depth code (see below); and
- Monitoring wells will be numbered consecutively beginning with MW-9.

8.2 SAMPLE IDENTIFICATION

Each sample will be given a unique alphanumeric identifier in accordance with the following classification system:

SAMPLE IDENTIFICATION

LL*	NN*	N-N	LL
Sample Type	Sample Number	Depth Code	QC Identifier

	Solid	Water
Sample Type:	MW - Monitoring Well Boring SB – Soil Boring TP – Test Pit	MW - Monitoring Well
Sample Number:	Number referenced to a sample location map.	
Depth Code:	Depth of sample interval (0-2”, 0-2’, 2-4’, 10-12’, etc.)	
QC Identifier:	FB - Field Blank TB - Trip Blank WB - Wash or Rinse Blank	MS - Matrix Spike MD - Matrix Spike Duplicate MB - Matrix Blank

* L = Letter
* N = Number

Field duplicate samples will be assigned identifiers that do not allow the laboratory to distinguish them as field duplicates. Each sample container will be labeled prior to packing for shipment. The sample identifier, site name, date and time of sampling, and analytical parameters will be written on the label in waterproof ink and recorded in the field log book.

8.3 CHAIN OF CUSTODY

- A Chain-of-Custody (COC) record (Figure 8.1 or similar) will accompany the sample containers during selection and preparation at the laboratory, during shipment to the field, and during return shipment to the laboratory;
- The COC will identify each sample container and the analytical parameters for each, and will list the field personnel that collected the samples, the project name and number, the name of the analytical laboratory that will receive the samples, and the method of sample shipment;
- If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample shipment;
- The COC will be completed by field personnel as samples are collected and packed for shipment;
- Erroneous markings will be crossed-out with a single line and initialed by the author;
- The REMARKS space will be used to indicate if the sample is a matrix spike, matrix spike duplicate, or matrix duplicate;
- Trip and field blanks will be listed on separate rows;
- After the samples have been collected and sample information has been listed on the COC form, the method of shipment, the shipping cooler identification number(s), and the shipper airbill number will be entered on the COC;
- A second member of the field team will review the COC for completeness and accuracy whenever possible;
- Finally, a member of the sampling team will write his/her signature, the date, and time on the first RELINQUISHED BY space. Duplicate copies of each COC must be completed;
- One copy of the COC will be retained by sampling personnel. Blind duplicate samples will be identified on the copy retained by the sampling crew. The other copy and the original will be sealed in a plastic bag and taped inside the lid of the shipping cooler without the additional identification of blind duplicate samples;
- Sample shipments will be refrigerated at 4^{o}C, typically by packing with ice, to preserve the samples during shipment;
- After the shipping cooler is closed, custody seals provided by the laboratory will be affixed to the latch and across the front and back of the cooler lid, and signed by the person relinquishing the samples to the shipper;
- The seal will be covered with clear tape, and the cooler lid will be secured by wrapping with packing tape;

- The cooler will be relinquished to the shipper, typically an overnight carrier;
- The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the samples will not be analyzed; and
- The samples must be delivered to the laboratory within 48 hours of collection.

8.4 SAMPLE DOCUMENTATION

The Field Team Leader will be retaining a copy of the COC, and, in addition, the Field Team Leader will ensure that the following information about each sample is recorded in the field log book:

- Sample identifier;
- Identification of sampled media (e.g., soil, sediment, groundwater);
- Sample location with respect to known reference point;
- Physical description of sample location;
- Field measurements, (e.g., pH, temperature, conductivity, and water levels);
- Date and time of collection;
- Sample collection method;
- Volume of groundwater purged before sampling;
- Number of sample containers;
- Analytical parameters;
- Preservatives used; and
- Shipping information:
  - Dates and method of sample shipments;
  - Chain-of-Custody Record numbers;
  - Federal Express Air Bill numbers; and
  - Sample recipient (e.g., laboratory name).

Figure 8.1 Chain-of-Custody Form

ACCUTEST Laboratories

CHAIN OF CUSTODY

PAGE ___ OF ___

2235 Route 130, Dayton, NJ 08810
TEL. 732-329-0200 FAX: 732-329-3499/3480
www.accutest.com

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job #

Client / Reporting Information	Project Information	
Company Name	Project Name:	
Street Address	Street	Billing Information (if different from Report to)
City State Zip	City State	Company Name
Project Contact E-mail	Project #	Street Address
Phone # Fax #	Client Purchase Order #	City State Zip
Sampler(s) Name(s) Phone #	Project Manager	Attention:

Requested Analysis (see TEST CODE sheet)

Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
TB-Trip Blank

Accutest Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	DI Water	MEOH	ENCORE														LAB USE ONLY

"Collection" spans Date and Time; "Number of preserved Bottles" spans HCl through ENCORE.

