OFF-SITE REMEDIAL INVESTIGATION WORK PLAN
Site # C130140
Operable Unit 2

September 2009

EBC Project No: DGC0701

Former Darby Drugs Distribution Center
80-100 Banks Avenue
Rockville Centre, NY

Prepared for:

Darby Group Companies
865 Merrick Avenue
Westbury, NY 11590

Submitted to:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233

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FORMER DARBY DISTRIBUTION CENTER
ROCKVILLE CENTRE, NEW YORK

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TABLE OF CONTENTS
OUII OFF-SITE REMEDIAL INVESTIGATION
WORK PLAN
Former Darby Drugs Distribution Center
Rockville Centre, NY

TABLE OF CONTENTS
OUII OFF-SITE REMEDIAL INVESTIGATION WORK PLAN
Former Darby Drugs Distribution Center
Rockville Centre, NY

TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

This Remedial Investigation (RI) Work Plan has been prepared by Environmental Business Consultants (EBC) on behalf of Darby Group Companies, Inc. (Darby) to characterize the off-site groundwater plume associated with a commercial property located at 80-100 Banks Avenue, Rockville Centre, New York (**Figure 1**).

The chlorinated solvent, tetrachloroethylene (PCE), was first identified on the property, during a Phase II investigation performed in November 2003 as part of the due diligence by a potential purchaser of the property. The PCE is believed to have been released between 1972 and 1978 when a textile company leased the southern parcel (80 Banks Avenue) of the property. The contract vendee to purchase the property (Chase Partners) applied for and was accepted into the New York State Brownfield Clean-up Program (BCP) as a volunteer. Chase Partners entered into a Brownfield Clean-up Agreement (BCA) with the New York Department of Environmental Conservation (NYSDEC) on June 29, 2005. The property has since been purchased by Avalon Bay Communities (Avalon) of Melville, NY.

P.W. Grosser Consulting, Inc. (PWGC), on behalf of Chase Partners, submitted a Draft Remedial Investigation (RI) Report and an Interim Remedial Measure (IRM) Work Plan for on-site contamination in September 2004. The IRM Work Plan was formally approved for implementation by the NYSDEC on May 12, 2006. Under the Brownfields Program a volunteer is not required to investigate or remediate contamination which has left the boundaries of the property. The Draft RI Report for investigation of on-site contamination indicated that a groundwater plume containing PCE as high as 20,000 ug/L was leaving the property in a southerly direction.

Further investigation and remediation of on-site contamination will be addressed under a modified Brownfield Cleanup Agreement between Chase Partners, Avalon and the NYSDEC.

The NYSDEC has designated the off-site component of the investigation and remediation of contamination related to the Former Darby Drugs Distribution Center as Operable Unit 2. The purpose of this Remedial Investigation Work Plan for Operable Unit 2 is to characterize the nature and extent of the off-site PCE plume, and to collect data necessary to evaluate remedial alternatives under a Feasibility Study.

1.1 Site Location and Description

The subject property is located at 80-100 Banks Avenue, Village of Rockville Centre, Town of Hempstead, Nassau County, New York. The site is situated at the northwest intersection of Nassau Street and Banks Avenue. The property comprises a total area of 7.1 acres, and is identified as Lots 27 and 30, Block 539, Section 38 on the Nassau County Tax Maps.

The site is currently improved with a one-story, 150,000 square foot warehouse building and a two-story 24,000 square foot office building. The property is currently owned by Avalon, who purchased the property from Chase. The property was formerly owned by Darby who ceased operation at the site in November 2000. Darby has occupied the building since 1978 and operated it as a pharmaceutical product warehouse and distribution center. The buildings are currently vacant and undergoing demolition. Avalon is pursuing the phased development of two residential buildings consisting of a 100,492 square foot north complex and a 60,128 square foot south complex.

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2.0 SITE BACKGROUND

A historical document search, conducted as part of the BCP application process, and a previous Phase I Environmental Site Assessment, performed by a potential purchaser of the property, identified a textile company as a former occupant of the property. The company, known as Downen Zeir Knits, leased the southern parcel (80 Banks Avenue) of the property between 1972 and 1978. The company used processing water from pumping and injection wells located on the property and operated at least one dry-cleaning machine. Little else was determined about the operations of Downen Zeir Knits.

Darby, which recently sold the property to Avalon, occupied both parcels (80 Banks Avenue and 100 Banks Avenue) from 1978 to 2000 as a pharmaceutical product warehouse and distribution center.

The chlorinated solvent, tetrachloroethylene (PCE), was first identified on the property, during a Phase II investigation performed in November 2003 as part of the due diligence by a potential purchaser of the property. The PCE is believed to have been released between 1972 and 1978 during the tenancy of Downen Zeir Knits.

2.1 Previous Investigations

2.1.1 Phase 1 Environmental Site Assessment, ESI (March - 2002)

A Phase I Environmental Site Assessment (Phase I) was conducted by EcolSciences, Inc. (ESI) in March, 2002 to determine if there were any recognized environmental conditions associated with the subject site.

The document search identified records from the Nassau County Department of Health (NCDH) detailing the proper removal of four heating oil underground storage tanks (USTs). In addition, during the site reconnaissance, ESI identified an electrical panel along the western wall of the southern warehouse area containing circuit breakers with faded labels for “well pumps” and “dry cleaning still unit”.There was no record or information of a dry cleaning operation at the site. ESI recommended a test boring program beneath the concrete floor to assess potential impacts from possible former dry cleaning operations at the site, and soil samples in the vicinity of the heating oil tanks to verify the findings of the NCDH.

2.1.2 Preliminary Soils and Foundation Investigation Report (MTA - August 2003)

Melick-Tully and Associates (MTA) performed a number of borings on the subject property as part of a geotechnical analysis of site conditions to assist in the design of the proposed residential buildings. The investigation initially consisted of six soil borings with a recommendation that monitoring wells be installed for the basement design. A total of six monitoring wells were installed between January and May, 2003.

The MTA borings revealed that the geology beneath the site consists of 1 to 4 feet of sand fill material. Beneath the fill material is an orange-tan sand with gravel to a depth varying from 12 to 16 feet below grade. Beneath the sand and gravel unit is a black silty clay, which was determined to be 9 feet thick. The clay unit is underlain by sand to at least 31 feet below grade, the depth at which the borings were terminated.

MTA reported that the depth to water at the site varies between 5 to 9 feet below grade depending upon surface elevation. The water table was determined to exist within the sand unit situated above the black silty clay unit. Groundwater flow was determined to vary from a westerly to a southerly direction as you move west to east across the site.

2.1.3 Phase I1 Environmental Investigation (ESI - January 2004)

The Phase II investigation was completed by ESI in January, 2004. ESI identified a total of seven areas of concern (AOC) as part of their scope of work. In addition to the former heating oil tanks and the former potential dry cleaning still unit, other AOC's were identified as a result of further field observation and a geophysical survey performed as part of the Phase II investigation. A total of nineteen borings were advanced during the investigation with thirty-one soil samples submitted for analysis. Eleven groundwater samples were analyzed including five from the soil borings and six from the pre-existing monitoring wells installed by MTA. The results of the Phase II Investigation identified significant concentrations of PCE in soil and groundwater beneath the southwest corner of the building. Concentrations exceeding the pure product solubility of PCE were found at some locations just above the clay surface, indicating that DNAPL is present above the clay. Soil samples collected in the vicinity of the former fuel oil tanks did not indicate that a release had occurred at either location.

2.1.4 Draft Remedial Investigation Report (PWGC- September, 2004)

A Remedial Investigation (RI) was performed by P.W. Grosser Consulting, Inc. (PWGC) during March 15 - March 26, 2004 to: collect data of sufficient quality and quantity to adequately characterize the nature and extent of contamination at the site, evaluate contaminant migration, characterize the potential exposure to human health and the environment and select the most appropriate remedial technology.

Summary of the Nature and Extent of Contamination

The results of the RI confirmed the findings of the previous investigations and support a release scenario of liquid phase PCE beneath the floor near the western wall of the south building. From here, PCE as a DNAPL, migrated along the clay surface to a low point approximately 50 feet east of the release point. There is sufficient evidence to indicate that DNAPL remains in this area of the building. A competent clay layer, approximately 9 feet thick, was documented throughout the site. The report concluded that the presence of the clay limited the vertical migration of PCE in the soil column to a maximum depth of 18 feet below the surface. The clay surface was deepest in borings beneath the building and shallowest in borings at the property boundaries, effectively preventing further lateral migration of mobile DNAPL.

The Draft RI Report concluded that shallow soil contamination, above the guidance value of 1,400 µg/kg, is limited to an area approximately 40 feet by 60 feet. Contamination at the clay surface was reported to be more extensive, covering an area roughly 180 feet by 160 feet.

The report noted that significant PCE contamination in soil was also found at the clay surface outside of the building in the north end of the west parking area. The location is in the general vicinity of a suspected leaching structure. The Report suggested that the structure, if present, may have received process water from the building contaminated with volatile organic compounds (VOCs).

The report concluded that the presence of DNAPL and high PCE concentrations in soil were acting as a continuing source of contamination to the shallow groundwater, and that a shallow groundwater plume of chlorinated VOCs (CVOCs), primarily PCE, is emanating from the source area beneath the southwestern portion of the south building. PCE concentrations in the source area were reported at or above the pure product solubility, providing further evidence of DNAPL in this area. The report concluded that the plume is migrating south in the direction of groundwater flow, toward the Long Island Bus Depot. PCE concentrations at the south property line were reported at 28,000 µg/L.

A supplemental investigation completed by PWGC at the site in August and September of 2008 (PWGC SIR Report 1/09) identified dissolved PCE contamination in a permeable sand zone beneath the clay layer at a depth of 30-50 feet below the surface. The report also identified elevated PCE concentrations in soil gas at the south property line. The off-site investigation of the dissolved CVOC plume beneath the clay and CVOCs in soil gas, will be addressed in this off-site RI work plan.

Summary of the Exposure Assessment

According to the Draft RI Report, based on the historic use of the property, the release probably occurred sometime during the period of 1972 to1978 when the 80 Banks Avenue property was occupied by a textile company. Potential receptors for a dissolved CVOC plume leaving the site would include the Rockville Centre Wellfield located on the west side of Mill River in Lister Park, and downgradient commercial and residential properties via vapor intrusion. The wellfield is not expected to be at risk of impact, since the wells are screened within the Magothy Aquifer and the plume appears to be confined to the upper 15 feet of the water column by a local clay layer. Furthermore, water quality data for the wells compiled by the Nassau County Department of Health do not indicate impact from an on-going source of contamination. With respect to vapor impacts, there are few developed properties between 80-100 Banks Avenue and Mill River, where the plume would be expected to discharge. Developed properties include the MTA bus depot on Nassau Street and the Hampton Suites Hotel located on the north side of Sunrise Highway. If the plume fails to discharge to Mill River and continues south, it will encounter a residential area south of S. Village Avenue, approximately 1,750 feet from the site.

The assessment of CVOCs in soil gas off-site will be performed as part of this investigation work plan. Soil vapor intrusion evaluations, if necessary, will be performed on structures within the area of the shallow off-site plume as determined by the New York State Department of Health.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Site Conceptual Model

Although the date(s) and circumstances surrounding the release of PCE at the site are not known, it has been theorized that the release occurred while a textile company identified as Downen-Zeir Knits occupied the 80 Banks Avenue building from 1972 to 1978. If this is correct, then the groundwater plume would have been in transit for 31 to 37 years. Estimates of the hydraulic conductivity of the shallow (above clay) media, ranged from 0.077 to 0.51 ft per day. Using the high end of the hydraulic conductivity range, a measured water table gradient of 0.01 ft/ft and an average porosity of 25 percent, yields an average groundwater seepage velocity of 0.02 ft per day. Assuming a low organic carbon content of the soil (0.0001) gives a PCE retardation factor of 1.3 and a PCE transport velocity of 0.015 ft per day. Using these values the shallow PCE plume would have traveled only 169 to 202 feet during the estimated 31-37 year transport time. In this case the toe of the plume would not extend beyond the MTA Bus garage property.

Since the reported hydraulic conductivity values are low for a sand based media, it is possible that they are a function of the age and condition of the test wells and are not representative of the aquifer. Assuming that the measured hydraulic conductivity values are incorrect and that the seepage velocity approximates 0.50 feet per day (PCE velocity of 0.38 ft/day, assuming an FOC of 0.0001 for the soil), PCE leaving the site would have traveled a distance of 4,300 to 5,132 feet over the same 31 to 37 year transport time (). If this were the case and the plume continues in a southerly direction, as indicated at the south property line, the most likely path would take it beneath the MTA Bus garage, the Babylon branch of the Long Island Railroad and the Hampton Suites hotel. Under this scenario the plume would continue south beneath Sunrise Highway, and would eventually be expected to trend west toward, Mill River in response to the influence of natural groundwater discharge to this feature. . The plume would then discharge to the river at some point south of the MTA propertythough it may also continue further south toward a residential area. If, of course, the organic content of the soil is greater, or the groundwater seepage velocity is closer to the measured values, the toe of the plume may be somewhere in-between the MTA property and the River.

Based on the presence of liquid phase PCE at the site, and the high concentrations detected in soil and groundwater on the property in 2004, it is probable that the plume is still attached to the source area forming a continuous zone of impacted groundwater to the point of discharge (see **Figure 2**). The presence of a competent clay layer at 11 to 18 feet below the surface has limited the vertical extent of soil contamination to this depth. However, groundwater sampling below the clay, as performed by PWGC (on-site Supplemental RIR, 1/09) reported a maximum PCE level of 5,800 ug/L at a depth of 36-40 feet in vertical profile well VP-2008-02. VP-2008-02 was located adjacent to a line of diffusion wells installed as part of a closed loop cooling system by the former Downen-Zeir operation. PWGC also collected samples from each of the 3 supply (pumping) wells and 4 diffusion (injection) wells which were installed at the site in 1972. Of these, only diffusion well DIFFW-04 had PCE concentrations above standards with a concentration of 1,400 ug/L.

According to the NYSDEC well completion reports filed at the time of installation, four 4-inch diameter diffusion wells and three 8-inch supply wells were installed at the time. All of the wells were installed to a total depth of 50 feet. The supply wells each had 10 feet of screen, while each of the

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diffusion wells had 13 feet of screen. According to PWGC, the total depth of the diffusion wells as measured during the supplemental RI, varied from 19.82 to 47 feet. This indicates that sediment had completely sealed off the screen section in each well with the exception of DIFFW-04, which had 10 feet of screen exposed. In contrast, the total depth of the supply wells ranged from 40.04 to 43.3 feet indicating that at lease some portion of the screen was exposed in each well.

The PCE concentrations in DIFFW-04 and in VP02 may be the result of leakage around the well seal either during the sampling procedure or at some time in the past. It may also be the result of contaminant infiltration into the cooling water system. Since this system would be pressurized, the later case is considered less likely. In either scenario DNAPL would not been released into the deeper groundwater zone (beneath the clay). It has also not yet been established if the potentiometric surface of the lower groundwater unit (below clay) is higher (inducing potential upward flow) or lower (inducing potential downward flow).

When analyzed to show the 20 percent and 50 percent of range response, the geophysical well logs (**Attachment A**) obtained by PWGC for the vertical profile locations, define a groundwater transport zone within the 30 to 50 foot depth at each location. This is followed by a silt and clay zone to 100 feet. PCE entering the groundwater system below the clay would migrate along this transport zone in the direction of groundwater flow. Contaminant transport through this zone has been confirmed by the high concentration sampling interval (36-40 ft), as obtained by PWGC in VP-2008-02.

Flow direction in the below clay transport zone is assumed to be south, consistent with that of the upper zone.Based on the results of on-site soil gas sampling (PWGC, SIR 1/09), CVOCs may be off-gassing from high concentration areas of the CVOC plume. The assessment of CVOCs in soil gas off-site will be performed as part of this investigation work plan.

3.2 Groundwater Sampling

The purpose of the off-site investigation is to characterize the position, concentration and extent of the off-site portion of the groundwater plume above and below the clay, and to determine the location of the discharge point, if, in fact, it terminates at Mill River.

3.2.1 Shallow Groundwater Zone

Investigation of the extent of the shallow CVOC plume will be accomplished by collecting groundwater samples in up to five transects orientated perpendicular to the direction of groundwater flow. The transects will be separated by a distance of approximately 350 feet as shown in **Figure 3**. The first transect is located along the rear of the MTA-LI Bus garage. Two of the subsequent transects (if required) will be located within the New York State Department of Transportation (NYSDOT) right-of-way along Sunrise Highway and Merrick Road, The final two transects (if required) will be located within the Village of Rockville Centre Park along the eastern shore of Mill River.

Each transect will consist of 4 to 6 sampling points, spaced 30 to 50 feet apart. If the plume extends further south, additional transects may be required. If it terminates closer to the northern end of the river, however, fewer transects will be needed. To make sure that the sampling point intersects the plume vertically, two samples will be collected from each location; one from the water table interface and one from a depth of 15 feet or the clay surface whichever comes first. The samples will be collected from temporary points installed with a truck or track-mounted push-probe sampler (Geoprobe™). The Geoprobe™ uses a hydraulically driven percussion hammer to drive a small diameter stainless steel retractable screen into the ground with minimal disturbance. The procedure for collecting a sample involves driving the sampler to the desired depth and retracting the rods to expose the screen. Samples are collected by inserting disposable polyethylene tubing into the rods and connecting the tubing to a peristaltic pump to lift the water into laboratory supplied containers. The polyethylene tubing will be disposed of between the collection of each new sample. and preserved in accordance with the analytical method.

The first transect (see **Figure 4**) will also include shallow samples from three locations (T1GW1-T1GW3) along the east side of Smith Pond to delineate the western edge of the plume in this area.

Standard operating procedures for Geoprobe™ operation and groundwater sampling with the retractable screen system are provided in **Attachment B**. A sample matrix showing the number, type and analysis of samples collected during the OU2 RI is provided as **Table 1**.

The need, location and orientation of subsequent transects will be made in consultation with the NYSDEC and NYSDOH following receipt of the samples from the first transect locations.

3.2.2 Deep Groundwater Zone

To evaluate the extent of dissolved CVOC's identified below the clay, groundwater samples will be collected from three locations along the first transect on the MTA-Bus garage property and from two locations (1 on RVC property, 1 on MTA property) along the east side of Smith Pond (see Figure 4). At each location, samples will be collected from three intervals covering the entire width of the transport zone.

To assess the depth and thickness of the transport zone prior to obtaining groundwater samples, a soil boring will be advanced at each transect. The soil boring will include continuous discrete interval sampling through the upper clay layer and transport zone, continuing 4 feet into the silty-clay base at approximately 50 feet below surface. Soil sampling will be performed using the Geoprobe™ D-22 double rod sampling system. This system uses a 2.25 inch probe rod as an outer casing to effectively seal off the upper groundwater zone.

Upon confirmation of the lower silt/clay unit, an attempt will be made to collect a sample of pore water within this unit using the following procedure. The outer rod would be driven several feet into the unit to isolate it while a retractable groundwater sampler (D-21) is driven ahead and into the formation using the inner rods. Purging will then be performed to evacuate all water in the rods. If water does not recharge, then the silt/clay is essentially impermeable with limited ability to allow contaminant transport.

After the soil boring is completed and the transport zone has been defined, the depth and spacing of the deep groundwater sampling intervals within the transect will be adjusted to provide full coverage of the transport zone. The vertical distribution of CVOCs within this zone will be evaluated to determine the center of mass and if there are significant concentrations present at the top of the lower silt/clay unit.

Groundwater samples collected from beneath the clay will be collected using Geoprobe™ sampling equipment. The shallow groundwater zone will be isolated from the deep zone using a double casing method. This method will employ the Geoprobe™ D-21 groundwater profiler and the D-22 double rod sampling system. Groundwater and soil samples are collected through the outer 2.25 inch casing using 1.125 inch inner rods allowing discrete interval sampling. Both rods utilize neoprene O-rings to significantly reduce the potential for cross contamination between the upper and lower groundwater zones. Groundwater samples will be retrieved from the D-21 profiler using polyethylene tubing, a stainless steel check valve and the hand oscillation method. To assure that samples are representative of the interval selected, 1-3 outer rod volumes of water will be purged, prior to collecting each sample. Samples will be retained in laboratory supplied glassware and preserved in accordance with the analytical method. The polyethylene tubing will be disposed of between the collection of each new sample.

Standard operating procedures for Geoprobe™ operation and groundwater sampling with the D-21 and D-22 system are provided in **Attachment B**. A sample matrix showing the number, type and analysis of samples collected during the OU2 RI is provided as **Table 1**.

The need for additional below-clay samples in subsequent transects will be made in consultation with the NYSDEC and NYSDOH following receipt of the samples from the first transect locations.

Following retrieval of the soil /groundwater samples and the inner sampling rods, the borehole will be grouted through the clay layer using a bentonite-cement grout applied through the outer rods as they are retracted.

3.3 Monitoring Well Installation

To evaluate potential vertical flow components between the shallow and deep groundwater zones, and to determine the direction of groundwater flow in the deep zone, piezometer pairs will be installed at locations T1GW3, T1GW4 and T1GW6 (see **Figure 5**). Piezometer pairs will be constructed of 1-inch diameter PVC riser and ten feet of 0.01 slotted screen, installed using push-probe equipment. Shallow piezometers will be installed to intersect the water table with 2 feet of screen above and 8 feet of screen below the water table interface. The screen for deep piezometers will be set at 35 to 45 feet which is consistent with the screen depth proposed by PWGC for the on-site piezometers. Upon retrieval of the augers, the borehole will be sealed with a bentonite cement grout through the entire clay zone at each deep piezometer location. Each well will be sealed at the surface with a 1-foot thick hydrated bentonite seal and a 5 -inch diameter flush mount manhole.

To provide longer term (repeatable) monitoring points in subsequent downgradient transects, one small-diameter PVC monitoring well will be installed along the centerline location at each transect using Geoprobe™ equipment. The monitoring wells will be constructed of 1-inch diameter PVC riser and ten feet of 0.01 slotted screen. The wells will be set to intersect the water table with eight feet of screen below and 2 feet of screen above. Each well will be sealed at the surface with a 1-foot thick hydrated bentonite seal and a 5-inch diameter flush mount manhole.

Following installation each piezometer / monitoring well will be surveyed to determine the casing elevation to the nearest 0.010 foot. A synoptic round of water level measurements will also be made to calculate the water table and deep groundwater zone elevations. This information will then be used to determine the flow direction in each water bearing unit and vertical flow potential from the upper zone to the lower zone.

3.4 Soil Sampling

Since the residual soil contamination did not extend beyond the property boundaries, the collection of soil samples for source definition will not be included in this RI. However, a minimum of three soil samples, representative of the saturated media through which the off-site plume is migrating, will be collected for analysis of natural oxidant demand (NOD). The purpose of this analysis will be to assist in evaluating chemical oxidant treatment as a remedial alternative for the off-site plume.

Borings will be advanced using a track or truck mounted Geoprobe™ sampling system. The Geoprobe™ uses direct push technology to drive core samplers/groundwater probe points to the desired depth for soil or groundwater sample collection. Soil samples will be collected using a four-foot long two inch diameter macro-core sampler and disposable acetate liners. The liners will be disposed of and replaced prior to the collection of each new sample. Samples retained for analysis will be selected to be representative of the depth and orientation of the entire off-site plume, and will consist of a composite of the full sample retrieved by the macro-core sampler.

3.5 Surface Water Sampling

If the plume is discharging to Mill River it will be necessary to determine the concentration entering the river and its overall impact on the river's water quality. This will be performed by collecting groundwater samples from beneath the river sediments, at four locations along the western shoreline, and from surface water samples collected 300 feet upstream, 300 feet downstream and at the point of discharge.

Groundwater samples from beneath the river will be collected by manually driving probe rods 3 feet into the bottom sediments, collecting a sample through disposable polyethylene tubing and then withdrawing the rods. Water samples from the river will be grab samples taken from a consistent depth representative of the mid-point in the water column.

3.6 Soil Vapor Sampling

The collection of soil vapor samples will be incorporated into the off-site RI if a shallow CVOC plume is present beneath or adjacent to building structures. Soil vapor sampling will be in accordance with the Draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH 2/05). If CVOCs are present in soil gas, the results will be used to evaluate the potential for vapor intrusion into the building structures and if further investigation of the exposure pathway is warranted.

Vapor sampling locations will be selected in consultation with the NYSDOH and NYSDEC and as appropriate to be representative of shallow soil gas conditions. Since the water table is present at a depth of approximately 6 feet below the surface, the vapor implants will be set at an overall depth of 3 feet.

3.6.1 Soil Vapor Sampling Protocols

The vapor implants will be installed with Geoprobe™ equipment to an overall depth of 3 feet below the surface and constructed in the same manner at all locations to minimize possible discrepancies. The implants will be made from stainless steel and fitted with polyethylene tubing. Coarse sand or glass beads will be added to create a sampling zone of one foot in length and sealed above with a bentonite slurry for a minimum distance of 2 feet.

After installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) will be purged, using an electric or hand operated vauum pump, prior to collecting the samples to ensure samples collected are representative. Flow rates for both purging and collecting will not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling. Samples will be collected in 2 or 6 liter Summa® canisters fitted with 2-hour flow regulators. All canisters will be certified clean by the analytical laboratory. All samples will be collected over the same period of time submitted to York Analytical Laboratories, a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory.

A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, soil vapor purge volumes, volume of soil vapor extracted, vacuum of canisters before and after samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

As part of the vapor intrusion evaluation, a tracer gas will be used in accordance with NYSDOH protocols to serves as a quality assurance/quality control (QA/QC) device to verify the integrity of the soil vapor probe seal. Helium will be used as the tracer gas and a box will serve to keep it in contact with the probe during the testing. A portable monitoring device will be used to analyze a sample of soil vapor for the tracer prior to sampling. If tracer sample results show a significant presence of the tracer, the probe seals will be adjusted to prevent infiltration and retested using the helium tracer-gas method.

3.7 Laboratory Analysis

3.7.1 Analysis of Surface Water and Groundwater Samples

Collected groundwater and surface water samples will be placed in pre-cleaned laboratory supplied glassware, and placed in a cooler packed with ice or cold-paks for transport under proper chain-of-custody procedures to a NYSDOH certified laboratory for analysis. Samples will be submitted to the laboratory for a standard turnaround time, which is estimated to be two to three weeks.

Sample analysis will be provided by York Analytical Laboratories of Sheffield CT, Chem-Tech Laboratories of Moutainside, NJ, Severn-Trent Laboratories of Shelton, CT, or other New York State Department of Health ELAP-certified laboratory capable of providing ASP-category B deliverables. Groundwater and surface water samples will be analyzed for:

- Volatile Organic Compounds (VOCs) by EPA Method 8260;

3.7.2 Analysis of Soil and Groundwater Samples for Natural Oxidant Demand

A minimum of 3 groundwater samples and 3 soil samples from representative locations throughout the plume will be submitted for analysis of natural oxidant demand (NOD) to evaluate the use of chemical oxidation as a remedial option for the off-site plume. Samples retained for NOD will be shipped to Carus Chemical Company of LaSalle, IL for analysis.

3.7.3 Analysis of Soil Vapor Samples

All soil gas samples will be analyzed by York Analytical Laboratories of Sheffield CT, Chem-Tech Laboratories of Moutainside, NJ, Severn-Trent Laboratories of Shelton, CT, or other New York State Department of Health ELAP-certified laboratory capable of providing ASP-category B deliverables. Analytical procedures and corresponding reporting limits will be identified when reporting the sampling results. Soil gas samples will be analyzed for:

- Volatile Organic Compounds (VOCs) by EPA Method TO15

3.8 Access

Access to the transect locations is not expected to pose special problems. Permits, including fees and specified insurance requirements, will be required for the Village property and the NYSDOT right-of-way. An access agreement with specified insurance requirements may also be required for the MTA property.

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4.0 QUALITY ASSURANCE PROJECT PLAN

A Quality Assurance Project Plan (QAPP) has been prepared for this project and is included as **Attachment C** of this work plan. .

To comply with the quality assurance/quality control requirements of the project, the laboratory results will be reported to NYSDEC in accordance with the Analytical Services Protocol (ASP), Exhibit B - Category B Deliverables. This is a complete document package, which will allow for data validation. Sample analysis will be provided by either York Analytical Laboratories of Stafford CT, Chem-Tech Laboratories of Moutainside, NJ, Severn-Trent Laboratories of Shelton, CT, or other New York State Department of Health ELAP-certified laboratory capable of providing category-B deliverables. Such laboratories have demonstrated that they meet the requirements of the NYSDEC ASP which includes additional analytes and requires submission of data in a prescribed electronic format on diskettes. This certification is required for analyses and remediation of Superfund and other hazardous waste sites.

Field and laboratory QA/QC will include the analysis of trip blanks at the rate of one per cooler per shipment, and matrix spike/matrix spike duplicates (MS/MSD) at the rate of one for every 20 field samples. Since disposable tubing will be used to collect the samples, the preparation of field blanks will not be part of the QA/QC program.

It is estimated that 49 to 86 groundwater samples, 3 surface water samples, 5 to 7 trip blanks and 3 to 5 MS/MSD samples will be analyzed for VOCs during the investigation. In addition to the VOC analysis, 3 soil and 3 groundwater samples from different regions of the plume will be submitted to determine the natural oxidant demand (NOD), for use in evaluating a chemical oxidation remedial alternative.

5.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) takes into account the specific hazards inherent in conducting the off-site RI, and presents the minimum requirements which are to be met by Environmental Business Consultants (EBC), its subcontractors, and other personnel in order to avoid and, if necessary, protect against health and/or safety hazards. A HASP has been prepared and is provided in electronic form in **Attachment D** of this work plan.

Sub-contractors will have the option of adopting this HASP or developing their own site-specific document. If a subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in the off-site RI HASP prepared by EBC and must be made available to EBC and the NYSDEC.

Activities performed under the HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926. Modifications to the HASP may be made with the approval of the EBC Site Safety Manager (SSM) and/or Project Manager (PM).

6.0 COMMUNITY AIR MONITORING PLAN

The Community Air Monitoring Plan (CAMP) provides measures for protection for on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site commercial workers) from potential airborne contaminant releases resulting from investigation activities.

The action levels specified require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that the investigation work did not spread contamination off-site through the air.

The primary concerns during the investigation are odors from VOCs. The CAMP for this investigation is provided as **Attachment E**.

7.0 OFF-SITE REMEDIAL INVESTIGATION REPORT

Following completion of the investigation and receipt of the analytical data, EBC will prepare an Off-site Remedial Investigation Report which will include the following:

1. A description of the work which was performed under the off-site RI.

2. Any modification from this work scope and the reason for the modifications.

3. The nature and extent of the off-site groundwater plume.

4. The results of soil gas sampling and the potential for soil vapor intrusion into off-site structures.

5. Soil, and groundwater conditions that were observed.

6. Analytical data in tabular form comparing results to the most current applicable guidance.

7. Cross sections and data figures.

8. Laboratory analytical data, sampling logs and well completion logs for all samples and areas covered by the investigation.

9. Scaled drawings showing the locations of temporary sampling points, monitoring wells, soil gas and surface water sampling locations.

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8.0 PROJECT SCHEDULE

The first step in initiating the field sampling activities will be to call in case numbers to the one call utility mark-out center, initiate permitting for right of way access and prepare and mail access agreements for property owned or controlled by MTA and the Village of Rockville Centre. This effort will begin within one week following the NYSDEC approval of the Remedial Investigation Work Plan.

Once access is secured to the MTA property, mobilization to complete the first transect will be initiated within 2 weeks. Completion of the first transect including installation of the soil boring, sampling from the shallow and deep groundwater zones and installation of the piezometer pairs is expected to take 2 weeks. Laboratory results are expected to take approximately 2 weeks from the date of submission. The results from the first transect will be summarized and submitted, with a plan for the second transect, to the DEC Project Manager within 1 week following the receipt of the laboratory reports.

Mobilization for the 2nd and subsequent transects will begin within 2 weeks following submission of the data summary on the preceding transect, subject to concurrence and approval of the DEC Project Manager.

It is estimated that each subsequent transect will take 1 to 2 weeks to complete with preliminary laboratory results available within 2 weeks of submission.

9.0 REFERENCES

EcolSciences, Inc., March 28, 2002, *Phase I Environmental Site Assessment for 80-100 Banks Avenue, Rockville Centre, NY.*

EcolSciences, Inc., January 2004, *Phase II Environmental Investigation Report for 80-100 Banks Avenue, Rockville Centre, NY.*

Melick-Tully and Associates, April 4, 2002, *Preliminary Soils and Foundation Investigation Report, 80-100 Banks Avenue, Rockville Centre, NY.*

NYSDEC, Division of Environmental Restoration, May 2004, *Draft Brownfield Program Cleanup Guide.*

NYSDEC, Division of Environmental Restoration, December 2002, *Draft DER-10, Technical Guidance for Site Investigation and Remediaition.*

NYSDEC, Division of Technical and Administrative Guidance, January 24, 1994, *Memorandum # 4046, Determination of Soil Cleanup Objectives and Soil Cleanup Levels.*

NYSDEC, Division of Water, June 1998, Addendum April 2000, *Technical and Administrative Guidance Series 1:1:1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.*

PW Grosser Consulting Inc., September 2004*, Draft Remedial Investigation Report for 80-100 Banks Avenue, Rockville Centre, NY*

PW Grosser Consulting Inc., October 2005*, Interim Remedial Measure Work Plan for 80-100 Banks Avenue, Rockville Centre, NY,*

PW Grosser Consulting Inc., January 13*, 2009, Draft Supplemental Remedial Investigation Report, for Former Darby Drugs Distribution Center, 80-100 Banks Avenue, Rockville Centre, NY,*

TABLES

TABLE 1
SUMMARY OF
SAMPLING PROGRAM RATIONALE AND ANALYSIS

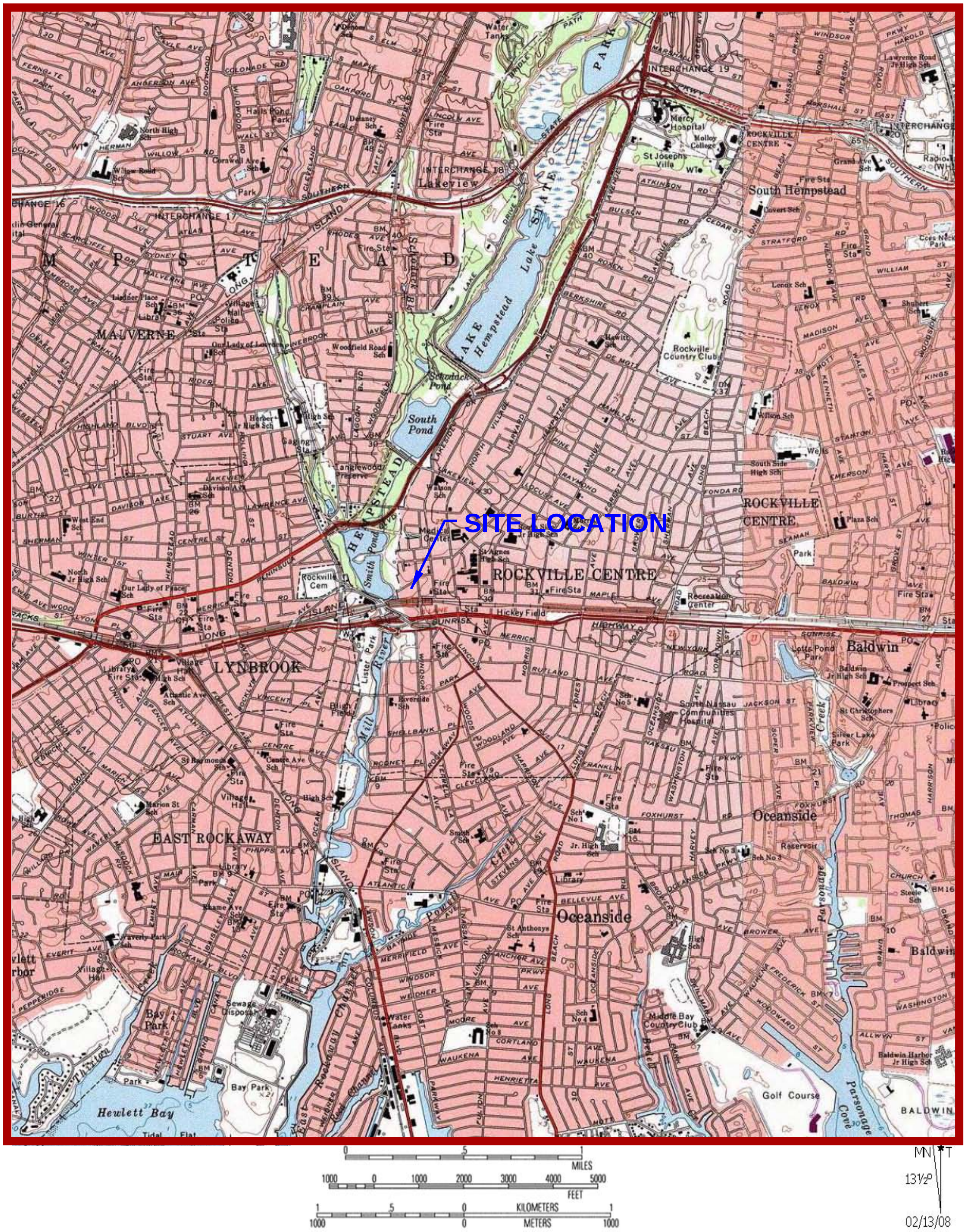
Matrix	Location	Approximate Number of Samples	Rationale for Sampling	Laboratory Analysis
Subsurface soil (2 to 15 feet bgs)	3 soil borings across site representative of off-site saturated media.	3	Provide natural oxidant demand of soils through which plume is migrating for evaluation of chem-ox remedial alternative.	Natural oxidant demand
Total (Soils)		3		
Shallow Groundwater	2 sampling levels from 4 to 6 temporary sampling points installed in 3 to 5 transects perpendicular to groundwater flow.	24 to 30	Define nature and extent of off-site CVOC plume	VOCs EPA Method 8260B
Shallow Groundwater	2 sampling levels from 3 temporary sampling points installed along the western edge of the Smith Pond.	6	Define western extent of impacted groundwater reported near drywells located west of the former Darby building and plume migration toward Mill River culvert.	VOCs EPA Method 8260B
Shallow Groundwater	4 sampling points installed beneath the bottom of Mill River.	4	Determine CVOC concentration discharging to Mill River.	VOCs EPA Method 8260B
Shallow Groundwater	3 samples representative of off-site conditions along the flow path of the plume.	3	Determine naural oxidant demand of groundwater for evaluation of chem-ox remedial alternative.	Natural oxidant demand
Deep Groundwater	3 sampling levels in the transport zone beneath the clay layer from 5 temporary sampling points installed as part of the first transect.	15	Define nature and extent of off-site CVOC plume beneath clay layer	VOCs EPA Method 8260B
Total (Groundwater)		52 to 58		
Surface Water	Mill River - I sample 300 feet upstream, downstream and at the point of plume discharge. Samples collected at midpoint in the water column.	3	Determine CVOC concentration in Mill River as a result of plume discharge.	VOCs EPA Method 8260B
Total (Surface Water)		3		
MS/MSD	Matrix spike and Matrix spike duplicates at the rate of one per 20 samples	3	To meet requirements of QA / QC program	VOCs EPA Method 8260B
Trip Blanks	One laboratory prepared trip blank to accompany samples each time they are delivered to the laboratory.	5 to 7	To meet requirements of QA / QC program	VOCs EPA Method 8260B
Total (QA / QC Samples)		8 to 10		

TABLE 2
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	**Matrix**	**Sampling Device**	**No. of Samples**	**Parameter**	**Sample Container**	**Sample Preservation**	**Analytical Method#**	**CRQL / MDL**	**Holding Time**
Groundwater (Geoprobe)	Water	Geoprobe sampler	52-58	VOCs	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/L)	10 days
Surface Waterr (Direct fill)	Water	Direct fill	3	VOCs	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/L)	10 days
Trip Blank	Water	Direct Fill of Sample Bottles	5-7	TCL Volatile Organic Compounds	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/l)	10 days

Notes:
All holding times listed are from Verified Time of Sample Receipt (VTSR) unless noted otherwise. * Holding time listed is from time of sample collection.
The number in parentheses in the "Sample Container" column denotes the number of containers needed. All bottles will comply with OSWER Directive 9240.0-05A: "Specifications and Guidance for Obtaining Contaminant - Free Sample Containers", EPA 540/R-93/051, December 1992.
Triple volume required when collected MS/MSD samples
The number of trip blanks are estimated.
(1) Targeted volatile organic compounds include trichloroethene, 1,1,1-trichloroethane, and tetrachloroethene.
CRQL / MDL = Contract Required Quantitation Limit / Method Detection Limit.
ASTM = American Society for Testing and Materials.
MCAWW = Methods for Chemical Analysis of Water and Wastes.
SW846 = Test Methods for Evaluating Solid Waste - Physical/Chemical Methods.
NA = Not available or not applicable.

