136 Fuller Road Site

ALBANY COUNTY, NEW YORK

Site Management Plan

NYSDEC Site Number: C401055

Prepared for:

Fuller Partners, LLC
PO Box 370
133 Route 395
East Chatham, NY 12060

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision #	Submitted Date	Summary of Revision	DEC Approval Date
0	March 2013	Final Site Management Plan	April 15, 2013
1	July 21, 2016	Modify wells in groundwater monitoring program and change PRR period to every three years	August 2, 2016
2	August 30, 2018	Modify wells in groundwater monitoring program. HVE/SVE system modification to add recovery well R-11 and disconnect R-1 and R-3	

FEBRUARY 2019

I Joseph M. Lanaro certify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

STATE OF NEW YORK
JOSEPH MARTIN LANARO
070126
LICENSED PROFESSIONAL ENGINEER

Mr. Joseph M. Lanaro, PE

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification: BCP Site No. C401055, 136 Fuller Road Site
136 Fuller Road, Albany, Albany County, New York

Institutional Controls:	An Environmental Easement that: 1. Allows commercial and industrial site uses. Vegetable gardens and farming on the property are prohibited. 2. Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH. 3. All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP. 4. Potential for vapor intrusion must be evaluated for any buildings developed on the site, and any potential impacts that are identified must be monitored or mitigated. 5. Requires the remedial party or site owner to complete and submit to NYSDEC a periodic certification of the ICs and ECs. 6. Requires compliance with the SMP.
Engineering Controls:	Sub-Slab Depressurization System (SSDS), a High Vacuum Extraction/Soil Vapor Extraction (HVE/SVE System), and a cover are maintained at the site.

Inspections:	Frequency
1. Site-wide inspection	Annually
Monitoring:	**Frequency**
1. Groundwater Monitoring. The following six wells would be sampled on a quarterly basis: MW-10, MW-25, MW-27, MW-30, MW-32, MW-33. On an annual basis (one of the four quarters), the following 15 wells would be sampled: MW-3, MW-7, MW-9, MW-10, MW-13, MW-18, MW-20, MW-25, MW-27, MW-29, MW-30, MW-31, MW-32, MW-33, and MW-37:	Quarterly and Annually
2. HVE/SVE Monitoring	Monthly
Reporting:	**Frequency**
1. Groundwater Monitoring 2. HVE/SVE System Effluent Monitoring 3. Site Inspection 4. Periodic Review Report	1. Quarterly 2. Quarterly 3. Annually 4. Every three years (2015, 2018, 2021, 2024, etc.)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SITE MANAGEMENT PLAN

EXECUTIVE SUMMARY

This Site Management Plan (SMP) was prepared to manage the remaining volatile organic compounds (VOCs) in the site subsurface and specifies the methods necessary to ensure compliance with the site remedy which consists of: a High Vacuum Extraction / Soil Vapor Extraction (HVE/SVE) System, a Sub-Slab Depressurization System (SSDS), a Site Cover, Institutional Controls (ICs) and Engineering Controls (ECs).

The 136 Fuller Road (Site) is approximately a 15-acre land parcel situated in the City of Albany and its current use is primarily for the recycling of PET plastic bottles to raw plastic for re-use. The Site historically contained a large capacity bulk storage tank farm; it is believed tetrachloroethylene and other VOCs were released in this area. Remaining VOCs in the Site subsurface soil and groundwater are being addressed utilizing this SMP by Fuller Partners LLC through the Brownfield Cleanup Program (BCP).

Because VOCs at the site were not removed to acceptable Commercial Use Soil Cleanup Objectives (SCOs) at the issuance of the Certificate of Completion (COC), the COC was issued requiring the Site to meet the BCP's Track 4 SCOs. Areas of the Site that have not been the subject of a comprehensive sampling program to a depth of 15 feet are classified as having the potential to exceed the Track 1 Unrestricted Use SCOs. To address this, the entire Track 4 BCP Site is currently protective of the public health and the environment due to the existing Site Cover of the top one foot of soil/lawn, the building foundations, asphalt pavement and sidewalks. As a result, this SMP requires the Excavation Work Plan in Appendix A to be implemented during any disturbance (i.e. soil excavation/new construction, etc.) of the Site Cover when excavating below a depth of one foot.

The ICs place restrictions on site use and mandate:

- The operation and maintenance of the HVE/SVE system, Appendix H,
- The operation and maintenance of the SSDS system, Appendix G,
- The maintenance of the Site Cover, Section 3.2
- Groundwater monitoring and groundwater use restrictions, Section 3.3.1,
- Performance of periodic inspections, certifications and Periodic Review Report, Section 5.

In the future, through a properly implemented NYSDEC-approved Work Plan, the property owner could characterize subsurface soil for all or a portion of this BCP Site to a depth of 15 feet and compare the analytical results to the Soil Cleanup Objectives of 6 NYCRR Part 375. If the soil results met the Commercial Use SCOs, the property owner could petition the NYSDEC Project Manager to modify the SMP to remove the cover restrictions and associated soil management plan requirements for the area of the Site meeting the Commercial Use SCOs to a depth of 15 feet.

1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 INTRODUCTION

This document is required as an element of the remedial program at 136 Fuller Road (hereinafter referred to as the "Site") under the New York State (NYS) Brownfield Cleanup Program (BCP) administered by New York State Department of Environmental Conservation (NYSDEC). The site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index# A4-0618-02-09, Site # C401055, which was executed on April 27, 2009.

1.1.1 General

Fuller Partners, LLC entered into a BCA with the NYSDEC to remediate the property located in City of Albany, Albany County, New York. This BCA required the Remedial Party, Fuller Partners, LLC, to investigate and remediate contaminated media at the site. A figure showing the site location and boundaries of this 15.56-acre "site" is provided in **Figure 1**. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Environmental Easement and is included as **Appendix B**. The metes and bounds are noted on the attached survey, included as **Figure 2**.

After completion of the interim remedial measures described in the Remedial Investigation Report and Final Engineering Report, some contamination was left in the subsurface at this site, which is hereafter referred to as 'remaining contamination." This Site Management Plan (SMP) was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This SMP was updated in 2019 to reflect to addendums that reduced the groundwater monitoring program and Periodic Review Reporting schedule. All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

This SMP was prepared by The Chazen Companies, on behalf of Fuller Partners, LLC, in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 3, 2010, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing the Institutional Controls (ICs) and Engineering Controls (ECs) that are required by the Environmental Easement for the site.

1.1.2 Purpose

The site contains contamination left after completion of the interim remedial measures. Engineering Controls have been incorporated into the site remedy to control exposure to remaining contamination during the use of the site to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Albany County Clerk, will require compliance with this SMP and all ECs and ICs placed on the site. The ICs place restrictions on site use, and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. This SMP specifies the methods necessary to ensure compliance with all ECs and ICs required by the Environmental Easement for contamination that remains at the site. In addition, operation of the interim remedial measures will be continued as implementation of the Remedial Work Plan. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor’s successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

This SMP provides a detailed description of all procedures required to manage remaining contamination at the site after completion of the Remedial Measures, including: (1) implementation and management of all Engineering and Institutional Controls; (2) media monitoring; (3) operation and maintenance of all treatment, collection, containment, or recovery systems; (4) performance of periodic inspections, certification of results, and submittal of Periodic Review Reports; and (5) defining criteria for termination of treatment system operations.

To address these needs, this SMP includes three plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual for complex systems).

This plan also includes a description of Periodic Review Reports for the periodic submittal of data, information, recommendations, and certifications to NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the environmental easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA (Index # A4-0618-02-09; Site # C401055) for the site, and thereby subject to applicable penalties.

1.1.3 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. In accordance with the Environmental Easement for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.2 SITE BACKGROUND

1.2.1 Site Location and Description

The site is located in the City of Albany, County of Albany, New York and is identified as Section 53 Block 1 and Lot 47 on the City of Albany Tax Map. The site is a 15.56-acre area bounded by Consolidated Rail Corporation Railroad tracks to the north, Interstate 90 highway exit ramp (Exit #2) to the south and east, and Fuller Road to the west (see **Figure 2**). The Metes and Bounds of the site are described on this survey.

1.2.2 Site History

The site was developed in 1955 as the Mohawk Brush Company which produced brushes for the Fuller Brush Company and operated for approximately 20 years until the early 1970s. Following the exit of Mohawk Brush Company, the property apparently fell tax delinquent and was acquired by the City of Albany in or about 1974. The City then leased to Star Textiles, manufacturers of poly-fill material used for the inside of jackets, blankets, and other textiles until the late 1980s. Star Textiles continued as Star Plastics producing plastic resins from recycled materials. In 1997, UltrePet, LLC acquired the business from Star Plastics, leased the site from then-owner Fuller Reality, who subsequently sold the property to the current owner, Fuller Partners, LLC. A 2004 Phase I Environmental Site Assessment and a 2006 Phase II ESA Site Subsurface Investigation were conducted for Fuller Partners LLC prior to purchasing the site. These investigations were used as the basis of initially characterizing site soil, groundwater and soil vapor impacts. The current site owners purchased the site in December of 2006 and entered into the NYSDEC Brownfields Cleanup Program in 2009. Fuller Partners have continued site investigation activities in 2005, 2006, and with the Remedial Investigation (RI) in 2012. Collectively, these investigations have served to identify petroleum and chemical solvent impacts to soil and groundwater quality. The primary contaminants identified are tetrachloroethylene (PCE) and other chlorinated volatile organic compounds (VOCs) and diesel-range petroleum constituents. PCE was not documented as ever being used at the site, but a source area of PCE groundwater contamination has been discovered. The origin of the PCE contamination is still unknown.

1.2.3 Geologic Conditions

Depth to groundwater ranges between 4 feet and 10 feet below the ground surface and this shallow groundwater flows to the south. A groundwater flow figure is shown in Figure 3A.

Bedrock was not encountered in any of the deepest wells (40 feet deep). The soil across the site is primarily a silty sand with areas of clay. A geologic cross section is shown in Figure 3B.