Turnaround Time (Business days)	Approved By (Accutest PM): / Date:	Data Deliverable Information		Comments / Special Instructions
☐ Std. 15 Business Days		☐ Commercial "A" (Level 1)	☐ NYASP Category A	
☐ Std. 10 Business Days (by Contract only)	__________	☐ Commercial "B" (Level 2)	☐ NYASP Category B	
☐ 10 Day *RUSH*	__________	☐ FULLT1 (Level 3)	☐ State Forms	
☐ 5 Day *RUSH*	__________	☐ NJ Reduced	☐ EDD Format ______	
☐ 3 Day *EMERGENCY*	__________	☐ Commercial "C"		
☐ 2 Day *EMERGENCY*	__________	☐ Other ______		
☐ 1 Day *EMERGENCY*	__________	Commercial "A" = Results Only		
Emergency & Rush T/A data available VIA Lablink		Commercial "B" = Results + QC Summary		

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1		1	2		2
Relinquished by Sampler: 3	**Date Time:**	**Received By:** 3	**Relinquished By:** 4	**Date Time:**	**Received By:** 4
Relinquished by: 5	**Date Time:**	**Received By:** 5	**Custody Seal #** ☐ Intact ☐ Not intact	**Preserved where applicable** ☐	**On Ice** ☐ **Cooler Temp.**

APPENDIX C

Quality Assurance Project Plan

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN FOR THE SITE CHARACTERIZATION OF THE INLAND PARCELS, FORMER PRATT OIL WORKS SITE
Long Island City, New York

AUGUST 2008

Prepared by:

PARSONS

200 Cottontail Lane

Somerset, New Jersey 08873

Prepared for:

ExxonMobil

Exxon Mobil Corporation

100 Walnut Avenue

Clark, New Jersey 07066

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SECTION 1

PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) specifies analytical methods to be used to ensure that data from the proposed site characterization are precise, accurate, representative, comparable, and complete.

1.1 INTRODUCTION

ExxonMobil is undertaking a site investigation to characterize subsurface conditions at the Inland Parcels of the Former Pratt Oil Works (FPOW) Site.

1.2 PROJECT OBJECTIVES

The objective of the Site Characterization is to assess environmental conditions at the Inland Parcels.

1.3 SCOPE OF WORK

The scope of work for the Inland Parcels of the FPOW Site is described in the Site Characterization Work Plan. Samples will be collected from test pits, soil borings, and groundwater monitoring wells. These samples will be analyzed using the USEPA SW-846 "Test Methods for Evaluating Solid Waste," November 1986, 3rd edition (and subsequent updates).

1.4 DATA QUALITY OBJECTIVES AND PROCESSES

The quality assurance and quality control objectives for all measurement data include:

- ***Precision*** - an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and matrix spike duplicates;
- ***Accuracy*** - a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Sampling accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks;
- ***Representativeness*** - expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be determined by assessing a number of investigation procedures, including chain of custody, decontamination, and analysis of field blanks and trip blanks;

- ***Completeness*** - the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested; and

- ***Comparability*** - expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis, instrument calibrations, using standard reporting units and reporting formats, and data validation.

Each of the above objectives is discussed in detail in Section 3.

SECTION 2

PROJECT ORGANIZATION

This Site Investigation will be completed for ExxonMobil by Parsons. Parsons will arrange for the test pitting and drilling, and provide an on-site field representative to perform the soil logging and soil sampling. Parsons will also arrange for surveying and perform groundwater sampling activities. Parsons will perform the data analysis and reporting tasks.

Key contacts for this project are as follows:

ExxonMobil Project Manager:	Mr. Frank Messina Telephone: (732) 850-4009
Project Manager:	Mr. Christopher Del Monico Telephone: (732) 537-3533 Fax: (732) 868-3110
Laboratory Representative:	Mr. Matt Cordova Telephone: (732) 355-4550 Fax: (732) 329-3499

SECTION 3

QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES FOR MEASUREMENT OF DATA

3.1 INTRODUCTION

The quality assurance and quality control (QA/QC) objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in the following subsections. They are formulated to meet the requirements of the USEPA SW-846. The analytical methods and their Contract Required Quantitation Limits (CRQLs) are provided in Section 7.

3.2 PRECISION

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	Relative Percent Difference.
V1, V2	=	The two values to be compared.
|V1 - V2|	=	The absolute value of the difference between the two values.
(V1 + V2)/2	=	The average of the two values.

The data quality objectives for analytical precision, calculated as the RPD between duplicate analyses, are presented in Tables 3.1 and 3.2.

TABLE 3.1
QUALITY CONTROL LIMITS FOR WATER SAMPLES

Analytical Parameters	Analytical Method (a)	Matrix Spike (MS) Compounds	Laboratory Accuracy and Precision MS/MSD (b) % Recovery	MS/MSD RPD (c)	LCS (d) % Recovery	Surrogate Compounds	Surrogate % Recovery
VOCs (e)	8260	All target volatile compounds	Laboratory determined QC limits	Laboratory determined QC limits	Laboratory determined QC limits	Toluene-d8 Bromofluorobenzene 1,2-Dichloroethane-d4	Laboratory determined QC limits
SVOCs (f)	8270	All target semivolatile compounds	Laboratory determined QC limits	Laboratory determined QC limits	Laboratory determined QC limits	Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol 2-Chlorophenol-d4 1,2-Dichlorobenzene-d4	Laboratory determined QC limits
Pesticides/ PCBs (h)	8082	Gamma-BHC (Lindane) Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT	56-123 40-131 40-120 52-126 56-121 38-127	15 20 20 18 21 27	NA NA NA NA NA NA	Tetrachloro-m-xylene Decachlorobiphenyl	60-150 (g) 60-150 (g)
Inorganics	6010,7470/7471, 7841,9010, OIA-1677	Inorganic Analyte	75-125	20	80-120	NA	NA