FIGURES



Source: USGS Lynbrook Quadrangle, 1969, Contour Interval = 5 feet

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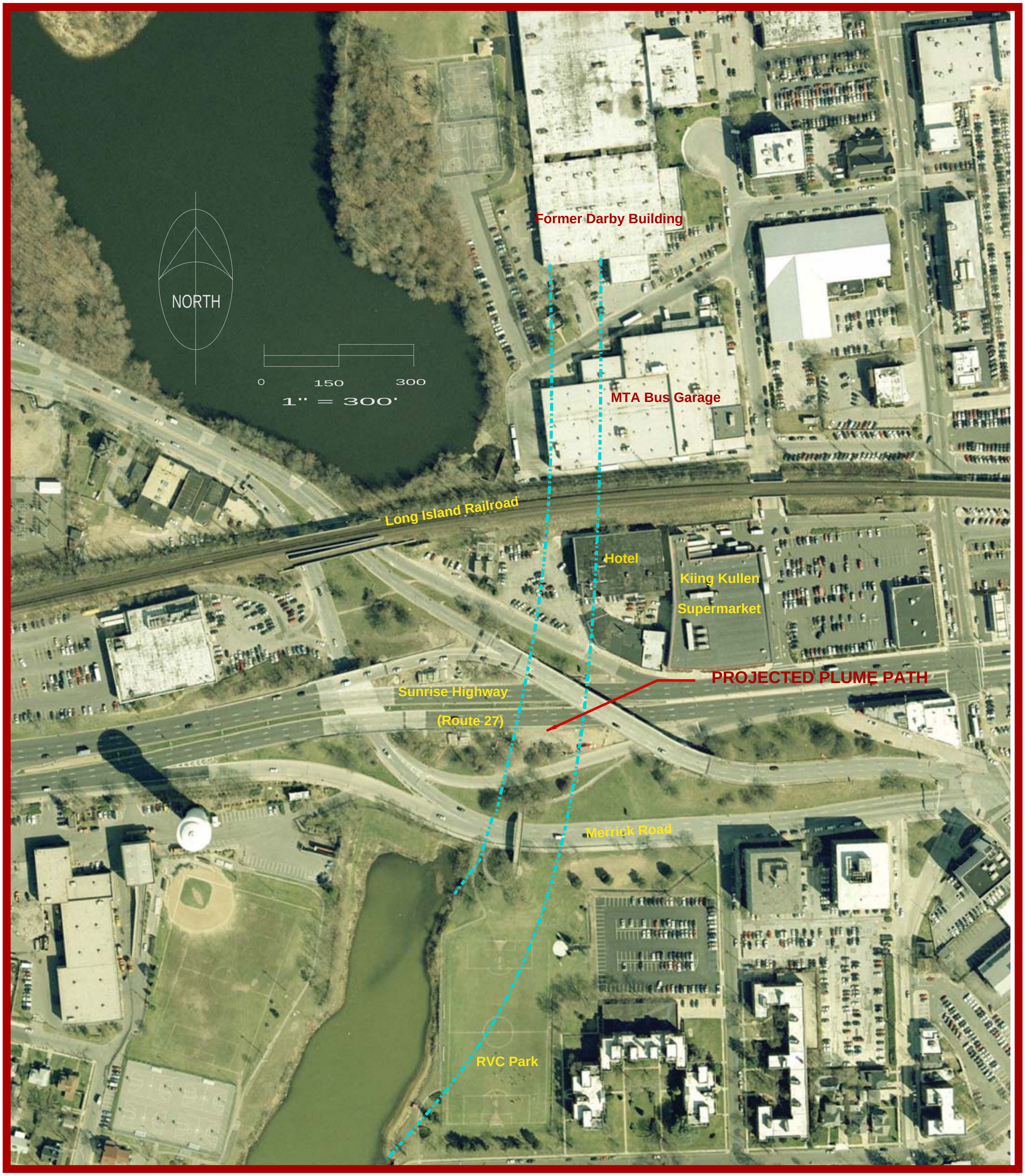
FORMER DARBY WAREHOUSE
ROCKVILLE CENTRE, NY
SITE LOCATION MAP

FIGURE 1



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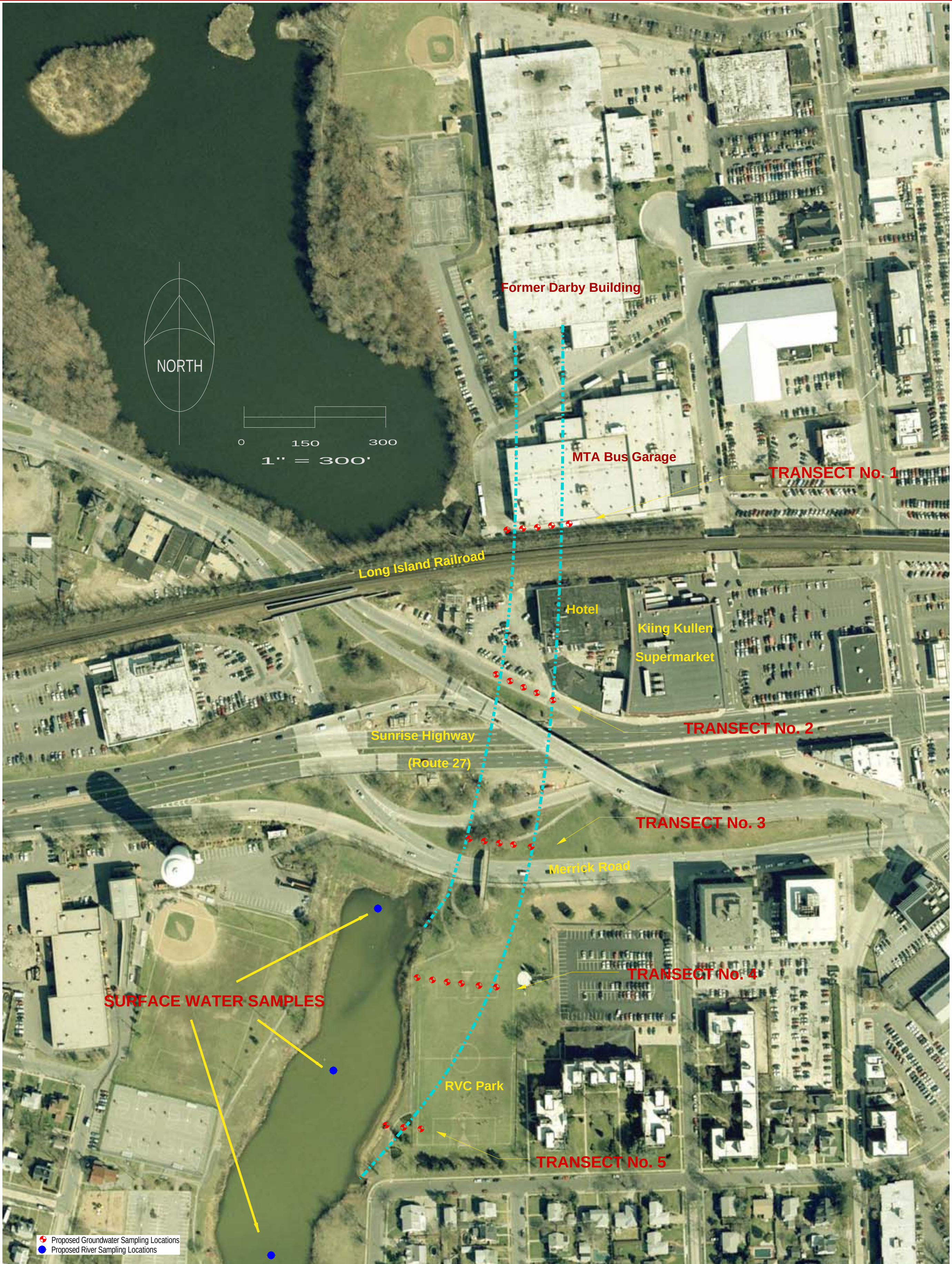
Fax 631. 924 .2870

FORMER DARBY WAREHOUSE
ROCKVILLE CENTRE, NY
PROJECTED PATH OF OFF-SITE PLUME

FIGURE 2



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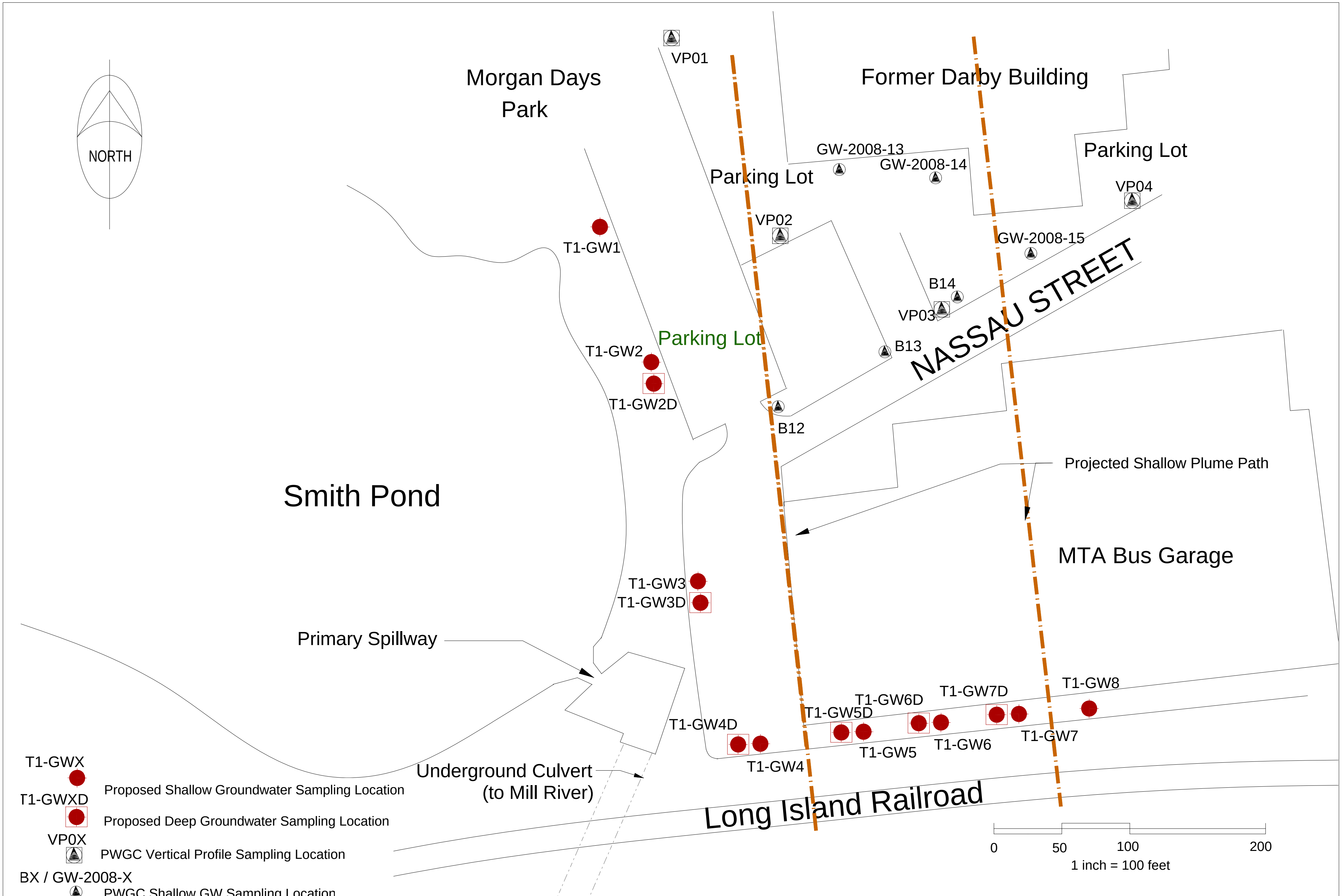
FORMER DARBY WAREHOUSE
ROCKVILLE CENTRE, NY
PROPOSED TRANSECT LOCATIONS

FIGURE 3



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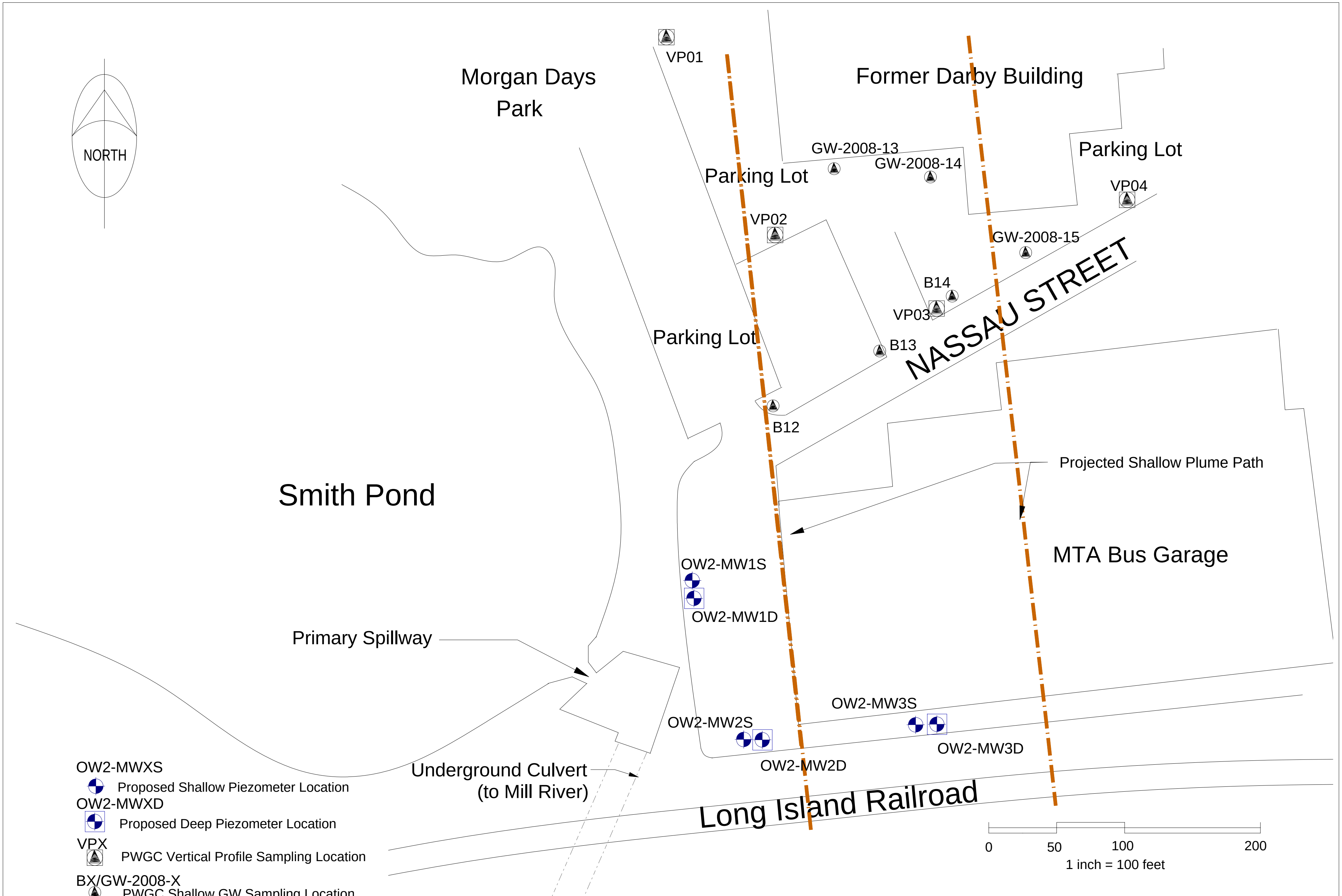
ENVIRONMENTAL BUSINESS CONSULTANTS

FORMER DARBY DRUGS SITE
80-100 BANKS AVENUE, ROCKVILLE CENTRE, NY

FIGURE 4 PROPOSED SAMPLING LOCATIONS
FIRST TRANSECT



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FORMER DARBY DRUGS SITE
80-100 BANKS AVENUE, ROCKVILLE CENTRE, NY

FIGURE 5 PROPOSED PIEZOMETER LOCATIONS
FIRST TRANSECT

ATTACHMENT A
Annotated Geophysical Logs

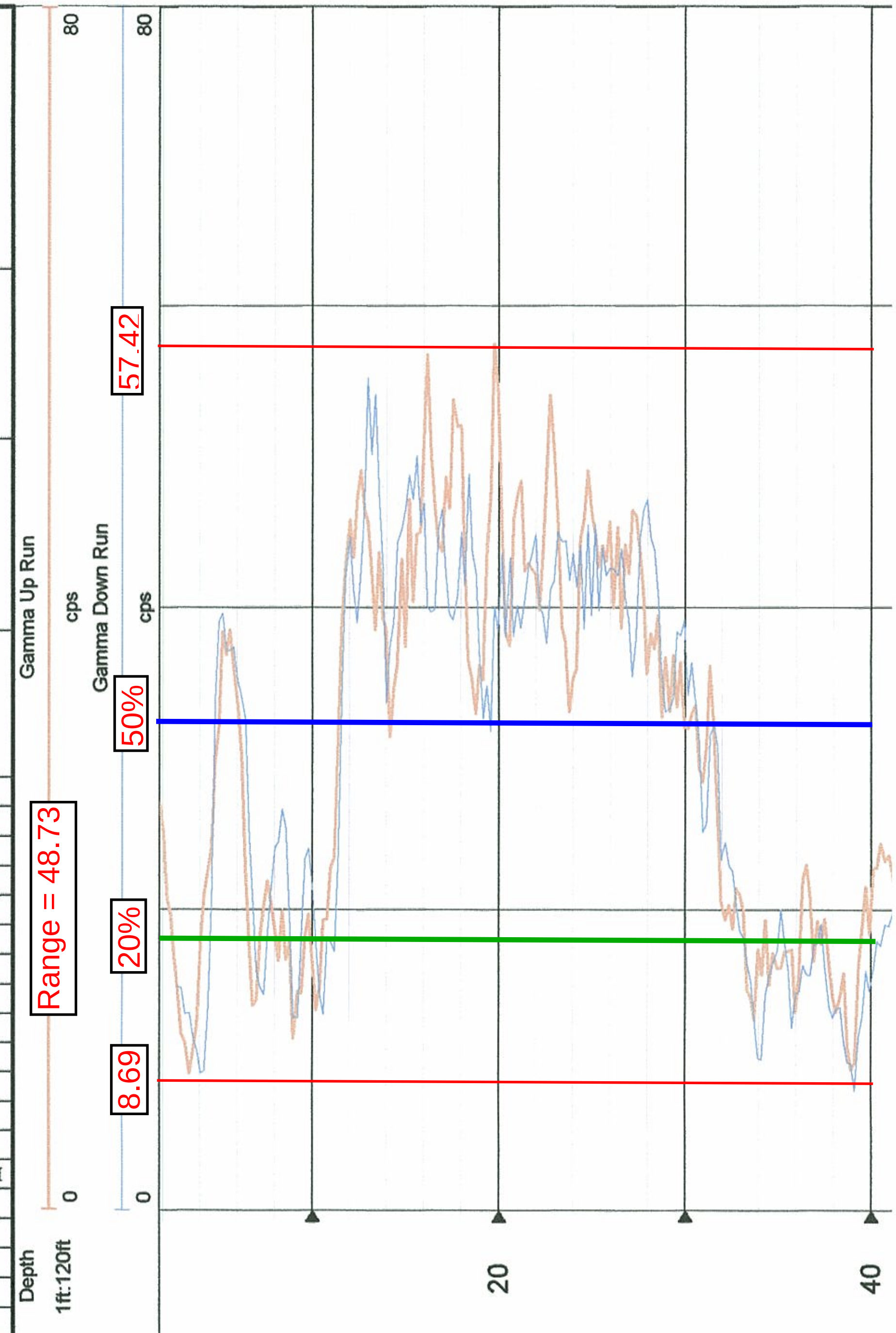
MSI

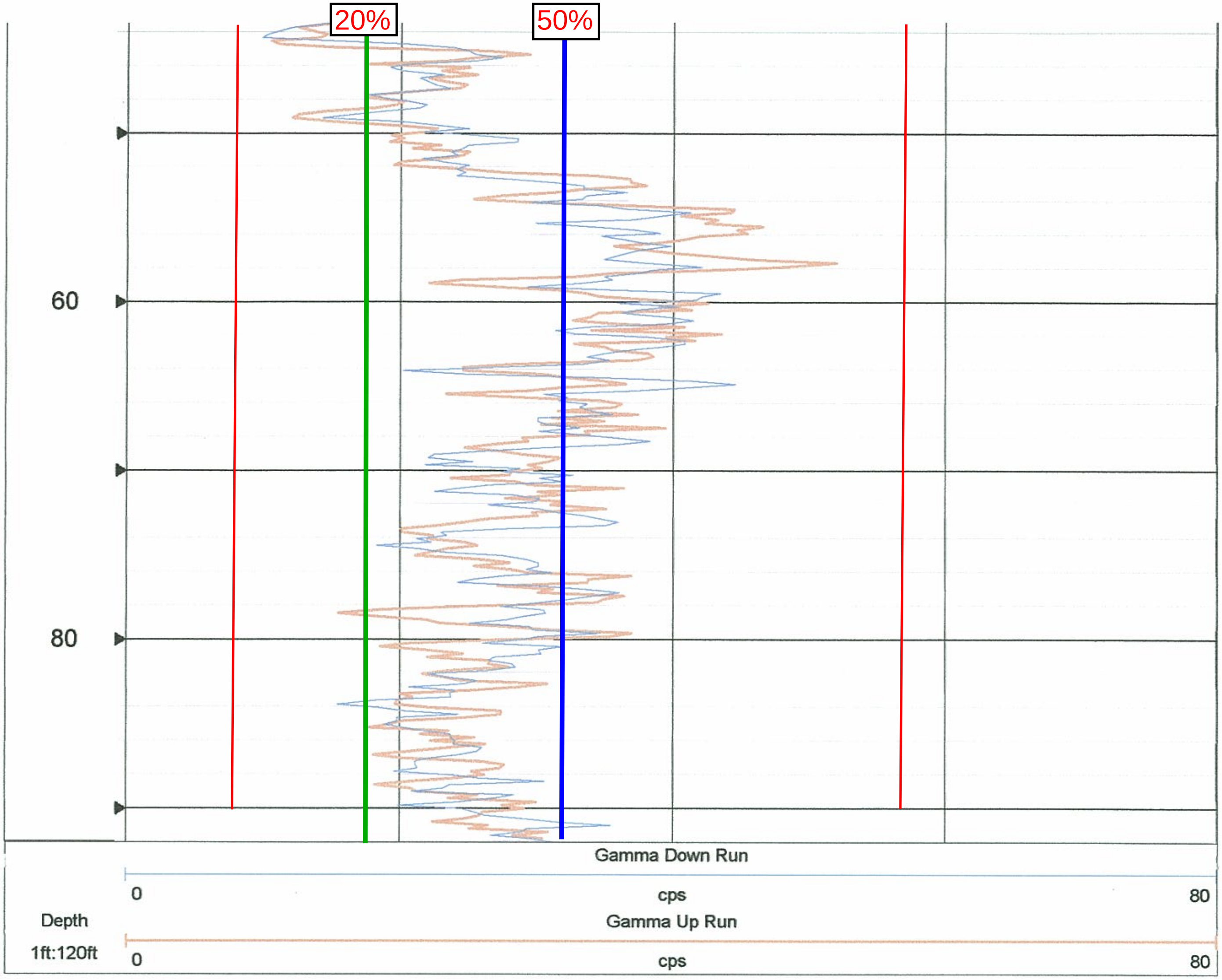
CO	COMPANY	ASSOCIATED ENVIRONMENTAL	
WELL	WELL ID	VP - 01	
FLD	FIELD	PROJECT AVB - 0801	
CTY	COUNTRY	NASSAU	STATE NEW YORK
STE	LOCATION 80 - 100 BANKS AVE., ROCKVILLE CENTRE		OTHER SERVICES
FILING No	SEC	TWP RGE	

PERMANENT DATUM	ELEVATION	K.B.
LOG MEAS. FROM	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM		G.L.

DATE	OCTOBER 6, 2008	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER	100 FEET	LEVEL	
DEPTH-LOGGER	93.3 FEET	MAX. REC. TEMP.	
BTM LOGGED INTERVAL			
TOP LOGGED INTERVAL			
OPERATING RIG TIME			
RECORDED BY	BENJAMIN RICE		
WITNESSED BY	MENZY JEAN-BAPTISTE		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
				4 INCH	HSA		TOTAL DEPTH



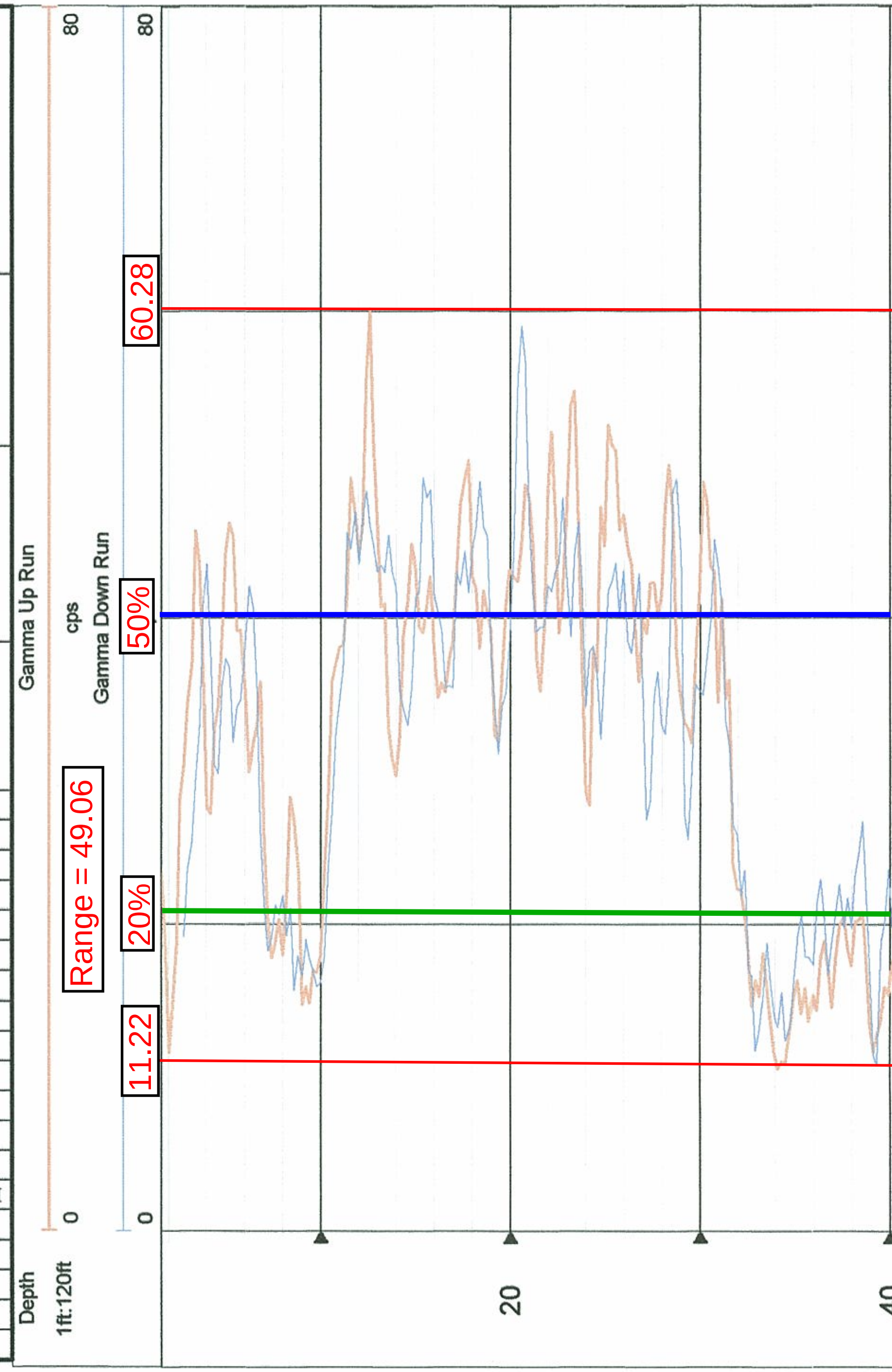

20%
50%
60
80
Gamma Down Run
0
cps
80
Depth
1ft:120ft
Gamma Up Run
0
cps
80

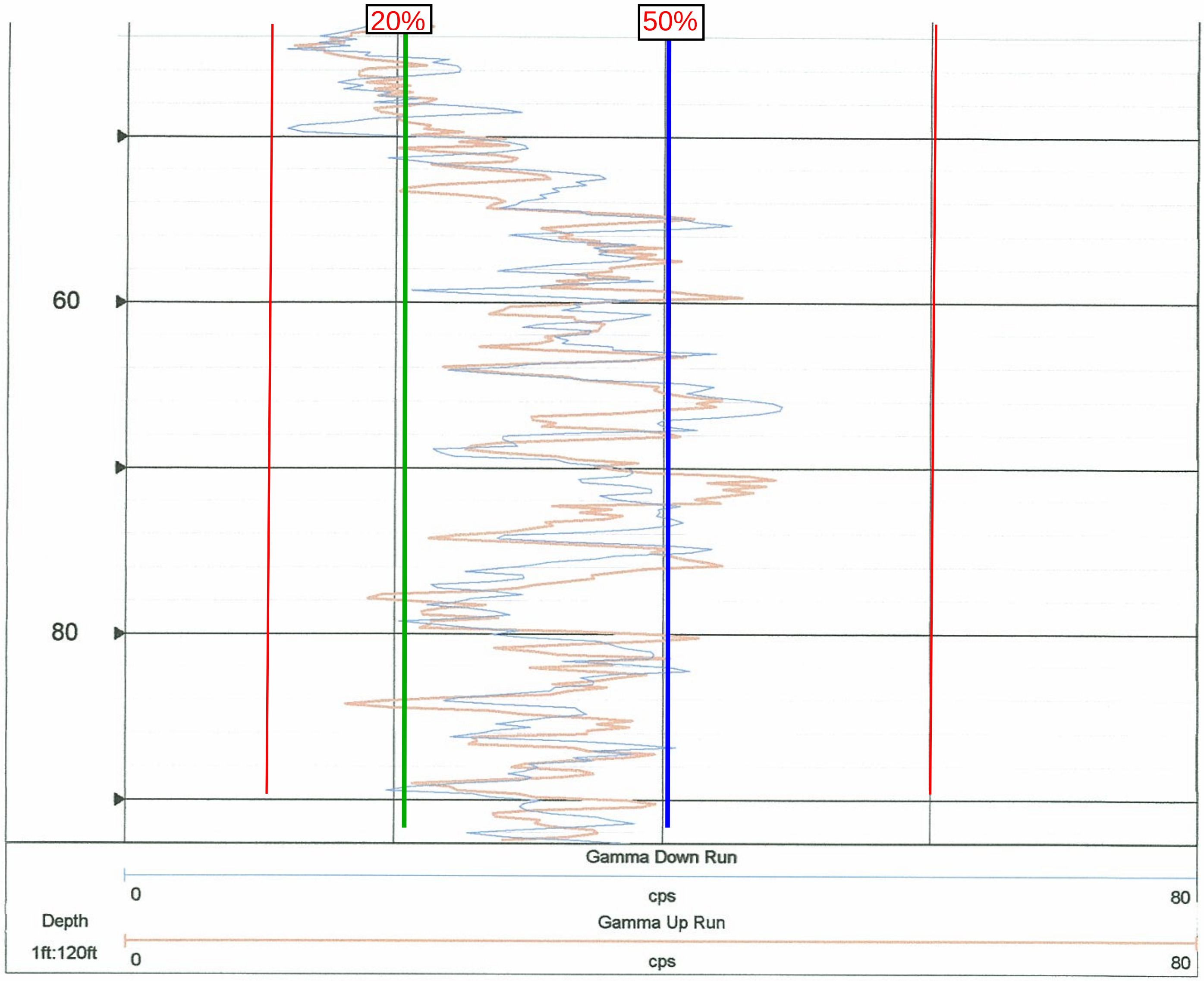
MSI

CO	COMPANY	ASSOCIATED ENVIRONMENTAL	
WELL	WELL ID	VP - 02	
FLD	FIELD	PROJECT AVB - 0801	
CTY	COUNTRY	NASSAU	STATE NEW YORK
STE	LOCATION 80 - 100 BANKS AVE., ROCKVILLE CENTRE		OTHER SERVICES
FILING No	SEC	TWP RGE	

PERMANENT DATUM		ELEVATION	K.B.
LOG MEAS. FROM	BLACKTOP	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.
DATE	OCTOBER 6, 2008	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER	100 FEET	LEVEL	
DEPTH-LOGGER	94 FEET	MAX. REC. TEMP.	
BTM LOGGED INTERVAL			
TOP LOGGED INTERVAL			
OPERATING RIG TIME			
RECORDED BY	BENJAMIN RICE		
WITNESSED BY	MENZY JEAN-BAPTISTE		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
				4 INCH	HSA		TOTAL DEPTH