A shallow clay layer in the northern site area was encountered between five and ten feet below grade with a great degree of variability in the depth of the clay interface. This clay appears to be present as a clay column with a slight irregularly shaped bowl-like feature at its surface that appears to retain shallow groundwater and source VOC compounds. The clay column lies beneath a vegetated area of the site that was formerly occupied by a Fuller Brush chemical storage tank farm, and is considered to be the source area of site contaminants. A deeper and more consistent clay layer at 30+ feet below the ground surface was confirmed across the rest of the site during the installation of deep soil borings. The clay layer encountered at depths equal to or greater than 30 feet is interpreted to be a continuous, naturally-occurring clay layer beneath the shallow sandy site aquifer.

Beneath the clay layer, till was encountered at a depth of 40 feet bgs in one boring (B-3) and refusal was encountered at 48 feet bgs in another boring (MW-29) that may also have been due to the presence of till.

1.3 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

A Remedial Investigation (RI) was performed to characterize the nature and extent of contamination at the site. The results of the RI are described in detail in the following reports:

- *Remedial Investigation Report, Fuller Partners LLC, 136 Fuller Road,* dated July 19, 2007, and prepared by The Chazen Companies. This RI was performed prior to entering the BCP and documents original findings and subslab vapor/indoor air quality results
- *Remedial Investigation/Alternatives Analysis Report 136 Fuller Road Site Brownfield Cleanup Program NYSDEC Site No. C401055*, dated August 2012, and prepared by The Chazen Companies. This RI was performed under the BCP, delineated the soil and groundwater quality impacts, documented IRMs implemented at the site, and presented an analysis of remedial alternatives.

Generally, the RI determined that the contaminants of concern are tetrachloroethylene (PCE) and its degradation products, and petroleum (primarily total xylenes) in soil and groundwater. The source area appears to be in a former tank farm section of the property immediately adjacent to the north side of the building. Contamination is predominantly present in the top 10 feet of saturated soil and groundwater, which is first encountered between 8 and 10 feet below the ground surface.

A contaminant plume extends beneath the site building and in a downgradient direction beyond the southern side of the site building.

PCE was identified in a few soil samples in the 500 ppm range. Elevated levels of chlorinated VOCs were found in several groundwater samples including cis-1, 2-Dichloroethylene (8,700 ppb compared to a standard of 5 ppb) and PCE (38,000 ppb compared to a standard of 5 ppb). Low levels (5 ppb-34 ppb) of PCE in the groundwater may have migrated off site to the north.

Below is a summary of site conditions when the RI field investigations were performed in 2006 and 2010:

Soil

The source area soils contained VOC concentrations greater than Commercial Use SCOs in the top 15 feet of soil. Concentrations were greater in the area above a shallow clay formation in the source area where groundwater was noted to be mounded. Evidence of free phase chlorinated solvents (DNAPL) and petroleum (LNAPL) were also detected in soil in this source area. The source area is situated in a former tank farm location on the northern side of the site building. The source area is being mitigated as an IRM with a total fluids vacuum extraction system.

VOC constituents reported in soil at concentrations greater than the Unrestricted Use SCOs and/or the Commercial Use SCOs from 2010 RI samples are shown on **Figures 5 and 6**.

- Concentrations of petroleum-related VOCs, primarily total xylenes, in the source area, greater than 1 ppm, are primarily located exterior to the northern side of the building. **Figure 5** depicts concentrations of petroleum-range VOCs.
- Chlorinated VOC (CVOC) concentrations, primarily PCE, in the source area are depicted on **Figure 6**. Total CVOC concentrations greater than 4 ppm are located exterior to the northern side of the building and extend horizontally to the south approximately 50 feet beneath the building and vertically between 5 and 17 feet below the exterior ground surface in this area of the site.

One isolated area of shallow soil (0 to 2 feet) contained SVOC concentrations greater than Commercial Use SCOs. This isolated SVOC-impact area is at boring B-3, south of the site building (See **Figure 4)**. Since the B3 sampling, the pavement in this area was repaired and the ground area that was sampled at the B-3 location has been covered with asphalt, creating a cap over this localized impacted area.

The site samples met the Commercial Use SCOs for metals. Two samples contained nickel concentrations greater than the Unrestricted Use SCO but much less than the Commercial Use SCO. While chromium was detected consistently across the site at concentrations greater than the Unrestricted Use SCO, the concentrations were substantially less than the Commercial Use SCO. Site-wide concentrations of both metals met the Residential Use SCO. As such, metals are not considered site contaminants and there are no associated site management activities relating to metals.

Site-Related Groundwater

Groundwater has been impacted by contamination in source area soils. Groundwater in the source area contained elevated VOC concentrations ranging up to approximately 45,000 ppb of total VOCs; groundwater in the downgradient plume area was generally less than 100 ppb for total VOCs. VOC concentrations were greatest in the source area above the shallow clay formation where groundwater was noted to be mounded. PCE is the primary CVOC reported.

VOC constituents reported in groundwater at concentrations greater than the SCGs from 2010 RI sample analysis are presented in **Figures 7 and 8**.

- Concentrations of the petroleum-related VOCs ethylbenzene, toluene and total xylenes in the source area groundwater are depicted on **Figure 7**. The concentrations of these constituents in groundwater are greater than 5 ppb on the northern side of the building and extending under the building as far south (downgradient) as MW-33. Groundwater from well MW-27exhibited the highest concentrations of petroleum constituents.
- Chlorinated VOC (CVOC) concentrations, primarily PCE, in the source area are depicted on **Figure 8**. Groundwater samples from wells MW-27, MW-29 and MW-30 exhibited the highest concentrations. The total CVOC concentrations greater than 100 ppb are present exterior to the building along the northern side of the building and extend beneath the building to the vicinity of MW-33.

Site-Related Soil Vapor Intrusion

Based on the results of the slab soil vapor and indoor air quality sampling that were presented in the 2007 report, NYSDEC and NYDOH determined that no additional SVI sampling was needed and a sub-slab depressurization system should be installed in the groundwater plume area as an Interim Remedial Measure under the BCP.

1.4 SUMMARY OF REMEDIAL ACTIONS

The site was remediated in accordance with the NYSDEC-approved *Interim Remedial Measures Work Plan*, dated June 2010 and the *Sub-Slab Depressurization System Design Report*, dated February 2011; and the *Interim Remedial Measures Work Plan High Vacuum Extraction/Soil Vapor Extraction*, dated December 2010 with the *Interim Remedial Measures Design Report High Vacuum Extraction/Soil Vapor Extraction*, dated March 2011.

The following is a summary of the Remedial Actions performed at the site:

1. Construction and operation/maintenance of a sub-slab depressurization system in site building over the groundwater impact area. To provide effective depressurization for the impacted area, the system consists of three SSDS zones with two screened vapor extraction wells in each zone. Each zone is connected to one regenerative blower; the three blowers are situated above a loading dock overhang on the north side of the building, and east of the HVE/SVE trailer.

2. Construction and operation/maintenance of a High Vacuum Extraction/Soil Vapor Extraction system (HVE/SVE) in the source area. On-site HVE/SVE extraction wells in the source area are connected to a vacuum system used to extract impacted groundwater, DNAPL (via the HVE) and soil vapor (via the SVE and HVE) from the aquifer and impacted shallow soil. In 2018, the HVE/SVE System was modified consistent with the April 10, 2018 *Corrective Measures Work Plan*, that was approved on April 11, 2018 (Appendix J).

3. Construction and maintenance of a soil cover system consisting of asphalt pavement to prevent human exposure to a limited area of contaminated surface soil remaining at the site;

4. Execution and recording of an Environmental Easement to restrict land use and prevent future exposure to contamination remaining at the site.

5. Institutional Controls in place at the site include: land use limits allowing the use and development of the controlled property for commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws; restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the New York State Department of Health (NYSDOH) or Albany County DOH; and prohibits agriculture or vegetable gardens on the controlled property.

6. Development and implementation of a Site Management Plan for long term management of remaining contamination as required by the Environmental Easement, which includes plans for: (1) Institutional and Engineering Controls, (2) monitoring, (3) operation and maintenance and (4) reporting;

1.4.1 Site-Related Treatment Systems

No long-term treatment systems were installed as part of the site remedy.

1.4.2 Remaining Contamination

Figures 5 and 6 summarize the results of soil samples at the site prior to implementation of the remedial measures. **Figure 9** shows areas exceeding Unrestricted Use SCOs based on data gathered during remedial investigations. Following implementation of the HVE/SVE system, soil quality improvement is being indirectly documented via the periodic sampling of groundwater and concentrations and rates of vapors extracted from the subsurface.

Groundwater monitoring well sampling was performed every other month during system operations in 2011/2012. These data are the most recent representation of remaining contamination at the site, although continued improvement is expected with continued operation of the HVE/SVE. The sampling program included wells primarily located in the source area and for some events the well sampling program was expanded to include wells in the groundwater plume area.

The data show an overall continued reduction in VOC concentrations in the source area, since the pre-IRM sampling. A few wells (MW-25, MW-30, and MW-33) have shown increased VOC concentrations in the last few sampling events. This is considered likely to be the result of increased and ongoing dewatering of the source area which is capturing and pulling VOCs towards the source area through a change in the area gradient flow directions, and recovering these captured VOCs in the aqueous phase removed with the HVE.

2.0 ENGINEERING AND INSTITUTIONAL CONTROL PLAN

2.1 INTRODUCTION

2.1.1 General

Since remaining contaminated soil and groundwater/soil vapor exists beneath the site, Engineering Controls and Institutional Controls (EC/ICs) are required to protect human health and the environment. This Engineering and Institutional Control Plan describes the procedures for the implementation and management of all EC/ICs at the site. The EC/IC Plan is one component of the SMP and is subject to revision by NYSDEC.

2.1.2 Purpose

This plan provides:

- A description of all EC/ICs on the site;
- The basic implementation and intended role of each EC/IC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the features to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of EC/ICs, such as the implementation of the Excavation Work Plan for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the EC/ICs required by the site remedy, as determined by the NYSDEC.