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990; any subsequent revisions shall supersede this information
(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) Target Compound List Volatile Organic Compounds
(f) Target Compound List Semivolatile Organic Compounds
NA - Not Applicable

TABLE 3.2
QUALITY CONTROL LIMITS FOR SOIL SAMPLES

			Laboratory Accuracy and Precision				
Analytical Parameter	**Analytical Method (a)**	**Matrix Spike (MS) Compounds**	**MS/MSD (b) % Recovery**	**MS/MSD RPD (c)**	**LCS (d) % Recovery**	**Surrogate Compounds**	**Surrogate % Recovery**
VOCs (e)	8260	All target volatile compounds	Laboratory determined QC limits	Laboratory determined QC limits	Laboratory determined QC limits	Toluene-d8 Bromofluorobenzene 1,2-Dichloroethane-d4	Laboratory determined QC limites
SVOCs (f)	8270	All target semivolatile compounds	Laboratory determined QC limits	Laboratory determined QC limits	Laboratory determined QC limits	Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol 2-Chlorophenol-d4 1,2-Dichlorobenzene-d4	Laboratory determined QC limites
Pesticides/ PCBs (h)	8082	Gamma-BHC (Lindane) Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT	46-127 35-130 34-132 31-134 42-139 23-134	50 31 43 38 45 50	NA NA NA NA NA NA	Tetrachloro-m-xylene Decachlorobiphenyl	60-150 (g) 60-150 (g)
Inorganics	6010, 7470/7471, 7841, 9010	Inorganic Analyte	75-125	20 (k)	80-120	NA	NA

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990, any subsequent revisions shall supersede this information
(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) Target Compound List Volatile Organic Compounds
(f) Target Compound List Semivolatile Organic Compounds
NA - Not Applicable

3.3 ACCURACY

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise." Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

%R	=	Percent recovery.
SSR	=	Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.
SR	=	Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.
SA	=	Spiked analyte: concentration of the analyte spike added to the sample.

The acceptance limits for accuracy for each parameter are presented in Tables 3.1 and 3.2.

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the Field Sampling Plan. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate, and Chain-of-custody procedures are presented in Sections 4 and 5.

3.5 COMPLETENESS

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

3.6 COMPARABILITY

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the U.S. Environmental Protection Agency (USEPA) or National Institute of Standards and Technology (NIST);

- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

SECTION 4

SAMPLING PROGRAM

4.1 INTRODUCTION

The sampling program will provide data concerning the presence and the nature and extent of contamination of groundwater and soil, if any. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. Sample locations, and the number of environmental and QC samples to be taken are given in Table 4.1. The sampling procedures are presented in the Field Sampling Plan.

4.2 SAMPLE CONTAINER PREPARATION AND SAMPLE PRESERVATION

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the USEPA. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged and the appropriate preservatives will be added. The types of containers are provided in Tables 4.2 and 4.3.

Samples shall be preserved according to the preservation techniques given in Tables 4.2 and 4.3. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4^{o}C with ice, and delivered to the laboratory within 24 to 48 hours of collection. Chain-of-custody procedures are described in Section 5.

4.3 SAMPLE HOLDING TIMES

The sample holding times for organic and inorganic parameters are given in Tables 4.2 and 4.3 and must be in accordance with the NYSDEC ASP requirements. The NYSDEC ASP holding times must be strictly adhered to by the laboratory. Any holding time exceedances must be reported to ExxonMobil.

4.4 FIELD QC SAMPLES

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

a. Trip Blanks - A Trip Blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml VOA vial containing distilled, deionized water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for target compound list (TCL) volatiles analysis. The Trip Blank will be analyzed for TCL volatile organic compounds to assess any contamination from sampling and transport, and internal laboratory procedures.

b. Field Blanks - Field Blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix. Field blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory that has passed through a decontaminated bailer or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The field blank may be analyzed for all or some of the parameters of interest.

The duplicates will consist of:

a. Coded Field Duplicate - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.

b. MS/MSD - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Tables 3.1 and 3.2.

TABLE 4.1
SUMMARY OF SAMPLES AND ANALYSES

Matrix	Parameter	Analytical Method	Field Samples: Field Samples	Field Samples: Field Duplicate	Field Samples: MS/MSD[a] (Total)	Field Samples: Sub-Total	QC Blanks: Rinse Blanks [b]	QC Blanks: Trip Blank[c]	Total
Soil Samples (from soil borings, test pits, and monitoring well borings)	TCL VOCs	EPA SW 8260	40	2	2/2	46	2	0	48
	TCL SVOCs	EPA SW 8270B	40	2	2/2	46	2	0	48
	TAL Metals	EPA SW 6010, 7470/7471, 7841, 9010	40	2	2/2	46	2	0	48
	PCBs	EPA SW 8082	40	2	2/2	46	2	0	48
	Pesticides	EPA SW 8081	40	2	2/2	46	2	0	48
Groundwater Samples	TCL VOCs	EPA SW 8260	10	1	1/1	13	1	2[c]	16
	TCL SVOCs	EPA SW 8270	10	1	1/1	13	1	-	14
	TAL Metals	EPA SW 6010, 7470/7471, 7841, 9010	10	1	1/1	13	1	-	14
	PCBs	EPA SW 8082	10	1	1/1	13	1	-	14
	Pesticides	EPA SW 8081	10	1	1/1	13	1	-	14
Free Product Samples	Hydrocarbon Fingerprinting	Modified Methods 8015, 8260, 8270	TBD [d]	-		-	-	-	TBD

(a) Matrix spike / matrix spike duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analysis.