20%
50%
60
80
Gamma Down Run
0
cps
80
Depth
1ft:120ft
Gamma Up Run
0
cps
80

MSI

COMPANY	ASSOCIATED ENVIRONMENTAL
WELL ID	VP - 03
FIELD	PROJECT AVB - 0801
COUNTRY	NASSAU
STATE	NEW YORK

CO
WELL
FLD
CTY
STE
FILING No

LOCATION
80 - 100 BANKS AVE., ROCKVILLE CENTRE

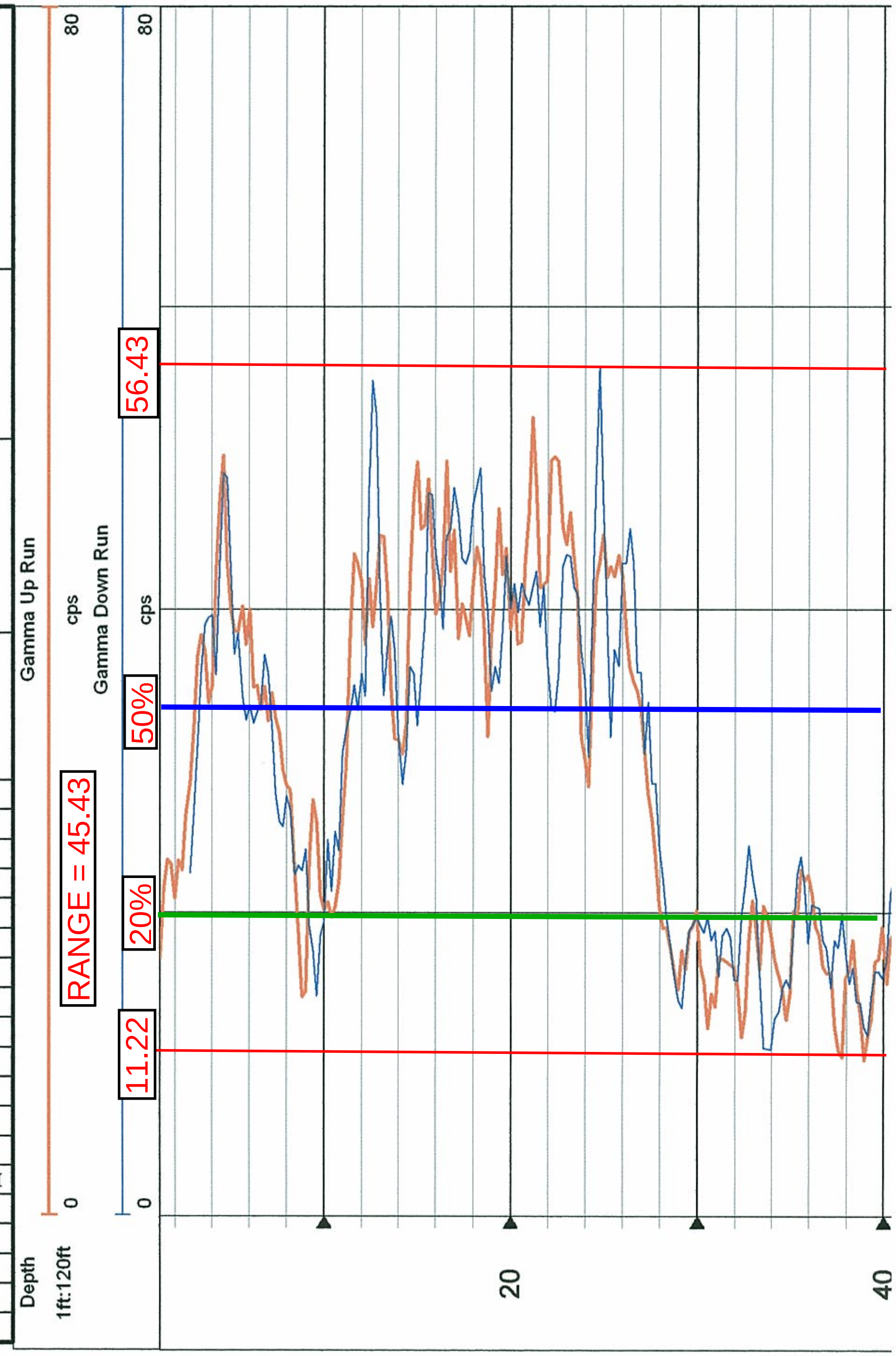
SEC TWP RGE

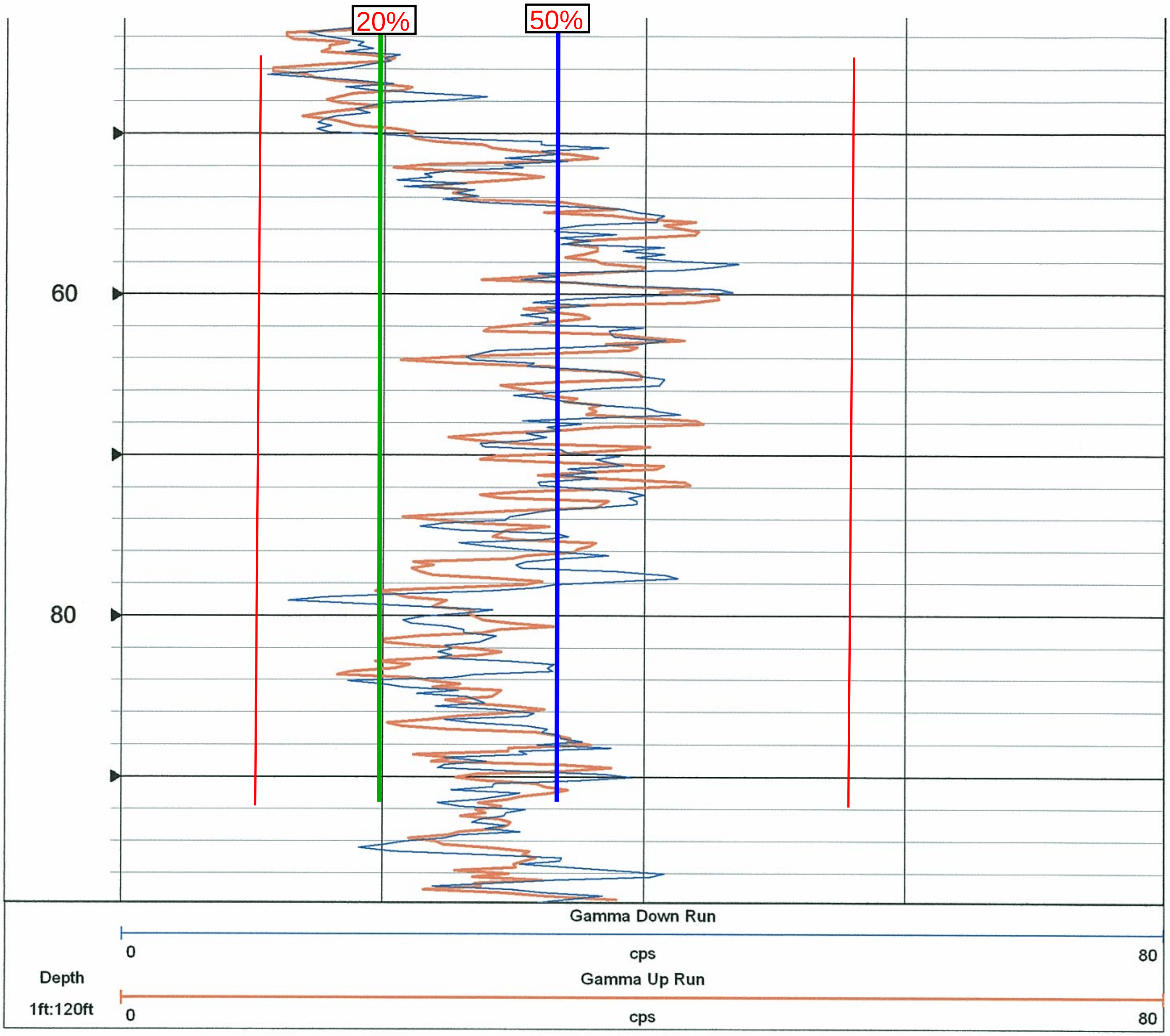
OTHER SERVICES

PERMANENT DATUM		ELEVATION	K.B.
LOG MEAS. FROM	BLACKTOP	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.

DATE	OCTOBER 2, 2008	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER	100 FEET	LEVEL	
DEPTH-LOGGER	99 FEET	MAX. REC. TEMP.	
BTM LOGGED INTERVAL			
TOP LOGGED INTERVAL			
OPERATING RIG TIME			
RECORDED BY	BENJAMIN RICE		
WITNESSED BY	DEREK ERSBAK		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
				4 INCH	HSA		TOTAL DEPTH





20%
50%
60
80
Gamma Down Run
0
cps
80
Depth
Gamma Up Run
1ft:120ft
0
cps
80

MSI

CO	COMPANY ASSOCIATED ENVIRONMENTAL
WELL	WELL ID VP - 04
FLD	FIELD PROJECT AVB - 0801
CTY	COUNTRY NASSAU
STE	STATE NEW YORK
FILING No	

LOCATION
80 - 100 BANKS AVE, ROCKVILLE CENTRE

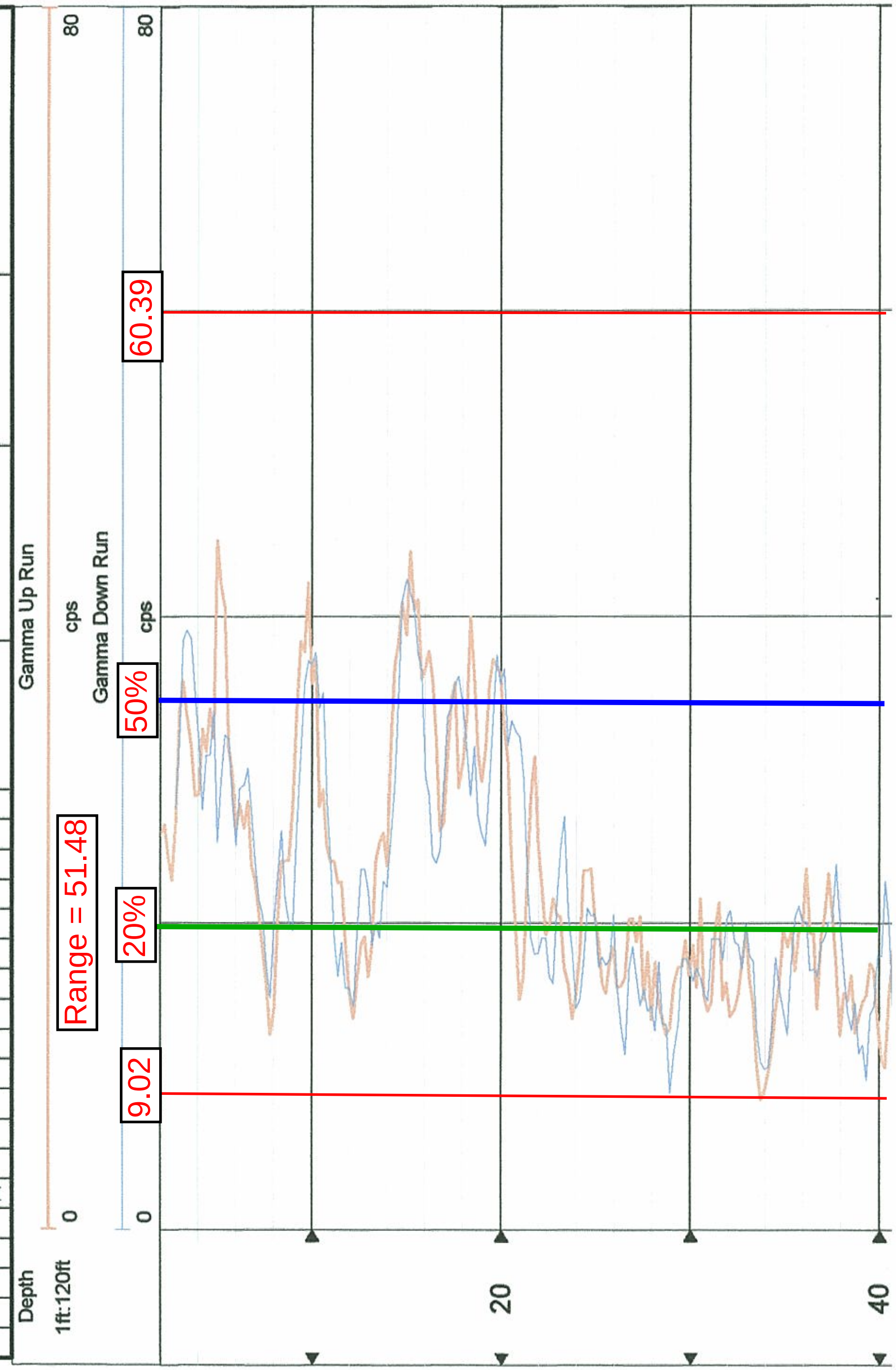
OTHER SERVICES

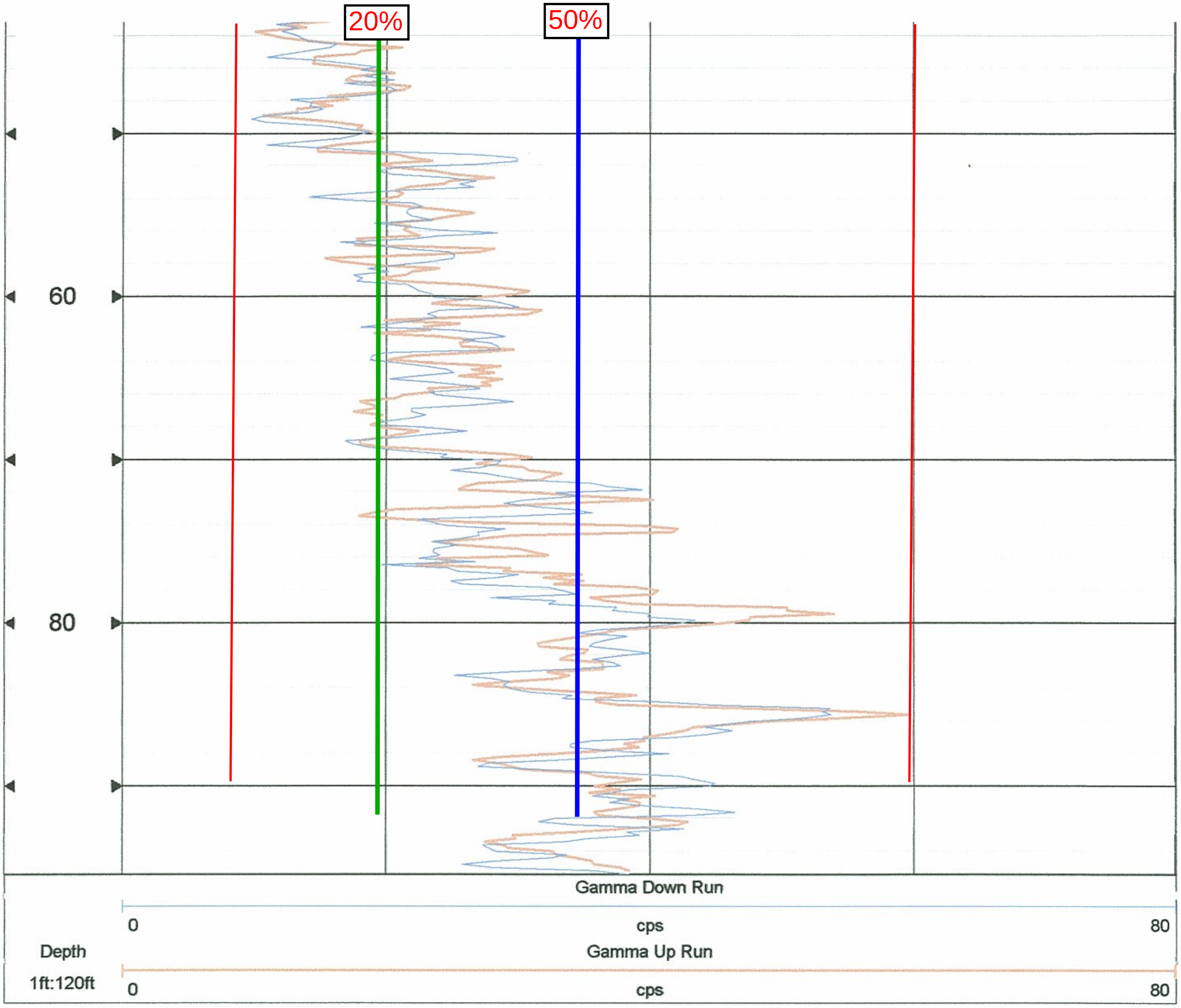
SEC TWP RGE

PERMANENT DATUM		ELEVATION	K.B.
LOG MEAS. FROM	BLACKTOP	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.

DATE	OCTOBER 2, 2008	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER	100 FEET	LEVEL	
DEPTH-LOGGER	98 FEET	MAX. REC. TEMP.	
BTM LOGGED INTERVAL			
TOP LOGGED INTERVAL			
OPERATING RIG TIME			
RECORDED BY	BENJAMIN RICE		
WITNESSED BY	TOM MELIA, PW GROSSER		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
				4 INCH	HSA		TOTAL DEPTH




20%
50%
60
80
Gamma Down Run
0
cps
80
Depth
Gamma Up Run
1ft:120ft
0
cps
80

ATTACHMENT B
Standard Operating Procedures

MODEL 5400 GEOPROBE™ OPERATION

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the collection of representative soil, soil-gas, and groundwater samples using a Model 5400 Geoprobe™ sampling device. Any deviations from these procedures should be documented in the site/field logbook and stated in project deliverables.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

The Geoprobe™ sampling device is used to collect soil, soil-gas and groundwater samples at specific depths below ground surface (BGS). The Geoprobe™ is hydraulically powered and is mounted in a customized four-wheel drive vehicle. The base of the sampling device is positioned on the ground over the sampling location and the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is pushed into the ground. A built-in hammer mechanism allows the probe to be driven through dense materials. Maximum depth penetration under favorable circumstances is about 50 feet. Components of the Model 5400 Geoprobe™ are shown in Figures 1 through 6 (Appendix A).

Soil samples are collected with a specially-designed sample tube. The sample tube is pushed and/or vibrated to a specified depth (approximately one foot above the intended sample interval). The interior plug of the sample tube is removed by inserting small-diameter threaded rods. The sample tube is then driven an additional foot to collect the samples. The probe sections and sample tube are then withdrawn and the sample is extruded from the tube into sample jars.

Soil gas can be collected in two ways. One method involves withdrawing a sample directly from the probe rods, after evacuating a sufficient volume of air from the probe rods. The other method involves collecting a sample through tubing attached by an adaptor to the bottom probe section. Correctly used, the latter method provides more reliable results.

Slotted lengths of probe can be used to collect groundwater samples if the probe rods can be driven to the water table. Groundwater samples are collected using either a peristaltic pump or a small bailer.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

Refer to specific ERT SOPs for procedures appropriate to the matrix, parameters and sampling objector.

Applicable ERT SOPs include:

ERT #2012, Soil Sampling

ERT #2007, Groundwater Well Sampling

ERT #2042, Soil Gas Sampling

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

A preliminary site survey should identify areas to be avoided with the truck. All underground utilities should be located and avoided during sampling. Begin sampling activities with an adequate fuel supply.

Decontamination of sampling tubes, probe rods, adaptors, non-expendable points and other equipment that contacts the soil is necessary to prevent cross-contamination of samples. During sampling, the bottom portion and outside of the sampling tubes can be contaminated with soil from other depth intervals.

Care must be taken to prevent soil which does not represent the sampled interval form being incorporated into the sample. Excess soil should be carefully wiped from the outside surface of the sampling tube and the bottom 3 inches of the sample should be discarded before extruding the sample into a sample jar.

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent upon the parameter(s) of interest. Guidelines for the containment, preservation, handling and storage of soil-gas samples are described in ERT SOP #2042, Soil-Gas Sampling.

Obtaining sufficient volume of soil for multiple analyses from one sample location may present a problem. The Geoprobe™ soil sampling system recovers a limited volume of soil and it is not possible to reenter the same hole and collect additional soil. When multiple analyses are to be performed on soil samples collected with the Geoprobe™, it is important that the relative importance of the analyses be identified. Identifying the order of importance will ensure that the limited sample volume will be used for the most crucial analyses.

5.0 EQUIPMENT/APPARATUS

Sampling with the Geoprobe™ involves use of the equipment listed below. Some of the equipment is used for all sample types, others are specific to soil (S), soil gas (SG), or groundwater (GW) as noted.

- Geoprobe™ sampling device
- Threaded probe rods (36", 24", and 12" lengths)
- Drive Caps
- Pull Caps
- Rod Extractor
- Expendable Point Holders
- Expendable Drive Points
- Solid Drive Points
- Extension Rods
- Extension Rod Couplers
- Extension Rod Handle
- Hammer Anvil
- Hammer Latch
- Hammer Latch Tool
- Drill Steels
- Carbide-Tipped Drill Bit
- Mill-Slotted Well Point (GW)
- Threaded Drive Point (GW)
- Well Mini-Bailer (GW)
- Tubing Bottom Check Valve (GW)
- 3/8" O.D. Low Density Polyethylene Tubing (GW, SG)
- Gas Sampling Adaptor and Cap (SG)
- Teflon Tape
- Neoprene "O" - Rings (SG)
- Vacuum System (mounted in vehicle) (SG)
- Piston Tip (S)
- Piston Rod (S)
- Piston Stop (S)
- Sample Tube (11.5" in length) (S)
- Vinyl Ends Caps (S)
- Sample Extruder (S)
- Extruder Pistons (Wooden Dowels) (S)
- Wire Brush
- Brush Adapters
- Cleaning Brush (Bottle)

6.0 REAGENTS

Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURES

Portions of the following sections have been condensed from the Model 5400 Geoprobe™ Operations Manual(1). Refer to this manual for more detailed information concerning equipment specifications, general maintenance, tools, throttle control, clutch pump, GSK-58 Hammer, and trouble-shooting. A copy of this manual will be maintained with the Geoprobe™ and on file in the Quality Assurance (QA) office.

7.1 Preparation

1. Determine extent of the sampling effort, sample matrices to be collected, and types and amounts of equipment and supplies required to complete the sampling effort.

2. Obtain and organize necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site

entry in accordance with the site-specific Health and Safety Plan.

5. Use stakes or flagging to identify and mark all sampling locations. All sample locations should be cleared for utilities prior to sampling.

7.2 Setup of Geoprobe™

1. Back carrier vehicle to probing location.

2. Shift the vehicle to park and shut off ignition.

3. Set parking brake and place chocks under rear tires.

4. Attach exhaust hoses so exhaust blows downwind of the sampling location (this is particularly important during soil gas sampling).

5. Start engine using the remote ignition at the Geoprobe™ operator position.

6. Activate hydraulic system by turning on the Electrical Control Switch located on the Geoprobe™ electrical control panel (Figure 1, Appendix A). When positioning the probe, always use the SLOW speed. The SLOW speed switch is located on the hydraulic control panel (Figure 2, Appendix A).

   Important: Check for clearance on vehicle roof before folding Geoprobe™ out of the carrier vehicle.

7. Laterally extend the Geoprobe™ from the vehicle as far as possible by pulling the EXTEND control lever toward the back of the vehicle while the Geoprobe™ is horizontal.

8. Using the FOOT control, lower the Derrick Slide so it is below cylinder (A) before folding the Geoprobe™ out of the carrier vehicle (Figure 3, Appendix A). This will ensure clearance at the roof of the vehicle.

9. Use the FOLD, FOOT, and EXTEND controls to place Geoprobe™ to the exact probing location. Never begin probing in the fully extended position.

10. Using the FOLD control, adjust the long axis of the probe cylinder so that it is perpendicular (visually) to the ground surface.

11. Using the FOOT control, put the weight of the vehicle on the probe unit. Do not raise the rear of the vehicle more than six inches.

    Important: Keep rear vehicle wheels on the ground surface when transferring the weight of the vehicle to the probe unit. Otherwise, vehicle may shift when probing begins.

12. When the probe axis is vertical and the weight of the vehicle is on the probe unit, probing is ready to begin.

7.3 Drilling Through Surface Pavement or Concrete

1. Position carrier vehicle to drilling location.

2. Fold unit out of carrier vehicle.

3. Deactivate hydraulics.

4. Insert carbide-tipped drill bit into hammer.

5. Activate HAMMER ROTATION control by turning knob counter-clockwise (Figure 4, Appendix A). This allows the drill bit to rotate when the HAMMER control is pressed.

6. Press down on HAMMER control to activate counterclockwise rotation.

7. Both the HAMMER control and the PROBE control must be used when drilling through the surface (Figure 4, Appendix A). Fully depress the HAMMER control, and incrementally lower the bit gradually into the pavement by periodically depressing the PROBE control.

8. When the surface has been penetrated, turn the HAMMER Control Valve knob

clockwise to deactivate hammer rotation and remove the drill bit from the HAMMER.

Important: Be sure to deactivate the rotary action before driving probe rods.

7.4 Probing

1. Position the carrier vehicle to the desired sampling location and set the vehicle parking brake.

2. Deploy Geoprobe ™ Sampling Device.

3. Make sure the hydraulic system is turned off.

4. Lift up latch and insert hammer anvil into hammer - push latch back in (Figure 5, Appendix A).

5. Thread the drive cap onto the male end of the probe rod.

6. Thread an expendable point holder onto the other end of the first probe rod.

7. Slip an expendable drive point into point holder.

8. Position the leading probe rod with expendable drive point in the center of the derrick foot and directly below the hammer anvil.

   Important: Positioning the first probe rod is critical in order to drive the probe rod vertically. Therefore, both the probe rod and the probe cylinder shaft must be in the vertical position (Figure 6, Appendix A).

9. To begin probing, activate the hydraulics and push the PROBE Control downward. When advancing the first probe rod, always use the SLOW speed. Many times the probe rods can be advanced using only the weight of the carrier vehicle. When this is the case, only the PROBE control is used.

   Important: When advancing rods, always keep the probe rods parallel to the probe cylinder shaft (Figure 6, Appendix A). This is done by making minor adjustments with the FOLD control. Failure to keep probe rods parallel to probe cylinder shaft may result in broken rods and increased difficulty in achieving desired sampling depth.

7.5 Probing - Percussion Hammer

The percussion hammer must be used in situations where the weight of the vehicle is not sufficient to advance the probe rods.

1. Make sure the Hammer Rotation Valve is closed.

2. Using the PROBE control to advance the rod, press down the HAMMER control to allow percussion to drive the rods (Figure 2, Appendix A).

   Important: Always keep static weight on the probe rod or the rod will vibrate and chatter while you are hammering, causing rod threads to fracture and break.

3. Keep the hammer tight to the drive cap so the rod will not vibrate.

4. Periodically stop hammering and check if the probe rods can be advanced by pushing only.

5. Any time the downward progress of the probe rods is refused, the derrick foot may lift off of the ground surface. When this happens, reduce pressure on the PROBE control. Do not allow the foot to rise more than six inches off the ground or the vehicle's wheels may lift off the ground surface, causing the vehicle to shift (Figure 6, Appendix A).

6. As the derrick foot is raised off the ground surface, the probe cylinder may not be in a perpendicular position. If this happens, use the FOLD control to correct the probe cylinder position.

7.6 Probing - Adding Rods

1. Standard probe rods are three feet in length. If the desired depth is more than three feet,

another rod must be threaded onto the rod that has been driven into the ground. In order to ensure a vacuum-tight seal (soil-gas sampling), two wraps of teflon tape around the thread is recommended.

2. Using the PROBE control, raise the probe cylinder as high as possible.

Important: Always deactivate hydraulics when adding rods.

3. Deactivate hydraulics.

4. Unthread the drive cap from the probe rod that is in the ground.

5. Wrap teflon tape around the threads.

6. Thread the drive cap onto the male end of the next probe rod to be used.

7. After threading the drive cap onto the rod to be added, thread the rod onto the probe rod that has been driven into the ground. Make sure threads have been teflon taped. Continue probing.

8. Continue these steps until the desired sampling depth has been reached.

7.7 Probing/Pulling Rods

1. Once the probe rods have been driven to depth, they can also be pulled using the Geoprobe™ Machine.

2. Turn off the hydraulics.

3. Lift up latch and take the hammer anvil out of the hammer.

4. Replace the drive cap from the last probe rod driven with a pull cap.

5. Lift up the hammer latch.

6. Activate the hydraulics.

7. Hold down on the PROBE control, and move the probe cylinder down until the latch can be closed over the pull cap.

Important: If the latch will not close over the pull cap, adjust the derrick assembly by using the extend control. This will allow you to center the pull cap directly below the hammer latch.

8. Retract the probe rods by pulling up on the PROBE control.

Important: Do not raise the probe cylinder all the way when pulling probe rods or it will be impossible to detach a rod that has been pulled out. However, it is necessary to raise the probe cylinder far enough to allow the next probe section to be pulled.

9. After retracting the first probe rod, lower the probe cylinder only slightly to ease the pressure off of the hammer latch.

10. Attach a clamping device to the base of the rods where it meets the ground to prevent rods from falling back into the hole.

11. Raise the hammer latch.

12. Hold the PROBE control up and raise the probe cylinder as high as possible.

13. Unthread the pull cap from the retracted rod.

14. Unthread the retracted rod.

15. Thread the pull cap onto the next rod that is to be pulled.

16. Continue these steps until all the rods are retracted from the hole.

17. Decontaminate all portions of the equipment that have been in contact with the soil, soil gas and groundwater.

7.8 Soil-Gas Sampling Without Interior Tubing

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Remove hammer anvil from hammer.

3. Thread on pull cap to end of probe rod.

4. Retract rod approximately six inches. Retraction of the rod disengages expendable drive point and allows for soil vapor to enter rod.

5. Unthread pull cap and replace it with a gas sampling cap. Cap is furnished with barbed hose connector.

Important: Shut engine off before taking sample (exhaust fumes can cause faulty sample data).

6. Turn vacuum pump on and allow vacuum to build in tank.

7. Open line control valve. For each rod used, purge 300 liters of volume. Example: Three rods used = 900 liters = .900 on gauge.

8. After achieving sufficient purge volume, close valve and allow sample line pressure gauge to return to zero. This returns sample train to atmospheric pressure.

9. The vapor sample can now be taken.

    1. Pinch hose near gas sampling cap to prevent any outside vapors from entering the rods.

    2. Insert syringe needle into center of barbed hose connector and withdraw vapor sample.

10. To maintain suction at the sampling location, periodically drain the vacuum tank.

11. To remove rods, follow procedures outlined in Section 7.7.

7.9 Soil-Gas Sampling With Post-Run Tubing (PRT)

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Retract rod approximately six inches. Retraction of rod disengages expendable drive point and allows for soil vapor to enter rod.

3. Remove pull cap from the end of the probe rod.

4. Position the Geoprobe™ to allow room to work.

5. Secure PRT Tubing Adapter with "O" - Ring to selected tubing.

6. Insert the adapter end of the tubing down the inside diameter of the probe rods.

7. Feed the tubing down the hole until it hits bottom on the expendable point holder. Cut the tubing approximately two feet from the top probe rod.

8. Grasp excess tubing and apply some downward pressure while turning it in a counter-clockwise motion to engage the adapter threads with the expendable point holder.

9. Pull up lightly on the tubing to test engagement of threads.

10. Connect the outer end of the tubing to silicon tubing and vacuum hose (or other sampling apparatus).

11. Follow the appropriate sampling procedure (ERT SOP #2042, Soil Gas Sampling) to collect a soil-gas sample.

12. After collecting a sample, disconnect the tubing from the vacuum hose or sampling system.

13. Pull up firmly on the tubing until it releases from the adapter at the bottom of the hole.

14. Extract the probe rods from the ground and recover the expendable point holder with the attached adapter.

15. Inspect the "O"-ring at the base of the adapter to verify that proper sealing was achieved during sampling. The "O"-ring should be compressed.

Note: If the "O"-ring is not compressed, vapors from within the probe sections may have been collected rather than vapors from the intended sample interval.

7.10 Soil Sampling

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Assemble soil-sampling tube.

    1. Thread piston rod into piston tip.

    2. Insert piston tip into sample tube, seating piston tip into cutting edge of sample tube.

    3. Thread drive head into threaded end of sample tube.

    4. Thread piston stop pin into drive head. Stop pin should be tightened with wrench so that it exerts pressure against the piston rod.

3. Attach assembled sampler onto leading probe rod.

4. Drive the sampler with the attached probe rods to the top of the interval to be sampled.

5. Move probe unit back from the top of the probe rods to allow work room.

6. Remove drive cap and lower extension rods into inside diameter of probe rods using couplers to join rods together.

7. Attach extension rod handle to top extension rod.

8. Rotate extension rod handle clockwise until the leading extension rod is threaded into the piston stop in downhole.

9. Continue to rotate extension rod handle clockwise until reverse-threaded stop-pin has disengaged from the drive head.

10. Remove extension rods and attached stop-pin from the probe rods.

11. Replace drive cap onto top probe rod.

12. Mark the top probe rod with a marker or tape at the appropriate distance above the ground surface (dependent on sample tube length).

13. Drive probe rods and sampler the designated distance. Be careful not to overdrive the sampler which could compact the soil sample in the tube, making it difficult to extrude.

Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Correct Method - Sample Location S-6, 12.0' - 13.0'. Incorrect Method - Sample Location S-6, 12.0'.

14. Retract probe rods from the hole and recover the sample tube. Inspect the sample tube to confirm that a sample was recovered.

15. Disassemble sampler. Remove all parts.

16. Position extruder rack on the foot of the Geoprobe™ derrick.

17. Insert sample tube into extruder rack with the cutting end up.

18. Insert hammer anvil into hammer.

19. Position the extruder piston (wood dowel) and push sample out of the tube using the PROBE control on the Geoprobe™. Collect the sample as it is extruded in an appropriate sample container.

Caution: use care when performing this task. Apply downward pressure gradually. Use of excessive force could result in injury to operator or damage to tools. Make sure proper diameter extruder piston is used.

20. To remove rods follow procedures outlined in Section 7.7.

7.11 Groundwater Sampling

1. Follow Sections 7.1 thorough 7.6 with the following exception: the Mill-Slotted Well Rod with attached threaded drive point should be the first section probed into the ground. Multiple sections of mill-slotted well rods can be used to provide a greater vertical section into which groundwater can flow.

2. Probe to a depth at which groundwater is expected.

3. Remove Drive Cap and insert an electric water-level indicator to determine if water has entered the slotted sections of probe rod. Refer to ERT SOP #2043, Water Level Measurement, to determine water level.

4. If water is not detected in the probe rods, replace the drive cap and continue probing. Stop after each additional probe length and determine if groundwater has entered the slotted rods.
5. After the probe rods have been driven into the saturated zone, sufficient time should be allowed for the water level in the probe rods to stabilize.

   Note: It will be difficult if not impossible to collect a groundwater sample in aquifer material small enough to pass through the slots (<0.02 inch diameter).

6. Groundwater samples may be collected with the 20-mL well Mini-Bailer or a pumping device. If samples are being collected for volatile organic analysis (VOA), the 20-mL Well Mini-Bailer should be used. If samples are being collected for a variety of analyses, VOA samples should be collected first using the bailer. Remaining samples can be collected by pumping water to the surface. Withdrawing water with the pump is more efficient than collecting water with the 20-mL well Mini-Bailer.

   Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Sample Location GW-6, 17'-21' bgs, water level in probe rods is 17 feet bgs, and the leading section of probe rod is 21 feet bgs. The water sample is from this zone, not from 17 feet bgs or 21 feet bgs.

7. Remove rods following procedures outlined in Section 7.7.

8.0 CALCULATIONS

Calculating Vapor Purge Volume for Soil-Gas Sampling without Interior Tubing

Volume of Air to be Purged (Liters) = 300 x Number of Rods in the Ground

Volume in Liters/1000 = Reading on Vacuum Pump Instrument Gauge

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and the REAC site specific Health and Safety Plan. The following is a list of health and safety precautions which specifically apply to Geoprobe™ operation.

1. Always put vehicle in "park", set emergency the brake, and place chocks under the tires, before engaging remote ignition.

2. If vehicle is parked on a loose or soft surface, do not fully raise rear of vehicle with probe foot, as vehicle may fall or move.

3. Always extend the probe unit out from the vehicle and deploy the foot to clear vehicle roof line before folding the probe unit out.

4. Operators should wear OSHA approved steel-toed shoes and keep feet clear of probe foot.

5. Operator should wear ANSI approved hard hats.

6. Only one person should operate the probe machine and the assemble or disassemble probe rods and accessories.

7. Never place hands on top of a rod while it is under the machine.

8. Turn off the hydraulic system while changing rods, inserting the hammer anvil, or attaching accessories.

9. Operator must stand on the control side of the probe machine, clear of the probe foot and mast, while operating controls.

10. Wear safety glasses at all times during the operation of this machine.

11. Never continue to exert downward pressure on the probe rods when the probe foot has risen six inches off the ground.

12. Never exert enough downward pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.

13. Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.

14. The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or combustibles.

15. Geoprobe™ operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.

16. Locations of buried or underground utilities and services must be known before starting to drill or probe.

17. Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.

18. Exercise extreme caution when using extruder pistons (wooden dowels) to extrude soil from sample tubes. Soil in the sample tube may be compacted to the point that the extruder piston will break or shatter before it will push the sample out.

19. A dry chemical fire extinguisher (Type ABC) should be kept with the vehicle at <u>all</u> times.

12.0 REFERENCES

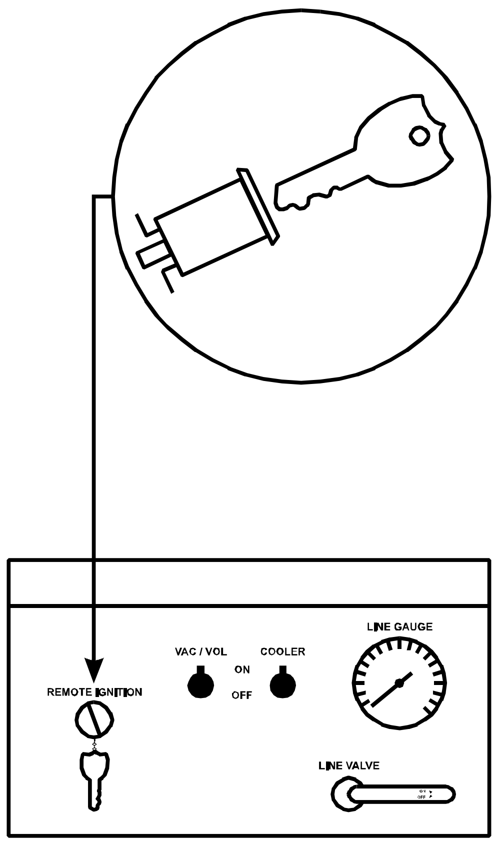
1. Model 5400 Geoprobe ™ Operations Manual. Geoprobe™ Systems, Salina, Kansas. July 27, 1990.