2.2 ENGINEERING CONTROLS

2.2.1 Engineering Control Systems

2.2.1.1 Source Area and Boring B-3 Area Protective Cover

Exposure to remaining contamination in soil at the site is prevented by a soil cover system placed over impacted areas of the site. These areas are limited to the areas shown on Figure 9 and consist primarily of subsurface soil in the source area, with a limited area of impacted surface soil located south of the site building (boring B-3). In the source area, this cover system is comprised of both the concrete building slabs and, externally, a minimum of 12 inches of clean soil underlain by an impermeable delineating liner and concrete building slabs. In the boring B-3 area, approximately 0.5 feet of asphalt pavement is the cover. The Excavation Work Plan that appears in Appendix A outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection and maintenance of this cover are provided in the Monitoring Plan included in Section 4 of this SMP.

2.2.1.2 Sub-slab Depressurization System

The system consists of three SSDS zones with two screened vapor extraction wells (VEWs) in each zone. The remedial objective is to mitigate soil vapors beneath the building. **Figure 10** shows the system components and layout. Each zone is connected to one regenerative blower with PVC pipe and manifold sections. Each blower provides sufficient vacuum extraction capacity to produce a minimum vacuum pressure of 35± inches of Water Column at each VEW with an estimated flow of 10 cubic feet per minute or greater per well. An inline sample port and vacuum pressure gauge at each VEW allow for the operational monitoring of vacuum pressures at wellheads. The three blowers are situated above a loading dock overhang on the north side of the building, and east of the HVE/SVE trailer.

Periodic checks of the SSDS confirmed that the system is operating within design parameters. Operation, maintenance and monitoring of the system were transferred to the building maintenance personnel in March 2012.

Procedures for operating and maintaining the SSDS are documented in the Operation and Maintenance Plan (Section 4 of this SMP). Procedures for monitoring the system are included in the Monitoring Plan (Section 3 of this SMP). The Monitoring Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the site, occurs.

2.2.1.3 High Vacuum Extraction/Soil Vapor Extraction (HVE/SVE System)

In 2018, the HVE/SVE System was modified consistent with the April 10, 2018 *Corrective Measures Work Plan*, that was approved on April 11, 2018 (Appendix J). This section has been updated to reflect the 2018 system adjustments. Eight on-site HVE/SVE wells in the source area are connected to a vacuum system used to meet the remedial objective to extract impacted groundwater, DNAPL (via the HVE) and soil vapor (via the SVE) from the aquifer (**Figure 11**). A high level vacuum is applied to the wells which lowers the water table to 8 to 15 feet below ground surface. The SVE system extracts VOCs formerly trapped in the saturated source area soils by lowering the groundwater table to create unsaturated extraction conditions. The design includes the installation of an impermeable shallow liner system with drain pipes to limit infiltration of storm water into the source area and enhance conditions for vacuum extraction by creating a ”cover” over the moderately permeable soil area.

Piping from the wells is connected to SVE and HVE influent manifolds in the remediation trailer housing the HVE/SVE equipment. Vapor is directed through a phase separator to remove liquid from the vapor stream which is discharged to the atmosphere. Liquid separated from both the SVE and HVE systems flows through a product oil/water separator, through bag filters and a shallow tray VOC air stripping unit. Lastly, treated water is discharged to the on-site wastewater system in accordance with conditions of the sewer discharge permit.

Procedures for operating and maintaining the HVE/SVE are documented in the Operation and Maintenance Plan (Section 4 of this SMP). Procedures for monitoring the system are included in the Monitoring Plan (Section 3 of this SMP). The Monitoring Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the site, occurs.

2.2.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

2.2.2.1 Cover System

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

2.2.2.2 Sub-slab Depressurization System (SSDS)

The active SSDS will not be discontinued unless prior written approval is granted by the NYSDEC. In the event that monitoring data indicates that the SSDS is no longer required, a proposal to discontinue the SSDS will be submitted by the property owner to the NYSDEC and NYSDOH. Operation of the SSDS is anticipated to be terminated following completion of the remedy (i.e., operation of the HVE/SVE).

2.2.2.3 High Vacuum Extraction/Soil Vapor Extraction (HVE/SVE System)

The HVE/SVE system will not be discontinued unless prior written approval is granted by the NYSDEC. When monitoring data indicates that the HVE/SVE system is no longer required and/or no longer providing effective removal of site contaminants, a proposal to discontinue the system will be submitted by the property owner. Conditions that warrant discontinuing the HVE /SVE system include contaminant concentrations in groundwater that: (1) reach levels that are consistently below ambient water quality standards, (2) have become asymptotic to a low level over an extended period of time as accepted by the NYSDEC, or (3) the NYSDEC has determined that the HVE /SVE system has reached the limit of its effectiveness. This assessment will be based in part on post-remediation contaminant levels in groundwater collected from monitoring wells located in the source and plume areas. Systems will remain in place and operational until permission to discontinue their use is granted in writing by the NYSDEC.

This remedial activity will be considered complete when source area VOC contaminants have been substantially removed and/or are no longer being reduced by the system at a rate of effectiveness or efficiency that allows for the practical continued operation of this system.

2.3 INSTITUTIONAL CONTROLS

A series of Institutional Controls is required by the Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the site to commercial and industrial uses only. Adherence to these Institutional Controls on the site is required by the Environmental Easement and will be implemented under this Site Management Plan. These Institutional Controls are:

- Compliance with the Environmental Easement and this SMP by the Grantor and the Grantor's successors and assigns;
- All Engineering Controls must be operated and maintained as specified in this SMP;
- All Engineering Controls on the Controlled Property must be inspected at a frequency and in a manner defined in the SMP.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP.
- All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP.

Institutional Controls identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement.

The site has a series of Institutional Controls in the form of site restrictions. Adherence to these Institutional Controls is required by the Environmental Easement. Site restrictions that apply to the Controlled Property are:

- The property may only be used for commercial or industrial uses provided that the long-term Engineering and Institutional Controls included in this SMP are employed.
- The property may not be used for a higher level of use, such as residential use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC;
- All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- The use of the groundwater underlying the property is prohibited without treatment, if necessary, rendering it safe for intended use;
- The potential for vapor intrusion must be evaluated for any buildings developed on the site, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the property are prohibited;
- The site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted every three years and will be made by an expert that the NYSDEC finds acceptable.

2.3.1 Excavation Work Plan

The site will be remediated for commercial or industrial use. Any future intrusive work that will penetrate the soil cover or cap, or encounter or disturb the remaining contamination, including any modifications or repairs to the existing cover system will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix A to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the site. A sample HASP is attached as **Appendix C** to this SMP that is in current compliance with DER-10, and 29 CFR 1910, 29 CFR 1926, and all other applicable Federal, State and local regulations. Based on future changes to State and federal health and safety requirements, and specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted with the notification provided in Section A-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the periodic inspection and certification reports submitted under the Site Management Reporting Plan (See Section 5).

The site owner and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of excavation de-water, control of runoff from open excavations into remaining contamination, and for structures that may be affected by excavations (such as building foundations and bridge footings). The site owner will ensure that site development activities will not interfere with, or otherwise impair or compromise, the engineering controls described in this SMP.

2.3.2 Soil Vapor Intrusion Evaluation

Prior to the construction of any enclosed structures located over areas that contain remaining contamination and the potential for soil vapor intrusion (SVI) has been identified (see Figure 9), an SVI evaluation will be performed to determine whether any mitigation measures are necessary to eliminate potential exposure to vapors in the proposed structure. Alternatively, an SVI mitigation system may be installed as an element of the building foundation without first conducting an investigation. This mitigation system will include a vapor barrier and passive sub-slab depressurization system that is capable of being converted to an active system.

Prior to conducting an SVI investigation or installing a mitigation system, a work plan will be developed and submitted to the NYSDEC and NYSDOH for approval. This work plan will be developed in accordance with the most recent NYSDOH "Guidance for Evaluating Vapor Intrusion in the State of New York". Measures to be employed to mitigate potential vapor intrusion will be evaluated, selected, designed, installed, and maintained based on the SVI evaluation, the NYSDOH guidance, and construction details of the proposed structure.

Preliminary (unvalidated) SVI sampling data will be forwarded to the NYSDEC and NYSDOH for initial review and interpretation. Upon validation, the final data will be transmitted to the agencies, along with a recommendation for follow-up action, such as mitigation.

SVI sampling results, evaluations, and follow-up actions will also be summarized in the next Periodic Review Report.

2.4 INSPECTIONS AND NOTIFICATIONS

2.4.1 Inspections

Inspections of all remedial components installed at the site will be conducted at the frequency specified in the SMP Monitoring Plan schedule. A comprehensive site-wide inspection will be conducted annually, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether Engineering Controls continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria;
- Sampling and analysis of appropriate media during monitoring events;
- If site records are complete and up to date; and
- Changes, or needed changes, to the remedial or monitoring system;

Inspections will be conducted in accordance with the procedures set forth in the Monitoring Plan of this SMP (Section 3). The reporting requirements are outlined in the Periodic Review Reporting section of this plan (Section 5).

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the EC/ICs implemented at the site by a qualified environmental professional as determined by NYSDEC.

2.4.2 Notifications

Notifications will be submitted by the property owner to the NYSDEC as needed for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Brownfield Cleanup Agreement (BCA) 6NYCRR Part 375, and/or Environmental Conservation Law.
- 7-day advance notice of any proposed ground-intrusive activities pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundations structures that reduces or has the potential to reduce the effectiveness of other Engineering Controls and likewise any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of Engineering Controls in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of the Brownfield Cleanup Agreement (BCA) and all approved work plans and reports, including this SMP

- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing.

2.5 CONTINGENCY PLAN

Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions.

2.5.1 Emergency Telephone Numbers

In the event of any environmentally related situation or unplanned occurrence requiring assistance the Owner or Owner's representative(s) should contact the appropriate party from the contact list below. For emergencies, appropriate emergency response personnel should be contacted. Prompt contact should also be made to the owner's qualified environmental professional. These emergency contact lists must be maintained in an easily accessible location at the site.