(b) One rinse blanks per 20 samples will be collected when non-disposable (decontaminated) sampling equipment is used.

(c) Trip blanks will be collected for each day a groundwater VOCs sample is sent to the laboratory.

(d) Number of free product samples collected for analysis (if any) will be determined in the field.

TBD - To Be Determined

TABLE 4.2

WATER SAMPLE CONTAINERIZATION, PRESERVATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation (a)	Holding Time (b)
Volatile Organic Compounds (VOCs)	2-40 mL glass vial w/ Teflon septum	Cool to 4^{o}C	12 days
Semivolatile Organics Compounds (SVOCs)	1000 mL glass w/ Teflon lined cap	Cool to 4^{o}C	5 days for extraction, 40 days for analysis
Metals	1000 mL plastic bottle	Nitric Acid to pH < 2 Cool to 4^{o}C	6 months, except mercury (26 days)
Pesticides/PCBs	Glass w/teflon cap	Cool to 4^{o}C	5 days*
Free Product	Glass w/teflon cap	NA	NA

(a) All samples to be preserved in ice during collection and transport. VOC samples may be preserved with HCL depending on laboratory used.

(b) Days from validated time of sample receipt (VTSR).

* Extraction of water samples for PCB/pesticides analysis by separatory funnel must be completed within 7 days of VTSR. Continuous liquid-liquid extraction is the required extraction for water samples for SVOCs. Continuous liquid-liquid extraction and concentration of water samples for SVOCs analysis completed within 7 days of VTSR. Extracts of water samples must be analyzed within 40 days of extraction.

TABLE 4.3

SOIL SAMPLE
CONTAINERIZATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation [(a)]	Holding Time [(b)]
Volatile Organic Compounds (VOCs)	Wide-mouth glass w/ teflon lined cap	Cool to 4ºC	10 days
Other Organic Compounds [(c)]	Wide-mouth glass w/ teflon lined cap	Cool to 4ºC	10 days*
Metals	Wide-mouth plastic or glass	Cool to 4ºC	6 months, except mercury (26 days)

(a) All samples to be preserved in ice during collection and transport. VOC samples may be preserved with HCL depending on laboratory used.

(b) Days from validated time of sample receipt (VTSR).

(c) Semivolatile organic compounds or PCBs/pesticides.

* Sohxlet or sonication procedures for extraction and concentration of soil/waste samples for SVOCs must be completed within 10 days of VTSR. Sohxlet or sonication procedures for extraction and concentration of soil/sediment/waste samples for PCBs must be completed within 10 days of VTSR.Extracts of soil samples must be analyzed within 40 days of extraction.

SECTION 5

SAMPLE TRACKING AND CUSTODY

5.1 INTRODUCTION

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the Chain-of-custody (COC) and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 5.1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