2. Geoprobe™ Systems - 1995-96 Tools and Equipment Catalog.

APPENDIX A

Figures

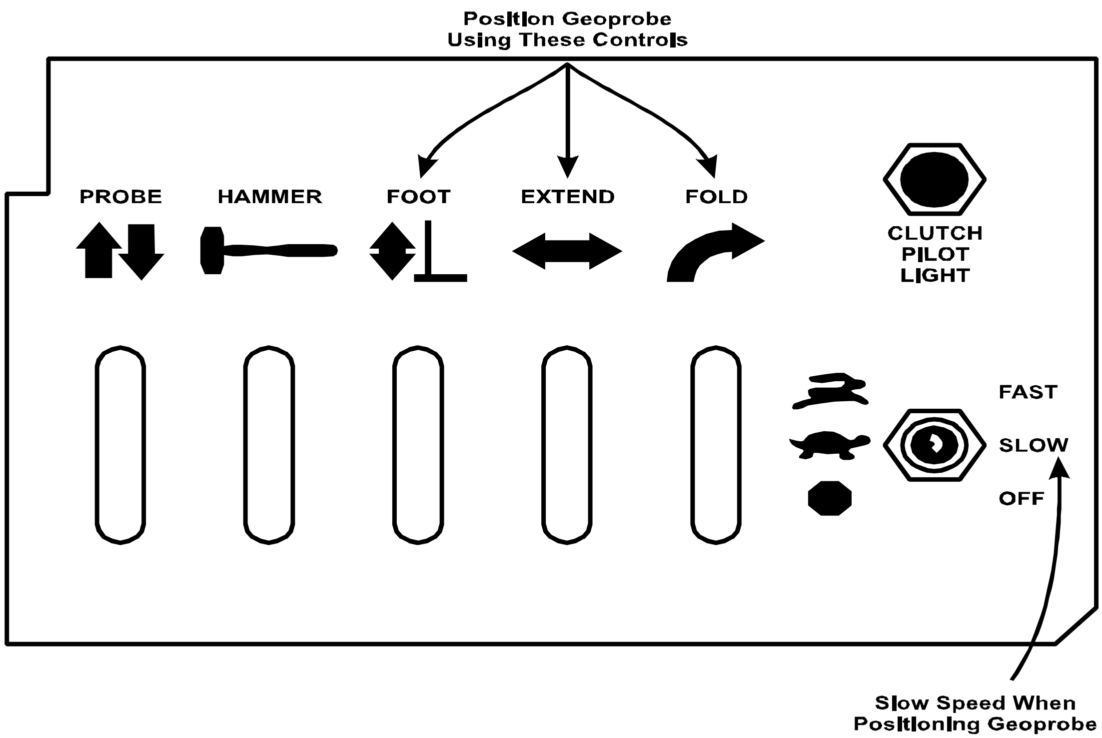
FIGURE 1. Electrical Control Panel



APPENDIX A (Cont'd)

Figures

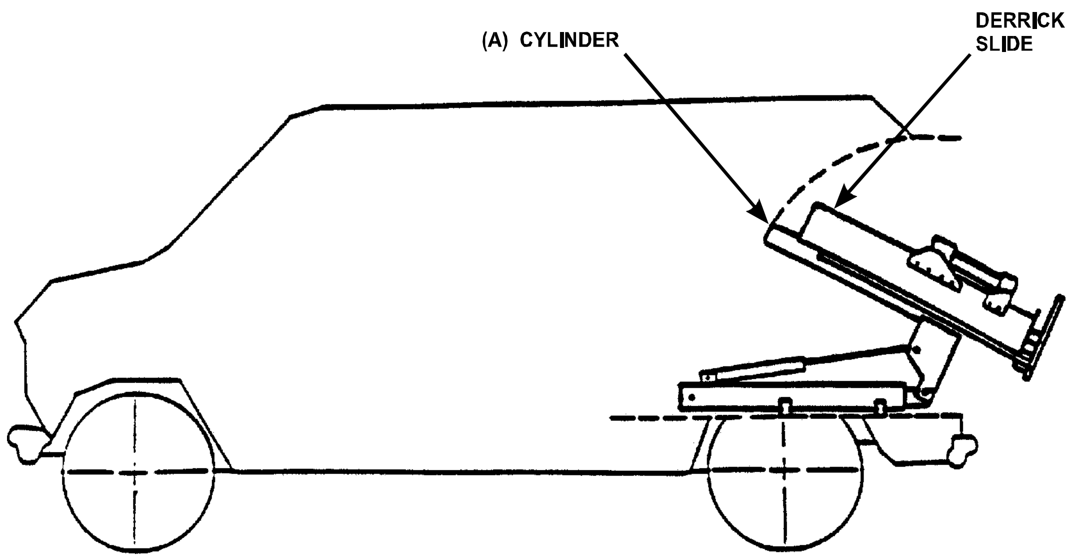
FIGURE 2. Hydraulic Control Panel



APPENDIX A (Cont'd)

Figures

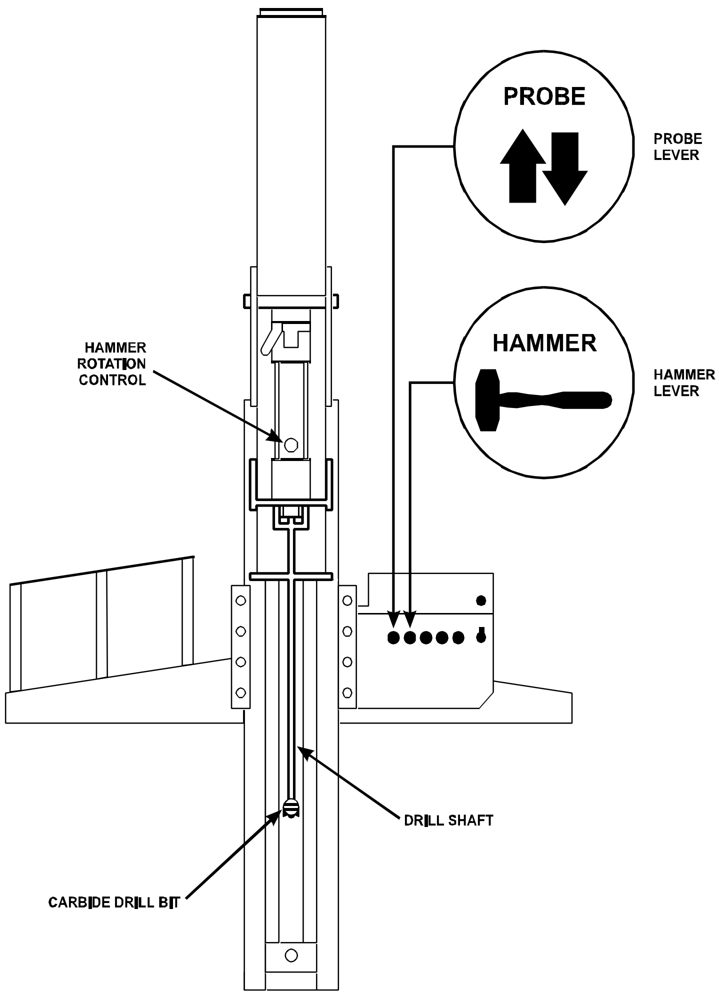
FIGURE 3. Deployment of Geoprobe ™ from Sampling Vehicle



APPENDIX A (Cont'd)

Figures

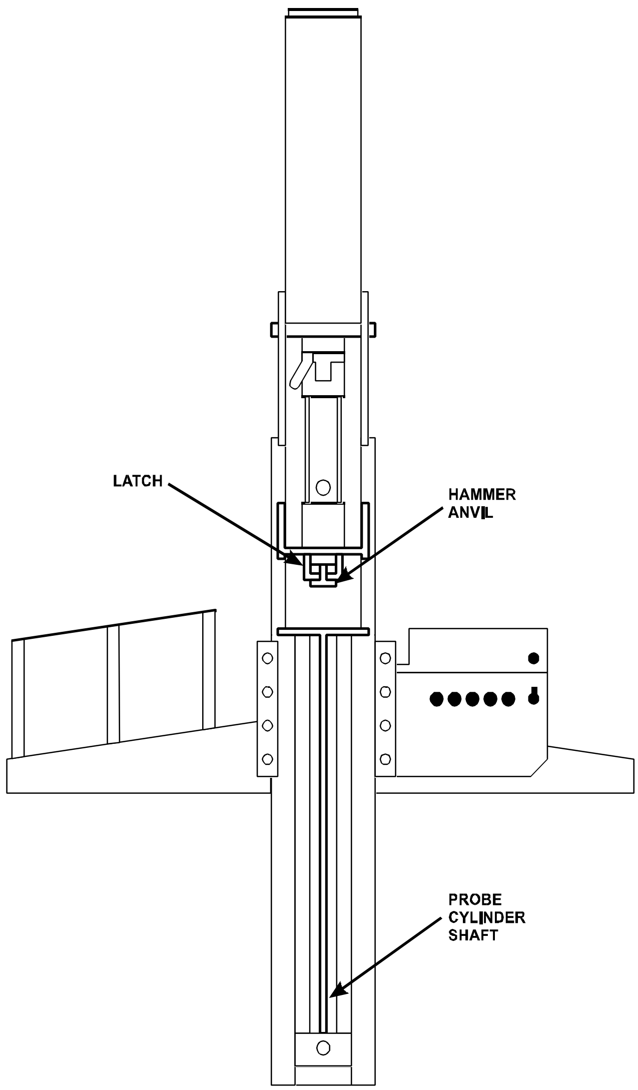
FIGURE 4. Geoprobe ™ Setup for Drilling Through Concrete and Pavement



APPENDIX A (Cont'd)

Figures

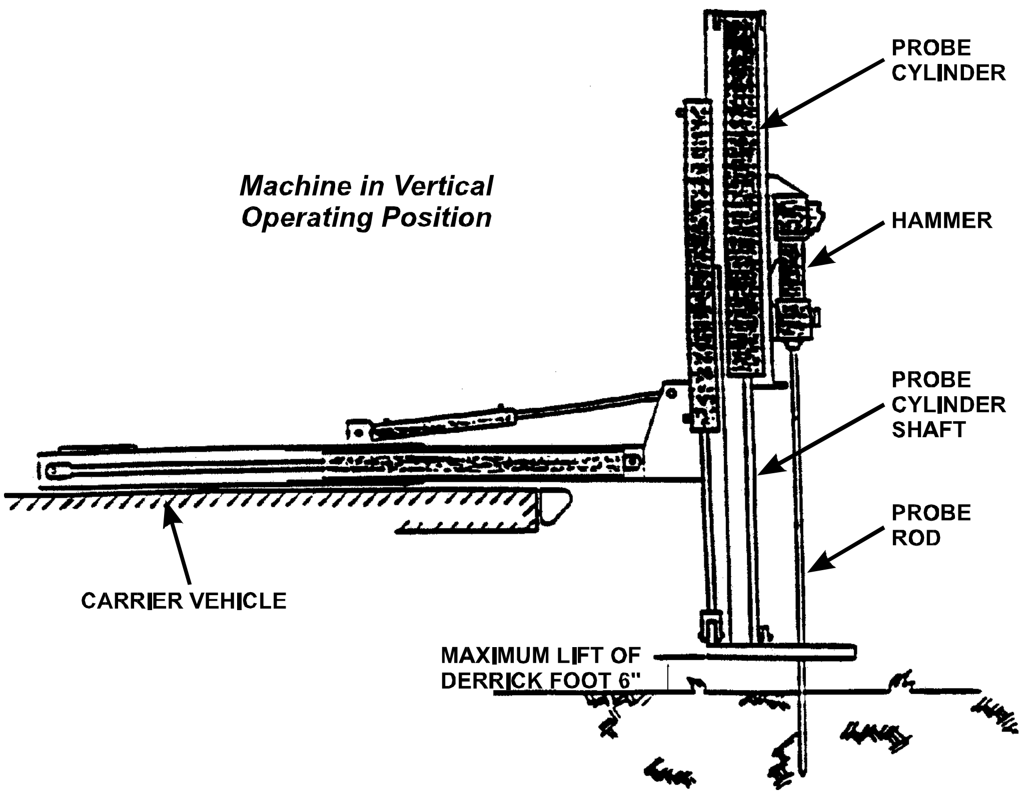
FIGURE 5. Inserting Hammer Anvil



APPENDIX A (Cont'd)

Figures

FIGURE 6. Probe Cylinder Shaft and Probe Rod - Parallel and Vertical

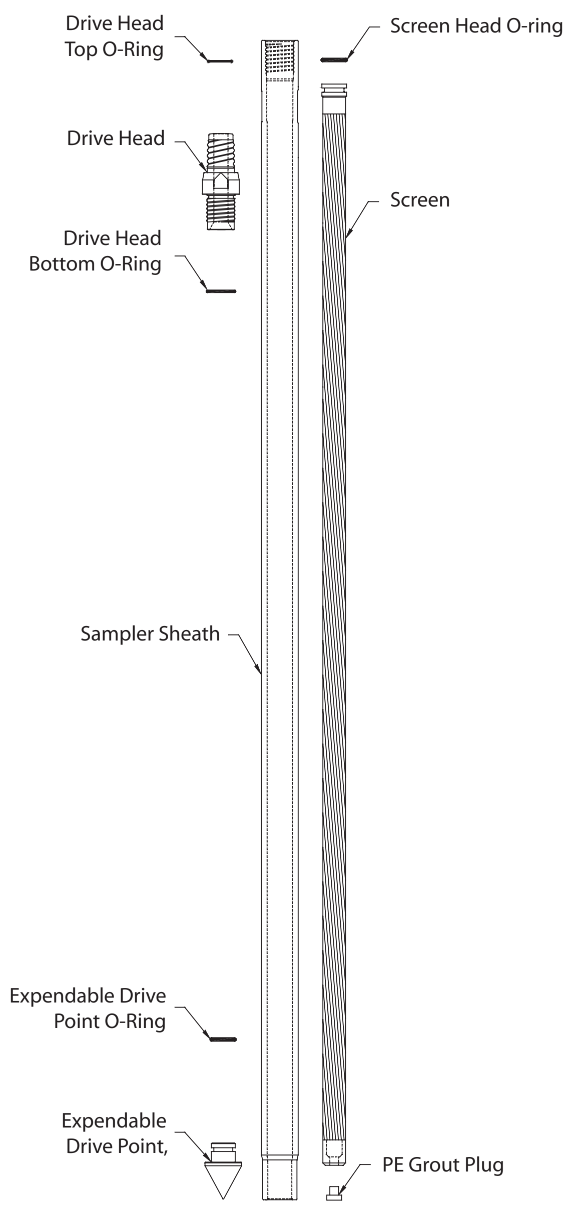


GEOPROBE® SCREEN POINT 16 GROUNDWATER SAMPLER

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3142

PREPARED: November, 2006



GEOPROBE® SCREEN POINT 16 GROUNDWATER SAMPLER PARTS

1.0 OBJECTIVE

The objective of this procedure is to drive a sealed stainless steel or PVC screen to depth, deploy the screen, obtain a representative water sample from the screen interval, and grout the probe hole during abandonment. The Screen Point 16 Groundwater Sampler enables the operator to conduct abandonment grouting that meets American Society for Testing and Materials (ASTM) Method D 5299 requirements for decommissioning wells and borings for environmental activities (ASTM 1993).

2.0 BACKGROUND

2.1 Definitions

Geoprobe®: A brand name of high quality, hydraulically powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and monitoring, soil conductivity and contaminant logging, grouting, and materials injection.

Screen Point 16 (SP16) Groundwater Sampler: A direct push device consisting of a PVC or stainless steel screen that is driven to depth within a sealed, steel sheath and then deployed for the collection of representative groundwater samples. The assembled SP16 Sampler is approximately 51.5 inches (1308 mm) long with an OD of 1.625 inches (41 mm). Upon deployment, up to 41 inches (1041 mm) of screen can be exposed to the formation. The Screen Point 16 Groundwater Sampler is designed for use with 1.5-inch probe rods and machines equipped with the more powerful GH60 Hydraulic Hammer. Operators with GH40 Series hammers may chose to use this sampler in soils where driving is difficult.

Rod Grip Pull System: An attachment mounted on the hydraulic hammer of a direct push machine which makes it possible to retract the tool string with extension rods or flexible tubing protruding from the top of the probe rods. The Rod Grip Pull System includes a pull block with rod grip jaws that are bolted directly to the machine. A removable handle assembly straddles the tool string while hooking onto the pull block to effectively grip the probe rods as the hammer is raised. A separate handle assembly is required for each probe rod diameter.

2.2 Discussion

In this procedure, the assembled Screen Point 16 Groundwater Sampler (Fig. 2.1A) is threaded onto the leading end of a Geoprobe® probe rod and advanced into the subsurface with a Geoprobe® direct push machine. Additional probe rods are added incrementally and advanced until the desired sampling interval is reached. While the sampler is advanced to depth, O-ring seals at each rod joint, the drive head, and the expendable drive point provide a watertight system. This system eliminates the threat of formation fluids entering the screen before deployment and assures sample integrity.

Once at the desired sampling interval, extension rods are sent downhole until the leading rod contacts the bottom of the sampler screen. The tool string is then retracted approximately 44 inches (1118 mm) while the screen is held in place with the extension rods (Fig. 2.1B). As the tool string is retracted, the expendable point is released from the sampler sheath. The tool string and sheath may be retracted the full length of the screen or as little as a few inches if a small sampling interval is desired.

There are three types of screens that can be used in the Screen Point 16 Groundwater Sampler. Two of the these, a stainless steel screen with a standard slot size of 0.004 inches (0.10 mm) and a PVC screen with a standard slot size of 0.010 inches (0.25 mm), are recovered with the tool string after sampling. The third screen is also manufactured from PVC with a standard slot size of 0.010 inches (0.25 mm), but is designed to be left downhole when sampling is complete. This disposable screen has an exposed screen length of approximately 43 inches (1092 mm). The two screens that are recovered with the sampler both have an exposed screen length of approximately 41 inches (1041 mm).

(continued on following page)

An O-ring on the head of the stainless steel screens maintains a seal at the top of the screen. As a result, any liquid entering the sampler during screen deployment must first pass through the screen. PVC screens do not require an O-ring because the tolerance between the screen head and sampler sheath is near that of the screen slot size.

The screens are constructed such that flexible tubing, a mini-bailer, or a small-diameter bladder pump can be inserted into the screen cavity. This makes direct sampling possible from anywhere within the saturated zone. A removable plug in the lower end of the screens allows the user to grout as the sampler is extracted for further use.

Groundwater samples can be obtained in a number of ways. A common method utilizes polyethylene (TB25L) or Teflon® (TB25T) tubing and a Check Valve Assembly (GW4210). The check valve (with check ball) is attached to one end of the tubing and inserted down the casing until it is immersed in groundwater. Water is pumped through the tubing and to the ground surface by oscillating the tubing up and down.

An alternative means of collecting groundwater samples is to attach a peristaltic or vacuum pump to the tubing. This method is limited in that water can be pumped to the surface from a maximum depth of approximately 26 feet (8 m). Another technique for groundwater sampling is to use a stainless steel Mini-Bailer Assembly (GW41). The mini-bailer is lowered down the inside of the casing below the water level where it fills with water and is then retrieved from the casing.

The latest option for collecting groundwater from the SP16 sampler is to utilize a Geoprobe® MB470 Series Mechanical Bladder Pump (MBP)*. The MBP may be used to meet requirements of the low-flow sampling protocol (Puls and Barcelona 1996, ASTM 2003). Through participation in a U.S. EPA Environmental Technology Verification study, it was confirmed that the MB470 can provide representative samples (EPA 2003).

**The Mechanical Bladder Pump is manufactured under U.S. Patent No. 6,877,965 issued April 12, 2005.*

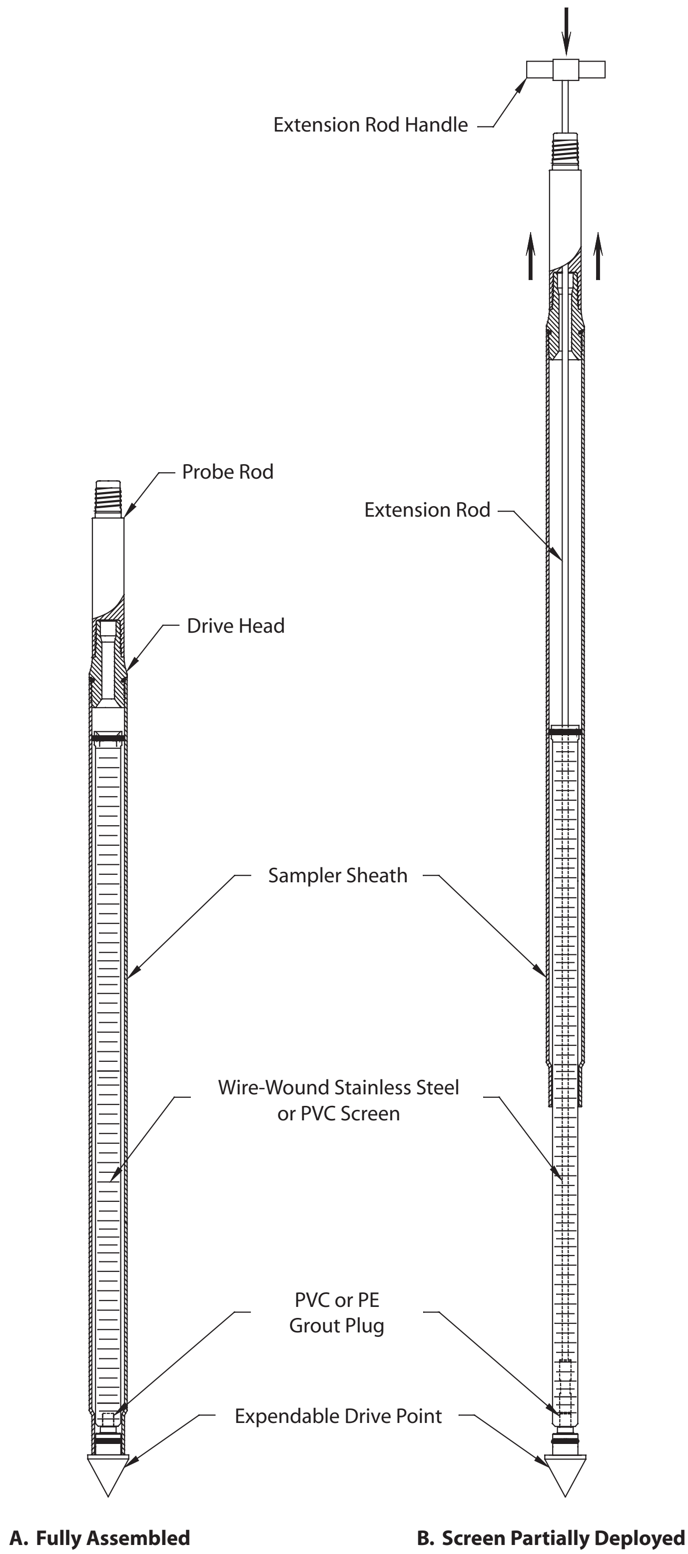


FIGURE 2.1
Screen Point 16 Groundwater Sampler

3.0 TOOLS AND EQUIPMENT

The following tools and equipment can be used to successfully recover representative groundwater samples with the Geoprobe® Screen Point 16 Groundwater Sampler. Refer to Figures 3.1 and 3.2 for identification of the specified parts. Tools are listed below for the most common SP16 / 1.5-inch probe rod configurations. Additional parts for optional rod sizes and accessories are listed in Appendix A.

SP16 Sampler Parts	**Part Number**
SP16 Sampler Sheath	15187
SP16 Drive Head, 0.5-inch bore, 1.5-inch rods*	18307
SP16 O-ring Service Kit, 1.5-inch rods *(includes 4 each of the O-ring packets below)*	15844
O-rings for Top of SP16 Drive Head, 1.5-inch rods only (Pkt. of 25)	*15389*
O-rings for Bottom of SP16 Drive Head (Pkt. of 25)	*13196*
O-rings for GW1520 Screen Head (Pkt. of 25)	*GW1520R*
O-rings for SP16 Expendable Drive Point (Pkt. of 25)	*GW1555R*
Screen, Wire-Wound Stainless Steel, 4-Slot*	GW1520
Grout Plugs, PE (Pkg. of 25)	GW1552K
Expendable Drive Points, steel, 1.625-inch OD (Pkg. of 25)*	GW1555K
Screen Point 16 Groundwater Sampler Kit, 1.5-inch Probe Rods *(includes 1 each of: 15187, 18307, 15844, GW1520, GW1535, GW1540, GW1555K, and GW1552K)*	15770

Probe Rods and Probe Rod Accessories	**Part Number**
Drive Cap, 1.5-inch probe rods, threadless, (for GH60 Hammer)	12787
Pull Cap, 1.5-inch probe rods	15090
Probe Rod, 1.5-inch x 60-inch*	11121

Extension Rods and Extension Rod Accessories	**Part Number**
Screen Push Adapter	GW1535
Grout Plug Push Adapter	GW1540
Extension Rod, 60-inch*	10073
Extension Rod Coupler	AT68
Extension Rod Handle	AT69
Extension Rod Jig	AT690
Extension Rod Quick Link Coupler, pin	AT695
Extension Rod Quick Link Coupler, box	AT696

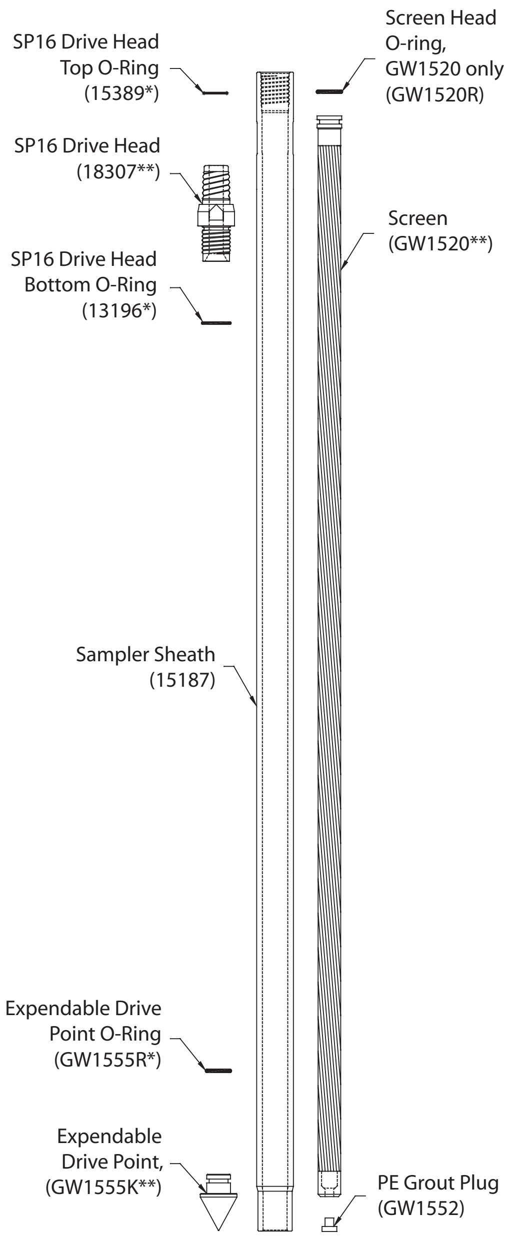
Grout Accessories	**Part Number**
Grout Nozzle, for 0.375-inch OD tubing	GW1545
High-Pressure Nylon Tubing, 0.375-inch OD / 0.25-inch ID, 100-ft. (30 m)	11633
Grout Machine, self-contained*	GS1000
Grout System Accessories Package, 1.5-inch rods	GS1015

Groundwater Purging and Sampling Accessories	**Part Number**
Polyethylene Tubing, 0.375-inch OD, 500 ft.*	TB25L
Check Valve Assembly, 0.375-inch OD Tubing*	GW4210
Water Level Meter, 0.438-inch OD Probe, 100 ft. cable*	GW2000
Mechanical Bladder Pump**	MB470
Mini Bailer Assembly, stainless steel	GW41

Additional Tools	**Part Number**
Adjustable Wrench, 6.0-inch	FA200
Adjustable Wrench, 10.0-inch	FA201
Pipe Wrenches	NA

* See Appendix A for additional tooling options.

** Refer to the Standard Operating Procedure (SOP) for the Mechanical Bladder Pump (Technical Bulletin No. MK3013) for additional tooling needs.



* Included in the SP16 O-ring Service Kit (15844)
** Part numbers show most common tool configuration. See Appendix A for alternative parts.

FIGURE 3.1
SP16 Sampler Parts

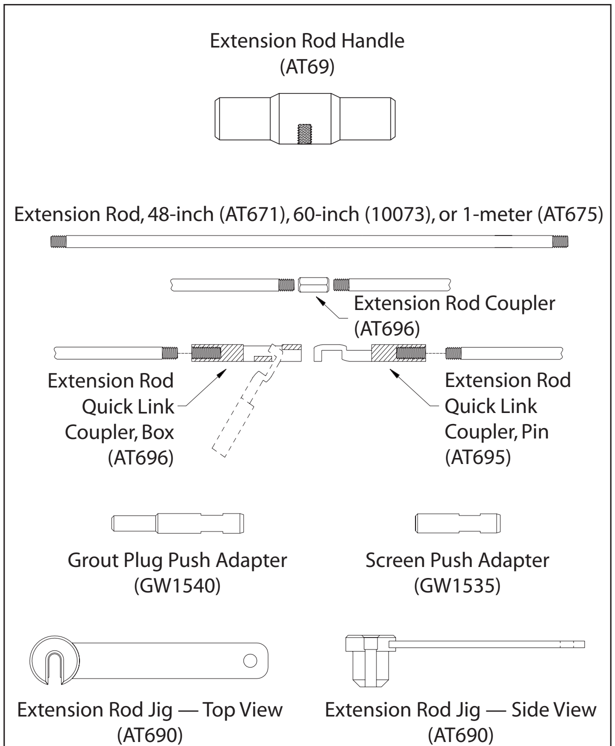


FIGURE 3.2
Geoprobe® Extension Rods and Accessories

4.0 OPERATION

4.1 Basic Operation

The SP16 sampler utilize a stainless steel or PVC screen which is encased in an alloy steel sampler sheath. An expendable drive point is placed in the lower end of the sheath while a drive head is attached to the top. O-rings on the drive head and expendable point provide a watertight sheath which keeps contaminants out of the system as the sampler is driven to depth.

Once the sampling interval is reached, extension rods equipped with a screen push adapter are inserted down the ID of the probe rods. The tool string is then retracted up to 44 inches (1118 mm) while the screen is held in place with the extension rods. The system is now ready for groundwater sampling. When sampling is complete, a removable plug in the bottom of the screen allows for grouting below the sampler as the tool string is retrieved.

4.2 Sampler Options

The Screen Point 15 and Screen Point 16 Groundwater Samplers are nearly identical. Subtle differences in the design of the SP16 sampler make it more durable than the earlier SP15 system. Operators of GH60-equipped machines should always utilize SP16 tooling. Operators of machines equipped with GH40 Series hammers may also choose SP16 tooling when sampling in difficult probing conditions.

A 1.75-inch OD Expendable Drive Point (17066K) and Disposable PVC Screen (16089) provide two useful options for the SP16 sampler. The 1.75-inch drive point may be used when soil conditions make it difficult to remove the sampler after driving to depth. The disposable PVC screen may be left downhole after sampling (when regulations permit) to eliminate the time required for screen decontamination.

4.3 Decontamination

In order to collect representative groundwater samples, all sampler parts must be thoroughly cleaned before and after each use. Scrub all metal parts using a stiff brush and a nonphosphate soap solution. Steam cleaning may be substituted for hand-washing if available. Rinse with distilled water and allow to air-dry before assembly.

4.4 SP16 Sampler Assembly (Figure 4.1)

Part numbers are listed for a standard SP16 sampler using 1.5-inch probe rods. Refer to Page 6 for screen and drive head alternatives.

1. Place an O-ring on a steel expendable drive point (GW1555K). Firmly seat the expendable point in the necked end of a sampler sheath (15187).

2. Install a PE Grout Plug (GW1552) in the bottom end of a Wire-wound Stainless Steel Screen (GW1520). Place a GW1520R O-ring in the groove on the top end of the screen.

3. Slide the screen inside of the sampler sheath with the grout plug toward the bottom of the sampler. Ensure that the expendable point was not displaced by the screen.

4. Install a bottom O-ring (13196) on a Drive Head (18307 or 15188). Thread the drive head into the sampler sheath using an adjustable wrench if necessary to ensure complete engagement of the threads. Attach a Drive Cap (12787 or 15590) to the top of the drive head.

NOTE: The 18307 drive head should be used whenever possible as the smaller 0.5-inch ID provides a greater material cross-section for increased durability.

Sampler assembly is complete.

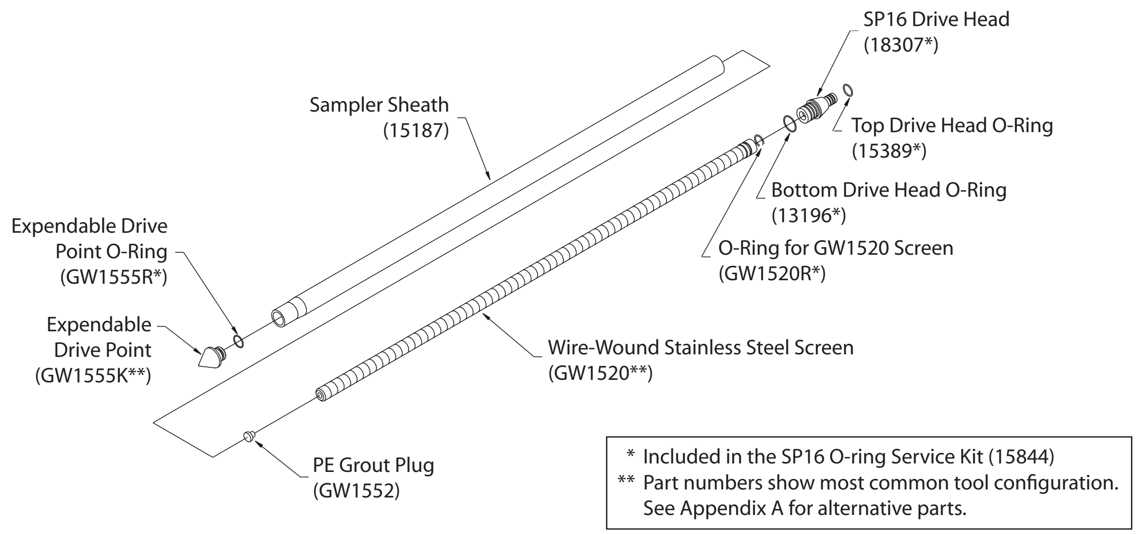


FIGURE 4.1
Screen Point 16 Groundwater Sampler Assembly

4.5 Advancing the SP16 Sampler

To provide adequate room for screen deployment with the Rod Grip Pull System, the probe derrick should be extended a little over halfway out of the carrier vehicle when positioning for operation.

1. Begin by placing the assembled sampler (Fig. 2.1.A) in the driving position beneath the hydraulic hammer of the direct push machine as shown in Figure 4.2.

2. Advance the sampler with the throttle control at slow speed for the first few feet to ensure that the sampler is aligned properly. Switch to fast speed for the remainder of the probe stroke.

3. Completely raise the hammer assembly. Remove the drive cap and place an O-ring in the top groove of the drive head. Distilled water may be used to lubricate the O-ring if needed.

Add a probe rod (length to be determined by operator) and reattach the drive cap to the rod string. Drive the sampler the entire length of the new rod with the throttle control at fast speed.

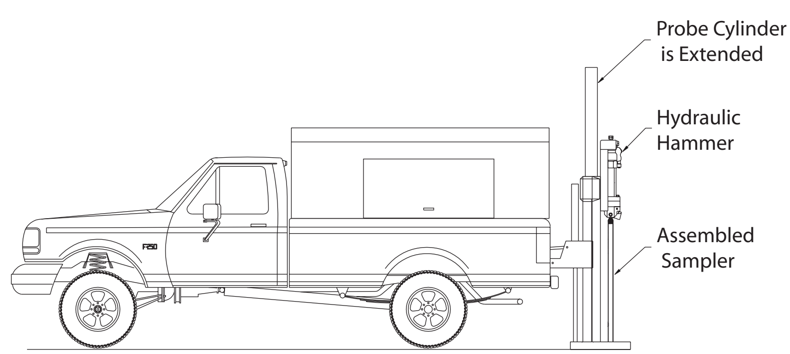


FIGURE 4.2
Screen Point 16 Groundwater Sampler in Driving Position

4. Repeat Step 3 until the desired sampling interval is reached. Approximately 12 inches (305 mm) of the last probe rod must extend above the ground surface to allow attachment of the puller assembly. A 12-inch (305 mm) rod may be added if the tool string is over-driven.

5. Remove the drive cap and retract the probe derrick away from the tool string.

4.6 Screen Deployment

1. Thread a screen push adapter (GW1535) on an extension rod of suitable length (AT671, 10073, or AT675). Attach a threaded coupler (AT68) to the other end of the extension rod. Lower the extension rod inside of the probe rod taking care not to drop it down the tool string. An extension rod jig (AT690) may be used to hold the rods.

2. Add extension rods until the adapter contacts the bottom of the screen. To speed up this step, it is recommended that Extension Rod Quick Links (AT695 and AT696) are used at every other rod joint.

3. Ensure that at least 48 inches (1219 mm) of extension rod protrudes from the probe rod. Thread an extension rod handle (AT69) on the top extension rod.

4. Maneuver the probe assembly into position for pulling.

5. Raise (pull) the tool string while physically holding the screen in place with the extension rods (Fig. 4.3.B). A slight knock with the extension rod string will help to dislodge the expendable point and start the screen moving inside the sheath.

   Raise the hammer and tool string about 44 inches (1118 cm) if using a GW1520 or GW1530 screen. At this point the screen head will contact the necked portion of the sampler sheath (Fig. 4.3.C.) and the extension rods will rise with the probe rods. Use care when deploying a PVC screen so as not to break the screen when it contacts the bottom of the sampler sheath.

   The Disposable Screen (16089) will extend completely out of the sheath if the tool string is raised more than 45 inches (1143 mm). Measure and mark this distance on the top extension rod to avoid losing the screen during deployment.

6. Remove the rod grip handle, lower the hammer assembly, and retract the probe derrick. Remove the top extension rod (with handle) and top probe rod. Finally, extract all extension rods.

7. Groundwater samples can now be collected with a mini-bailer, peristaltic or vacuum pump, tubing bottom check valve assembly, bladder pump, or other acceptable small diameter sampling device.

   When inserting tubing or a bladder pump down the rod string, ensure that it enters the screen interval. The leading end of the tubing or bladder pump will sometimes catch at the screen head giving the illusion that the bottom of the screen has been reached. An up-and-down motion combined with rotation helps move the tubing or bladder pump past the lip and into the screen.

4.7 Abandonment Grouting for GW1520 and GW1530 Screens

The SP16 Sampler can meet ASTM D 5299 requirements for abandoning environmental wells or borings when grouting is conducted properly. A removable grout plug makes it possible to deploy tubing through the bottom of GW1520 and GW1530 screens. A GS500 or GS1000 Grout Machine is then used to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling. Attach the rod grip puller to the top probe rod. Raise the tool string approximately 4 to 6 inches (102 to 152 cm) to allow removal of the grout plug.