Table 2.5.1a: Emergency Contact Numbers

Medical, Fire, and Police:	911
One Call Center:	(800) 272-4480 (3 day notice required for utility markout)
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362

Table 2.5.1b: Contact Numbers

Qualified Environmental Professional: Kim Baines	518-588-2104
Arlette St. Romain	518-824-1928

* Note: Contact numbers subject to change and should be updated as necessary

2.5.2 Map and Directions to Nearest Health Facility

Site Location: 136 Fuller Road in Albany, New York

Nearest Hospital Name: St. Peter's Hospital

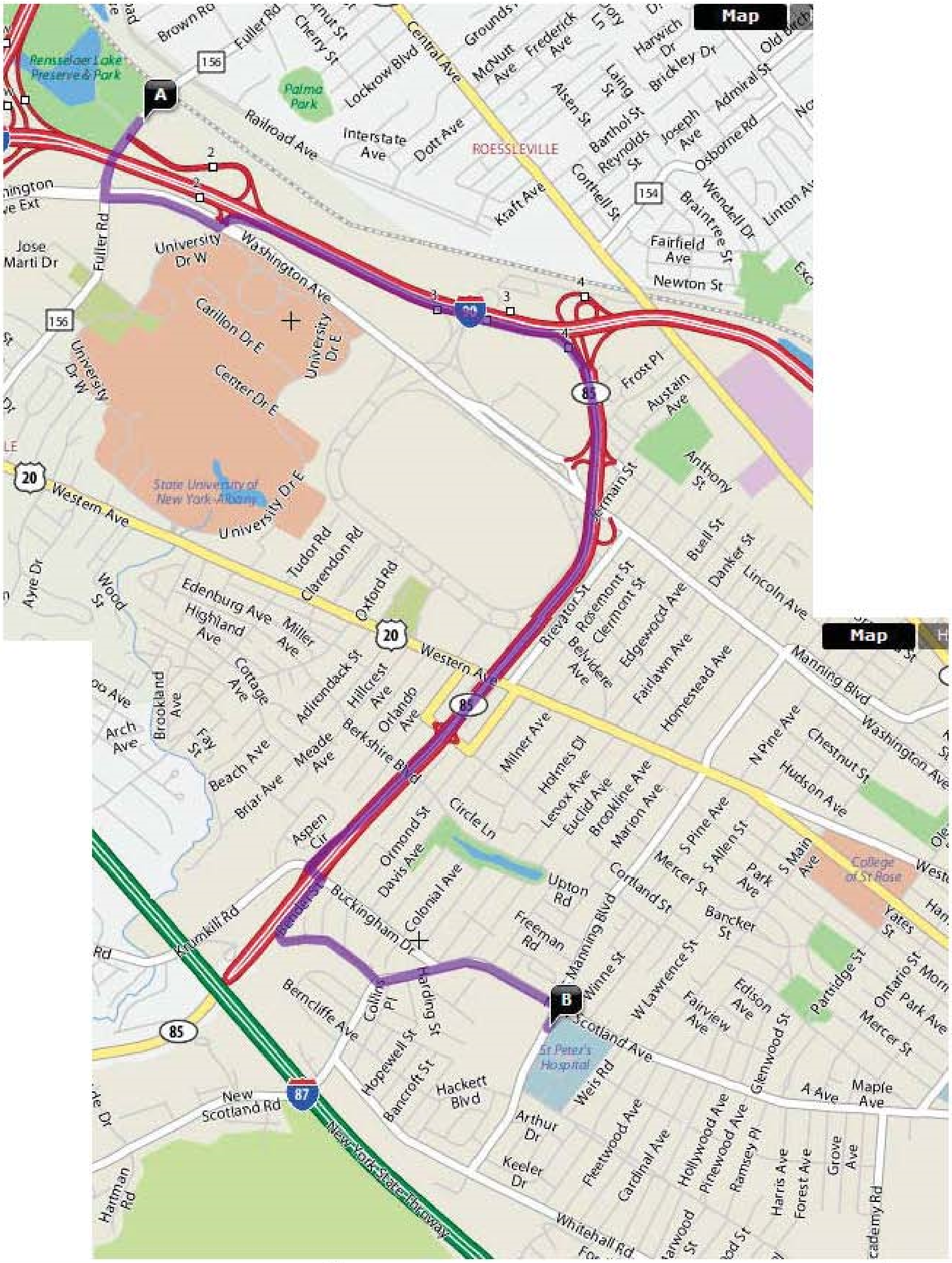
Hospital Location: 315 South Manning Boulevard in Albany, New York

Hospital Telephone: 911

Directions to St. Peters Hospital:

1.	Turn LEFT onto FULLER ROAD.	0.4 miles
2.	Turn LEFT onto WASHINGTON AVENUE.	0.3 miles
3.	Turn LEFT onto I-90E Ramp.	<0.1 miles
4.	Merge onto I-90 E	0.8 miles
5.	Take the Route 85 exit [exit 4] – toward SLINGERLANDS/VOORHEESVILLE.	0.3 miles
6.	Merge onto NY-85 S.	1.6 miles
7.	Take the exit toward MARIA COLLEGE/KRUMKILL ROAD.	0.2 miles
8.	Turn LEFT onto BUCKINGHAM DRIVE.	0.4 miles
9.	Turn LEFT onto NEW SCOTLAND AVENUE.	0.3 miles
10.	Turn RIGHT onto S MANNING BOULEVARD.	0.2 miles
11.	End at 315 MANNING BOULEVARD.	
	Total estimated time = 11 minutes	4.98 miles

Map Showing Route from the site to the Hospital:



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Capital District Office:
547 River Street, Troy, NY 12180
Phone: (518) 273-0055

Glens Falls Office:
110 Glen Street Glens Falls, NY 12801

FIGURE 1-HOSPITAL ROUTE MAP

Former Fuller Brush Manufacturing Facility
136 Fuller Road
City of Albany, Albany County, New York

Date: 2009
Scale: Not to Scale
Project #: 90618.00

2.5.3 Response Procedures

As appropriate, the fire department and other emergency response group will be notified immediately by telephone of the emergency. The emergency telephone number list is found at the beginning of this Contingency Plan (Table 2.5.1a). The list will also be posted prominently at the site in an area readily accessible to site personnel.

3.0 SITE MONITORING PLAN

3.1 INTRODUCTION

3.1.1 General

The Monitoring Plan describes the measures for evaluating the performance and effectiveness of the remedy to reduce or mitigate contamination at the site, the soil cover system, and all affected site media identified below. Monitoring of other Engineering Controls is described in Chapter 4, Operation, Monitoring and Maintenance Plan. This Monitoring Plan may only be revised with the approval of NYSDEC.

3.1.2 Purpose and Schedule

This Monitoring Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (i.e., groundwater);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards;
- Assessing achievement of the remedial performance criteria;
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring activities.

To adequately address these issues, this Monitoring Plan provides information on:

- Sampling locations, protocol, and frequency;
- Information on all designed monitoring systems (e.g., well logs);
- Analytical sampling program requirements;
- Reporting requirements;
- Quality Assurance/Quality Control (QA/QC) requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and

- Annual inspection and periodic certification.

Quarterly monitoring of the performance of the remedy and overall reduction in contamination on-site will be conducted quarterly during operation of the HVE/SVE system and for one year (four quarters) following termination of HVE/SVE system operation. The frequency thereafter will be annually. Trends in contaminant levels in groundwater in the affected areas will be evaluated to determine if the remedy continues to be effective in reaching remedial goals. Monitoring programs are summarized in Table 3.1.2 and outlined in detail in Sections 3.2 and 3.3 below.

Table 3.1.2: Monitoring/Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
Groundwater	Quarterly during operations of the HVE/SVE system and for one year after termination of HVE/SVE system. Sampling will be annual thereafter.	Groundwater	Volatile Organic Compounds by EPA Method 8260
SSDS	Quarterly during operations of the HVE/SVE system. Annual thereafter until the SSDS is terminated.	Physical system check	None
HVE/SVE System	Various, see OM&MP.	Physical system check and Influent/Effluent water and Effluent Vapor	Water - Volatile Organic Compounds by EPA Method 8260 Vapor - Volatile Organic Compounds by Method TO-15

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC and NYSDOH

3.2 SOIL COVER SYSTEM MONITORING

Soil cover monitoring is addressed separately from the other engineering controls in this SMP because it is a passive component of the site remedy. A site cover currently exists and will be maintained to allow for commercial and industrial use of the site. Any site redevelopment will maintain a site cover, which may consist of either of the structures such as buildings, pavement and sidewalks comprising the site development or a soil cover in areas where the upper one foot of exposed surface soil will exceed the applicable soil cleanup objectives. Where a soil cover is required it will be a minimum of one foot of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for commercial use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer. .

3.3 MEDIA MONITORING PROGRAM

3.3.1 Groundwater Monitoring

While the HVE/SVE system is operational, groundwater monitoring will be performed on a quarterly basis to assess the performance of the remedy. The quarterly monitoring will be continued for one year (four quarters) following termination of HVE/SVE system. Thereafter, sampling will be reduced to once per year. Five years after the HVE/SVE system is terminated, the need for groundwater sampling will be re-evaluated. The sampling frequency will be modified with the approval NYSDEC to the minimum necessary to monitor the effectiveness of the remedy.

The network of monitoring wells has been installed to monitor both source and plume area groundwater conditions at the site (Figures 4 and 12). The network of on-site wells has been designed based on the following criteria: wells in both the source and plume area, wells situated above the shallow clay layer, and two wells situated above the deeper clay layer. In 2018, an additional monitoring well (MW-37) was installed downgradient of MW-32 (Figure 12). The groundwater monitoring program was reduced per NYSDEC's approval in August 2, 2016, and two wells are added to the program as noted in Chazen's August 30, 2018 Proposed SMP Addendum #2 , both of which are in Appendix J. The following six wells would be sampled on a quarterly basis: MW-10, MW-25, MW-27, MW-30, MW-32, and MW-33. On an annual basis (one of the four quarters), the following 15 wells would be sampled: MW-3, MW-7, MW-9, MW-10, MW-13, MW-18, MW-20, MW-25, MW-27, MW-29, MW-30, MW-31, MW-32, MW-33, and MW-37.