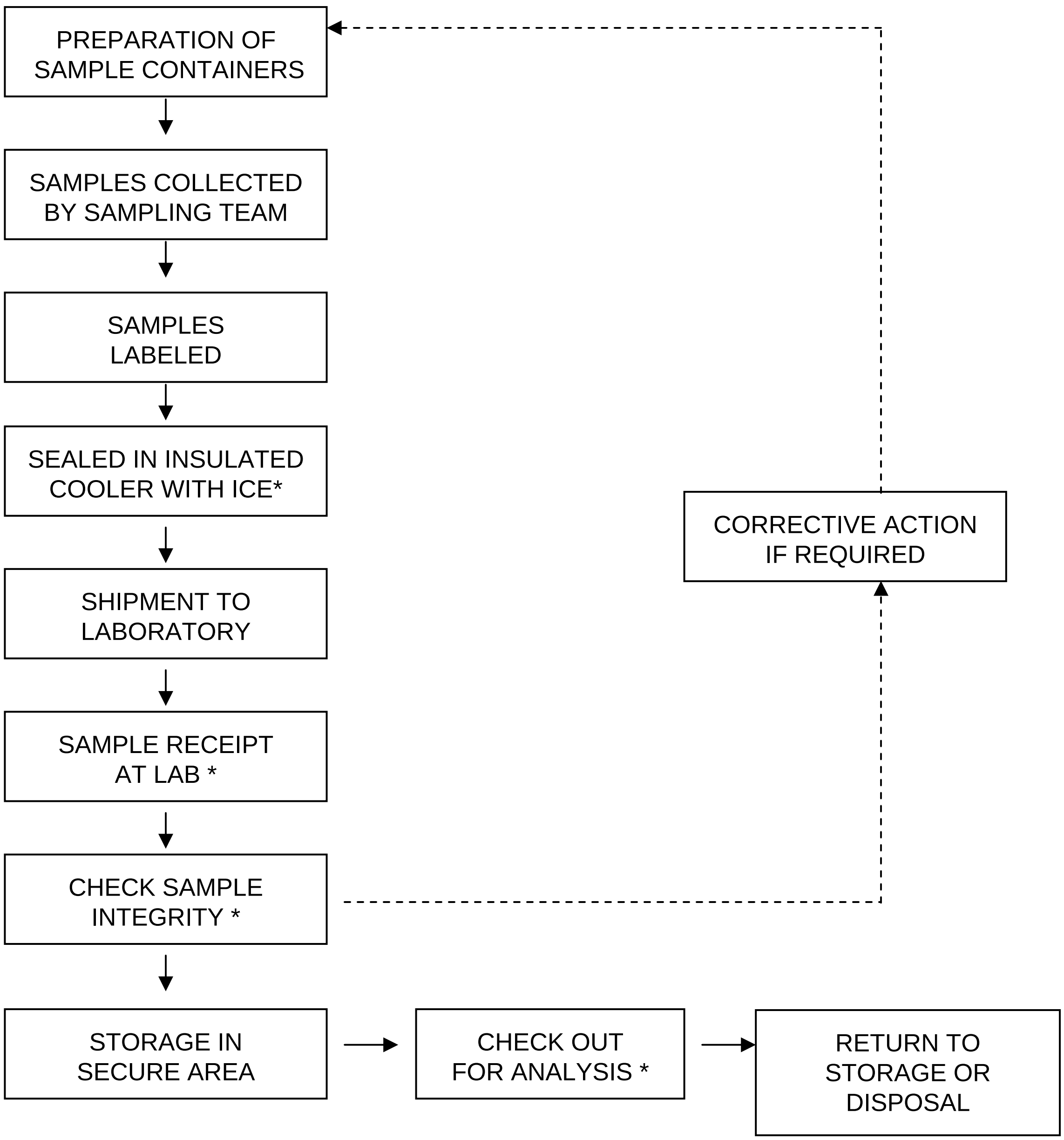
5.2 FIELD SAMPLE CUSTODY

A COC record (Figure 5.2 or similar) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The REMARKS space on the COC is used to indicate if the sample is a matrix spike, matrix spike duplicate, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC. Mistakes will be crossed out with a single line in ink and initialed by the author.

SAMPLE CUSTODY



* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Chain-of-Custody Record

ACCUTEST Laboratories

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
TEL. 732-329-0200 FAX: 732-329-3499/3480
www.accutest.com

PAGE ___ OF ___

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job #

Client / Reporting Information		Project Information		
Company Name		Project Name:		
Street Address		Street	Billing Information (if different from Report to)	
City State	Zip	City State	Company Name	
Project Contact	E-mail	Project #	Street Address	
Phone #	Fax #	Client Purchase Order #	City State	Zip
Sampler(s) Name(s)	Phone #	Project Manager	Attention:	

Requested Analysis (see TEST CODE sheet)

Matrix Codes
DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
TB-Trip Blank

Accutest Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	Number of preserved Bottles: HCl	NaOH	HNO3	H2SO4	NONE	DI Water	MEOH	ENCORE		Requested Analysis											LAB USE ONLY

Turnaround Time (Business days)	Approved By (Accutest PM): / Date:	Data Deliverable Information		Comments / Special Instructions
☐ Std. 15 Business Days		☐ Commercial "A" (Level 1)	☐ NYASP Category A	
☐ Std. 10 Business Days (by Contract only)	______________	☐ Commercial "B" (Level 2)	☐ NYASP Category B	
☐ 10 Day *RUSH*	______________	☐ FULLT1 (Level 3)	☐ State Forms	
☐ 5 Day *RUSH*	______________	☐ NJ Reduced	☐ EDD Format ________	
☐ 3 Day *EMERGENCY*	______________	☐ Commercial "C"		
☐ 2 Day *EMERGENCY*	______________	☐ Other ________		
☐ 1 Day *EMERGENCY*	______________	Commercial "A" = Results Only		
Emergency & Rush T/A data available VIA Lablink		Commercial "B" = Results + QC Summary		

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler: 1	Date Time:	Received By: 1	Relinquished By: 2	Date Time:	Received By: 2
Relinquished by Sampler: 3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal # ☐ Intact ☐ Not intact	Preserved where applicable ☐	On Ice ☐ Cooler Temp.

One copy of the COC is retained by sampling personnel (notations identifying blind duplicate samples will be added to this copy of the COC but not the others that will go to the laboratory) and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample will not be analyzed.

5.3 LABORATORY SAMPLE CUSTODY

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody;
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received;
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure;
- The samples will be stored in a secured area at a temperature of approximately 4^{o}C until analyses commence;
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control; and
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

SECTION 6

CALIBRATION PROCEDURES

6.1 FIELD INSTRUMENTS

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the Field Sampling Plan. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader. Copies of all the instrument manuals will be maintained on-site by the Field Team Leader.

Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photoionization detector) are provided in the Health and Safety Plan.

6.2 LABORATORY INSTRUMENTS

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 identified in Section 7.