2. Thread the Grout Plug Push Adapter (GW1540) onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extension rods until the adapter contacts the grout plug at the bottom of the screen. Attach the handle to the top extension rod. When the extension rods are slightly raised and lowered, a relatively soft rebound should be felt as the adapter contacts the grout plug. This is especially true when using a PVC screen.

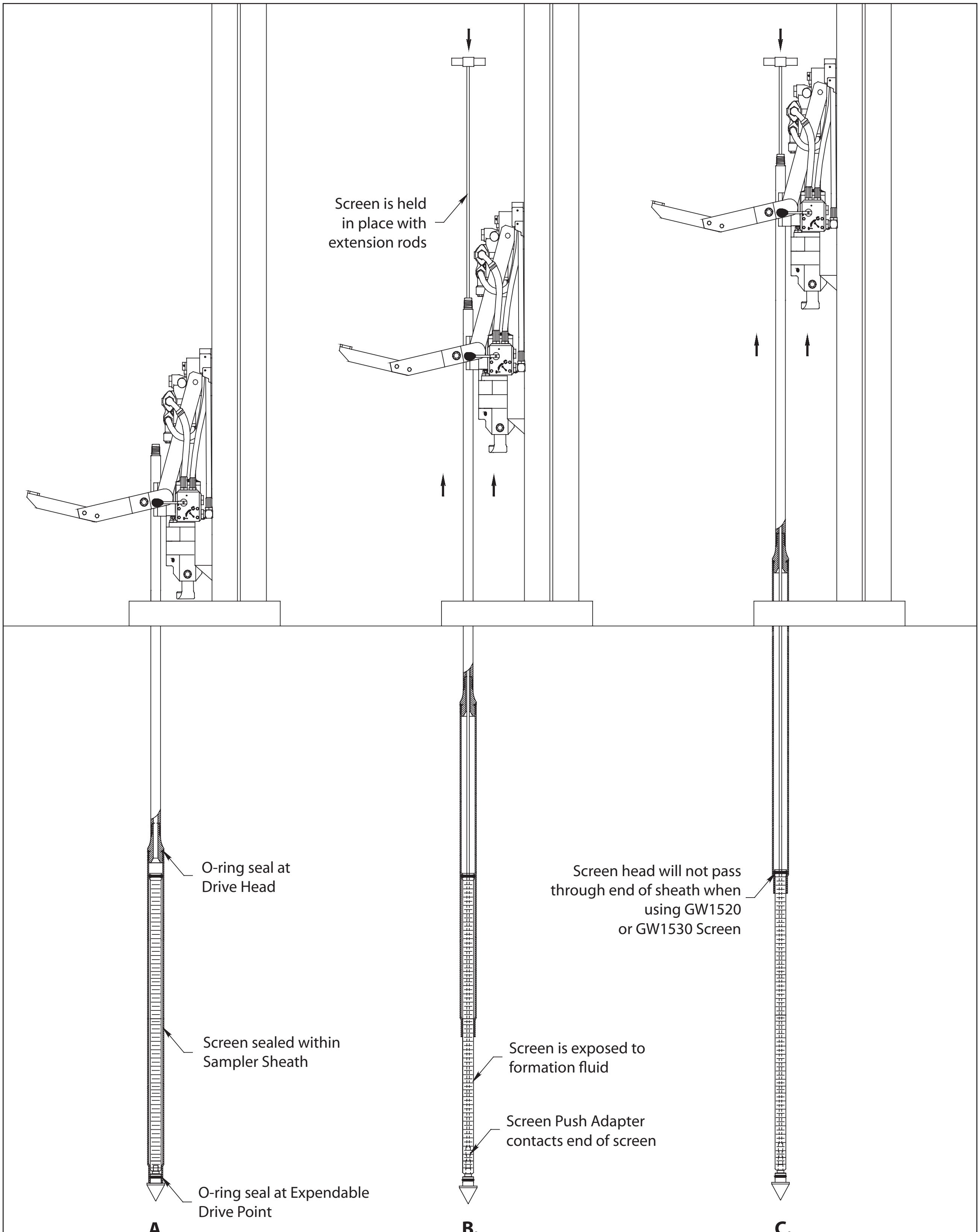


FIGURE 4.3
Screen Deployment for SP16 Sampler

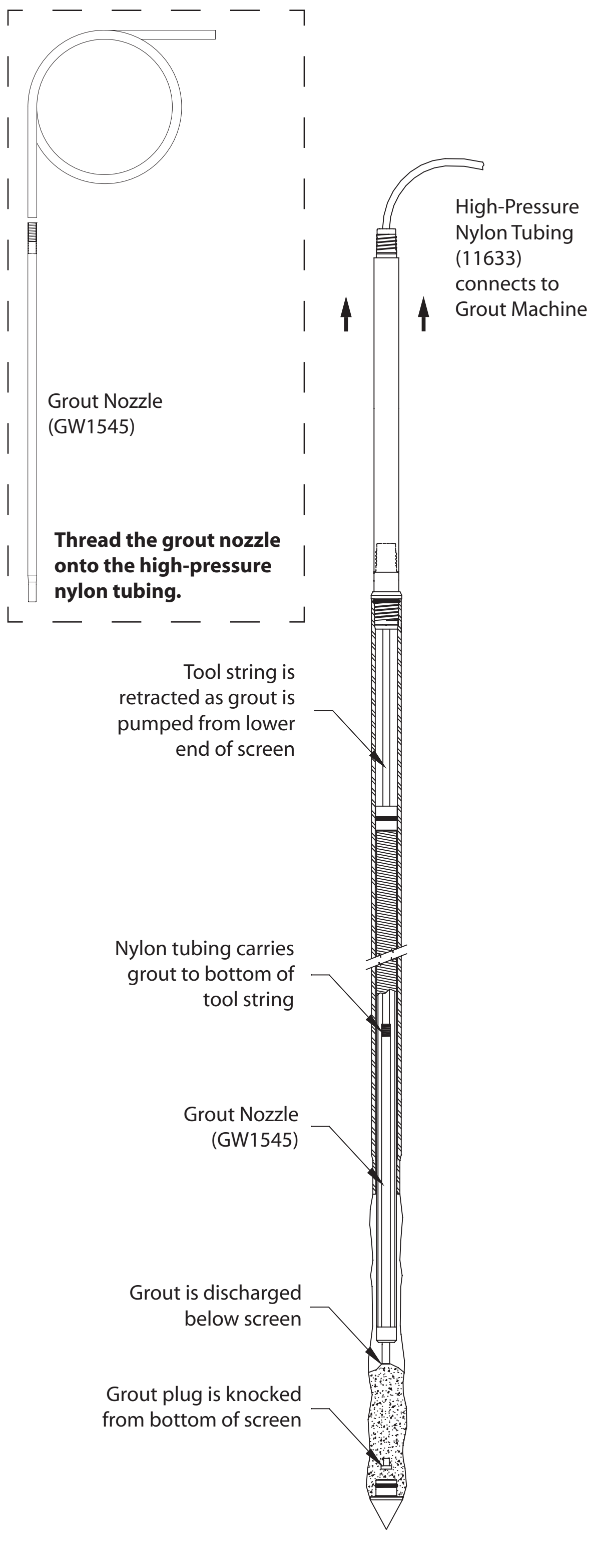


FIGURE 4.4

Grouting the SP16 Sampler With a GW1520 or GW1530 Screen

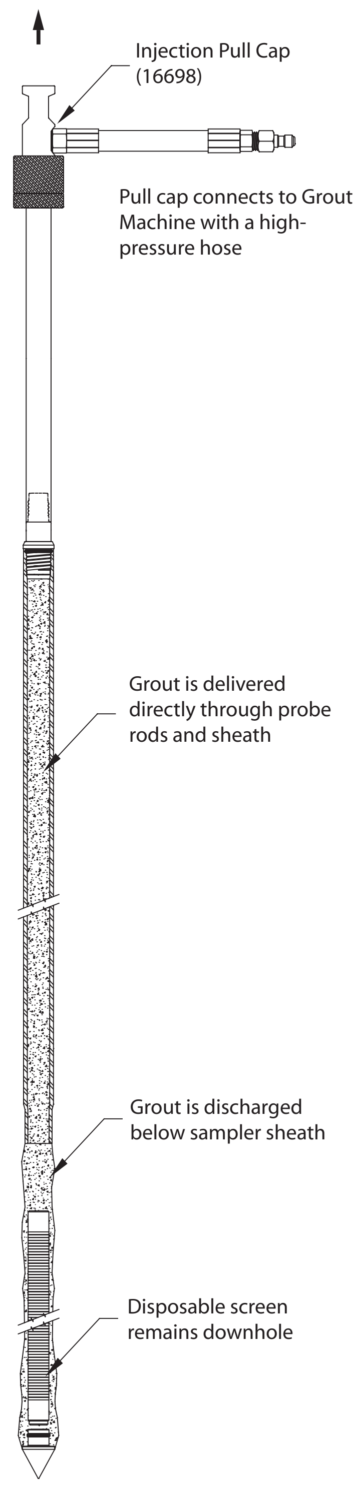


FIGURE 4.5

Grouting the SP16 Sampler With a 16089 Disposable Screen

3. Place a mark on the extension rod even with the top of the probe rod. Apply downward pressure on the extension rods and push the grout plug out of the screen. The mark placed on the extension rod should now be below the top of the probe rod. Remove all extension rods.

   Note: When working with a stainless steel screen, it may be necessary to raise and quickly lower the extension rods to jar the grout plug free. When the plug is successfully removed, a metal-on-metal sensation may be noted as the extension rods are gently "bounced" within the probe rods.

4. A Grout Nozzle (GW1545) is now connected to High-Pressure Nylon Tubing (11633) and inserted down through the probe rods to the bottom of the screen (Fig. 4.4). It may be necessary to pump a small amount of clean water through the tubing during deployment to jet out sediments that settled in the bottom of the screen. Resistance will sometimes be felt as the grout nozzle passes through the drive head. Rotate the tubing while moving it up-and-down to ensure that the nozzle has reached the bottom of the screen and is not hung up on the drive head.

   Note: *All probe rods remain strung on the tubing as the tool string is pulled. Provide extra tubing length to allow sufficient room to lay the rods on the ground as they are removed. An additional 20 feet is generally enough.*

5. Operate the grout pump while pulling the first rod with the rod grip pull system. Coordinate pumping and pulling rates so that grout fills the void left by the sampler. After pulling the first rod, release the rod grip handle, fully lower the hammer, and regrip the tool string. Unthread the top probe and slide it over the tubing placing it on the ground near the end of the tubing.

6. Repeat Step 5 until the sampler is retrieved. Do not bend or kink the tubing when pulling and laying out the probe rods. Sharp bends create weak spots in the tubing which may burst when pumping grout. Remember to operate the grout pump only when pulling the rod string. The probe hole is thus filled with grout from the bottom up as the rods are extracted.

7. Promptly clean all probe rods and sampler parts before the grout sets up and clogs the equipment.

4.8 Abandonment Grouting for the 16089 Disposable Screen

ASTM D 5299 requirements can also be met for the SP16 samplers when using the 16089 disposable screen. Because the screen remains downhole after sampling, the operator may choose either to deliver grout to the bottom of the tool string with nylon tubing or pump grout directly through the probe rods using an Injection Pull Cap (16698). A GS500 or GS1000 Grout Machine is needed to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling with the rod grip puller.

2. Thread the screen push adapter onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extension rods until the adapter contacts the bottom of the screen. Attach the handle to the top extension rod.

3. The disposable screen must be extended at least 46 inches (1168 mm) to clear the bottom of the sampler sheath. Considering the length of screen deployed in Section 4.7, determine the remaining distance required to fully extend the screen from the sheath. Mark this distance on the top extension rod.

4. Pull the tool string up to the mark on the top extension rod while holding the disposable screen in place.

   The screen is now fully deployed and the sampler is ready for abandonment grouting. Apply grout to the bottom of the tool string during retrieval using either flexible tubing (as described in Section 4.7) or an injection pull cap (Fig. 4.5). This section continues with a description of grouting with a pull cap.

5. Remove the rod grip handle and maneuver the probe assembly directly over the tool string. Thread an Injection Pull Cap (16698) onto the top probe rod and close the hammer pull latch over the top of the pull cap.

6. Connect the pull cap to a Geoprobe® grout machine using a high-pressure grout hose.

7. Operate the pump to fill the entire tool string with grout. When a sufficient volume has been pumped to fill the tool string, begin pulling the rods and sampler while continuing to operate the grout pump. Considering the known pump volume and sampler cross-section, time tooling withdrawal to slightly "overpump" grout into the subsurface. This will ensure that all voids are filled during sampler retrieval.

   The grouting process can lubricate the probe hole sufficiently to cause the tool string to slide back downhole when disconnected from the pull cap. Prevent this by withdrawing the tool string with the rod grip puller while maintaining a connection to the grout machine with the pull cap.

4.9 Retrieving the Screen Point 16 Sampler

If grouting is not required, the Screen Point 16 Sampler can be retrieved by pulling the probe rods as with most other Geoprobe® applications. The Rod Grip Pull System should be used for this process as it allows the operator to remove rods without completely releasing the tool string. This avoids having the probe rods fall back downhole when released during the pulling procedure. A standard Pull Cap (15164) may still be used if preferred. Refer to the Owner's Manual for your Geoprobe® direct push machine for specific instructions on pulling the tool string.

5.0 REFERENCES

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Appendix A
ALTERNATIVE PARTS

The following parts are available to meet unique soil conditions. See section 3.0 for a complete listing of the common tool configurations for the Geoprobe® Screen Point 16 Groundwater Sampler.

SP16 Sampler Parts and Accessories	**Part Number**
SP16 Drive Head, 0.625-inch bore, 1.5-inch rods	15188
Expendable Drive Points, aluminum, 1.625-inch OD (Pkg. of 25)	GW1555ALK
Expendable Drive Points, steel, 1.75-inch OD (Pkg. of 25)	17066K
Screen, PVC, 10-Slot	GW1530
Screen, Disposable, PVC, 10-Slot	16089

Groundwater Purging and Sampling Accessories	**Part Number**
Polyethylene Tubing, 0.25-inch OD, 500 ft.	TB17L
Polyethylene Tubing, 0.5-inch OD, 500 ft.	TB37L
Polyethylene Tubing, 0.625-inch OD, 50 ft.	TB50L
Check Valve Assembly, 0.25-inch OD Tubing	GW4240
Check Valve Assembly, 0.5-inch OD Tubing	GW4220
Check Valve Assembly, 0.625-inch OD Tubing	GW4230
Water Level Meter, 0.375-inch OD Probe, 100-ft. cable	GW2001
Water Level Meter, 0.438-inch OD Probe, 200-ft. cable	GW2002
Water Level Meter, 0.375-inch OD Probe, 200-ft. cable	GW2003
Water Level Meter, 0.438-inch OD Probe, 30-m cable	GW2005
Water Level Meter, 0.438-inch OD Probe, 60-m cable	GW2007
Water Level Meter, 0.375-inch OD Probe, 60-m cable	GE2008

Grouting Accessories	**Part Number**
Grout Machine, auxiliary-powered	GS500

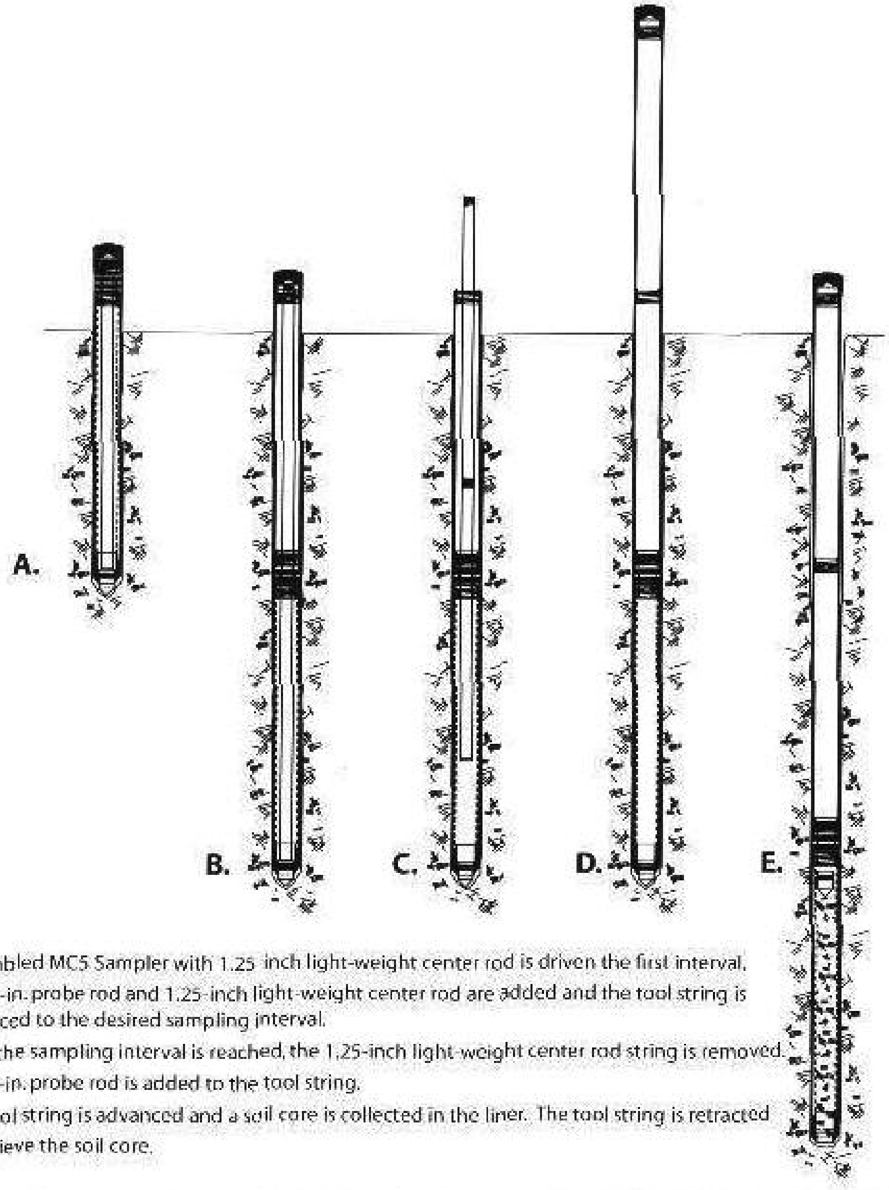
Probe Rods, Extension Rods, and Accessories	**Part Number**
Probe Rod, 1.5-inch x 1-meter	17899
Probe Rod, 1.5-inch x 48-inch	13359
Drive Cap, 1.5-inch rods (for GH40 Series Hammer)	15590
Rod Grip Pull Handle, 1.5-inch Probe Rods (for GH40 Series Hammer)	GH1555
Extension Rod, 48-inch	AT671
Extension Rod, 1-meter	AT675

GEOPROBE® MACRO-CORE® MC5
1.25-INCH LIGHT-WEIGHT CENTER ROD SOIL SAMPLING SYSTEM

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3139

PREPARED: November, 2006



A. Assembled MC5 Sampler with 1.25-inch light-weight center rod is driven the first interval.
B. A 2.25-in. probe rod and 1.25-inch light-weight center rod are added and the tool string is advanced to the desired sampling interval.
C. Once the sampling interval is reached, the 1.25-inch light-weight center rod string is removed.
D. A 2.25-in. probe rod is added to the tool string.
E. The tool string is advanced and a soil core is collected in the liner. The tool string is retracted to retrieve the soil core.

OPERATION OF THE MACRO-CORE® MC5 SOIL SAMPLING SYSTEM

Geoprobe Systems®

Geoprobe® and Geoprobe Systems®, Macro-Core®, and Direct Image®
are Registered Trademarks of Kejr, Inc., Salina, Kansas

Macro-Core® and Large Bore Soil Samplers
manufactured under US Patent 5,606,139.

Macro-Core® Closed-Piston Drive Point
manufactured under US Patent 5,542,481

1.0 OBJECTIVE

The objective of this procedure is to collect a representative soil sample at depth and recover it for visual inspection and/or chemical analysis.

2.0 BACKGROUND

2.1 Definitions

Geoprobe®*: A brand name of high quality, hydraulically-powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and testing, soil conductivity and contaminant logging, grouting, and materials injection.

**Geoprobe® and Geoprobe Systems® are registered trademarks of Kejr, Inc., Salina, Kansas.*

Macro-Core® MC5 Soil Sampler:** A solid barrel, direct push device for collecting continuous core samples of unconsolidated materials at depth. Although other lengths are available, the standard Macro-Core® MC5 Sample Tubes come in lengths of 48 inches and 60 inches with an outside diameter of 2.25 inches. Samples are collected inside a removable liner. The Macro-Core® MC5 Sampler may be used in an open-tube or closed-point configuration.

***Macro-Core® is a registered trademarks of Kejr, Inc., Salina, Kansas.*

Liner: A removable/replaceable, thin-walled tube inserted inside the Macro-Core® MC5 sample tube for the purpose of containing and storing soil samples. While other lengths are available, the most common Macro-Core® MC5 Liners are 48 inches and 60 inches in length. The liner length should correspond to the length of the sample tube used. Liner materials include stainless steel, Teflon®, and PVC.

1.25-inch Light-Weight Center Rods: Used as the inner Rod String for Macro-Core® MC5 sampling. 1.25-inch Light-Weight Center rods come in lengths of 48 inches and 60 inches. They provide a weight reduction of up to 64% over standard 1.25-inch probe rods.

2.2 Discussion

In this procedure, an assembled Macro-Core® MC5 Soil Sampler is driven one sampling interval into the subsurface and retrieved using a Geoprobe® direct push machine. The collected soil core is removed from the sampler along with the used liner. After decon, the Macro-Core® sampler is reassembled using a new liner. The clean sampler is then advanced back down the same hole to collect the next soil core. The Macro-Core® Sampler may be used as an open-tube or closed-point sampler.

The Macro-Core® MC5 Soil Sampler is commonly used as an open-tube sampler (Fig. 2.1A). In this configuration, coring starts at the ground surface with a sampler that is open at the leading end. The sampler is driven into the subsurface and then pulled from the ground to retrieve the first soil core. In stable soils, an open-tube sampler is advanced back down the same hold to collect the next core.

In unstable soils which tend to collapse into the core hold, the Macro-Core® MC5 Sampler can be equipped with a 1.25-inch Center Rod Closed-Point assembly (Fig 2.1B). The point fits firmly into the cutting shoe and is held in place by the 1.25-inch light-weight center rods. The Macro-Core® MC5 Center Rod System prevents collapsed soil from entering the sampler as it is advanced to the bottom of an existing hole, thus ensuring collection of a representative sample. Once the 1.25-inch light weight center rod system is removed, the point will be pushed up the liner during the next sampling interval. The point assembly is later retrieved from the sampler with the liner and soil core.

The Macro-Core® MC5 Soil Sampler is a true discrete sampler. It can be driven through undisturbed soil to a desired depth using the 1.25-inch Light Weight Center Rod System. Once the 1.25-inch light-weight center rods are removed, a representative sample is recovered from the desired depth.

Loose soils may fall from the bottom of the sampler as it is retrieved from depth. The MC Core Catcher (Fig. 3.1) alleviates this problem. Excellent results are obtained when the core catcher is used with saturated sands and other non-cohesive soils. A core catcher should not be used with tight soils as it may actually inhibit sample recovery. In that case, a MC Spacer Ring or extended shank cutting shoe can be used. Constructed of PVC, the core catcher is suitable for use with all Geoprobe® liners.

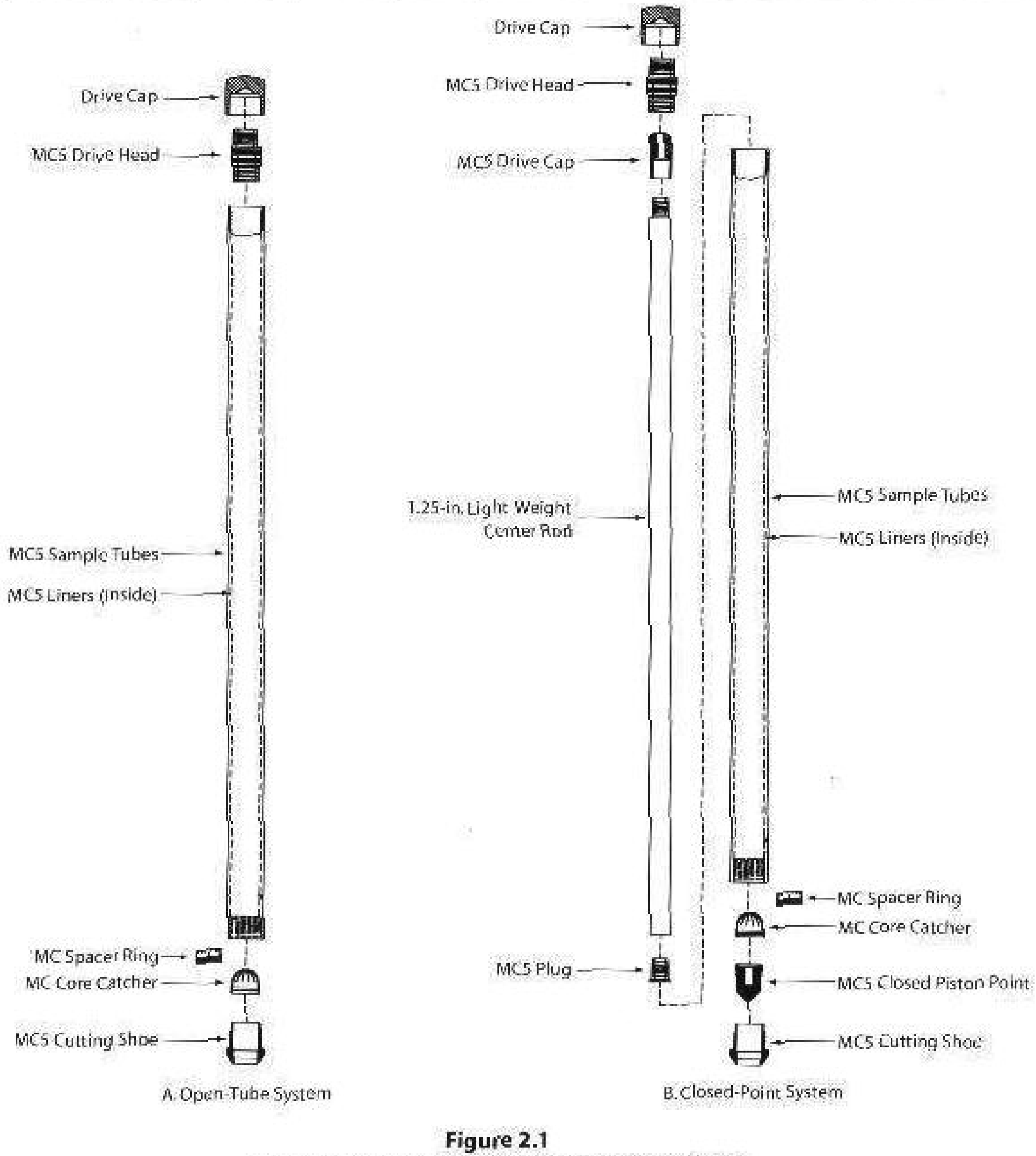


Figure 2.1
Macro-Core® MC5 Soil Sampler Configurations

3.0 TOOLS AND EQUIPMENT

The following tools and equipment can be used to recover representative soil cores with the MC5 Soil Sampling System. Sample tubes, 1.25-inch light-weight center rods, probe rods, and liners all need to be of equal length in order to obtain a sample. Refer to Figure 3.1 for identification of the specified parts. Additional tooling options are available in Appendix A.

MC5 Sampler Parts	Part Number
MC5 Drive Head, 2.25 in. bored	28646
MC5 Drive Head, 2.125 in. bored	23640
MC5 Sample Tubes, 60 in.	22992
MC5 Sample Tubes, 48 in.	22923
MC5 Sample Tubes, 1 m.	24239
MC5 Sample Tubes, 36 in.	24238
MC5 Sample Tubes, 24 in.	24237
MC5 Cutting Shoe, standard, 2.25 in. OD	22922
MC5 Cutting Shoe, undersized, 1.35 in. ID	23957
MC5 Cutting Shoe, standard, 2.25 in. OD (extended shank)	23978
MC5 Cutting Shoe, undersized, 1.35 in. ID (extended shank)	28237
MC5 Cutting Shoe, undersized, 1.25 in. ID (extended shank)	26078
MC5 Cutting Shoe, Heavy Duty, 1.35 in. ID,	29552
MC5 Closed Piston Point, standard	28113
MC5 Closed Piston Point, undersized	26865

Center Rods (1.25 in.) and Center Rod Accessories	Part Number
1.25-in. Center Rod, 60 in. Lightweight	27600
1.25-in. Center Rod, 48 in. Lightweight	21900
Probe Rod, 1.25 in. x 1 m.	AT1239
Probe Rod, 1.25 in. x 36 in.	AT1236
Probe Rod, 1.25 in. x 24 in.	AT1224
MC5 Drive Cap, 1.25 in. Center Rod, Threadless	23639
MC5 Plug Threaded, 1.25 in.	23641
1.25 in. Pull Cap	AT1204

Probe Rods and Probe Rod Accessories	Part Numbers for Specific Probe Rod OD	
	2.25-in. OD	2.125-in. OD
Probe Rod, 60 in.	25301	AT2160
Probe Rod, 48 in.	25300	AT2148
Probe Rod, 1 m.	25352	AT2139
Probe Rod, 2.125 in. x 36 in.		AT2136
Probe Rod, 2.125 in. x 24 in.		13072
Drive Cap, GH60 Series, Threadless	31530	8397
Drive Cap, GH40 Series, Threadless	31405	
Drive Cap, GH40 Series, Threaded		AT2101
Pull Cap	25298	AT2104

MC5 Liners, Accessories, and Miscellaneous Tools	Part Number
MC Liners, 60 in. (66 liners)	10074
MC Liners, 48 in. (66 liners)	AT927K
MC Liners, 1m. (66 liners)	AT928K
MC Liners, 36 in. (66 liners)	AT921K
MC Liners, 24 in. (66 liners)	AT926K
MC Core Catcher	AT8531
MC Spacer Ring	AT8532
MC Spacer Ring (Bulk Box of 500)	AT8533K
Vinyl End Caps (Package of 66)	AT726K
Liner Cutter	AT8010
Universal Liner Holder	22734
Rod Wiper Weldment	23633
Rod Wiper Doughnuts, 2.125-in and 2.25-in.	26876
Two Pipe Wrenches	

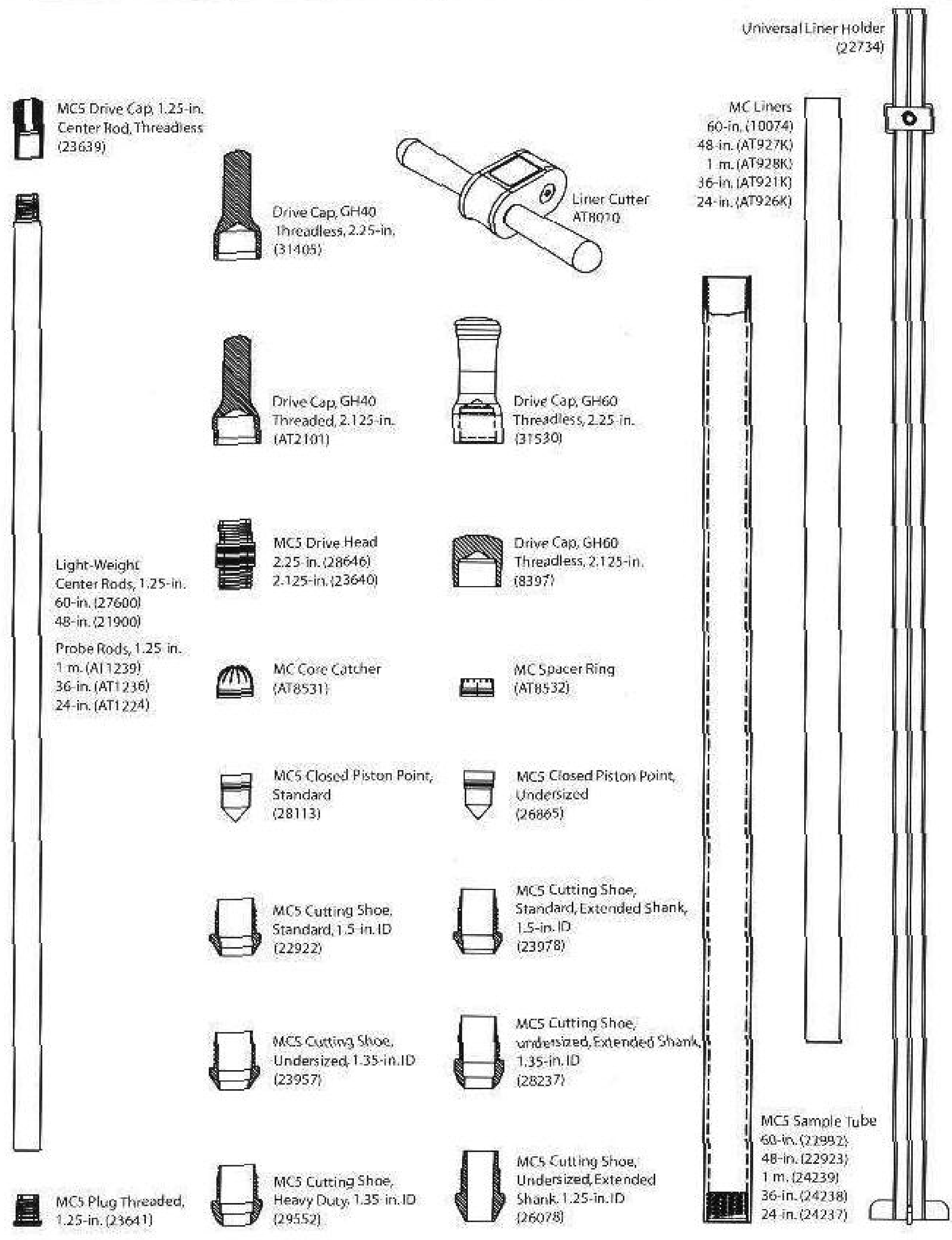


Figure 3.1
Macro-Core® MC5 Soil Sampler Parts

3.1 Tool Options

Five major components of the MC5 Soil Sampling System are sample tubes, probe rods, 1.25-inch light-weight center rods, sample liners, and cutting shoes. These items are manufactured in a variety of sizes to fit the specific needs of the operator. This section identifies the specific tool options available for use with the MC5 Soil Sampling System.

Sample Tubes
MC5 Sample tubes come in lengths of 60 inches (1524 mm), 48 inches (1219 mm), 1 meter, 36 inches (914 mm), and 24 inches (610 mm).

Probe Rods
Standard Geoprobe® 2.125-inch and 2.25-inch OD probe rods are required to operate the MC5 Soil Sampling System. The specific length of rods may be selected by the operator. The most common rod lengths used in MC5 Soil Sampling are the 60-inch and 48-inch rods.

1.25-inch Light-Weight Center Rods
1.25-inch Light-Weight Center Rods (1.25-inch / 32-mm OD) are recommended for the inner rod string of the MC5 system when utilizing an outer casing of 48- or 60-inch long rods. Choose the light-weight rod length that matches the length of rods used for the outer casing (48-inch light-weight rods with 48-inch outer casing, etc.). Currently, standard Geoprobe® 1.25-inch probe rods must be used with 24-inch, 36-inch, and 1-meter MC5 Sample Tubes.

A weight reduction of up to 64% is provided by the 1.25-inch Light-Weight Center Rods over standard 1.25-inch probe rods. As a result, considerably less energy is expended when retrieving the 1.25-inch Light-Weight Center Rods from within the outer casing during operation of the MC5 System.

Sample Liners
Sample liners are made of heavy-duty clear plastic for convenient inspection of the soil sample. Nominal lengths of 24 inches, 36 inches, 1 meter, 48 inches, and 60 inches are available. Choose the liner length corresponding to the length of the sample tube used (e.g. 60-inch liners with 60-inch sample tubes).

Cutting Shoes
Six cutting shoes are available for use with the MC5 Soil Sampling System (Fig. 3.2). The extended shank cutting shoes (23978, 28237, and 26078) fit inside the sample liner and help soil pass freely into the liner. The other three cutting shoes (22922, 23957, 29552) require an MC Core Catcher (AT8531) or MC Spacer Ring (AT8532) in order to properly connect to the sample liners.

The most prominently used cutting shoes are the two "standard" cutting shoes (22922 and 23978). These cutting shoes collect a 1.5-inch (38-mm) diameter soil core.

Undersized cuttings shoes (23957, 28237, and 29552) collect a smaller 1.35-inch (34-mm) soil core and are used in formations with plastic clays or other soil types that lead to overfilling of the sampler liner. Of these, the 29552 and 28237 cutting shoes are also thicker at the leading end for increased durability in harsh conditions where cobbles or large gravel are present.

Soil formations with highly plastic clays may call for an even smaller soil core. In these conditions, a 26078 cutting shoe with its 1.25-inch (32-mm) soil core is most effective.