The sampling frequency (including wells and frequency) may be modified with the approval of NYSDEC to reduce (or increase) based upon the need for such data. Samples from the wells will be analyzed for VOCs via EPA Method 8260.

Groundwater contours before implementation of the HVE/SVE system are shown on Figure 3, while Figure 12 shows groundwater contours observed during operation of the HVE/SVE system. Baseline groundwater quality conditions are presented in Table D1, and Figures 7 and 8 depict the baseline data. Figure 8b depicts the June 2018 total CVOC data. Monitoring well construction logs are included in Appendix D2.

Deliverables for the groundwater monitoring program are specified below.

3.3.1.1 Sampling Protocol

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

Each groundwater monitoring well will be gauged to determine the depth to groundwater. Following the gauging data collection, the well water was purged to allow for the collection of groundwater representative of the surrounding aquifer.

Low-flow sampling methodology will be implemented to slowly pump wells with a peristaltic pump to minimize drawdown until field parameters (pH, conductivity, temperature, turbidity, salinity, dissolved oxygen, and oxygen-reduction potential) are stabilized.

Groundwater samples will be collected in labeled laboratory-supplied bottles, and then immediately placed in a cooler with ice before being shipped to an ELAP certified analytical testing laboratory. Samples will be analyzed for VOCs by EPA Method 8260.

Results of the groundwater sampling will be reported to NYSDEC on a quarterly basis

3.3.1.2 Monitoring Well Repairs, Replacement and Decommissioning

If biofouling or silt accumulation occurs in the monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced (as per the Monitoring Plan), if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent periodic report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. Well abandonment will be performed in accordance with NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.3.2 HVE/SVE System Influent/Effluent Monitoring

HVE/SVE system influent and effluent monitoring will be performed on a monthly basis to monitor VOC removal and confirm that effluent action levels are being met.

Water samples will be collected from the total fluids influent to the system through the HVE (between the cyclone phase separator and the oil/water separator), and of the treated effluent water before it is discharged to the sanitary sewer. These liquid/water samples will be submitted to an ELAP certified analytical testing laboratory and will be analyzed for VOCs by EPA Method 8260.

A 3-Liter whole air sample will be collected in a Tedlar sampling bag from the effluent pipe just before the discharge stack and will also be submitted to an ELAP certified analytical testing laboratory and analyzed for VOCs by EPA Method TO-15.

The sampling frequency may be modified with the approval of NYSDEC. The SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

Deliverables for the HVE/SVE system monitoring program are specified below.

3.3.2.1 Sampling Protocol

Other field readings will be collected as well to document the: water flow through the system (gallons per minute), stack flow (cubic feet per minute), and stack PID reading (ppm). These data will be entered into the monitoring spreadsheet. Quarterly effluent reports will be submitted to NYSDEC, NYSDOH and Albany County Health Department.

3.4 SITE-WIDE INSPECTION

Site-wide inspections will be performed on a regular schedule at a minimum of once a year. Inspections will also be performed after all severe weather conditions that may affect Engineering Controls. During the site-wide inspections, an inspection form will be completed (Appendix F). The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities are being conducted;
- Compliance with permits and schedules included in the Operation and Maintenance Plan; and
- Confirm that site records are up to date.

3.5 MONITORING QUALITY ASSURANCE/QUALITY CONTROL

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

- QA/QC Objectives for Data Measurement;
- Sampling Program:

  - Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.
  - Sample holding times will be in accordance with the NYSDEC ASP requirements.
  - Field QC samples (e.g., trip blanks, coded field duplicates, and matrix spike/matrix spike duplicates) will be collected as necessary.
- Sample Tracking and Custody;
- Calibration Procedures:
  - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
  - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.
- Analytical Procedures;
- Internal QC and Checks;
- QA Performance and System Audits;
- Preventative Maintenance Procedures and Schedules;
- Corrective Action Measures.

3.6 MONITORING REPORTING REQUIREMENTS

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

All monitoring results not already reported to NYSDEC will be reported to NYSDEC on a periodic basis in the Periodic Review Report. A letter report will also be prepared subsequent to each groundwater sampling event. The letter will include, at a minimum:

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

Data will be reported in digital format as determined by NYSDEC. A summary of the monitoring program deliverables are summarized in Table 3.6 below.

Table 3.6: Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Quarterly groundwater monitoring	Within six weeks of completing field work
Annual groundwater monitoring	Within six weeks of completing field work
Monthly HVE/SVE system effluent monitoring	Quarterly, within six weeks of completing third sampling event

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC

4.0 OPERATION AND MAINTENANCE PLAN

Separate Operations and Maintenance Plans for the two mechanical engineering controls have been prepared and are attached as Appendix G for the SSDS, and Appendix H for the HVE/SVE system. The monitoring schedules for these engineering controls are presented in Section 3.1.2

Information on non-mechanical Engineering Controls (i.e., soil cover system) is provided in Section 3.2 - Engineering and Institutional Control Plan. A copy of these Operation and Maintenance Plans, along with the complete SMP, will be kept at the site. The Operation and Maintenance Plans are not to be used as a stand-alone document, but as component documents of the SMP.

5.0 INSPECTIONS, REPORTING AND CERTIFICATIONS

5.1 SITE INSPECTIONS

5.1.1 Inspection Frequency

All inspections will be conducted at the frequency specified in the schedules provided in Section 3 Monitoring Plan and Section 4 Operation and Maintenance Plan of this SMP. At a minimum, a site-wide inspection will be conducted annually. Inspections of remedial components will also be conducted when a breakdown of any treatment system component has occurred or whenever a severe condition has taken place, such as an erosion or flooding event that may affect the ECs.

5.1.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on the appropriate forms for their respective system which are contained in Appendices G (SSDS) and H (HVE/SVE system). Additionally, a general site-wide inspection form will be completed during the site-wide inspection (see Appendix F). These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including all media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format in the Periodic Review Report.

5.1.3 Evaluation of Records and Reporting

The results of the inspection and site monitoring data will be evaluated as part of the EC/IC certification to confirm that the:

- EC/ICs are in place, are performing properly, and remain effective;
- The Monitoring Plan is being implemented;
- Operation and maintenance activities are being conducted properly; and, based on the above items,

- The site remedy continues to be protective of public health and the environment and is performing as designed in the RWP and FER.

5.2 CERTIFICATION OF ENGINEERING AND INSTITUTIONAL CONTROLS

After the last inspection of the reporting period, the following certification will be prepared (by the QEP or PE while the HVE/SVE system is operating, and by the owner or their designated representative after the engineering control is terminated):

For each institutional or engineering control identified for the site, I certify that all of the following statements are true:

- The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;
- The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;
- Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;
- If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;
- Use of the site is compliant with the environmental easement;
- The engineering control systems are performing as designed and are effective (with respect to this statement, while the HVE/SVE is online, the NYSDEC may require, if it deems necessary, a certification from a Professional Engineer licensed to practice in New York State);

- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program; and

  Every three years the following certification will be added:

- The information presented in this report is accurate and complete.
- I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Professional Engineer or Qualified Environmental Professional].

  After the HVE/SVE system is removed, the certification can be changed to the Owner. If the site consists of multiple properties, the certification will include: I have been authorized and designated by all site owners to sign this certification for the site.

The signed certification will be included in the Periodic Review Report described below.

5.3 PERIODIC REVIEW REPORT

A Periodic Review Report will be submitted to the Department every third year beginning eighteen months after the Certificate of Completion is issued. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix B (Metes and Bounds). The report will be prepared in accordance with NYSDEC DER-10 and submitted within 45 days of the end of each certification period. Media sampling results will also incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site;
- Results of the required annual site inspections and severe condition inspections, if applicable;

- All applicable inspection forms and other records generated for the site during the reporting period in electronic format;
- A summary of any discharge monitoring data and/or information generated during the reporting period with comments and conclusions;
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedences highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends;
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format;
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RWP;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; and
  - The overall performance and effectiveness of the remedy.
- While the HVE/SVE system is online, a performance summary for the HVE/SVE system during the reporting period, including information such as:
  - The number of days the system was run for the reporting period;
  - A summary of the monthly flows;
  - An estimate of the contaminant mass removed;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;