SECTION 7

ANALYTICAL PROCEDURES

7.1 INTRODUCTION

Samples will be analyzed according to the USEPA SW-846 "Test Methods for Evaluating Solid Waste," November 1986, 3rd edition and subsequent updates. The methods to be used for the laboratory analysis of water and soil samples are presented in Table 7.1. These methods were selected because they attain the quantitation limits which are compiled on Table 7.1.

Table 7.1 Project Quantitation Limits

			Quantitation Limits	
	Analysis/Compound	**Method**	**Water**	**Soil**
	Volatile Organics		**(ug/L)**	**(ug/kg)**
1	1,1,1-Trichloroethane	SW8260B	5	5
2	1,1,2,2-Tetrachloroethane	SW8260B	5	5
3	1,1,2-Trichloroethane	SW8260B	5	5
4	1,1-Dichloroethane	SW8260B	5	5
5	1,1-Dichloroethene	SW8260B	5	5
6	1,2-Dichloroethane	SW8260B	5	5
7	1,2-Dichloroethene(total)	SW8260B	5	5
8	1,2-Dichloropropane	SW8260B	5	5
9	2-Butanone (MEK)	SW8260B	10	10
10	2-Hexanone	SW8260B	10	10
11	4-Methyl-2-pentanone(MIBK)	SW8260B	10	10
12	Acetone	SW8260B	10	10
13	Benzene	SW8260B	5	5
14	Bromodichloromethane	SW8260B	5	5
15	Bromoform	SW8260B	5	5
16	Bromomethane	SW8260B	5	5
17	Carbon Disulfide	SW8260B	5	5
18	Carbon Tetrachloride	SW8260B	5	5
19	Chlorobenzene	SW8260B	5	5
20	Chloroethane	SW8260B	5	5
21	Chloroform	SW8260B	5	5
22	Chloromethane	SW8260B	5	5
23	cis-1,3-Dichloropropene	SW8260B	5	5
24	Dibromochloromethane	SW8260B	5	5
25	Ethyl Benzene	SW8260B	5	5
26	Methylene Chloride	SW8260B	5	5
27	Styrene	SW8260B	5	5
28	Tetrachloroethene	SW8260B	5	5
29	Toluene	SW8260B	5	5
30	trans-1,3-Dichloropropene	SW8260B	5	5
31	Trichloroethene	SW8260B	5	5
32	Vinyl Chloride	SW8260B	5	5

	Table 7.1 Project Quantitation Limits			
			Quantitation Limits	
	Analysis/Compound	**Method**	**Water**	**Soil**
	Volatile Organics (con't)		**(ug/L)**	**(ug/kg)**
33	Xylenes (total)	SW8260B	5	5
34	Isopropylbenzene	SW8260B	5	5
35	1,2-Dichlorobenzene	SW8260B	5	5
36	1,3-Dichlorobenzene	SW8260B	5	5
37	1,4-Dichlorobenzene	SW8260B	5	5
38	1,2-Dibromo-3-chloropropane	SW8260B	5	5
39	1,2,4-Trichlorobenzene	SW8260B	5	5
40	1,2,3-Trichlorobenzene	SW8260B	5	5
41	1,1,2-Trichloro-1,2,2-trifluoroethane	SW8260B	5	5
42	Methyl Acetate	SW8260B	5	5
43	Methyl tert-butyl ether	SW8260B	5	5
44	Cyclohexane	SW8260B	5	5
45	Trichlorofluoromethane	SW8260B	5	5
46	Dichlorodifluoromethane	SW8260B	5	5
47	Methylcyclohexane	SW8260B	5	5
48	1,2-Dichloropropane	SW8260B	5	5
49	Bromochloromethane	SW8260B	5	5
	Semivolatile Organics		**(ug/L)**	**(ug/kg)**
1	Benzaldehyde	SW8270C	5	170
2	Acetophenone	SW8270C	5	170
3	Caprolactam	SW8270C	5	170
4	1,1'-Biphenyl	SW8270C	5	170
5	2,2'-oxybis(1-chloropropane)	SW8270C	5	170
6	2,4,5-Trichlorophenol	SW8270C	10	330
7	2,4,6-Trichlorophenol	SW8270C	5	170
8	2,4-Dichlorophenol	SW8270C	5	170
9	2,4-Dimethylphenol	SW8270C	5	170
10	2,4-Dinitrophenol	SW8270C	10	330
11	2,4-Dinitrotoluene	SW8270C	5	170
12	2,6-Dinitrotoluene	SW8270C	5	170
13	2-Chloronaphthalene	SW8270C	5	170
14	2-Chlorophenol	SW8270C	5	170
15	2-methyl-4,6-Dinitrophenol	SW8270C	10	330
16	2-Methylnaphthalene	SW8270C	5	170
17	2-Methylphenol	SW8270C	5	170
18	2-Nitrolaniline	SW8270C	10	330
19	2-Nitrophenol	SW8270C	5	170
20	3,3'-Dichlorobenzidine	SW8270C	5	170
21	3-Nitroaniline	SW8270C	10	330
22	4-Bromophenyl-phenyl ether	SW8270C	5	170
23	4-Chloro-3-methylphenol	SW8270C	5	170
24	4-Chloroaniline	SW8270C	5	170
25	4-Chlorophenyl-phenyl ether	SW8270C	5	170
26	4-Methylphenol	SW8270C	5	170
27	4-Nitroaniline	SW8270C	10	330
28	4-Nitrophenol	SW8270C	10	330
29	Acenaphthene	SW8270C	5	170
30	Acenaphthylene	SW8270C	5	170
31	Anthracene	SW8270C	5	170