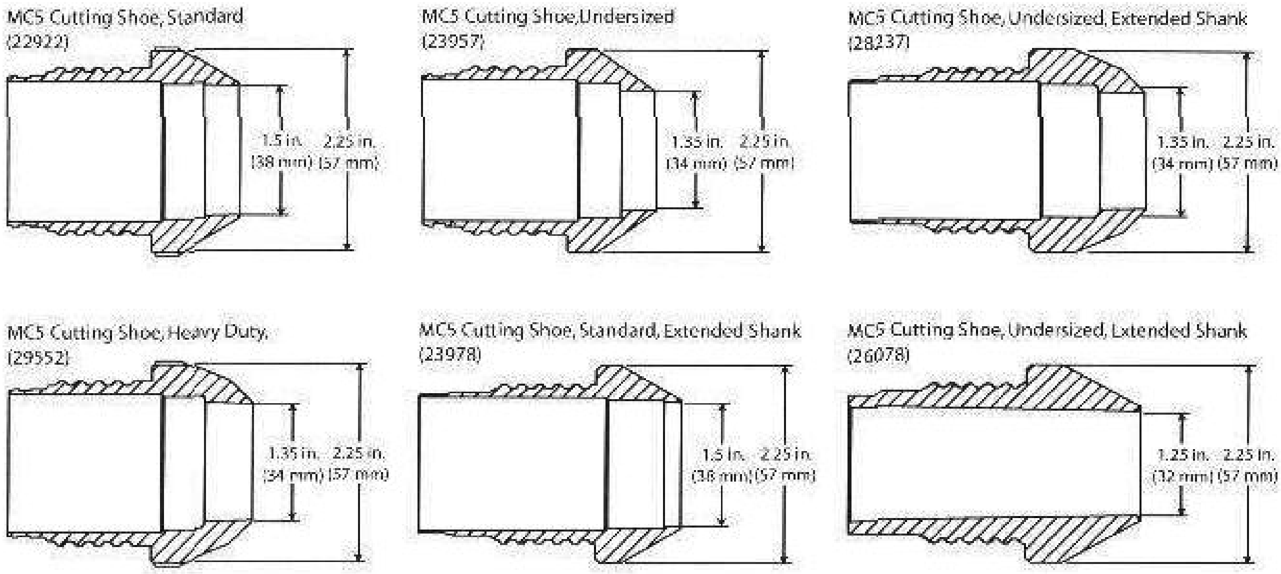


Figure 3.2
Cutting Shoe Options for Macro-Core® MC5 Soil Sampler

4.0 OPERATION

All parts shown in illustrations are those most commonly used configuration for the MC5 Sampling System. Refer to Section 3.0 for part numbers and additional tooling options.

4.1 Decontamination

Before and after each use, thoroughly clean all parts of the soil sampling system according to project requirements. Parts should be inspected for wear or damage at this time. During sampling, a clean new liner is used for each soil core.

Cleaning inside the probe rods and MC5 sample tubes is accomplished with the nylon brushes and extension rods listed in Appendix A. Thread a nylon brush and handle onto an extension rod of suitable length. Using clean water and phosphate-free soap, cycle the brush inside the probe rod or sample tube to remove contaminants. Rinse with clean water and allow to air dry.

4.2 Field Blank

It is suggested that a field blank be taken on a representative sample liner prior to starting a project and at regular intervals during extended projects. Liners can become contaminated in storage. A field blank will prove that the liners do not carry contaminates which can be transferred to soil samples. The following information is offered as an example method which may be used to take a field blank. Make the appropriate modifications for the specific analytes of interest to the investigation.

Example Procedure Required Equipment

MC Liner .... (1)
MC Vinyl End Caps .... (2)
Distilled Water .... (100 ml)
VOA Vial (or other appropriate sample container) .... (1)

1. Place a vinyl end cap on one end of the liner.
2. Pour 100 milliliters of distilled water (or other suitable extracting fluid) into the liner.
3. Place a vinyl end cap on the open end of the liner.
4. From the vertical position, repeatedly invert the liner so that the distilled water contacts the entire inner surface. Repeat this step for one minute.
5. Remove one end cap from the liner, empty contents into an appropriate sample container, and cap the container.
6. Perform analysis on the extract water for the analytes of interest to the investigation.

4.3 Open-Tube Sampler Assembly

1a. Using the MC Core Catcher
Place the open end of an MC Core Catcher over the threaded end of an MC5 Cutting Shoe (22992, 23957, 29552) as shown in Figure 4.2. Apply pressure to the core catcher until it snaps into the machined groove on the cutting shoe. The core catcher should be used in loose soils, especially saturated sands (non-cohesive soils). Use of the core catcher is not necessary in tough, cohesive soils or tight clays, and may interfere with sampling especially in soft clays. The "fingers" of the core catcher flex outward to let soil move into the liner while sampling.

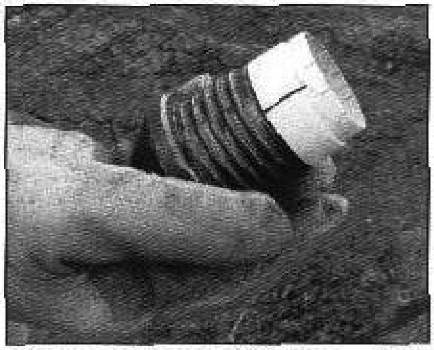


Figure 4.1. The spacer ring fits securely onto the MC5 Cutting Shoe.

1b. Using the MC Spacer Ring

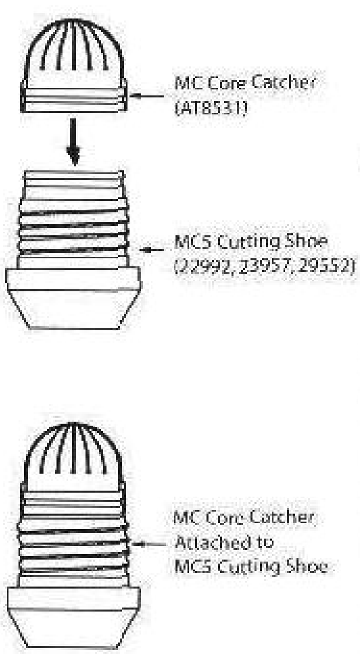


Figure 4.2
Core Catcher Attachment

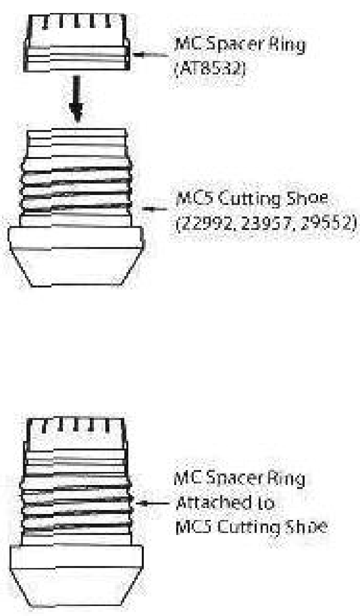


Figure 4.3
Spacer Ring Attachment

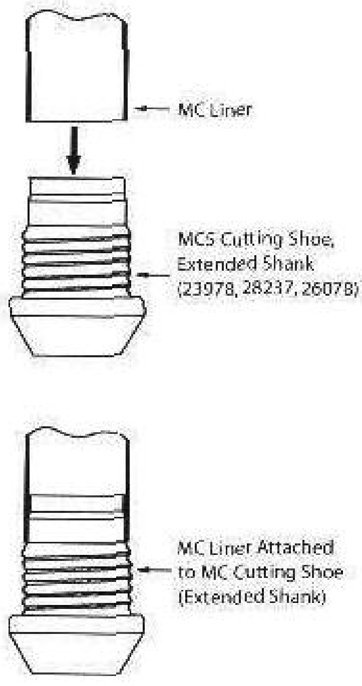


Figure 4.4
Liner Attachment on Extended Shank

Push the base of an MC Spacer Ring onto the threaded end of an MC5 Cutting Shoe (22992, 23957, 29552) until it snaps into the machined groove on the cutting shoe (Fig. 4.1 and Fig. 4.3). Spacer rings should be used when sampling cohesive soils. It allows soil to pass freely over the junction between the liner and cutting shoe.

1c. Using the Extended Shank Cutting Shoe

The cutting shoes with extended shanks (23978, 28237, 26078) do not use core catchers or spacer rings. MC5 Liners should securely slide onto the end of these cutting shoes (Fig. 4.4). The extended shank cutting shoes should only be used when sampling cohesive soils. When sampling loose soils, especially saturated sands (non-cohesive soils), a cutting shoe with an MC Core Catcher is recommended.

2. Place either end of the liner onto the spacer ring or core catcher (Fig. 4.6). If you are using a cutting shoe with an extended shank, do not use a spacer ring or core catcher (Fig. 4.7). The liner should fit securely onto the spacer ring, core catcher, or cutting shoe.

3. Slide whole assembly into either end of the sample tube (Fig. 4.8). Thread the cutting shoe onto the sample tube (Fig. 4.9). If the thread is clean, it should easily thread on by hand. In some cases, a wrench may be necessary for tightening. There shouldn't be a gap between the cutting shoe and sample tube.

4. Thread an MC5 Drive Head into the top of the sample tube (Fig. 4.10). Securely tighten the drive head by hand. Ensure that the end of the sample tube contacts the machined shoulder of the drive head.

Sampler Assembly is Complete

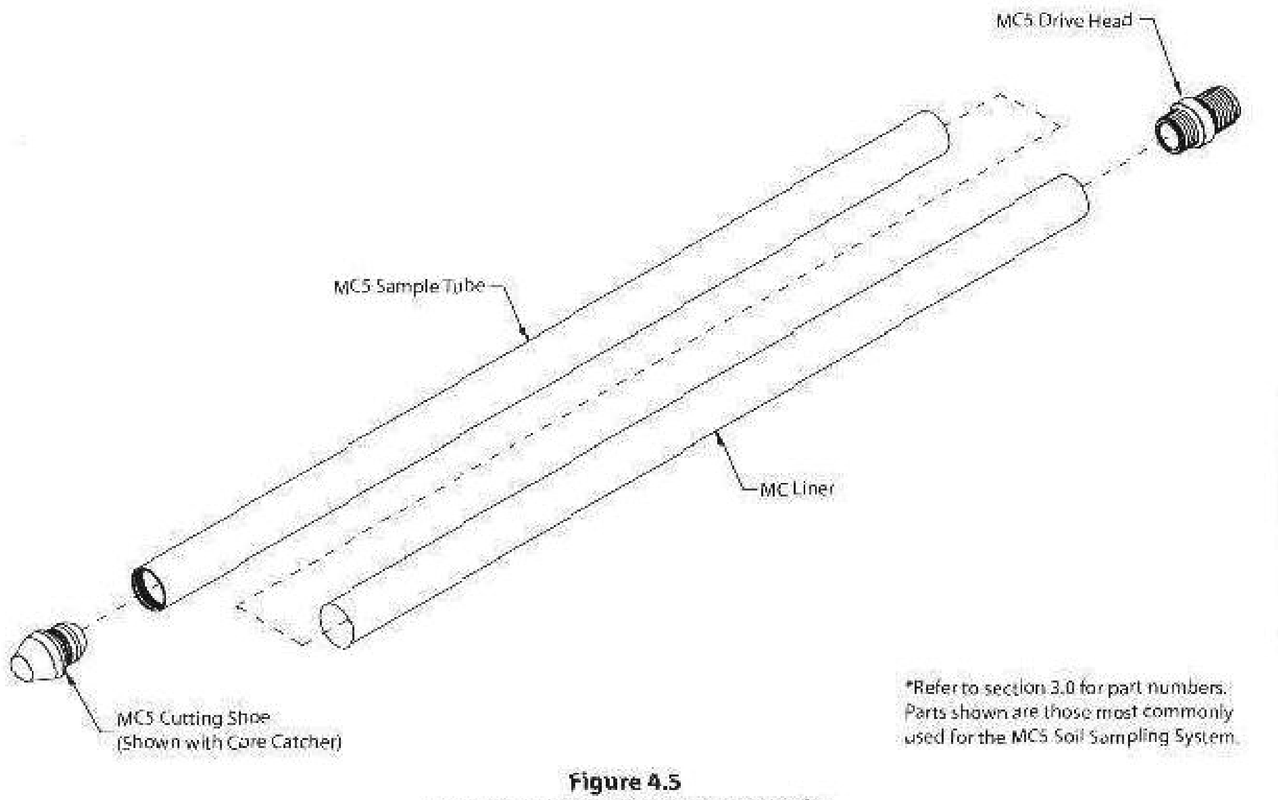


Figure 4.5
MC5 Open-Tube Sampler Assembly

Figure 4.6. Place either end of the liner onto the spacer ring or core catcher. The liner should fit securely.

Figure 4.7. Place either end of the liner onto the extended shank cutting shoe. (This is used in place of a spacer ring or core catcher)

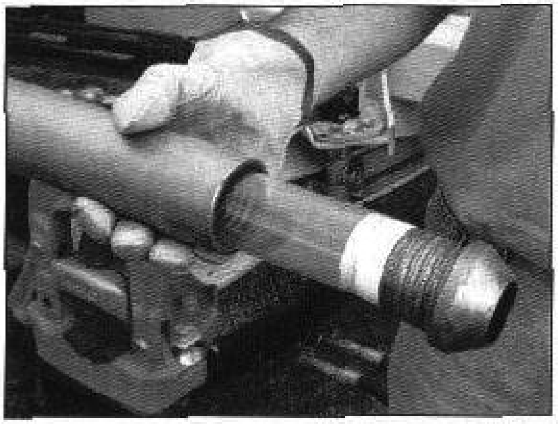


Figure 4.8. Slide whole assembly into either end of the sample tube.

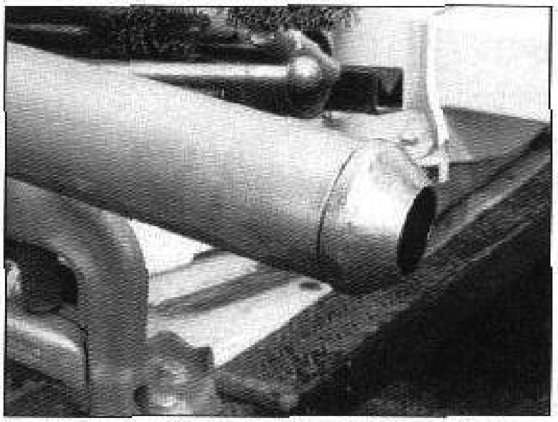


Figure 4.9. Thread the cutting shoe onto the sample tube.

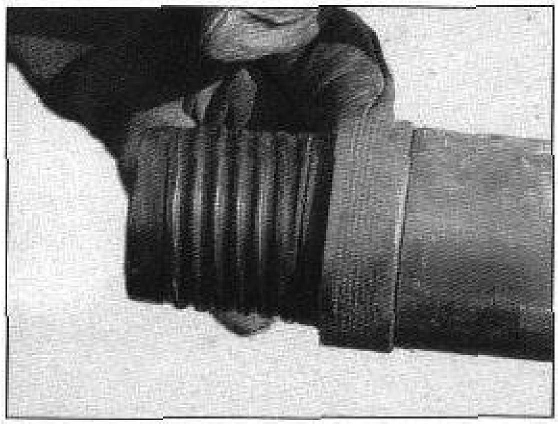


Figure 4.10. Thread the MC5 Drive Head onto the opposite end of the sample tube. Tighten by hand.

4.4 MC5 Closed-Point Sampler Assembly

The Macro-Core® 1.25-inch Light-Weight Center Rod Sampling System seals the leading end of the sampler with a point (Fig. 4.11) assembly that is held in place with a 1.25-inch light weight center rod. Once advanced to the top of the sampling interval, the 1.25-inch Light-Weight Center Rods are removed from the probe rod string.

1. Install an O-ring in the machined groove on the piston rod point (Fig. 4.12).

2. Push the MC5 Closed Piston Point (28113 or 26865) completely into the cutting shoe as shown in Figure 4.12. Note that the standard point (28113) is used with 1.5-inch (38-mm) ID cutting shoes and the undersized point (26865) is for cutting shoes with a 1.35-inch (34-mm) ID.

Figure 4.11. The MC5 Closed Piston Point slides into the cutting shoe.

3a. Using the MC Core Catcher
Place the open end of an MC Core Catcher over the threaded end of an MC5 Cutting Shoe (22992, 23957, 29552) as shown in Figure 4.13. Apply pressure to the core catcher until it snaps into the machined groove on the cutting shoe. The core catcher should be used in loose soils, especially saturated sands (non-cohesive soils). Use of the core catcher is not necessary in tough, cohesive soils or tight clays, and may interfere with sampling especially in soft clays. The "fingers" of the core catcher flex outward to let soil move into the liner while sampling.

3b. Using the MC Spacer Ring
Push the base of an MC Spacer Ring onto the threaded end of an MC5 Cutting Shoe (22992, 23957, 29552) until it snaps into the machined groove on the cutting shoe (Fig. 4.14). Spacer rings should be used when sampling cohesive soils. It allows soil to pass freely over the junction between the liner and cutting shoe.

3c. Using the Extended Shank Cutting Shoe
The cutting shoes with extended shanks (23978, 28237) do not use core catchers or spacer rings. MC5 Liners should securely slide onto the end of these cutting shoes (Fig. 4.15). The extended shank cutting shoes shoud only be used when sampling cohesive soils. When sampling loose soils, especially saturated sands (non-cohesive soils), a cutting shoe with an MC Core Catcher is recommended.

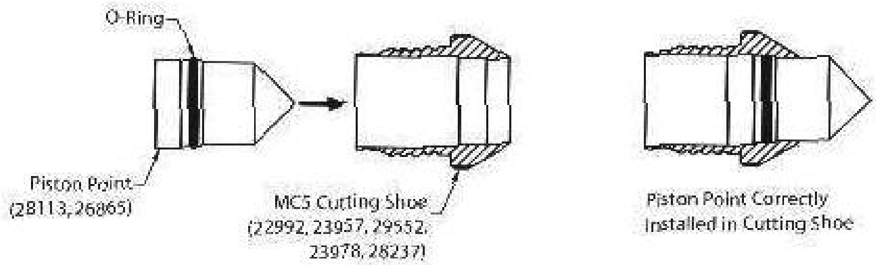


Figure 4.12
Installation of MC5 Closed Piston Point Assembly in MC5 Cutting Shoe

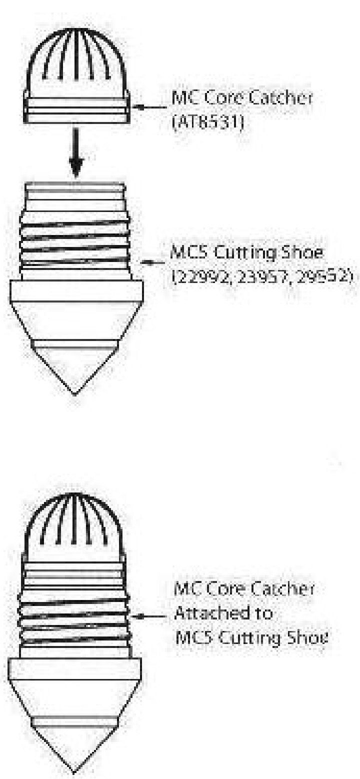


Figure 4.13
Core Catcher Attachment With Point Assembly

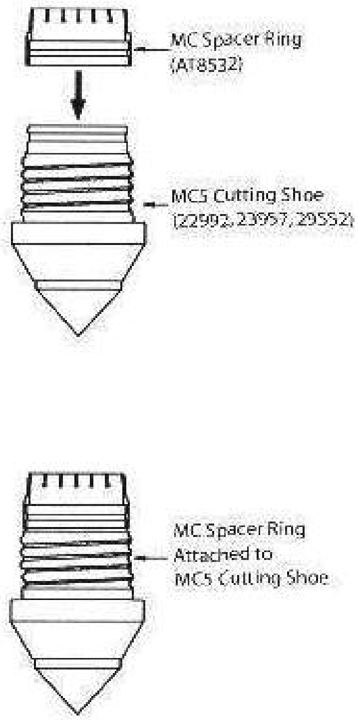


Figure 4.14
Spacer Ring Attachment With Point Assembly

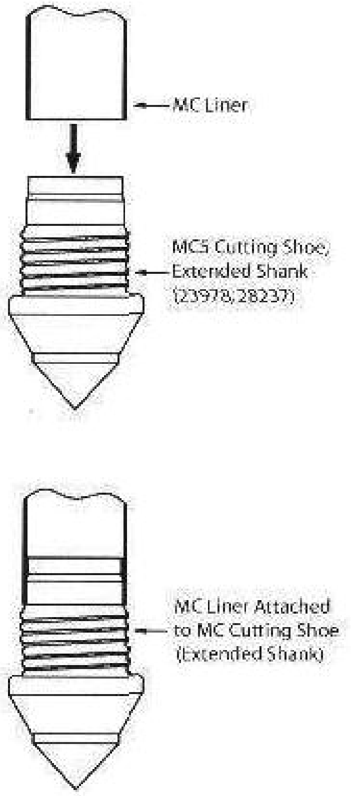


Figure 4.15
Liner Attachment on Extended Shank With Point Assembly

Refer to Figure 4.16 for MC5 Closed-Point Sampler Assembly

4. Place either end of the liner onto the spacer ring or core catcher (Fig. 4.18). If you are using a cutting shoe with an extended shank, do not use a spacer ring or core catcher (Fig. 4.19). The liner should fit securely onto the spacer ring, core catcher, or cutting shoe.

5. Slide whole assembly into either end of the sample tube (Fig. 4.20). Thread the cutting shoe onto the sample tube (Fig. 4.21). If the thread is clean, it should easily thread on by hand. In some cases, a wrench may be necessary for tightening. There shouldn't be a gap between the cutting shoe and sample tube.

6. Thread an MC5 Drive Head into the top of the sample tube. Securely tighten the drive head by hand. Ensure that the end of the sample tube contacts the machined shoulder of the drive head (Refer to Figure 4.10).

continued on page 14

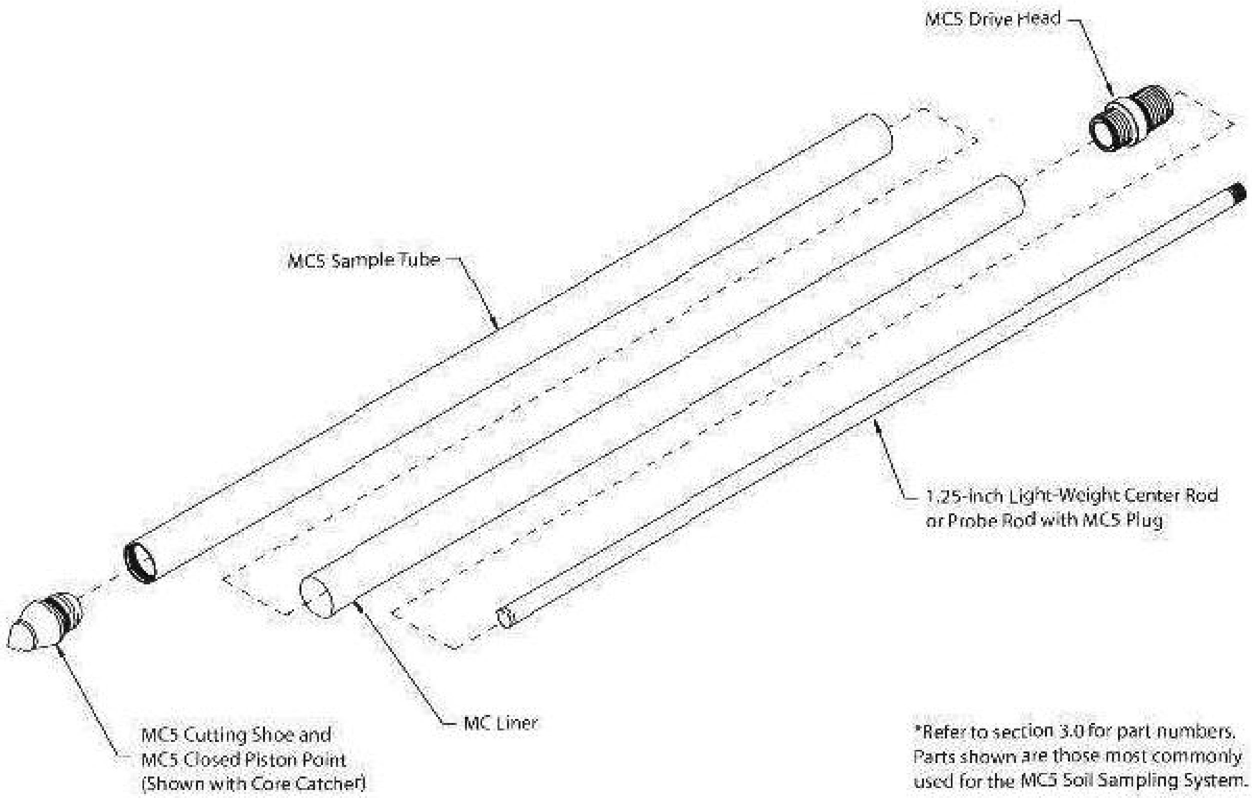


Figure 4.16
MC5 Closed-Point Sampler Assembly

7. Thread an MC5 Plug (23641) onto 1.25-inch light-weight center rod (Fig. 4.22). Note that light-weight center rods are only available in 48-inch and 60-inch lengths. Utilize 1.25-inch probe rods if other lengths are required.

8. Insert the light-weight center rod and MC5 Plug into sample tube assembly (Fig. 4.23), sending the plug end in first. Allow it to come in contact with the top of the Piston Point (Fig. 4.17).

Sampler Assembly is Complete

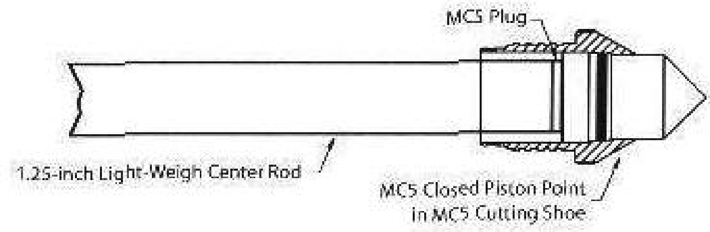


Figure 4.17
MC5 Closed-Point Center Rod Assembly

Figure 4.18. Place either end of the liner onto the spacer ring or core catcher. The liner should fit securely.

Figure 4.19. Place either end of the liner onto the extended shank cutting shoe. (This is used in place of a spacer ring or core catcher)

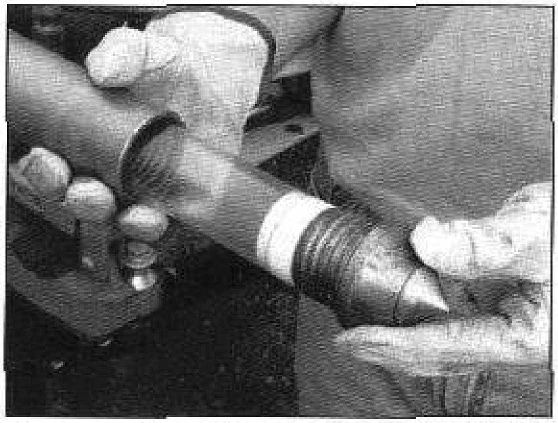


Figure 4.20. Slide whole assembly into either end of the sample tube.

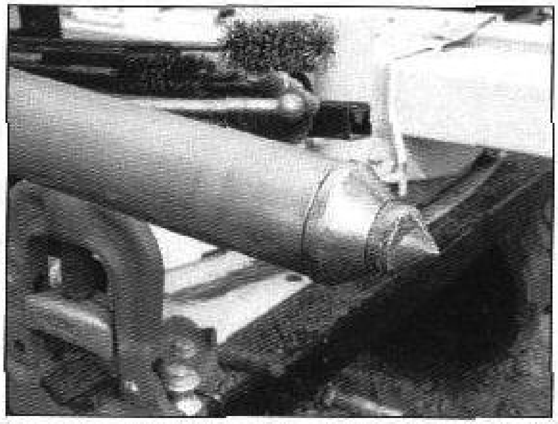


Figure 4.21. Thread the cutting shoe and point onto the sample tube.

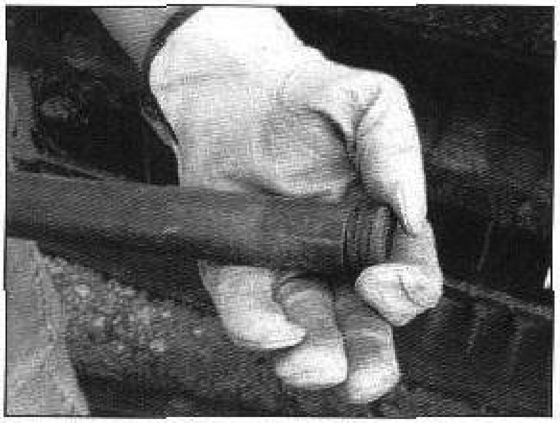


Figure 4.22. The MC5 Plug is threaded onto the end of the 1.25-inch light-weight center rod.

Figure 4.23. The MC5 Plug and a 1.25-inch light-weight center rod are inserted into the sample tube.

4.7 Open-Tube Sampling

The MC5 Open-Tube Sampler is used to gather continuous soil cores beginning from ground surface. A representative soil sample is obtained by driving the assembled sampler one sampling interval into the subsurface through undisturbed soil. Upon retrieving the sampler, the liner and soil core are removed. The sampler is then properly decontaminated, reassembled with a new liner, and inserted back down the same hole to collect the next soil core.

Instructions for operating the MC5 Open-Tube Sampler are given in this section.

1. Place a drive cap onto the drive head (Fig. 4.24) of an assembled Open-Tube Sampler (Refer to Section 4.3 for sampler assembly).

2. Raise the probe unit hammer assembly to its highest position by fully extending the probe cylinder.

3. Position the MC5 Sampler directly under the hammer with the cutting shoe centered between the toes of the probe foot. The sampler should now be parallel to the probe derrick. Step back from the unit and visually check sampler alignment (Fig. 4.25).

4. Apply static weight and hammer percussion to advance the sampler until the drive head reaches the ground surface. (Fig. 4.27A)

   NOTE: Activate hammer percussion whenever collecting soil. Percussion helps shear the soil at the leading end of the sampler so that it moves into the sample tube for increased recovery.

5. Raise the hammer assembly a few inches to provide access to the top of the sampler.

6. Remove the drive cap and thread a pull cap onto the sampler drive head (Fig. 4.26).

7. Lower the hammer assembly and hook the hammer latch over the pull cap. Raise the hammer assembly to pull the sampler completely out of the ground. If a winch is available, it can be used with a pull plate to retract the tool string. A Rod Grip Pull Handle can also be used to retract the tool string.

8. Proceed to Section 4.9 for instructions on recovering the soil core from the MC5 Sampler.

To sample consecutive soil cores, advance a clean sampler down the previously opened hole (Fig. 4.27B) to the top of the next sampling interval (Fig. 4.27C). Drive the tool string the length of the sampler to collect the next soil core (Fig. 4.27D). Switch to an MC5 Center Rod Sampler if excessive side slough is encountered.

NOTE: Use caution when advancing or retrieving the sampler within an open hole. Low side friction may allow the sampler and probe rods to drop down the hole when released. To prevent equipment loss, hold onto the tool string with a pipe wrench when needed.

Figure 4.24. Place drive cap onto sampler drive head.

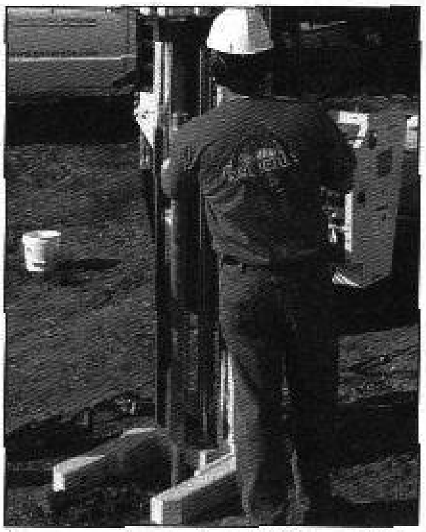


Figure 4.25. The sampler should be parallel to the probe derrick for driving.

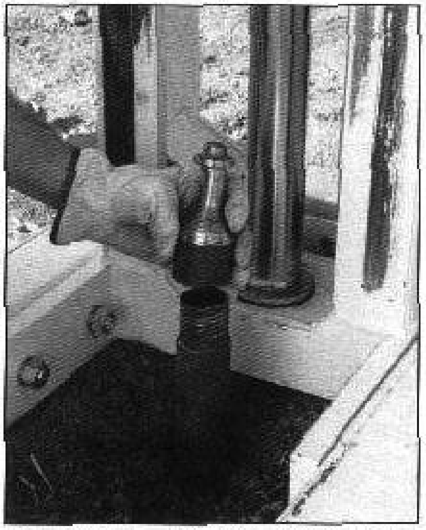
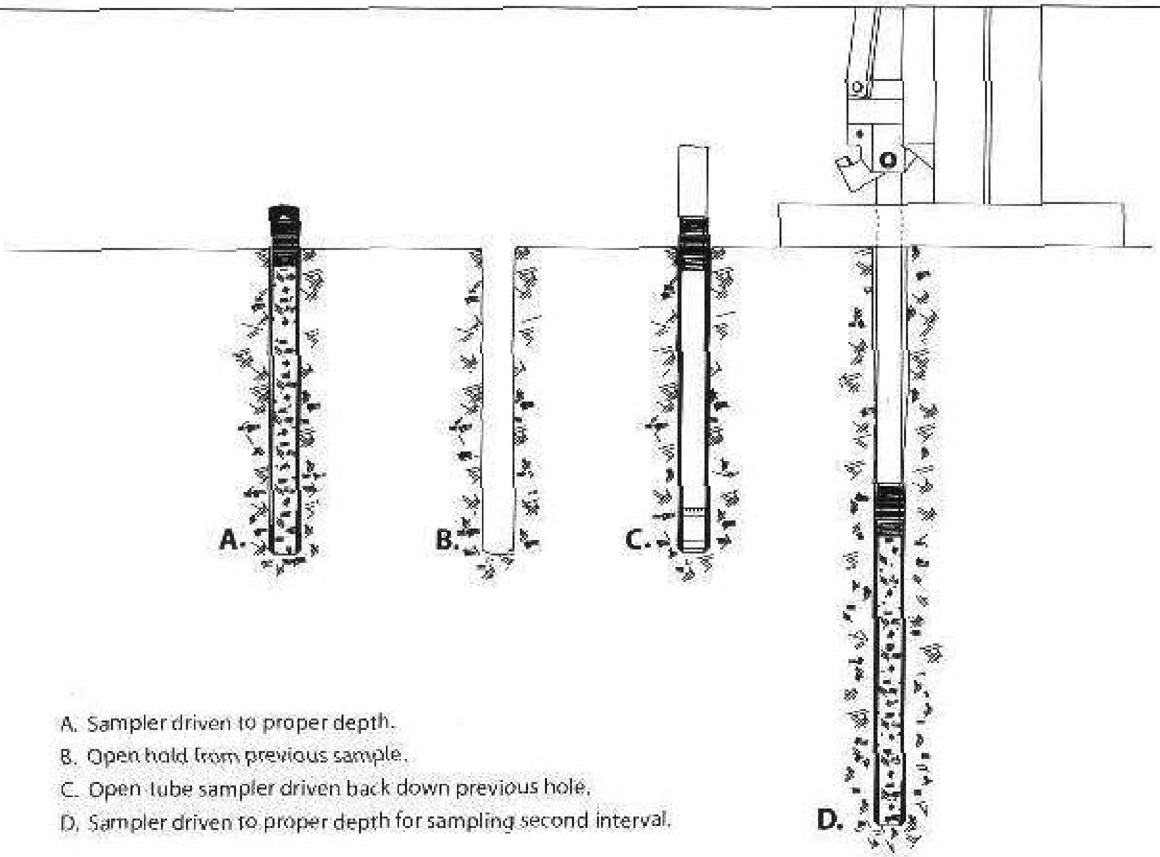


Figure 4.26. The pull cap is one way to remove the sampler from the ground.



A. Sampler driven to proper depth.
B. Open hold from previous sample.
C. Open-tube sampler driven back down previous hole.
D. Sampler driven to proper depth for sampling second interval.

Figure 4.27
Phases of MC5 Open-Tube Soil Sampling

4.8 Closed-Point Sampling with the MC5 Center Rod System

Material collapsing from the probe hole sidewall can make it difficult to collect representative soil cores from significant depths with an open-tube sampler. To overcome this problem, the MC5 Sampler can be equipped with a center rod assembly that will hold the piston point in place. This allows the sealed sampler to pass through the slough material and then it can be opened at the appropriate sampling interval.

Instructions for operating the MC5 Closed-Point Sampler are given in this section.

1. Place a drive cap onto the center rod and a drive cap onto the drive head of an assembled Closed-Point Sampler (Refer to Section 4.4 for sampler assembly).

2. Raise the probe unit hammer assembly to its highest position by fully extending the probe cylinder.

3. Position the MC5 Sampler directly under the hammer with the cutting shoe centered between the toes of the probe foot. The sampler should now be parallel to the probe derrick. Step back from the unit and visually check sampler alignment (Fig. 4.25).

4. Apply static weight and hammer percussion to advance the sampler until the drive head reaches the ground surface (Fig. 4.28A).

5. Add additional probe rods and 1.25-inch light-weight center rods to the tool string until the desired sampling interval is reached (Fig. 4.28B).