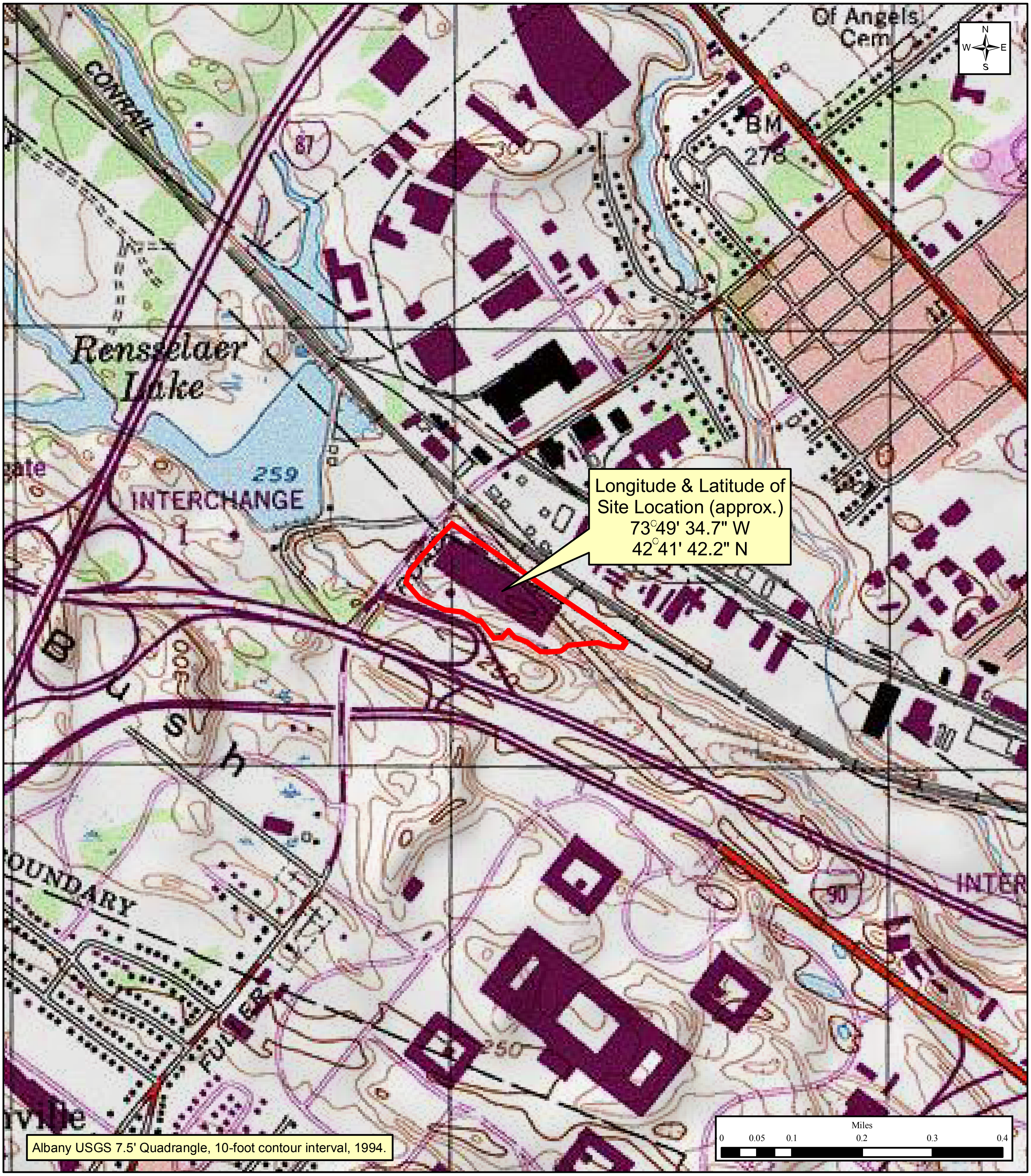
- A description of the resolution of performance problems;
- A summary of the performance, effluent and/or effectiveness monitoring; and
- Comments, conclusions, and recommendations based on data evaluation.

The Periodic Review Report will be submitted in electronic format to NYSDEC Central Office and the NYSDOH Bureau of Environmental Exposure Investigation.

5.4 CORRECTIVE MEASURES PLAN

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a corrective measures plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the corrective measures plan until it is approved by the NYSDEC.

Figures



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Glens Falls Office:
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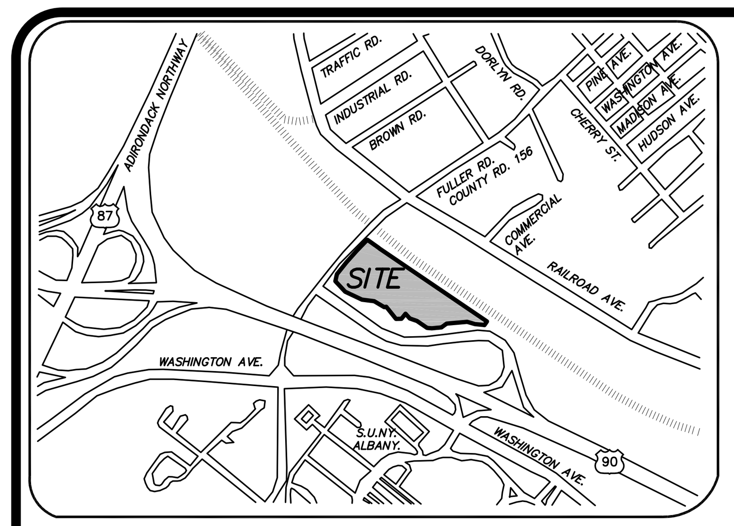
Phone: (518) 812-0513

Fuller Partners, LLC

Site Location Map

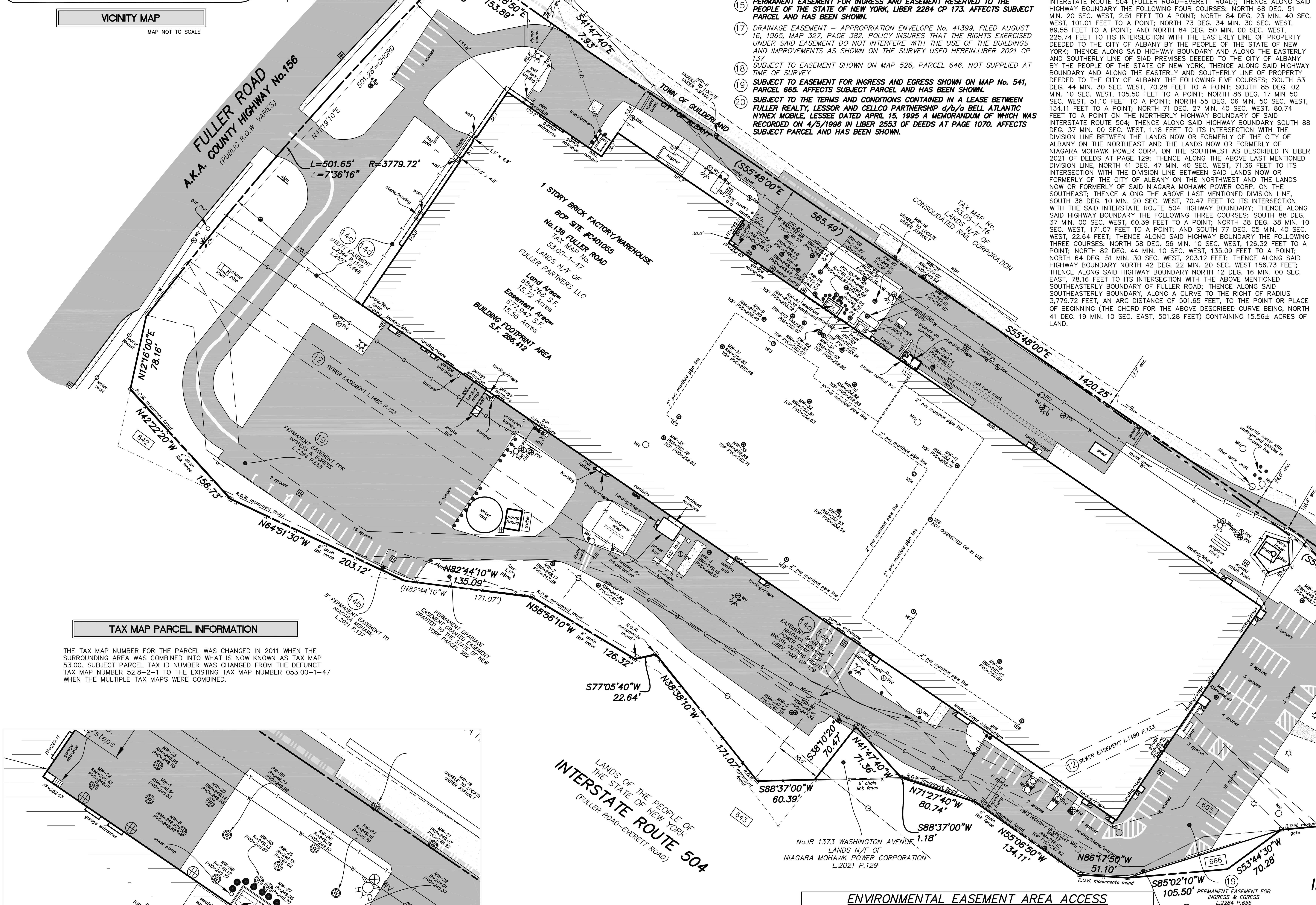
136 Fuller Road
City of Albany
Albany County, New York

Drawn:	CLC
Date:	01/01/2007
Scale:	As Shown
Project:	90618.00
Figure:	1



VICINITY MAP

MAP NOT TO SCALE



NOTES CORRESPONDING TO SCHEDULE B SECTION 2 ITEMS

(11) DRAINAGE EASEMENT – LIBER 1437 CP 283. CANNOT PLOT, MAP REFERENCE NOT SUPPLIED AT TIME OF SURVEY.

(12) **SEWER EASEMENT – LIBER 1450 CP 60 AS MODIFIED BY LIBER 1480 CP 123. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(13) WATER LINE EASEMENT – LIBER 1450 CP 60. CANNOT BE PLOTTED. VAGUE IN DESCRIPTION

(14a) **UTILITY EASEMENT – LIBER 2021 CP 129. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(14a) **UTILITY BRUSH CUTTING RIGHTS – LIBER 2021 CP 129. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(14b) **UTILITY EASEMENT – LIBER 2021 CP 137. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(14c) **UTILITY EASEMENT – LIBER 2344 CP 1119. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(14d) **UTILITY EASEMENT – LIBER 2597 CP 448. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(15) **PERMANENT EASEMENT FOR INGRESS AND EASEMENT RESERVED TO THE PEOPLE OF THE STATE OF NEW YORK, LIBER 2284 CP 173. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(17) DRAINAGE EASEMENT – APPROPRIATION ENVELOPE No. 41399, FILED AUGUST 16, 1965, MAP 327, PAGE 382. POLICY INSURES THAT THE RIGHTS EXERCISED UNDER SAID EASEMENT DO NOT INTERFERE WITH THE USE OF THE BUILDINGS AND IMPROVEMENTS AS SHOWN ON THE SURVEY USED HEREIN.LIBER 2021 CP 137

(18) SUBJECT TO EASEMENT SHOWN ON MAP 526, PARCEL 646. NOT SUPPLIED AT TIME OF SURVEY

(19) **SUBJECT TO EASEMENT FOR INGRESS AND EGRESS SHOWN ON MAP No. 541, PARCEL 665. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