Table 7.1 Project Quantitation Limits				
			Quantitation Limits	
	Analysis/Compound	**Method**	**Water**	**Soil**
	Semivolatile Organics (con't)		**(ug/L)**	**(ug/kg)**
32	Benzo(a)anthracene	SW8270C	5	170
33	Benzo(a)pyrene	SW8270C	5	170
34	Benzo(b)fluoranthene	SW8270C	5	170
35	Benzo(g,h,i)perylene	SW8270C	5	170
36	Benzo(k)fluoranthene	SW8270C	5	170
37	bis(2-Chloroethoxy) methane	SW8270C	5	170
38	bis(2-Chloroethyl) ether	SW8270C	5	170
39	bis(2-ethylhexyl)phthalate	SW8270C	5	170
40	Butylbenzylphthalate	SW8270C	5	170
41	Carbazole	SW8270C	5	170
42	Chrysene	SW8270C	5	170
43	Di-n-butylphthalate	SW8270C	5	170
44	Di-n-octylphthalate	SW8270C	5	170
45	Dibenz(a,h)anthracene	SW8270C	5	170
46	Dibenzofuran	SW8270C	5	170
47	Diethylphthalate	SW8270C	5	170
48	Dimethylphthalate	SW8270C	5	170
49	Fluoranthene	SW8270C	5	170
50	Fluorene	SW8270C	5	170
51	Hexachlorobenzene	SW8270C	5	170
52	Hexachlorobutadiene	SW8270C	5	170
53	Hexachlorocyclopentadiene	SW8270C	5	170
54	Hexachloroethane	SW8270C	5	170
55	Indeno(1,2,3-cd)pyrene	SW8270C	5	170
56	Isophorone	SW8270C	5	170
57	N-Nitroso-di-n-propylamine	SW8270C	5	170
58	N-nitrosodiphenylamine	SW8270C	5	170
59	Naphthalene	SW8270C	5	170
60	Nitrobenzene	SW8270C	5	170
61	Pentachlorophenol	SW8270C	10	330
62	Phenanthrene	SW8270C	5	170
63	Phenol	SW8270C	5	170
64	Pyrene	SW8270C	5	170
65	1,2,4,5-Tetrachlorobenzene	SW8270C	5	170
66	Atrazine	SW8270C	5	170
	PCBs		**(ug/L)**	**(ug/kg)**
1	Arochlor-1016	608 / SW8082	0.065	33
2	Arochlor-1221	608 / SW8082	0.065	33
3	Arochlor-1232	608 / SW8082	0.065	33
4	Arochlor-1242	608 / SW8082	0.065	33
5	Arochlor-1248	608 / SW8082	0.065	33
6	Arochlor-1254	608 / SW8082	0.065	33
7	Arochlor-1260	608 / SW8082	0.065	33
8	Arochlor-1262	608 / SW8082	0.065	33
9	Arochlor-1268	608 / SW8082	0.065	33
	Pesticides		**(ug/L)**	**(ug/kg)**
1	alpha-BHC	SW8081	0.05	0.002
2	beta-BHC	SW8081	0.05	0.002

Table 7.1 Project Quantitation Limits				
			Quantitation Limits	
	Analysis/Compound	**Method**	**Water**	**Soil**
	Pesticides		**(ug/L)**	**(ug/kg)**
3	delta-BHC	SW8081	0.05	0.002
4	gamma-BHC (Lindane)	SW8081	0.05	0.002
5	Heptachlor	SW8081	0.05	0.002
6	Aldrin	SW8081	0.05	0.002
7	Heptachlor Epoxide	SW8081	0.05	0.002
8	Endosulfan I	SW8081	0.05	0.002
9	Dieldrin	SW8081	0.1	0.003
10	4,4'-DDE	SW8081	0.1	0.003
11	Endrin	SW8081	0.1	0.003
12	Endosulfan II	SW8081	0.1	0.003
13	4,4'-DDD	SW8081	0.1	0.003
14	Endosulfan Sulfate	SW8081	0.1	0.003
15	4,4'-DDT	SW8081	0.1	0.003
16	Methoxychlor	SW8081	0.5	0.017
17	Endrin ketone	SW8081	0.1	0.003
18	Endrin aldehyde	SW8081	0.1	0.003
19	alpha-Chlordane	SW8081	0.05	0.002
20	gamma-Chlordane	SW8081	0.05	0.002
21	Toxaphene	SW8081	5	0.170
	Metals		**(mg/L)**	**(mg/kg)**
1	Antimony	SW6010B	0.006	5.0
2	Arsenic	SW6010B	0.01	1
3	Barium	SW6010B	0.01	1
4	Beryllium	SW6010B	0.005	0.5
5	Cadmium	SW6010B	0.005	0.5
6	Chromium	SW6010B	0.01	1
7	Copper	SW6010B	0.03	2.5
8	Lead	SW6010B	0.01	0.5
9	Mercury	SW7470A/7471A	0.0002	0.01
10	Nickel	SW6010B	0.04	4
11	Selenium	SW6010B	0.01	1
12	Silver	SW6010B	0.01	1
13	Thallium	SW7841	0.002	1
14	Zinc	SW6010B	0.02	2
*15	Vanadium	SW6010B	0.05	1
*16	Cobalt	SW6010B	0.05	1
*17	Aluminum	SW6010B	0.2	20
*18	Calcium	SW6010B	5	500
*19	Iron	SW6010B	0.1	10
*20	Magnesium	SW6010B	5	500
*21	Manganese	SW6010B	0.015	1.5
*22	Potassium	SW6010B	5	500
*23	Sodium	SW6010B	5	500
*24	Cyanide	SW9010A	0.01	0.01