6. Once the sampling interval is reached, remove the center rod string (Fig. 4.28C).

7. Add an additional probe rod to the string and place a drive cap on the probe rod (Fig. 4.28D).

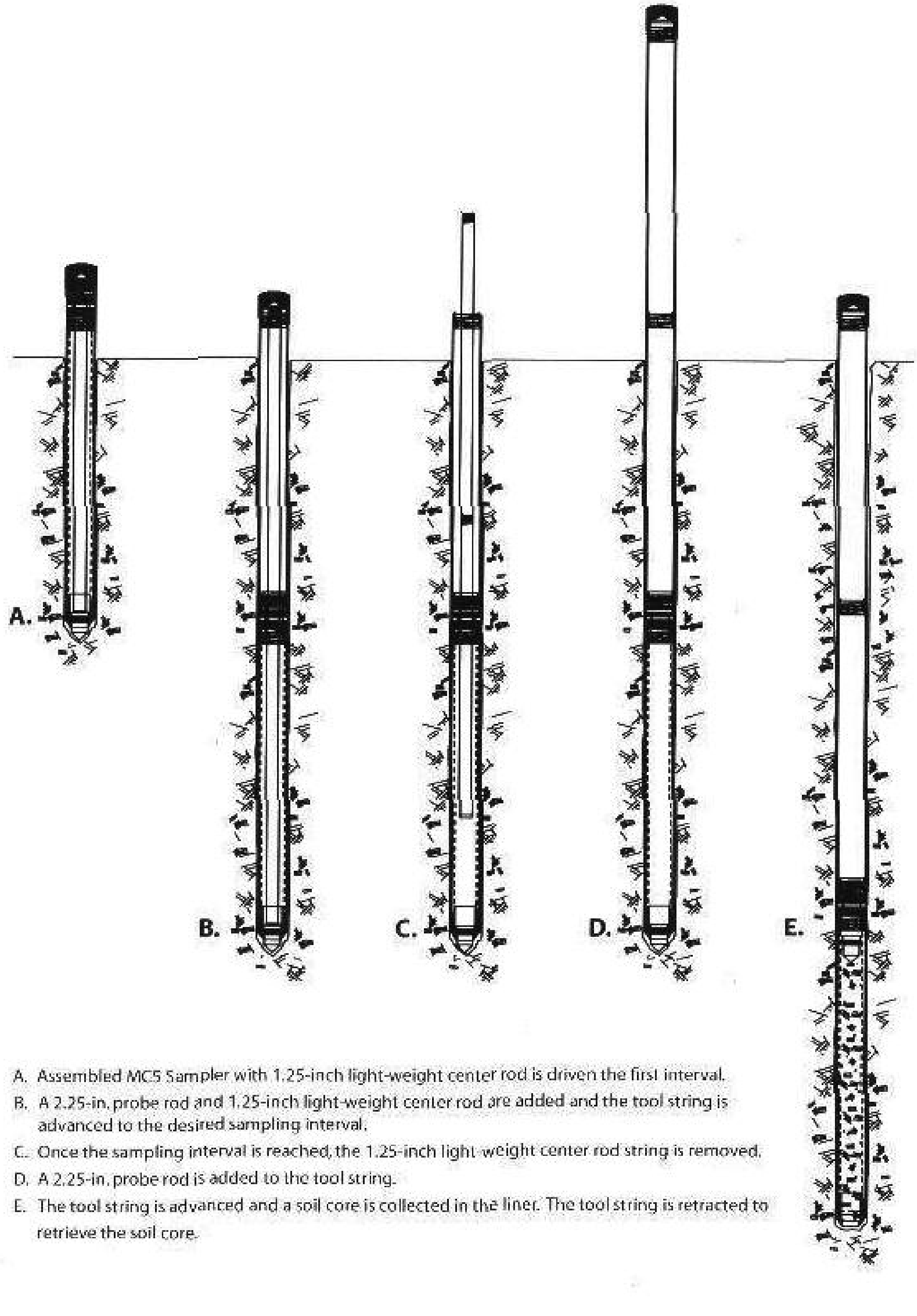
8. Advance the tool string to collect the soil core in the liner (Fig. 4.28E).

   NOTE: Activate hammer percussion whenever collecting soil. Percussion helps shear the soil at the leading end of the sampler so that it moves into the sample tube for increased recovery.

9. Lower the hammer assembly and hook the hammer latch over the pull cap. Raise the hammer assembly to pull the first probe rod out of the ground. Remove the rod and place the pull cap on the next rod of the tool string. Continue pulling probe rods until the MC5 Sampler is brought to the ground surface. If a winch is available, it can be used with a pull plate to retract the tool string. An RG Handle is another option to retract the tool string.

   NOTE: Use caution when advancing or retrieving the sampler within an open hole. Low side friction may allow the sampler and probe rods to drop down the hole when released. To prevent equipment loss, hold onto the tool string with a pipe wrench when needed.

10. Proceed to Section 4.9 for instructions on recovering the soil core from the MC5 Sampler.



A. Assembled MC5 Sampler with 1.25-inch light-weight center rod is driven the first interval.
B. A 2.25-in. probe rod and 1.25-inch light-weight center rod are added and the tool string is advanced to the desired sampling interval.
C. Once the sampling interval is reached, the 1.25-inch light-weight center rod string is removed.
D. A 2.25-in. probe rod is added to the tool string.
E. The tool string is advanced and a soil core is collected in the liner. The tool string is retracted to retrieve the soil core.

Figure 4.28
Phases of MC5 Closed-Point Center Rod System

4.9 Soil Core Recovery

The soil sample is easily removed from the MC5 Sampler by unthreading the cutting shoe and pulling out the liner (Fig. 4.29). A few sharp taps on the cutting shoe with a pipe wrench will often loosen the threads sufficiently to allow removal by hand. If needed, the exterior of the cutting shoe features wrench flats for attaching a wrench to loosen tight threads. With the cutting shoe removed, simply pull the liner and soil core from the sample tube (Fig. 4.31). A Hydraulic Liner Extruder is also available for mounting on your machine to remove liners (Fig. 4.30).

If the closed-point sampler is used, the piston point is now retrieved from the end of the liner (Fig. 4.32). Secure the soil sampler by placing a vinyl end cap on each end of the liner.

Undisturbed soil samples can be obtained from liners by splitting the liner. The MC Liner (AT8010) is used to make longitudinal cuts along the liner (Fig. 4.33).

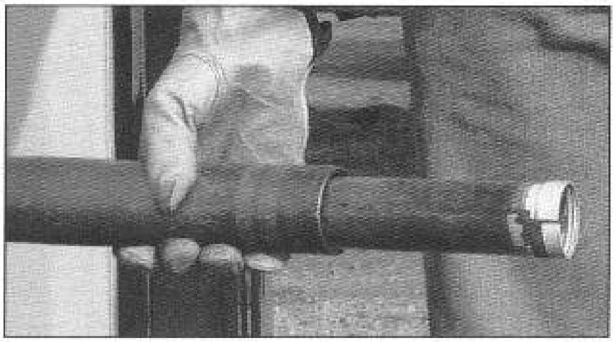


Figure 4.29. Remove the MC5 Cutting Shoe and liner from the MC5 Sampler Tube.

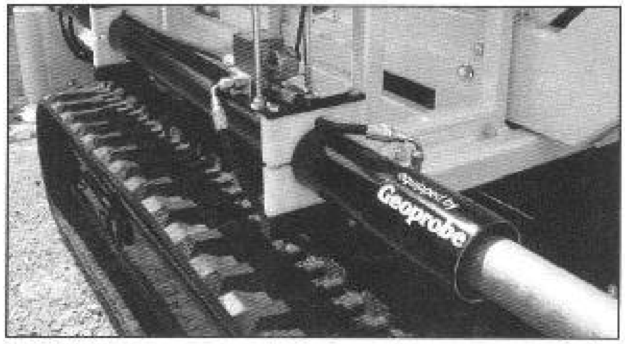


Figure 4.30. The Hydraulic Liner Extruder helps remove the liner.

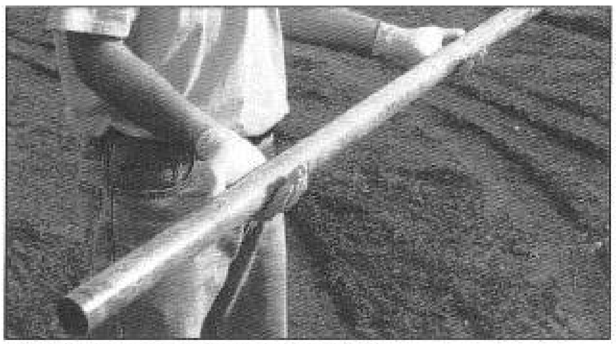


Figure 4.31. MC5 Liner filled with soil core.

Figure 4.32. MC5 Closed Piston Point is retrieved from the top of the liner.

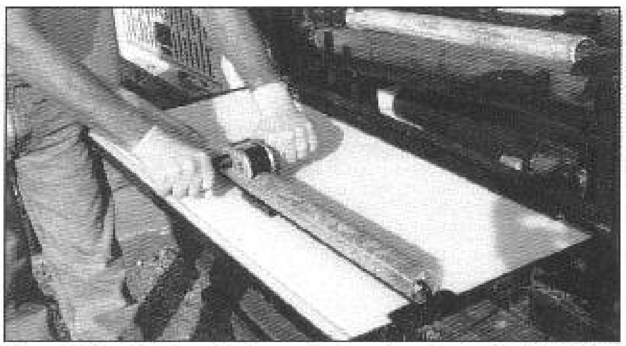


Figure 4.33. MC Liner Cutter makes two longitudinal cuts in PVC Liners.

4.10 Tips to Maximize Sampling Productivity

The following suggestions are based on the collective experiences of Geoprobe® operators:

1. Organize your truck or van. Assign storage areas to all tools and equipment for easy location. Transport sample tubes, probe rods, 1.25-inch light-weight center rods, and liners in racks. Above all, minimize the number of items lying loose in the back of your vehicle.

2. Take three or four samplers to the field. This allows the collection of several samples before stopping to clean and decontaminate the equipment. A system is sometimes used where one individual operates the probe while another marks the soil cores and decontaminates the used samplers.

3. A machine vise is recommended. With the sampler held in a vise, the operator has both hands free to remove the cutting shoe, drive head, and sample liner. Cleanup is also easier with both hands free. Geoprobe® offers an optional machine vise (FA300).

4. Organize your worksite. Practice with the sampler to identify a comfortable setup and then use the layout whenever sampling. A collapsible table or stand is handy to hold decontaminated sampler tubes and liners. Equipment may also be protected from contamination by placing it on a sheet of plastic on the ground.

   Instead of counting probe rods for each trip in-and-out of the probe hole, identify separate locations for "new" rods and "used" rods. Collect the first sample from the open hole using "new" rods. As each probe rod is removed during sampler retrieval, place it in the "used" rod location. Now advance a clean sampler back down the same hole using all of the rods from the "used" location. Add one "new" rod to the string and then drive the tools to collect the next soil core. Once again, remove each probe rod and place it in the "used" rod location as the sampler is retrieved. Repeat this cycle using all the "used" rods to reach the bottom of the probe hole, and one "new" rod to fill the sampler.

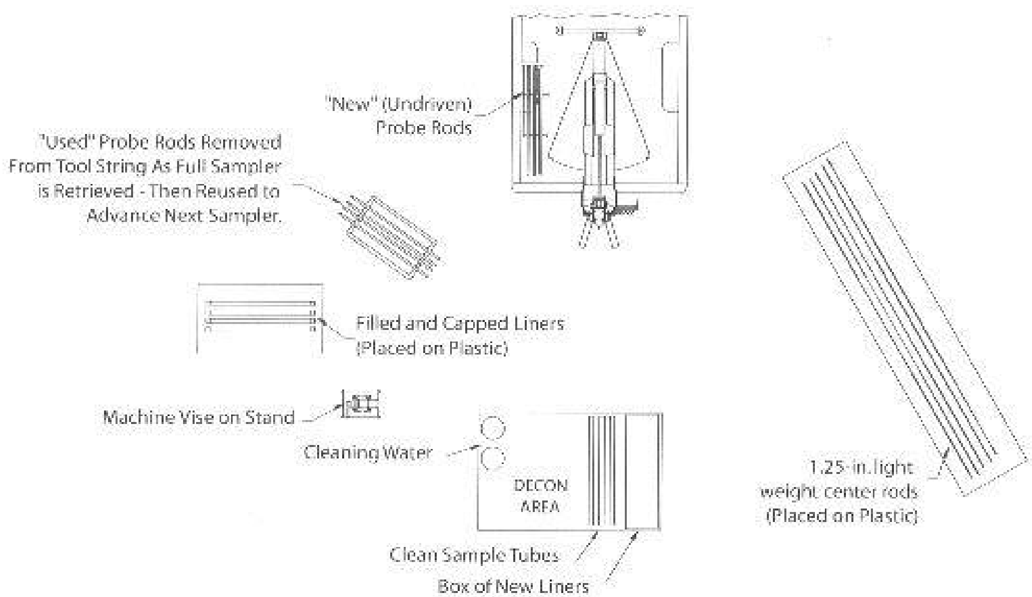


Figure 4.36
Equipment Layout Example to Maximize Sampling Productivity

5. Cleanup is very important from the standpoint of operation as well as decontamination. Remove all dirt and grit from the threads of the drive head, cutting shoe, and sample tube with a nylon brush (BU700). Without sufficient cleaning, the cutting shoe and drive head will not thread completely onto the sample tube and probe rods. The threads may be damaged if the sampler is driven in this condition.

   Ensure that all soil is removed from inside the sample tube. Sand particles are especially troublesome as they can bind liners in the sampler. Full liners are difficult to remove under such conditions. In extreme cases, the soil sample must be removed from the liner before it can be freed from the sample tube.

5.0 REFERENCES

Geoprobe Systems®, 2003. *Tools Catalog, V.6.*

APPENDIX A
ALTERNATIVE PARTS

Geoprobe® Tools and Equipment	Part Number
Drive Cap, GH40 Series, Threaded, 2.25 in	25362
Drive Cap, GH60 Series, Threaded, 2.25 in	25363
Drive Cap, GH60 Series, Threaded, 2.125 in	15673
Nylon Brush, Macro Core® Tool	BU700
Nylon Brush, 2.25-in. and 2.125-in. probe rods	BU2125
Extension Rod Handle	AT69
Extension Rod (60-in.)	10073
Extension Rod (48-in.)	AT671
Extension Rod (36-in.)	AT67

ATTACHMENT C
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN
Off-Site Plume - Former Darby Drugs
80-100 Banks Avenue, Rockville Centre, NY

Site # C130140
Operable Unit 2

Prepared on behalf of:

DARBY GROUP COMPANIES
865 Merrick Avenue
Westbury, NY 11590

Prepared by:

ENVIRONMENTAL BUSINESS CONSULTANTS
1808 Middle Country Road
Ridge, NY 11961

TABLE OF CONTENTS

QUALITY ASSURANCE PROJECT PLAN
OU2 - Off-Site Plume - Former Darby Drugs, Rockville Centre, NY

TABLES

1.0 INTRODUCTION

To ensure the successful completion of the project. each individual responsible for a given component of the project must be aware of the quality assurance objectives of his / her particular work and of the overall project. The EBC Project Manager, Charles Sosik will be directly responsible to the client for the overall project conduct and quality assurance/quality control (QAIQC) for the project. The project manager will be responsible for overseeing all technical and administrative aspects of the project and for directing QA/QC activities.

Reporting directly to the project manager will be the Field Operations Officer, Kevin Brussee; who will also serve as the laboratory coordinator and Health & Safety Officer (HSO). The HSO will be responsible for overseeing all health and safety aspects of the project.

1.1 Organization

Project QA will be maintained under the direction of the Project Manager, in accordance with this QAPP. QC for specific tasks will be the responsibility of the individuals and organizations listed below, under the direction and coordination of the Project Manager
.

GENERAL RESPONSIBILITY	SCOPE OF WORK	RESPONSIBILITY OF QUALITY CONTROL
Field Operations	Supervision of Field Crew, groundwater sampling, river sampling	Kevin Brussee
Laboratory Analysis	Analysis of groundwater samples by NYSDEC ASP methods Laboratory	NYSDOH-Certified Laboratory
Data review	Review for completeness and compliance	3rd party validation

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2.0 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

2.1 Overview

Overall project goals are defined through the development of Data Quality Objectives (DQOs), which are qualitative and quantitative Statements that specify the quality of the data required to support decisions; DQOs, as described in this section, are based on the end uses of the data as described in the work plan.

In this plan, Quality Assurance and Quality Control are defined as follows:

- Quality Assurance - The overall integrated program for assuring reliability of monitoring and measurement data.
- Quality Control - The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.

2.2 QA / QC Requirements For Analytical Laboratory

Samples will be analyzed by a New York State Department of Health (NYSDOH) certified laboratory. Data generated from the laboratory will be used primarily to evaluate off-site contaminant levels of PCE and known break-down products. The QA requirements for all subcontracted analytical laboratory work performed on this project are described below. QA elements to be evaluated include accuracy, precision, sensitivity, representativeness, and completeness. The data generated by the analytical laboratory for this project are required to be sensitive enough to achieve detection levels low enough to meet required quantification limits as specified in NYSDEC Analytical Services Protocol (NYSDEC ASP, 06/2000. The analytical results meeting the required quantification limits will provide data sensitive enough to meet the data quality objectives of this remedial program as described in the work plan. Reporting of the data must be clear, concise, and comprehensive. The QC elements that are important to this project are completeness of field data, sample custody, sample holding times, sample preservation, sample storage, instrument calibration and blank contamination.

2.2.1 Instrument Calibration

Calibration curves will be developed for each of the compounds to be analyzed. Standard concentrations and a blank will be used to produce the initial curves. The development of calibration curves and initial calibration response factors must be consistent with method requirements presented in the most recent version of NYSDEC ASP (06/2000).

2.2.2 Continuing Instrument Calibration

The initial calibration curve will be verified every 12 hrs by analyzing one calibration standard. The standard concentration will be the midpoint concentration of the initial calibration curve. The calibration check compound must come within 25% relative percent difference (RPD) of the average response factor obtained during initial calibration. If the RPD is greater than 25%, then corrective action must be taken as provided in the specific methodology.

2.2.3 Method Blanks

Method blank or preparation blank is prepared from an analyte·free matrix which includes the same reagents, internal standards and surrogate standards as me related samples. II is carried through the entire sample preparation and analytical procedure. A method blank analysis will be performed once for each 12 hr period during the analysis of samples for volatiles. An acceptable method blank will contain less than five (5) times the CRQL of methylene chloride, acetone and 2-butanone. For all other target compounds, the method blank must contain less than or equal to the CRQL of any single target compound. For non-target peaks in the method blank, the peak area must be less than 10 percent of the nearest internal standard. The method blank will be used to demonstrate the level of laboratory background and reagent contamination that might result from the analytical process itself.

2.2.4 Trip Blanks.

Trip blanks consist of a single set of sample containers filled at the laboratory with deionized. laboratory-grade water. The water used will be from the same source as that used for the laboratory method blank. The containers will be carried into the field and handled and transported in the same way as the samples collected that day. Analysis of the trip blank for VOCs is used to identify contamination from the air, shipping containers, or from other items coming in contact with the sample bottles. (The bottles holding the trip blanks will be not opened during this procedure.) A complete set of trip blanks will be provided with each shipment of samples to the certified laboratory.

2.2.5 Surrogate Spike Analysis

For organic analyses, all samples and blanks will be spiked with surrogate compounds before purging or extraction in order to monitor preparation and analyses of samples. Surrogate spike recoveries shall fall within the advisory limits in accordance with the NY5DEC ASP protocols for samples falling within the quantification limits without dilution.

2.2.6 Matrix Spike / Matrix Spike Duplicate / Matrix Spike Blank (MS/MSDIMSB) Analysis

MS, MSD and MSB analyses will be performed to evaluate the matrix effect of the sample upon the analytical methodology along with the precision of the instrument by measuring recoveries. The MS / MSD / MSB samples will be analyzed for each group of samples of a similar matrix at a rate of one for every 20 field samples. The RPD will be calculated from the difference between the MS and MSD. Matrix spike blank analysis will be performed to indicate the appropriateness of the spiking solution(s) used for the MS/MSD.

2.3 Accuracy

Accuracy is defined as the nearness of a real or the mean (x) of a set of results to the true value. Accuracy is assessed by means of reference samples and percent recoveries. Accuracy includes both precision and recovery and is expressed as percent recovery (% REC). The MS sample is used to determine the percent recovery. The matrix spike percent recovery (% REC) is calculated by the following equation:

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

Where:
SSR = spike sample resuhs
SR = sample results
SA = spike added from spiking mix

2.4 Precision

Precision is defined as the measurement of agreement of a set of replicate results among themselves without a Precision is defined as the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analyses.

Analytical precision is expressed in terms of RPD. The RPD is calculated using the following formula:

$$RPD = \frac{D^1 - D^2}{(D^1 - D^2)/2} \times 100$$

Where:
RPD = relative percent difference
D^1 = first sample value
D^2 = second sample value (duplicate)

2.5 Sensitivity

The sensitivity objectives for this plan require that data generated by the analytical laboratory achieve quantification levels low enough to meet the required detection limits specified by NYSDEC ASP and to meet all site-specific standards, criteria and guidance values (SGCs) established for this project.

2.6 Representativeness

Representativeness is a measure of the relationship of an individual sample taken from a particular site to the remainder of that site and the relationship of a small aliquot of the sample (i.e., the one used in the actual analysis) to the sample remaining on site. The representativeness of samples is assured by adherence to sampling procedures described in the Investigative Work Plan.

2.7 Completeness

Completeness is a measure of the quantity of data obtained from a measurement system as compared to the amount of data expected from the measurement system. Completeness is defined as the percentage of all results that are not affected by failing QC qualifiers, and should be between 70 and 100% of all analyses performed. The objective of completeness in laboratory reporting is to provide a thorough data support package. The laboratory data package provides documentation of sample analysis and results in the form of summaries, QC data, and raw analytical data. The laboratory will be required to submit data packages that follow NYSDEC ASP reporting format which, at a minimum, will include the following components:

1. All sample chain-of-custody forms.
2. The case narrative(s) presenting a discussion of any problems and/or procedural changes required during analyses. Also presented in the case narrative are sample summary forms.
3. Documentation demonstrating the laboratory's ability to attain the contract specified detection limits for all target analytes in all required matrices.
4. Tabulated target compound results and tentatively identified compounds.
5. Surrogate spike analysis results (organics).
6. Matrix spike/matrix spike duplicate/matrix spike blank results.
7. QC check sample and standard recovery results
8. Blank results (field, trip, and method).
9. Internal standard area and RT summary.

2.8 Laboratory Custody Procedures

The following elements are important for maintaining the field custody of samples:

- Sample identification
- Sample labels
- Custody records
- Shipping records
- Packaging procedures

Sample labels will be attached to all sampling bottles before field activities begin; each label will contain an identifying number. Each number will have a suffix that identifies the site and where the sample was taken. Approximate sampling locations will be marked on a map with a description of the sample location. The number, type of sample, and sample identification will be entered into the field logbook. A chain-of-custody form, initiated at the analytical laboratory will accompany the sample bottles from the laboratory into the field. Upon receipt of the bottles and cooler, the sampler will sign and date the first received blank space. After each sample is collected and appropriately identified, entries will be made on the chain-of-custody form that will include:

- Site name and address
- Samplers' names and signatures

3.0 ANALYTICAL PROCEDURES

3.1 Laboratory Analysis

Samples will be analyzed by the NYSOEC ASP laboratory for VOCs by NYSDEC ASP Method 82608. If any modifications or additions to the standard procedures are anticipated. and if any nonstandard sample preparation or analytical protocol is to be used, the modifications and the nonstandard protocol will be explicitly defined and documented. Prior approval by EBC's PM will be necessary for any nonstandard analytical or sample preparation protocol used by the laboratory, i.e., dilution of samples or extracts by greater than a factor of five (5).

Additional analyses that may be performed specifically to assess the feasibility of utilizing chemical oxidants as a possible method to remediate PCE in groundwater include natural oxidant demand of both soil and groundwater samples.

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4.0 DATA REDUCTION, REVIEW, AND REPORTING

4.1 Overview

The process of data reduction, review, and reporting ensures the assessments or a conclusion based on the final data accurately reflects actual site conditions. This plan presents the specific procedures, methods, and format that will be employed for data reduction, review and reporting of each measurement parameter determined in the laboratory and field. Also described in this section is the process by which all data, reports, and work plans are proofed and checked for technical and numerical errors prior to final submission.

4.2 Data Reduction

Standard methods and references will be used as guidelines for data handling, reduction, validation, and reporting. All data for the project will be compiled and summarized with an independent verification at each step in the process to prevent transcription/typographical errors. Any computerized entry of data will also undergo verification review.

All data generated by the off-site laboratory will be reported in a specified format containing all required elements to perform data validation. Analytical results shall be presented on standard NYSDEC ASP-B forms or equivalents, and include the dates the samples were received and analyzed, and the actual methodology used. Laboratory QA/QC information required by the method protocols will be compiled, including the application of data QA/QC qualifiers as appropriate. In addition, laboratory worksheets, laboratory notebooks, chains-of-custody, instrument logs, standards records, calibration records, and maintenance records, as applicable, will be provided in the laboratory data packages to determine the validity of data. Specifics on internal laboratory data reduction protocols are identified in the laboratory's SOPs.

Following receipt of the laboratory analytical results by EBC, the data results will be compiled and presented in an appropriate tabular form. Where appropriate, the impacts of QA/QC qualifiers resulting from laboratory or external validation reviews will be assessed in terms of data usability.

4.3 Laboratory Data Reporting

All sample data packages submitted by the analytical laboratory will be required to be reported in conformance to the NYSDEC ASP (6/2000), Category B data deliverable requirements as applicable to the method utilized.

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5.0 CORRECTIVE ACTION

Review and implementation of systems and procedures may result in recommendations for corrective action. Any deviations from the specified procedures within approved project plans due to unexpected site-specific conditions shall warrant corrective action. All errors, deficiencies, or other problems shall be brought to the immediate attention of the EBC PM, who in turn shall contact the Quality Assurance/Data Quality Manager or his designee (if applicable).

Procedures have been established to ensure that conditions adverse to data quality are promptly investigated, evaluated and corrected. These procedures for review and implementation of a change are as follows:

- Define the problem.
- Investigate the cause of the problem.
- Develop a corrective action to eliminate the problem, in consultation with the personnel who defined the problem and who will implement the change.
- Complete the required form describing the change and its rationale (see below for form requirements).
- Obtain all required written approvals.
- Implement the corrective action.
- Verify that the change has eliminated the problem.

During the field investigation, all changes to the sampling program will be documented in field logs/sheets and the EBC PM advised.

If any problems occur with the laboratory or analyses, the laboratory must immediately notify the PM, who will consult with other project staff. All approved corrective actions shall be controlled and documented.

All corrective action documentation shall include an explanation of the problem and a proposed solution which will be maintained in the project file or associated logs. Each report must be approved by the necessary personnel (e.g., the PM) before implementation of the change occurs. The PM shall be responsible for controlling, tracking, implementing and distributing identified changes.

TABLE 1
SUMMARY OF
SAMPLING PROGRAM RATIONALE AND ANALYSIS

Matrix	Location	Approximate Number of Samples	Rationale for Sampling	Laboratory Analysis
Subsurface soil (2 to 15 feet bgs)	3 soil borings across site representative of off-site saturated media.	3	Provide natural oxidant demand of soils through which plume is migrating for evaluation of chem-ox remedial alternative.	Natural oxidant demand
Total (Soils)		3		
Shallow Groundwater	2 sampling levels from 4 to 6 temporary sampling points installed in 3 to 5 transects perpendicular to groundwater flow.	24 to 30	Define nature and extent of off-site CVOC plume	VOCs EPA Method 8260B
Shallow Groundwater	2 sampling levels from 3 temporary sampling points installed along the western edge of the Smith Pond.	6	Define western extent of impacted groundwater reported near drywells located west of the former Darby building and plume migration toward Mill River culvert.	VOCs EPA Method 8260B
Shallow Groundwater	4 sampling points installed beneath the bottom of Mill River.	4	Determine CVOC concentration discharging to Mill River.	VOCs EPA Method 8260B
Shallow Groundwater	3 samples representative of off-site conditions along the flow path of the plume.	3	Determine naural oxidant demand of groundwater for evaluation of chem-ox remedial alternative.	Natural oxidant demand
Deep Groundwater	3 sampling levels in the transport zone beneath the clay layer from 5 temporary sampling points installed as part of the first transect.	15	Define nature and extent of off-site CVOC plume beneath clay layer	VOCs EPA Method 8260B
Total (Groundwater)		52 to 58		
Surface Water	Mill River - I sample 300 feet upstream, downstream and at the point of plume discharge. Samples collected at midpoint in the water column.	3	Determine CVOC concentration in Mill River as a result of plume discharge.	VOCs EPA Method 8260B
Total (Surface Water)		3		
MS/MSD	Matrix spike and Matrix spike duplicates at the rate of one per 20 samples	3	To meet requirements of QA / QC program	VOCs EPA Method 8260B
Trip Blanks	One laboratory prepared trip blank to accompany samples each time they are delivered to the laboratory.	5 to 7	To meet requirements of QA / QC program	VOCs EPA Method 8260B
Total (QA / QC Samples)		8 to 10		

TABLE 2
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	No. of Samples	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDL	Holding Time
Groundwater (Geoprobe)	Water	Geoprobe sampler	52-58	VOCs	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/L)	10 days
Surface Waterr (Direct fill)	Water	Direct fill	3	VOCs	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/L)	10 days
Trip Blank	Water	Direct Fill of Sample Bottles	5-7	TCL Volatile Organic Compounds	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/l)	10 days

Notes:
All holding times listed are from Verified Time of Sample Receipt (VTSR) unless noted otherwise. * Holding time listed is from time of sample collection.
The number in parentheses in the "Sample Container" column denotes the number of containers needed. All bottles will comply with OSWER Directive 9240.0-05A: "Specifications and Guidance for Obtaining Contaminant - Free Sample Containers", EPA 540/R-93/051, December 1992.
Triple volume required when collected MS/MSD samples
The number of trip blanks are estimated.
(1) Targeted volatile organic compounds include trichloroethene, 1,1,1-trichloroethane, and tetrachloroethene.
CRQL / MDL = Contract Required Quantitation Limit / Method Detection Limit.
ASTM = American Society for Testing and Materials.
MCAWW = Methods for Chemical Analysis of Water and Wastes.
SW846 = Test Methods for Evaluating Solid Waste - Physical/Chemical Methods.
NA = Not available or not applicable.

ATTACHMENT D
Health and Safety Plan

HEALTH AND SAFETY PLAN
Off-Site Plume - Former Darby Drugs
80-100 Banks Avenue, Rockville Centre, NY

Site # C130140
Operable Unit 2

Prepared on behalf of:

DARBY GROUP COMPANIES
865 Merrick Avenue
Westbury, NY 11590

Prepared by:

ENVIRONMENTAL BUSINESS CONSULTANTS
1808 Middle Country Road
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Table of Contents

HEALTH AND SAFETY PLAN

Former Darby Drugs Distribution Center – 80-100 Banks Avenue, Rockville Centre, NY

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Table of Contents (Continued)

FIGURES

APPENDICES

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STATEMENT OF COMMITMENT

This Health and Safety Plan (HASP) has been prepared to ensure that workers are not exposed to risks from hazardous materials during the planned Remedial Investigation of the off-site plume related to the former Darby Drugs Distribution Center at 80-100 Banks Avenue, Rockville Centre, New York.

This HASP, which applies to persons present in the investigation area actually or potentially exposed to hazardous materials, describes emergency response procedures for actual and potential chemical hazards. This HASP is also intended to inform and guide personnel entering the work area or exclusion zone. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy by signing off on receipt of their individual copy of the document. Contractors and suppliers are retained as independent contractors and are responsible for ensuring the health and safety of their own employees.

1.0 INTRODUCTION AND SITE ENTRY REQUIREMENTS

This document describes the health and safety guidelines developed by Environmental Business Consultants (EBC) for the Operable Unit 2 Remedial Investigation for the off-site plume related to the former Darby Drugs distribution center in Rockville Centre, NY, to protect personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes during subsurface investigation activities. In accordance with the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response Final rule, this HASP, including the attachments, addresses safety and health hazards related to subsurface sample collection activities and is based on the best information available. The HASP may be revised by EBC at the request of Darby Group, Companies (the Owner) and/or the New York State Department of Environmental Conservation upon receipt of new information regarding site conditions. Changes will be documented by written amendments signed by EBC's project manager, site safety officer and/or the EBC health and safety consultant.

1.1 Training Requirements

Personnel entering the exclusion zone or decontamination zone are required to be certified in health and safety practices for hazardous waste site operations as specified in the Federal OSHA Regulations CFR 1910.120e (revised 3/6/90).

Paragraph (e - 3) of the above referenced regulations requires that all on-site management personnel directly responsible for or who supervise employees engaged in hazardous waste operations, must initially receive 8 hours of supervisor training related to managing hazardous waste work.

Paragraph (e - 8) of the above referenced regulations requires that workers and supervisors receive 8 hours of refresher training annually on the items specified in Paragraph (e-1) and/or (e-3).

Additionally all on-site personnel must receive adequate site-specific training in the form of an on-site Health and Safety briefing prior to participating in field work with emphasis on the following:

- Protection of the adjacent community from hazardous vapors and / or dust which may be released during intrusive activities.
- Identification of chemicals known or suspected to be present on-site and the health effects and hazards of those substances.
- The need for vigilance in personnel protection, and the importance of attention to proper use, fit and care of personnel protective equipment.
- Decontamination procedures.
- Site control including work zones, access and security.
- Hazards and protection against heat or cold.
- The proper observance of daily health and safety practices, such as entry and exit of work zones and site. Proper hygiene during lunch, break, etc.

- Emergency procedures to be followed in case of fire, explosion and sudden release of hazardous gases.

Health and Safety meetings will be conducted on a daily basis and will cover protective clothing and other equipment to be used that day, potential and chemical and physical hazards, emergency procedures, and conditions and activities from the previous day.

1.2 Medical Monitoring Requirements

Field personnel and visitors entering the exclusion zone or decontamination zone must have completed appropriate medical monitoring required under OSHA 29 CFR 1910.120(f). Medical monitoring enables a physician to monitor each employee's health, physical condition, and his fitness to wear respiratory protective equipment and carry out on-site tasks.

1.3 Site Safety Plan Acceptance, Acknowledgment and Amendments

The project superintendent and the site safety officer are responsible for informing personnel (EBC employees and/or owner or owners representatives) entering the work area of the contents of this plan and ensuring that each person signs the safety plan acknowledging the on-site hazards and procedures required to minimize exposure to adverse effects of these hazards. A copy of the Acknowledgement Form is included in **Appendix A**.

Site conditions may warrant an amendment to the HASP. Amendments to the HASP are acknowledged by completing forms included in **Appendix B**.

1.4 Key Personnel - Roles and Responsibilities

Personnel responsible for implementing this Construction Health and Safety Plan are:

Name	Title	Address	Contact Numbers
Mr. Kevin Brussee	EBC Project Manager	1808 Middle Country Road Ridge, NY 11961	(631) 504-6000 (631) 338-1749
Mr. Charles B. Sosik	EBC PM Alternate	1808 Middle Country Road Ridge, NY 11961	(631) 504-6000 (631) 357-4927
Mr. Damian Lawyer	EBC Site Safety Officer	1808 Middle Country Road Ridge, NY 11961	(631) 504-6000

The project manager is responsible for overall project administration and, with guidance from the site safety officer, for supervising the implementation of this HASP. The site safety officer will conduct daily (tail gate or tool box) safety meetings at the project site and oversee daily safety issues. Each subcontractor and supplier (defined as an OSHA employer) is also responsible for the health and safety of its employees. If there is any dispute about health and safety or project activities, on-site personnel will attempt to resolve the issue.

If the issue cannot be resolved at the site, then the project manager will be consulted.

The site safety officer is also responsible for coordinating health and safety activities related to hazardous material exposure on-site. The site safety officer is responsible for the following:

1. Educating personnel about information in this HASP and other safety requirements to be observed during site operations, including, but not limited to, decontamination procedures, designation of work zones and levels of protection, air monitoring, fit testing, and emergency procedures dealing with fire and first aid.

2. Coordinating site safety decisions with the project manager.

3. Designating exclusion, decontamination and support zones on a daily basis.

4. Monitoring the condition and status of known on-site hazards and maintaining and implementing the air quality monitoring program specified in this HASP.

5. Maintaining the work zone entry/exit log and site entry/exit log.

6. Maintaining records of safety problems, corrective measures and documentation of chemical exposures or physical injuries (the site safety officer will document these conditions in a bound notebook and maintain a copy of the notebook on-site).

The person who observes safety concerns and potential hazards that have not been addressed in the daily safety meetings should immediately report their observations/concerns to the site safety officer or appropriate key personnel.

2.0 SITE BACKGROUND AND SCOPE OF WORK

The subject property is located at 80-100 Banks Avenue, Village of Rockville Centre, Town of Hempstead, Nassau County, New York. The site is situated at the northwest intersection of Nassau Street and Banks Avenue. The property comprises a total area of 7.1 acres, and is identified as Lots 27 and 30, Block 539, Section 38 on the Nassau County Tax Maps.

The site is currently improved with a one-story, 150,000 square foot warehouse building and a two-story 24,000 square foot office building. The property is currently owned by Darby, who ceased operation at the site in November 2000. Darby has occupied the building since 1978 and operated it as a pharmaceutical product warehouse and distribution center. The building is largely vacant and is currently utilized as temporary storage for miscellaneous supplies and equipment by Darby. Chase Partners is contract vendee in an agreement to purchase the property from Darby. Chase is planning the demolition of the existing structures and the phased development of two residential buildings consisting of a 100,492 square foot north complex and a 60,128 square foot south complex.

A historical document search, conducted as part of the BCP application process, and a previous Phase I Environmental Site Assessment, performed by a potential purchaser of the property, identified a textile company as a former occupant of the property. The company known as Downen Zeir Knits leased the southern parcel (80 Banks Avenue) of the property between 1972 and 1978. The company used processing water from pumping and injection wells located on the property and operated at least one dry-cleaning machine. Little else was determined about the operations of Downen Zeir Knits.

Darby, which currently owns the property, occupied both parcels 80 Banks Avenue and 100 Banks Avenue from 1978 to 2000 as a pharmaceutical product warehouse and distribution center. The chlorinated solvent, tetrachloroethylene (PCE), was first identified on the property, during a Phase II investigation performed in November 2003 as part of the due diligence by a potential purchaser of the property. The PCE is believed to have been released between 1972 and 1978 during the tenancy of Downen Zeir Knits.

The NYSDEC has designated the off-site component of the investigation and remediation of contamination related to the Former Darby Drugs Distribution Center as Operable Unit 2. The purpose of the Remedial Investigation for Operable Unit 2 is to characterize the nature and extent of the off-site PCE plume, and to collect data necessary to evaluate remedial alternatives under a Feasibility Study.

2.1 Previous Investigations

2.1.1 Phase 1 Environmental Site Assessment, ESI (March - 2002)

A Phase I Environmental Site Assessment (Phase I) was conducted by EcolSciences, Inc. (ESI) in March, 2002 to determine if there were any recognized environmental conditions associated with the subject site.

The document search identified records from the Nassau County Department of Health (NCDH) detailing the proper removal of four heating oil underground storage tanks (USTs). In addition, during the site reconnaissance, ESI identified an electrical panel along the western wall of the southern warehouse area containing circuit breakers with faded labels for "well pumps" and "dry cleaning still unit".There was no record or information of a dry cleaning operation at the site. ESI recommended a test boring program beneath the concrete floor to assess potential impacts from possible former dry cleaning operations at the site, and soil samples in the vicinity of the heating oil tanks to verify the findings of the NCDH. A copy of the ESI Phase I report has been submitted with the BCP application.