(20) **SUBJECT TO THE TERMS AND CONDITIONS CONTAINED IN A LEASE BETWEEN FULLER REALTY, LESSOR AND CELLCO PARTNERSHIP d/b/a BELL ATLANTIC NYNEX MOBILE, LESSEE DATED APRIL 15, 1995 A MEMORANDUM OF WHICH WAS RECORDED ON 4/5/1996 IN LIBER 2553 OF DEEDS AT PAGE 1070. AFFECTS SUBJECT PARCEL AND HAS BEEN SHOWN.**

SITE AND ENVIRONMENTAL EASEMENT AREA DESCRIPTION

ALL THAT PARCEL OF LAND SITUATE IN THE CITY OF ALBANY, ALBANY COUNTY, STATE OF NEW YORK, LYING ON THE SOUTHEASTERLY SIDE OF FULLER ROAD AND NORTHERLY AND NORTHEASTERLY OF INTERSTATE ROUTE 504 (FULLER ROAD–EVERETT ROAD) AND BEING MORE PARTICULARLY BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A BEND POINT IN THE SOUTHEASTERLY BOUNDARY OF FULLER ROAD (COUNTY HIGHWAY No.156), SAID POINT BEING THE MOST NORTHERLY CORNER OF A PARCEL OF LAND CONVEYED TO THE CITY OF ALBANY IN LIBER 2046 OF DEEDS, PAGE 679, SAID POINT ALSO BEING ON THE REPUTED CITY LINE BETWEEN THE TOWN OF GUILDERLAND ON THE NORTHEAST AND CITY OF ALBANY ON THE SOUTHWEST; RUNNING THENCE FROM SAID POINT OF BEGINNING ALONG SAID REPUTED CITY LINE. SOUTH 54 DEG. 48 MIN. 50 SEC. EAST, 153.89 FEET TO A POINT ON THE SOUTHWESTERLY BOUNDARY OF LANDS NOW OR FORMERLY OF CONSOLIDATED RAIL CORPORATION; THENCE ALONG SAID SOUTHWESTERLY BOUNDARY THE FOLLOWING THREE COURSES: SOUTH 41 DEG. 47 MIN. 40. SEC. EAST, 7.93 FEET TO A POINT; SOUTH 55 DEG. 48 MIN. 00 SEC. EAST, 565.49 FEET TO A POINT: SOUTH 54 DEG. 43 MIN. 49 SEC. EAST, 854.91 FEET TO A POINT; THENCE THROUGH THE LANDS NOW OR FORMERLY OF THE CITY OF ALBANY , SOUTH 34 DEG. 11 MIN. 40 SEC. WEST, 32.33 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF INTERSTATE ROUTE 504 (FULLER ROAD–EVERETT ROAD); THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING FOUR COURSES: NORTH 68 DEG. 51 MIN. 20 SEC. WEST, 2.51 FEET TO A POINT; NORTH 84 DEG. 23 MIN. 40 SEC. WEST, 101.01 FEET TO A POINT; NORTH 73 DEG. 34 MIN. 30 SEC. WEST, 89.55 FEET TO A POINT; AND NORTH 84 DEG. 50 MIN. 00 SEC. WEST, 225.74 FEET TO ITS INTERSECTION WITH THE EASTERLY LINE OF PROPERTY DEEDED TO THE CITY OF ALBANY BY THE PEOPLE OF THE STATE OF NEW YORK; THENCE ALONG SAID HIGHWAY BOUNDARY AND ALONG THE EASTERLY AND SOUTHERLY LINE OF SIAD PREMISES DEEDED TO THE CITY OF ALBANY BY THE PEOPLE OF THE STATE OF NEW YORK, THENCE ALONG SAID HIGHWAY BOUNDARY AND ALONG THE EASTERLY AND SOUTHERLY LINE OF PROPERTY DEEDED TO THE CITY OF ALBANY THE FOLLOWING FIVE COURSES; SOUTH 53 DEG. 44 MIN. 30 SEC. WEST, 70.28 FEET TO A POINT; SOUTH 85 DEG. 02 MIN. 10 SEC. WEST, 105.50 FEET TO A POINT; NORTH 86 DEG. 17 MIN 50 SEC. WEST, 51.10 FEET TO A POINT; NORTH 55 DEG. 06 MIN. 50 SEC. WEST, 134.11 FEET TO A POINT; NORTH 71 DEG. 27 MIN. 40 SEC. WEST. 80.74 FEET TO A POINT ON THE NORTHERLY HIGHWAY BOUNDARY OF SAID INTERSTATE ROUTE 504; THENCE ALONG SAID HIGHWAY BOUNDARY SOUTH 88 DEG. 37 MIN. 00 SEC. WEST, 1.18 FEET TO ITS INTERSECTION WITH THE DIVISION LINE BETWEEN THE LANDS NOW OR FORMERLY OF THE CITY OF ALBANY ON THE NORTHEAST AND THE LANDS NOW OR FORMERLY OF NIAGARA MOHAWK POWER CORP. ON THE SOUTHWEST AS DESCRIBED IN LIBER 2021 OF DEEDS AT PAGE 129; THENCE ALONG THE ABOVE LAST MENTIONED DIVISION LINE, NORTH 41 DEG. 47 MIN. 40 SEC. WEST, 71.36 FEET TO ITS INTERSECTION WITH THE DIVISION LINE BETWEEN SAID LANDS NOW OR FORMERLY OF THE CITY OF ALBANY ON THE NORTHWEST AND THE LANDS NOW OR FORMERLY OF SAID NIAGARA MOHAWK POWER CORP. ON THE SOUTHEAST; THENCE ALONG THE ABOVE LAST MENTIONED DIVISION LINE, SOUTH 38 DEG. 10 MIN. 20 SEC. WEST, 70.47 FEET TO ITS INTERSECTION WITH THE SAID INTERSTATE ROUTE 504 HIGHWAY BOUNDARY; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: SOUTH 88 DEG. 37 MIN. 00 SEC. WEST, 60.39 FEET TO A POINT; NORTH 38 DEG. 38 MIN. 10 SEC. WEST, 171.07 FEET TO A POINT; AND SOUTH 77 DEG. 05 MIN. 40 SEC. WEST, 22.64 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: NORTH 58 DEG. 56 MIN. 10 SEC. WEST, 126.32 FEET TO A POINT; NORTH 82 DEG. 44 MIN. 10 SEC. WEST, 135.09 FEET TO A POINT; NORTH 64 DEG. 51 MIN. 30 SEC. WEST, 203.12 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY NORTH 42 DEG. 22 MIN. 20 SEC. WEST 156.73 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY NORTH 12 DEG. 16 MIN. 00 SEC. EAST, 78.16 FEET TO ITS INTERSECTION WITH THE ABOVE MENTIONED SOUTHEASTERLY BOUNDARY OF FULLER ROAD; THENCE ALONG SAID SOUTHEASTERLY BOUNDARY, ALONG A CURVE TO THE RIGHT OF RADIUS 3,779.72 FEET, AN ARC DISTANCE OF 501.65 FEET, TO THE POINT OR PLACE OF BEGINNING (THE CHORD FOR THE ABOVE DESCRIBED CURVE BEING, NORTH 41 DEG. 19 MIN. 10 SEC. EAST, 501.28 FEET) CONTAINING 15.56± ACRES OF LAND.