SECTION 8

DATA REDUCTION, VALIDATION, AND REPORTING

8.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in standard format. Sample data deliverables will meet the requirements of the July 2005 NYSDEC Analytical Services Protocol (ASP) for Category B data deliverables.

The completed copies of the Chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

8.2 DATA REDUCTION

Two copies of the analytical data packages and an electronic disk deliverable will be provided by the laboratory approximately 30 days after receipt of a complete sample delivery group. The Project Manager will immediately arrange for filing one package; a second copy, and the disk deliverable, will be used to generate summary tables. These tables will form the database for assessment of the site contamination condition.

The electronic deliverable format required is an ASCII comma delimited file with the fields and character lengths summarized in Table 8.1.

Each diskette deliverable must be formatted and copied using an MS-DOS operating system. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this can not be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All diskette deliverables must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Task Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

TABLE 8.1

FIELD AND CHARACTER LENGTHS
FOR DISK DELIVERABLE

Description	Length	Format
Field Sample ID (as shown on COC)	15	Character
Cas. No. (including -'s)	10	Character
Parameter Name	31	Character
Concentration	13	Numeric
Qualifier	4	Character
Units	8	Character
SDG	8	Character
Lab Sample ID	15	Character
Date Sampled (from COC)	D	Date
Matrix (soil/water/air)	5	Character
Method Detection Limit	13	Numeric
Method Code	8	Character
Lab Code	6	Character

8.3 DATA VALIDATION

Data validation will be performed in accordance with USEPA Region II standard operating procedures (SOPs) for organic and inorganic data review. These validation guidelines are regional modifications to the National Functional Guidelines for organic and inorganic data review (USEPA 1999 and 2004). Validation will include the following:

- Verification of 100% of all QC sample results (both qualitative and quantitative);
- Verification of the identification of 100% of all sample results (both positive hits and non-detects);
- Recalculation of 10% of all investigative sample results; and
- Preparation of a Data Usability Summary Report (DUSR).

A DUSR will be prepared and reviewed by the QAO before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each SDG will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS and MSD results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;

- Interference check sample;
- Laboratory check samples;
- Duplicates;
- Matrix Spike;
- Furnace atomic absorption analysis QC;
- ICP serial dilutions; and
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected at given value;
- "UJ" - Estimated not detected at given value;
- "J" - Estimated value;
- “N” – Presumptive evidence at the value given;
- "R" - Result not useable; and
- No Flag - Result accepted without qualification.

SECTION 9

INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 QUALITY ASSURANCE BATCHING

Each set of samples will be analyzed concurrently with calibration standards, method blanks, matrix spikes (MS), matrix spike duplicates (MSD) or laboratory duplicates, and QC check samples (if required by the protocol). The MS/MSD samples will be designated by the field personnel. If no MS/MSD samples have been designated, the laboratory will contact the ExxonMobil Project Manager for corrective action.

9.2 CALIBRATION STANDARDS AND SURROGATES

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

9.3 ORGANIC BLANKS AND MATRIX SPIKE

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives". The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO_4$. The matrix spike is generated by addition of surrogate standard to each sample.

9.4 TRIP AND FIELD BLANKS

Trip blanks and field blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and to evaluate the possibility of atmospheric or cross contamination of the samples.

SECTION 10

QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

10.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the project QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 SYSTEM AUDITS

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

10.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that PE samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

10.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Noncompliances will be logged, and documented through audit findings which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within 15 days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

SECTION 11

PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

11.1 PREVENTIVE MAINTENANCE PROCEDURES

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 SCHEDULES

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 RECORDS

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

SECTION 12

CORRECTIVE ACTION

12.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at Site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the Site, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 12.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

CORRECTIVE ACTION REQUEST

Number: ___________________________ Date: _____________

TO: ____

You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _______________

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

___________	_______	___________	_________	____________	_________
Originator	Date	Approval	Date	Approval	Date

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B) PREVENTION

(C) AFFECTED DOCUMENTS

C.A. FOLLOWUP:

CORRECTIVE ACTION VERIFIED BY: ______________________________ DATE:______________

SECTION 13

REFERENCES

USEPA, 1986. SW-846 "Test Method for Evaluating Solid Waste," dated November 1986. U.S. Environmental Protection Agency, Washington, D.C.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan.

USEPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7- U.S. Environmental Protection Agency, Washington, D.C.