2.1.2 Preliminary Soils and Foundation Investigation Report (MTA - August 2003)

Melick-Tully and Associates (MTA) performed a number of borings on the subject property as part of a geotechnical analysis of site conditions to assist in the design of the proposed residential buildings. The investigation initially consisted of six soil borings with a recommendation that monitoring wells be installed for the basement design. A total of six monitoring wells were installed between January and May, 2003.

The MTA borings revealed that the geology beneath the site consists of 1 to 4 feet of sand fill material. Beneath the fill material is an orange-tan sand with gravel to a depth varying from 12 to 16 feet below grade. Beneath the sand and gravel unit is a black silty clay, which was determined to be 9 feet thick. The clay unit is underlain by sand to at least 31 feet below grade, the depth at which the borings were terminated.

MTA reported that the depth to water at the site varies between 5 to 9 feet below grade depending upon surface elevation. The water table was determined to exist within the sand unit situated above the black silty clay unit. Groundwater flow was determined to vary from a westerly to a southerly direction as you move west to east across the site.

2.1.3 Phase I1 Environmental Investigation (ESI - January 2004)

The Phase II investigation was completed by ESI in January, 2004. ESI identified a total of seven areas of concern (AOC) as part of their scope of work. In addition to the former heating oil tanks and the former potential dry cleaning still unit, other AOC's were identified as a result of further field observation and a geophysical survey performed as part of the Phase II investigation. A total of nineteen borings were advanced during the investigation with thirty-one soil samples submitted for analysis. Eleven groundwater samples were analyzed including five from the soil borings and six from the pre-existing monitoring wells installed by MTA. The results of the Phase II Investigation identified significant concentrations of PCE in soil and groundwater beneath the southwest corner of the building. Concentrations exceeding the pure product solubility of PCE were found at some locations just above the clay surface, indicating that DNAPL is present above the clay Soil samples collected in the vicinity of the former fuel oil tanks did not indicate that a release had occurred at either location.

2.1.4 Draft Remedial Investigation Report (PWGC- September, 2004)

A Remedial Investigation (RI) was performed by PWGC during March 15 - March 26, 2004 to: collect data of sufficient quality and quantity to adequately characterize the nature and extent of contamination at the site, evaluate contaminant migration, characterize the potential exposure to human health and the environment and select the most appropriate remedial technology.

Summary of the Nature and Extent of Contamination
The results of the RI confirmed the findings of the previous investigations and support a release scenario of liquid phase PCE beneath the floor near the western wall of the south building. From here, PCE as a DNAPL, migrated along the clay surface to a low point approximately 50 feet east of the release point. There is sufficient evidence to indicate that DNAPL remains in this area of the building. A competent clay layer, approximately 9 feet thick, was documented throughout the site. The presence of the clay limited the vertical migration of PCE in the soil column to a maximum depth of 18 feet below the surface. The clay surface was deepest in borings beneath the building and shallowest in borings at the property boundaries, effectively preventing further migration of mobile DNAPL.

Shallow soil contamination, above the guidance value of 1,400 µg/kg, is limited to an area approximately 40 feet by 60 feet. Contamination at the clay surface is more extensive, covering an area roughly 180 feet by 160 feet.

Significant PCE contamination in soil was also found at the clay surface outside of the building in the north end of the west parking area. This location is in the general vicinity of a suspected leaching structure. The structure, if present, may have received VOC-contaminated process water from the building.

The presence of DNAPL and high PCE concentrations in soil is acting as a continuing source of contamination to the shallow groundwater.

A shallow groundwater plume of chlorinated VOCs, primarily PCE, is emanating from the source area beneath the southwestern portion of the south building. PCE concentrations in the source area were reported at or above the pure product solubility, providing further evidence of DNAPL in this area. The plume is migrating south in the direction of groundwater flow, toward the Long Island Bus Depot. PCE concentrations at the south property line were reported at 28,000 µg/L.

Summary of the Exposure Assessment
Based on the historic use of the property, the release probably occurred sometime during the period of 1972 to1978 when the 80 Banks Avenue property was occupied by a textile company. Potential receptors for a dissolved VOC plume leaving the site would include the Rockville Centre Wellfield located on the west side of Mill River in Lister Park, and downgradient commercial and residential properties via vapor intrusion. The wellfield is not expected to be at risk of impact, since the wells are screened within the Magothy Aquifer and the plume appears to be confined to the upper 15 feet of the water column by a local clay layer. Furthermore, water quality data for the wells compiled by the Nassau County Department of Health do not indicate impact from an on-going source of contamination. With respect to vapor impacts, there are few developed properties between 80-100 Banks Avenue and Mill River, where the plume would be expected to discharge. Developed properties include the bus depot and 2 or 3 commercial buildings located along the north side of Sunrise Highway. If the plume fails to discharge to Mill River and continues south, it will encounter a residential area south of S. Village Avenue,

approximately 1,750 feet from the site.

2.4 Scope of Phase II Subsurface Investigation

The purpose of the off-site investigation is to characterize the position, concentration and extent of the off-site portion of the groundwater plume, and to determine the location of the discharge point, if, in fact, it terminates at Mill River.

This will be accomplished by collecting groundwater samples in five transects orientated perpendicular to the direction of groundwater flow. The transects will be separated by a distance of approximately 350 feet as shown in Figure 3. Two of the transects will be located within the New York State Department of Transportation (NYSDOT) right-of-way along Sunrise Highway and Merrick Road and two will be located within the Village of Rockville Centre Park along the eastern shore of Mill River.

Each transect will consist of 4 to 6 sampling points, spaced 30 to 50 feet apart. If the plume extends further south, additional transects may be required. If it terminates closer to the northern end of the river, however, fewer transects will be needed. To make sure that the sampling point intersects the plume vertically, two samples will be collected from each location; one from the water table interface and one from a depth of 15 feet or the clay surface whichever comes first. The samples will be collected from temporary points installed with a truck or track-mounted push-probe sampler (Geoprobe™). The Geoprobe™ uses a hydraulically driven percussion hammer to drive a small diameter stainless steel retractable screen into the ground with minimal disturbance. The procedure for collecting a sample involves driving the sampler to the desired depth and retracting the rods to expose the screen. Samples are collected by inserting disposable polyethylene tubing into the rods and connecting the tubing to a peristaltic pump to lift the water into laboratory supplied containers. The polyethylene tubing will be disposed of between the collection of each new sample.

If the plume is discharging to Mill River it will be necessary to determine the concentration entering the river and its overall impact on the river's water quality. This will be performed by collecting groundwater samples from beneath the river sediments, at four locations along the western shoreline, and from surface water samples collected 300 feet upstream, 300 feet downstream and at the point of discharge.

Groundwater samples from beneath the river will be collected by manually driving probe rods 3 feet into the bottom sediments, collecting a sample through disposable polyethylene tubing and then withdrawing the rods. Water samples from the river will be grab samples taken from a consistent depth representative of the mid-point in the water column.

3.0 SITE HAZARD EVALUATION

This section identifies the hazards associated with the proposed scope of work, general physical hazards that can be expected at most sites; and presents a summary of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate these hazards. Those that cannot be eliminated must be guarded against using engineering controls and/or personal protective equipment.

This HASP has been developed for work performed at the site in association with a Phase II subsurface investigation. The primary hazards to the field crew will be physical hazards related to sample collection procedures and equipment, and chemical exposures to the sampling crew and commercial workers within the building from exposure to potential contaminants which may be present at the site.

3.1 Physical Hazards

3.1.1 Tripping Hazards

An area of risk associated with on-site activities are presented by uneven ground, concrete, curbstones or equipment which may be present at the site thereby creating a potential tripping hazard. During intrusive work, care should be taken to mark or remove any obstacles within the exclusion zone.

3.1.2 Cuts and Lacerations

Field activities that involve drilling and boring equipment may result in cuts or lacerations from machinery and tools used in collecting samples, cutting disposable tubing and opening acetate sleeves and liners. A first aid kit approved by the American Red Cross will be available during all subsurface investigative activities.

3.1.3 Lifting Hazards

Improper lifting by workers is one of the leading causes of industrial injuries. Field workers and drillers may be required to lift heavy objects such as drilling tools, buckets of decontamination water, cement, etc. Therefore, all members of the field crew should be trained in the proper methods of lifting heavy objects. All workers should be cautions against lifting objects too heavy for one person.

3.1.4 Utility Hazards

Before conducting any subsurface boring or sampling, the drilling contractor will be responsible for locating and verifying all existing utilities at each excavation.

3.1.5 Traffic Hazards

All traffic, vehicular and pedestrian, shall be maintained and protected at all times consistent with local, state and federal agency regulations regarding such traffic and in accordance with NYCDOT guidelines. The drilling contractor shall carry on his operations without undue interference or delays to traffic. The drilling contractor shall furnish all labor, materials, guards, barricades, signs, lights, and anything else necessary to maintain traffic and to protect his work and the public, during operations.

3.2 Work in Extreme Temperatures

Work under extremely hot or cold weather conditions requires special protocols to minimize the chance that employees will be affected by heat or cold stress.

3.2.1 Heat Stress

The combination of high ambient temperature, high humidity, physical exertion, and personal protective apparel, which limits the dissipation of body heat and moisture, can cause heat stress.

The following prevention, recognition and treatment strategies will be implemented to protect personnel from heat stress. Personnel will be trained to recognize the symptoms of heat stress and to apply the appropriate treatment.

1. Prevention
    a. Provide plenty of fluids. Available in the support zone will be a 50% solution of fruit punch and water or plain water.
    b. Work in Pairs. Individuals should avoid undertaking any activity alone.
    c. Provide cooling devices. A spray hose and a source of water will be provided to reduce body temperature, cool protective clothing and/or act as a quick-drench shower in case of an exposure incident.
    d. Adjustment of the work schedule. As is practical, the most labor-intensive tasks should be carried out during the coolest part of the day.

2. Recognition and Treatment
    a Heat Rash (or prickly heat):
    Cause: Continuous exposure to hot and humid air, aggravated by chafing clothing.
    Symptoms: Eruption of red pimples around sweat ducts accompanied by intense itching and tingling.
    Treatment: Remove source or irritation and cool skin with water or wet cloths.

    b. Heat Cramps (or heat prostration)
    Cause: Profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.
    Symptoms: Muscular weakness, staggering gait, nausea, dizziness, shallow breathing, pale and clammy skin, approximately normal body temperature.

Treatment: Perform the following while making arrangement for transport to a medical facility. Remove the worker to a contamination reduction zone. Remove protective clothing. Lie worker down on back in a cool place and raise feet 6 to 12 inches. Keep warm, but loosen all clothing. If conscious, provide sips of salt-water solution, using one teaspoon of salt in 12 ounces of water. Transport to a medical facility.

c. Heat Stroke

Cause: Same as heat exhaustion. This is also an extremely serious condition.

Symptoms: Dry and hot skin, dry mouth, dizziness, nausea, headache and rapid pulse.

Treatment: Cool worker immediately by immersing or spraying with cool water or sponge bare skin after removing protective clothing. Transport to hospital.

3.2.2 Cold Exposure

Exposure to cold weather, wet conditions and extreme wind-chill factors may result in excessive loss of body heat (hypothermia) and /or frostbite. To guard against cold exposure and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be readily available, rest periods should be adjusted as needed, and the physical conditions of on-site field personnel should be closely monitored. Personnel and supervisors working on-site will be made aware of the signs and symptoms of frost bite and hypothermia such as shivering, reduced blood pressure, reduced coordination, drowsiness, impaired judgment, fatigue, pupils dilated but reactive to light and numbing of the toes and fingers.

3.3 Chemical Hazards

There is no data available which confirms that any contamination is present at the site. The Phase I assessment did not identify any recognized environmental conditions which would suggest that contaminants may be present except the historical use of the site described as manufacturing. However, “urban fill” materials, present throughout the New York City area typically contain elevated levels of semi-volatile organic compounds and metals. These “contaminants” are not related to a chemical release occurring on the site, but are inherent in the reworked fill material in the area which contains ash and bits of tar and asphalt.

The primary routes of exposure to these contaminants are inhalation, ingestion and absorption.

There is also no information that groundwater, which is present at a depth of approximately 7.5 feet below the surface contains contaminants. However, given the shallow depth to the groundwater and the highly developed nature of the area, contaminants from surface spills, road runoff and leaking sewer and drain pipes may have affected groundwater quality. .

Appendix C includes information sheets for suspected chemicals that may be encountered at the site.

3.3.1 Respirable Dust and Direct Contact with Soil and Groundwater

Dust may be generated from drilling activities. If visible observation detects elevated levels of dust, a program of wetting will be employed by the site safety officer. If elevated dust levels persist, the site safety office will employ dust monitoring using a particulate monitor (Miniram or equivalent). If monitoring detects concentrations greater than 150 μg/m3 over daily background, the site safety officer will take corrective actions as defined herein, including the use of water for dust suppression and if this is not effective, requiring workers to wear APRs with efficiency particulate air (HEPA) cartridges.

Absorption pathways for dust and direct contact with soil and groundwater will be mitigated with the implementation of latex gloves, hand washing and decontamination exercises when necessary.

3.3.2 Organic Vapors

Based on results of the Phase I investigation, VOCs are not expected to be encountered at the site. However, the potential for encountering VOCs in soil from an unknown on-site source or in groundwater from an unknown off-site source exists. Therefore, soil boring activities may cause the release of organic vapors to the atmosphere. The site safety officer will periodically monitor organic vapors with a Photoionization Detector (PID) during drilling activities to determine whether organic vapor concentrations exceed action levels shown below.

PID Response	Action
Sustained readings of 5 ppm or greater	Shut down equipment and allow area to vent. Resume when readings return to background
Sustained readings of 5 ppm or greater that do not subside after venting	Implement Vapor Release Plan (Section 6.8). Re-evaluate respiratory protection as upgrade may be required.

4.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) shall be selected in accordance with the site air monitoring program, OSHA 29 CFR 1910.120(c), (g), and 1910.132. Protective equipment shall be NIOSH approved and respiratory protection shall conform to OSHA 29 CFR Part 1910.133 and 1910.134 specifications; head protection shall conform to 1910.135; eye and face protection shall conform to 1910.133; and foot protection shall conform to 1910.136. The only true difference among the levels of protection from D thru B is the addition of the type of respiratory protection. **It is anticipated that work will be performed in Level D PPE.**

4.1 Level D

Level D PPE shall be donned when the atmosphere contains no known hazards and work functions preclude splashes, immersion, or the potential for inhalation of, or contact with, hazardous concentrations of harmful chemicals. Level D PPE consists of:

- standard work uniform, coveralls, or tyvek, as needed;
- steel toe and steel shank work boots;
- hard hat;
- gloves, as needed;
- safety glasses;
- hearing protection;
- equipment replacements are available as needed.

4.2 Level C

Level C PPE shall be donned when the concentrations of measured total organic vapors in the breathing zone exceed background concentrations (using a portable OVA, or equivalent), but are less than 5 ppm. The specifications on the APR filters used must be appropriate for contaminants identified or expected to be encountered. Level C PPE shall be donned when the identified contaminants have adequate warning properties and criteria for using APR have been met. Level C PPE consists of:

- chemical resistant or coated tyvek coveralls;
- steel-toe and steel-shank workboots;
- chemical resistant overboots or disposable boot covers;
- disposable inner gloves (surgical gloves);
- disposable outer gloves;
- full face APR fitted with organic vapor/dust and mist filters or filters appropriate for the identified or expected contaminants;
- hard hat;
- splash shield, as needed; and,
- ankles/wrists taped with duct tape.

The site safety officer will verify if Level C is appropriate by checking organic vapor concentrations using compound and/or class-specific detector tubes.

- chemical resistant coveralls;
- steel-toe and steel-shank workboots;
- chemical resistant overboots or disposable boot covers;
- disposable inner gloves;
- disposable outer gloves;
- hard hat; and,
- ankles/wrists taped.

The exact PPE ensemble is decided on a site-by-site basis by the Site Safety Officer with the intent to provide the most protective and efficient worker PPE.

4.3 Activity-Specific Levels of Personal Protection

The required level of PPE is activity-specific and is based on air monitoring results (Section 4.0) and properties of identified or expected contaminants. **It is expected that site work will be performed in Level D.** If air monitoring results indicate the necessity to upgrade the level of protection engineering controls (i.e. Facing equipment away from the wind and placing site personnel upwind of excavations, active venting, etc.) will be implemented before requiring the use of respiratory protection.

5.0 SITE CONTROL

5.1 Work Zones

The primary purpose of site controls is to establish the perimeter of a hazardous area, to reduce the migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by unauthorized persons. When operations are to take place involving hazardous materials, the site safety officer will establish an exclusion zone, a decontamination zone, and a support zone. These zones "float" (move around the site) depending on the tasks being performed on any given day. The site safety officer will outline these locations before work begins and when zones change. The site safety officer records this information in the site log book. **It is expected that for soil boring and sampling activities, identification of an exclusion zone, decontamination zone, and support zone will not be necessary.**

Tasks requiring OSHA 40-hour Hazardous Waste Operations and Emergency Response Operations training are carried out in the exclusion zone. The exclusion zone is defined by the site safety officer but will typically be a 50-foot area around work activities. Gross decontamination (as determined by the site Health and Safety Officer) is conducted in the exclusion zone; all other decontamination is performed in the decontamination zone or trailer.

Protective equipment is removed in the decontamination zone. Disposable protective equipment is stored in receptacles staged in the decontamination zone, and non-disposable equipment is decontaminated. All personnel and equipment exit the exclusion zone through the decontamination zone. If a decontamination trailer is provided the first aid equipment, an eye wash unit, and drinking water are kept in the decontamination trailer.

The support zone is used for vehicle parking, daily safety meetings, and supply storage. Eating, drinking, and smoking are permitted only in the support zone. When a decontamination trailer is not provided, the eye wash unit, first aid equipment, and drinking water are kept at a central location designated by the site safety officer.

6.0 CONTINGENCY PLAN/EMERGENCY RESPONSE PLAN

Site personnel must be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather.

Emergency telephone numbers and a map to the hospital will be posted in the command post. Site personnel should be familiar with the emergency procedures, and the locations of site safety, first aid, and communication equipment.

6.1 Emergency Equipment On-site

Private telephones:	Site personnel.
Two-way radios:	Site personnel where necessary.
Emergency Alarms:	On-site vehicle horns*.
First aid kits:	On-site, in vehicles or office.
Fire extinguisher:	On-site, in office or on equipment.

* Horns: Air horns will be supplied to personnel at the discretion of the project superintendent or site safety officer.

6.2 Emergency Telephone Numbers

General Emergencies	911
Nassau County Police	911
South Nassau Communities Hospital	(516) 763-3938
NYSDEC Spills Division	1-800-457-7362
NYSDEC Hazardous Waste Division	1-718-482-4994
Nassau County Department of Health	1-212-788-4711
Rockville Centre Fire Department	911
National Response Center	1-800-424-8802
Poison Control	(800) 962-1253
Site Safety Officer	1-631-504-6000

6.3 Personnel Responsibilities During an Emergency

The project manager is primarily responsible for responding to and correcting any emergency situations. However, in the absence of the project manager, the site safety officer shall act as the project manager's on-site designee and perform the following tasks:

- Take appropriate measures to protect personnel including: withdrawal from the exclusion zone, evacuate and secure the site, or upgrade/downgrade the level of protective clothing and respiratory protection;

- Ensure that appropriate federal, state, and local agencies are informed and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. If toxic materials are released to the air, the local authorities should be informed in order to assess the need for evacuation;

- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;
- Determine the cause of incidents and make recommendations to prevent recurrence; and,
- Ensure that all required reports have been prepared.

The following key personnel are planned for this project:

- Project Manager — Mr. Kevin Brussee (631) 504-6000
- Site Safety Officer — Mr. Damion Lawyer (631) 504-6000

6.4 Medical Emergencies

A person who becomes ill or injured in the exclusion zone will be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination will be completed and first aid administered prior to transport. First aid will be administered while waiting for an ambulance or paramedics. A Field Accident Report (**Appendix D**) must be filled out for any injury.

A person transporting an injured/exposed person to a clinic or hospital for treatment will take the directions to the hospital (**Appendix D**).and information on the chemical(s) to which they may have been exposed (**Appendix C**).

6.5 Fire or Explosion

In the event of a fire or explosion, the local fire department will be summoned immediately. The site safety officer or his designated alternate will advise the fire commander of the location, nature and identification of the hazardous materials on-site. If it is safe to do so, site personnel may:

- use fire fighting equipment available on site; or,
- remove or isolate flammable or other hazardous materials that may contribute to the fire.

6.6 Evacuation Routes

Evacuation routes established by work area locations for each site will be reviewed prior to commencing site operations. As the work areas change, the evacuation routes will be altered accordingly, and the new route will be reviewed.

Under extreme emergency conditions, evacuation is to be immediate without regard for equipment. The evacuation signal will be a continuous blast of a vehicle horn, if possible, and/or by verbal/radio communication.
When evacuating the site, personnel will follow these instructions:

- Keep upwind of smoke, vapors, or spill location.

- Exit through the decontamination corridor if possible.

- If evacuation through the decontamination corridor is not possible, personnel should remove contaminated clothing once they are in a safe location and leave it near the exclusion zone or in a safe place.

- The site safety officer will conduct a head count to ensure that all personnel have been evacuated safely. The head count will be correlated to the site and/or exclusion zone entry/exit log.

- If emergency site evacuation is necessary, all personnel are to escape the emergency situation and decontaminate to the maximum extent practical.

6.7 Spill Control Procedures

Spills associated with site activities may be attributed to project equipment and include gasoline, diesel and hydraulic oil. In the event of a leak or a release, site personnel will inform their supervisor immediately, locate the source of spillage and stop the flow if it can be done safely. A spill containment kit including absorbent pads, booms and/or granulated speedy dry absorbent material will be available to site personnel to facilitate the immediate recovery of the spilled material. Daily inspections of site equipment components including hydraulic lines, fuel tanks, etc. will be performed by their respective operators as a preventative measure for equipment leaks and to ensure equipment soundness. In the event of a spill, site personnel will immediately notify the NYSDEC (1-800-457-7362), and a spill number will be generated.

6.8 Vapor Release Plan

If work zone organic vapor (excluding methane) exceeds 5 ppm, then a downwind reading will be made either 200 feet from the work zone or at the property line, whichever is closer. If readings at this location exceed 5 ppm over background, the work will be stopped.

If 5 ppm of VOCs are recorded over background on a PID at the property line, then an off-site reading will be taken within 20 feet of the nearest residential or commercial property, whichever is closer. If efforts to mitigate the emission source are unsuccessful for 30 minutes, then the designated site safety officer will:

- contact the local police;
- continue to monitor air every 30 minutes, 20 feet from the closest off-site property. If two successive readings are below 5 ppm (non-methane), off-site air monitoring will be halted.
- All property line and off site air monitoring locations and results associated with vapor releases will be recorded in the site safety log book.

APPENDIX A

SITE SAFETY ACKNOWLEDGEMENT FORM

DAILY BREIFING SIGN-IN SHEET

Date:______________________________ Person Conducting Briefing:_______________________

Project Name and Location:____

1. AWARENESS (topics discussed, special safety concerns, recent incidents, etc…):

____

____

____

____

2. OTHER ISSUES (HASP changes, attendee comments, etc…):

____

____

____

3. ATTENDEES (Print Name):

1.	11.
2.	12.
3.	13.
4.	14.
5.	15.
6.	16.
7.	17.
8.	18.
9.	19.
10.	20.

APPENDIX B

SITE SAFETY PLAN AMENDMENTS

SITE SAFETY PLAN AMENDMENT FORM

Site Safety Plan Amendment #:____

Site Name: ____

Reason for Amendment:____

____

____

____

Alternative Procedures:____

____

____

____

Required Changes in PPE:____

____

____

____

______________________________ ____________________

Project Superintendent (signature) **Date**

______________________________ ____________________

Health and Safety Consultant (signature) **Date**

______________________________ ____________________

Site Safety Officer (signature) **Date**

APPENDIX C

CHEMICAL HAZARDS

CHEMICAL HAZARDS

The attached Chemical Safety Table includes contaminants of concern that have been identified in soils and/or groundwater at the site and which may be encountered during the off-site investigation.

Chemical Data

COMPOUND	CAS#	ACGIH TLV	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Tetrachloro-ethylene	127-18-4	25 ppm TWA,100 ppm STEL	100 ppm	Inhalation Skin Absorption Skin Contact Ingestion	Irritates eyes, nose, throat; nausea; flushed face & neck; vertigo, dizziness, incoordination, headache, somnolence; skin erythema; potential human carcinogen	Eyes, skin, resp. system, CNS, liver, kidneys	VP= 14 mm Hg Chloroform like odor, IP= 9.32 eV
Trichloroethene	79-01-6	50 ppm TWA, 100 STEL	100 ppm	Inhalation Ingestion Skin Contact	Irritates eyes, throat; redness, tearing, blurred vision, vertigo, dizziness, incoordination, irregular heart beat, potential human carcinogen	Heart, nervous system, liver and kidneys	VP= 60 mm Hg Irritating odor at high concentrations
Vinyl Chloride	75-01-04	5 ppm	1 ppm	Inhalation Ingestion Skin Contact	Mild irritation to eyes, blurred vision, dizziness, confusion, tingling in hands and feet, symptoms of frost bite, confirmed human carcinogen	Nervous system, liver, spleen, respiratory sys. and kidneys	VP= 35.3 psig, sweet etheral odor
1,1,1-trichloroethane	71-55-6	350 ppm TWA, 450 ppm STEL	350 ppm	Inhalation Ingestion Skin Contact	Irritates eyes, skin; headache, lassitude, CNS depression, poor equilibrium; dermatitis; cardiac arrhythmia	Eyes, skin, CNS, CVS, liver	VP= 100 mm Hg Chloroform like odor IP= 11.0 eV
2-Butanone	78-93-3	200 ppm TWA, 300 ppm STEL	200 ppm	Inhalation Skin Contact Ingestion	Irritates eyes, nose, and throat; headache; dizziness; nausea; shortness of breath; skin redness and itching	Eyes, skin, CNS, resp. system	VP= 78 mm Hg Sharp mint-like odor
1,2-Dichloroethylene	156-60-5	200 ppm TWA	200 ppm	Inhalation Skin Absorption Ingestion	Irritates eyes, nose, and throat; nausea; drowsiness	Eyes, skin, resp. system	VP= 400 mm Hg Pleasant odor

Abbreviations

ACGIH = American Conference of Governmental Industrial Hygienists

C = Ceiling limit, not to be exceeded

CNS = Central Nervous System

CVS = Cardiovascular System

eV = Electron volt

IP = Ionization Potential

OSHA = Occupational Safety and Health Administration

ppm = parts per million

STEL = Short-term exposure limit (15 minutes)

TWA = Time-weighted average (8 hours)

VP = vapor pressure at approximately 68° F in mm Hg (mercury)

APPENDIX D

HOSPITAL INFORMATION AND MAP

FIELD ACCIDENT REPORT

FIELD ACCIDENT REPORT

This report is to be filled out by the designated Site Safety Officer after EVERY accident.

PROJECT NAME ________________________________ PROJECT. NO.______________

Date of Accident ____________________ Time ________ Report By _________________

Type of Accident (Check One):

( ) Vehicular ( ) Personal ( ) Property

Name of Injured ____ DOB or Age ________

How Long Employed ____

Names of Witnesses ____

____

Description of Accident ____

____

____

Action Taken ____

____

____

Did the Injured Lose Any Time? _______ How Much (Days/Hrs.)? ___________________

Was Safety Equipment in Use at the Time of the Accident (Hard Hat, Safety Glasses, Gloves, Safety Shoes, etc.)? ____

____

(If not, it is the EMPLOYEE'S sole responsibility to process his/her claim through his/her Health and Welfare Fund.)

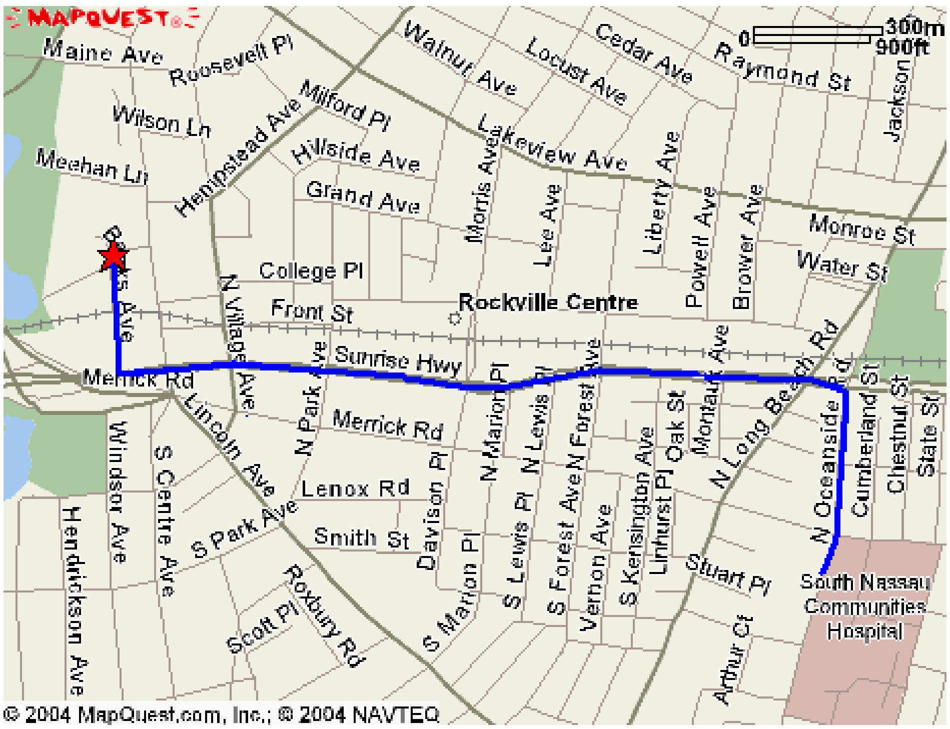
INDICATE STREET NAMES, DESCRIPTION OF VEHICLES, AND NORTH ARROW

HOSPITAL INFORMATION AND MAP

The hospital nearest the site is:

Distance: 3.5 miles **Approximate Travel Time:** 8 min

Good Samaritan Hospital
1000 Montauk Highway
West Islip, NY
(631) 376 4092



Directions:

Proceed south on Banks Avenue to Sunrise Highway.
Make a left (east) on Sunrise Highway and follow to Oceanside Road.
Make a right (south) on Oceanside Road and follow to South Nassau Communities Hospital.

Total distance: Approx. 1.7 miles

Address:

South Nassau Communities Hospital
2445 Oceanside Road
Oceanside, New York
(516) 763-3938

ATTACHMENT E
Community Air Monitoring Plan

FORMER DARBY DISTRIBUTION CENTER

ROCKVILLE CENTRE, NEW YORK

OPERABLE UNIT II OFF-SITE COMMUNITY AIR MONITORING PLAN

Site # C130140

June 2009

Prepared For:

DARBY GROUP COMPANIES
865 Merrick Avenue
Westbury, NY 11590

Prepared By:

EBC
ENVIRONMENTAL BUSINESS CONSULTANTS
1808 Middle Country Road
Ridge, NY 11961

COMMUNITY AIR MONITORING PLAN
TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

The Community Air Monitoring Plan (CAMP) provides measures for protection for on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the remedial work) from potential airborne contaminant releases resulting from the off-site Remedial Investigation to be conducted south (downgradient) of the former Darby Distribution Warehouse located at 80-100 Banks Avenue in Rockville Centre, NY.

The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that the remedial work did not spread contamination off-site through the air.

The primary concerns for this site are odors and dust particulates.

1.1 Regulatory Requirements

This CAMP was established in accordance with the following requirements:

- 29 CFR 1910.120(h): This regulation specifies that air shall be monitored to identify and quantify levels of airborne hazardous substances and health hazards, and to determine the appropriate level of protection for workers.
- New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan: This guidance specifies that a community air-monitoring program shall be implemented to protect the surrounding community and to confirm that the work does not spread contamination off-site through the air.
- New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Memorandum (TAGM) #4031 - Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites: This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

EBC
ENVIRONMENTAL BUSINESS CONSULTANTS
1808 Middle Country Road
Ridge, NY 11961
Phone 631.504.6000
Fax 631.924.2870

2.0 AIR MONITORING

The following sections contain information describing the types, frequency and location of real-time monitoring.

2.1 Real-Time Monitoring

This section addresses the real-time monitoring that will be conducted within the work area, and along work area perimeter, during drilling and sampling activities.

2.1.1 Work Area

The following instruments will be used for work area monitoring:

- PhotoionizationDetector (PID)
- Dust Monitor

Table 1-1 presents a breakdown of each main activity and provides the instrumentation, frequency and location of the real-time monitoring for the site. Table 1-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas.

2.1.2 Community Air Monitoring Requirements

To establish ambient air background concentrations, air will be monitored at several locations around the work area perimeter at a distance of approximately 20 feet from the sampling location before drilling activities begin. These points will be monitored periodically in series during drilling activities. When the drilling area is within 20 feet of potentially exposed populations or occupied structures, the perimeter monitoring points will be located to represent the nearest potentially exposed individuals.

Air will be monitored for VOCs with a portable photoionization detector (PID). Fugitive respirable dust will be monitored using a MiniRam Model PDM-3 aerosol monitor or equivalent if visible dust is observed by the Field Operations Officer. Table 1-1 presents a breakdown of each main activity and provides the instrumentation, frequency and location of the real-time monitoring for the site. Table 1-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas. All air monitoring data is documented in a site log book by the designated site safety officer. The log book will be made available to the DEC for review on-site and or copied and transmitted to the DEC case manager upon rerquest. EBC's site safety officer or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. All instruments will be zeroed daily and checked for accuracy. A daily log will be kept. If additional monitoring is required, the protocols will be developed and appended to this plan.

Table 1-1

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Frequency and Location of Air Monitoring

ACTIVITY	AIR MONITORING INSTRUMENT	FREQUENCY AND LOCATION
Drilling	PID	Screening every hour in Breathing Zone (BZ) during intrusive activities or if odors become apparent.
Drilling	Dust Monitor	If visible dust related to activity is observed

Table 1-2
Real-Time Air Monitoring Action Levels

AIR MONITORING INSTRUMENT	MONITORING LOCATION	ACTION LEVEL	SITE ACTION	REASON
PID	Breathing Zone	0-25 ppm, non-transient	None	Exposure below established exposure limits
PID	Breathing Zone	25-100 ppm, non-transient	Don APR Institute vapor/odor suppression measures	Based on potential exposure to VOCs
PID	Breathing Zone	>100 ppm, non-transient	Don ASR or SCBA, Institute vapor/odor suppression measures, Notify HSM.	Increased exposure to site contaminants, potential for vapor release to public areas.
PID	Work Area Perimeter	< 5 ppm	None	Exposure below established exposure limits.
PID	Work Area Perimeter	> 5 ppm	Stop work and implement vapor release response plan until readings return to acceptable levels, Notify HSM.	Increased exposure to site contaminants, potential for vapor release to public areas
Aerosol Monitor	Work Area Perimeter	< 150 $\mu g/m^3$	None	Exposure below established exposure limits.
Aerosol Monitor	Work Area Perimeter	>150 $\mu g/m^3$	Don ASR or SCBA, Institute dust suppression measures, Notify HSM.	Stop work and implement dust suppression techniques until readings return to acceptable levels, Notify HSM.

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3.0 VAPOR EMISSION RESPONSE PLAN

This section is excerpted from the NYSDOH guidance for Community Air Monitoring Plan - Ground Intrusive Activities.

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. Vapor suppression measures can also be taken at this time. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down. When work shutdown occurs, downwind air monitoring as directed by the Health & Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission Response Plan Section.

4.0 MAJOR VAPOR EMISSION RESPONSE PLAN

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source (see **Section 5.0**) are unsuccessful and if organic vapor levels are approaching 5 ppm above background for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.

However, the Major Vapor Emission Response Plan shall be immediately placed in effect if organic vapor levels are greater than 10 ppm above background.

Upon activation, the following activities will be undertaken:

1. All emergency Response Contacts as listed in the Health & Safety Plan will go into effect.

2. The local police authorities will immediately be contacted by the Health & Safety Officer and advised of the situation.

3. Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Health & Safety Officer.

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5.0 VAPOR / ODOR SUPPRESSION TECHNIQUES

Vapor / odor suppression techniques must be employed when action levels warrant the use of these techniques.

The techniques to be implemented for control of volatile organic odors from drilling will include one or more of the following:

- cease drilling activities and seal borehole
- limit working hours to favorable wind and temperature conditions
- employ engineering controls such as portable blowers to vent work area

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6.0 DUST SUPPRESSION TECHNIQUES

Although significant dust generation is not anticipated during investigative activities, reasonable dust-suppression techniques will be employed during all work that may generate dust, such as auger drilling and loading of excess drill cuttings. The following techniques were shown to be effective for controlling the generation and migration of dust during investigative activities:

- Wetting equipment and drill cuttings; and,
- Loading drill cuttings directly into drums and covering.

Using atomizing sprays will prevent overly wet conditions, conserve water, and offer an effective means of suppressing fugitive dust. It is imperative that utilizing water for suppressing dust will not create surface runoff.

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7.0 DATA QUALITY ASSURANCE

7.1 Calibration

Instrument calibration shall be documented on instrument calibration and maintenance sheets or in the designated field logbook. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

7.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the FOL/HSO for reference.

7.3 Data Review

The FOL/HSO will interpret all monitoring data based on Table 1-2 and his/her professional judgment. The FOL/HSO shall review the data with the HSM to evaluate the potential for worker exposure, upgrades/downgrades in level of protection, comparison to direct reading instrumentation and changes in the integrated monitoring strategy.

Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the HSM.

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8.0 RECORDS AND REPORTING

All readings must be recorded and available for review by personnel from NYSDEC and NYSDOH. Should any of the action levels be exceeded, the NYSDEC Case Manager will be notified verbally or electronically and the NYSDEC Division of Air Resources will be notified in writing within five (5) working days.

The notification shall include a description of the control measures implemented to prevent further exceedances.

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