RECORD DESCRIPTION

ALL THAT PARCEL OF LAND, SITUATE PARTIALLY IN THE CITY OF ALBANY AND PARTIALLY IN THE TOWN OF GUILDERLAND, ALBANY COUNTY, STATE OF NEW YORK, LYING ON THE SOUTHEASTERLY SIDE OF FULLER ROAD AND NORTHERLY AND NORTHEASTERLY OF INTERSTATE ROUTE 504 (FULLER ROAD–EVERETT ROAD) AND BEING MORE PARTICULARLY BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A BEND POINT IN THE SOUTHEASTERLY BOUNDARY OF FULLER ROAD (COUNTY HIGHWAY No.156), SAID POINT BEING THE MOST NORTHERLY CORNER OF A PARCEL OF LAND CONVEYED TO THE CITY OF ALBANY IN LIBER 2046 OF DEEDS, PAGE 679, SAID POINT ALSO BEING ON THE REPUTED CITY LINE BETWEEN THE TOWN OF GUILDERLAND ON THE NORTHEAST AND CITY OF ALBANY ON THE SOUTHWEST; RUNNING THENCE FROM SAID POINT OF BEGINNING ALONG SAID REPUTED CITY LINE. SOUTH 54 DEG. 48 MIN. 50 SEC. EAST, 153.89 FEET TO A POINT ON THE SOUTHWESTERLY BOUNDARY OF LANDS NOW OR FORMERLY OF CONSOLIDATED RAIL CORPORATION; THENCE ALONG SAID SOUTHWESTERLY BOUNDARY THE FOLLOWING TWO COURSES: SOUTH 41 DEG. 47 MIN. 40. SEC. EAST, 7.93 FEET TO A POINT; SOUTH 55 DEG. 48 MIN. 00 SEC. EAST, 1420.25 FEET TO A POINT; THENCE THROUGH THE LANDS NOW OR FORMERLY OF THE CITY OF ALBANY , SOUTH 34 DEG. 11 MIN. 40 SEC. WEST, 48.29 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF INTERSTATE ROUTE 504 (FULLER ROAD–EVERETT ROAD); THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING FOUR COURSES: NORTH 68 DEG. 51 MIN. 20 SEC. WEST, 2.51 FEET TO A POINT; NORTH 84 DEG. 23 MIN. 40 SEC. WEST, 101.01 FEET TO A POINT; NORTH 73 DEG. 34 MIN. 30 SEC. WEST, 89.55 FEET TO A POINT; AND NORTH 84 DEG. 50 MIN. 00 SEC. WEST, 225.74 FEET TO ITS INTERSECTION WITH THE EASTERLY LINE OF PROPERTY DEEDED TO THE CITY OF ALBANY BY THE PEOPLE OF THE STATE OF NEW YORK; THENCE ALONG SAID HIGHWAY BOUNDARY AND ALONG THE EASTERLY AND SOUTHERLY LINE OF SIAD PREMISES DEEDED TO THE CITY OF ALBANY BY THE PEOPLE OF THE STATE OF NEW YORK, THENCE ALONG SAID HIGHWAY BOUNDARY AND ALONG THE EASTERLY AND SOUTHERLY LINE OF PROPERTY DEEDED TO THE CITY OF ALBANY THE FOLLOWING FIVE COURSES; SOUTH 53 DEG. 44 MIN. 30 SEC. WEST, 70.28 FEET TO A POINT; SOUTH 85 DEG. 02 MIN. 10 SEC. WEST, 105.50 FEET TO A POINT; NORTH 86 DEG. 17 MIN 50 SEC. WEST, 51.10 FEET TO A POINT; NORTH 55 DEG. 06 MIN. 50 SEC. WEST, 134.11 FEET TO A POINT; NORTH 71 DEG. 27 MIN. 40 SEC. WEST. 80.74 FEET TO A POINT ON THE NORTHERLY HIGHWAY BOUNDARY OF SAID INTERSTATE ROUTE 504; THENCE ALONG SAID HIGHWAY BOUNDARY SOUTH 88 DEG. 37 MIN. 00 SEC. WEST, 1.18 FEET TO ITS INTERSECTION WITH THE DIVISION LINE BETWEEN THE LANDS NOW OR FORMERLY OF THE CITY OF ALBANY ON THE NORTHEAST AND THE LANDS NOW OR FORMERLY OF NIAGARA MOHAWK POWER CORP. ON THE SOUTHWEST AS DESCRIBED IN LIBER 2021 OF DEEDS AT PAGE 129; THENCE ALONG THE ABOVE LAST MENTIONED DIVISION LINE, NORTH 41 DEG. 47 MIN. 40 SEC. WEST, 71.36 FEET TO ITS INTERSECTION WITH THE DIVISION LINE BETWEEN SAID LANDS NOW OR FORMERLY OF THE CITY OF ALBANY ON THE NORTHWEST AND THE LANDS NOW OR FORMERLY OF SAID NIAGARA MOHAWK POWER CORP. ON THE SOUTHEAST; THENCE ALONG THE ABOVE LAST MENTIONED DIVISION LINE, SOUTH 38 DEG. 10 MIN. 20 SEC. WEST, 70.47 FEET TO ITS INTERSECTION WITH THE SAID INTERSTATE ROUTE 504 HIGHWAY BOUNDARY; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: SOUTH 88 DEG. 37 MIN. 00 SEC. WEST, 60.39 FEET TO A POINT; NORTH 38 DEG. 38 MIN. 10 SEC. WEST, 171.07 FEET TO A POINT; AND SOUTH 77 DEG. 05 MIN. 40 SEC. WEST, 22.64 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: NORTH 58 DEG. 56 MIN. 10 SEC. WEST, 126.32 FEET TO A POINT; NORTH 82 DEG. 44 MIN. 10 SEC. WEST, 171.07 FEET TO A POINT; AND SOUTH 77 DEG. 05 MIN. 40 SEC. WEST, 22.64 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: NORTH 58 DEG. 56 MIN. 10 SEC. WEST, 126.32 FEET TO A POINT; NORTH 82 DEG. 44 MIN. 10 SEC. WEST, 135.09 FEET TO A POINT; NORTH 64 DEG. 51 MIN. 30 SEC. WEST, 203.12 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY NORTH 42 DEG. 22 MIN. 20 SEC. WEST 156.73 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY NORTH 12 DEG. 16 MIN. 00 SEC. EAST, 78.16 FEET TO ITS INTERSECTION WITH THE ABOVE MENTIONED SOUTHEASTERLY BOUNDARY OF FULLER ROAD; THENCE ALONG SAID SOUTHEASTERLY BOUNDARY, ALONG A CURVE TO THE RIGHT OF RADIUS 3,779.72 FEET, AN ARC DISTANCE OF 501.65 FEET, TO THE POINT OR PLACE OF BEGINNING (THE CHORD FOR THE ABOVE DESCRIBED CURVE BEING, NORTH 41 DEG. 19 MIN. 10 SEC. EAST, 501.28 FEET) CONTAINING 15.72± ACRES OF LAND

Note: the above description describes the same property as in schedule A of title commitment No.NTA–A–120070 of Stewart Title Insurance Company, bearing an effective date of 4/12/2012

Note: the above Record Description fails to mathematically close with an error of 310.92'.

MAP REFERENCES

1. A MAP ENTITLED "SURVEY OF A PORTION OF LANDS OF THE CITY OF ALBANY TO BE CONVEYED TO STAR TEXTILE AND RESEARCH, INC." MADE BY C.T. MALE ASSOCIATES, P.C., DATED APRIL 25, 1985, LAST REVISED 2/10/2004.

2. NEW YORK STATE DEPARTMENT OF TRANSPORTATION MAP FOR CONVEYANCE MAP 524 PARCEL 642, 643, 644, MAP 541 PARCEL 665, MAP 545–C PARCEL 670

PARKING TABLE

REGULAR PARKING	89
HANDICAPPED PARKING	0
TOTAL PARKING SPACES	89

LEGEND

R.O.W.	RIGHT OF WAY
No.	NUMBER
enc.	ENCROACHMENT
P.O.B.	POINT OF BEGINNING
S.F.	SQUARE FEET
N/F	NOW OR FORMERLY
Ft.	FEET
Deg.	DEGREE
R	RECORD
M	MEASURED
N	NORTH
S	SOUTH
E	EAST
W	WEST
tel.	TELEPHONE
elec.	ELECTRIC
L.	LIBER
P.	PAGE
	CITY LINE
	SITE LIMIT LINE
	PAVEMENT
	CONCRETE
	MONUMENT
	IRON ROD
MH	MANHOLE
	CATCHBASIN
	SIGN
	BOLLARD
	FENCE LINE
	GUARD RAIL
	OVERHEAD WIRE, UTILITY POLE & GUY WIRE
	TRAFFIC FLOW ACCESS AREA
WV	WATER VALVE
PIV	POST INDICATOR VALVES
GV	GAS VALVE
	STREET LIGHT
MW–32	ENVIRONMENTAL MONITOR WELL
RW–R6	RECOVERY WELL
VE4	VAPOR EXTRACTION WELL
	STONE
	GRAVEL
	DIRT

GENERAL NOTES

1. UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209–2, OF THE NEW YORK STATE EDUCATION LAW.

2. ONLY COPIES FROM THE ORIGINAL OF THIS SURVEY MARKED WITH THE LAND SURVEYOR'S SIGNATURE AND AN ORIGINAL EMBOSSED OR INK SEAL SHALL BE CONSIDERED VALID TRUE COPIES.

3. THIS SURVEY WAS PREPARED FOR THE PARTIES AND PURPOSE INDICATED HEREON. ANY EXTENSION OF THE USE BEYOND THE PARTIES OR PURPOSE INDICATED IS EXPRESSLY FORBIDDEN WITHOUT WRITTEN RELEASE OR PERMISSION OF FRANCIS G. McCLOSKEY, LICENSE No. 049441.

4. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT SURVEYED OR EXAMINED OR CONSIDERED AS PART OF THIS SURVEY.

5. THIS SURVEY MAP IS SUBJECT TO WHATEVER FACTS AN ACCURATE AND CURRENT ABSTRACT OF TITLE MAY SHOW.

6. ABSTRACT OF TITLE PROVIDED BY STEWART TITLE INSURANCE COMPANY, TITLE No.NTA–A–120070, EFFECTIVE DATE 4/12/2012.

7. SPOT ELEVATIONS AND CONTOURS ARE BASED ON NAVD88 DATUM.

8. UNDERGROUND UTILITIES SHOWN ARE TAKEN FROM FIELD LOCATION WHERE POSSIBLE AND FROM RECORD DATA. THEIR EXACT LOCATION IN THE FIELD MAY DIFFER FROM THAT SHOWN HEREIN AND ADDITIONAL UTILITIES MAY EXIST. CALL DIG SAFELY NEW YORK AT 1–800–962–7962 TO HAVE UTILITIES MARKED ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION.

9. THERE IS NO OBSERVABLE EVIDENCE OF CEMETERIES, EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS WITHIN RECENT MONTHS ON SUBJECT PARCEL.

10. THERE IS NO OBSERVABLE EVIDENCE OF SUBJECT PARCEL BEING USED AS A SOLID WASTE DUMP, SUMP OR SANITARY LANDFILL.

11. THERE IS NO VISIBLE EVIDENCE OF UNUSUAL SUBSURFACE MATTERS SUCH AS , BUT NOT LIMITED TO, CONDEMNATION BY THE EPA OR FAA BUILDING HEIGHT RESTRICTION ON SUBJECT PARCEL.

ZONING INFORMATION

C–M DISTRICT
LIGHT INDUSTRIAL DISTRICT

MIN. FRONT YARD	20 FEET
MIN. SIDE YARD	10 FEET ON ONE SIDE MINIMUM OF 30 FEET ON BOTH SIDES
MIN. REAR YARD	20 FEET
MAX. BUILDING HEIGHT	55 FEET
MAX. LOT COVERAGE	50%

ZONING INFORMATION ADOPTED FROM: CODE OF THE CITY OF ALBANY VOLUME II ARTICLE XI SECTION 375–75

SURVEYOR'S CERTIFICATE

TO: **1. THE PEOPLE OF THE STATE OF NEW YORK ACTING THROUGH ITS COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (2) STEWART TITLE INSURANCE COMPANY**

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH "MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS," JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS IN 2011, ITEMS 1, 2, 3, 4, 6(a), 7(a), 7(b)(1), 8, 9, ,11(a), 11(b), 13, 16, 17, 18 OF TABLE A THEREOF, PURSUANT TO THE ACCURACY STANDARDS AS ADOPTED BY ALTA AND ACSM AND IN EFFECT ON THE DATE OF THIS CERTIFICATION, UNDERSIGNED FURTHER CERTIFIES THAT IN MY PROFESSIONAL OPINION, AS A LAND SURVEYOR REGISTERED IN THE STATE OF NEW YORK, THE RELATIVE POSITIONAL ACCURACY OF THIS SURVEY DOES NOT EXCEED THAT WHICH IS SPECIFIED THEREIN.

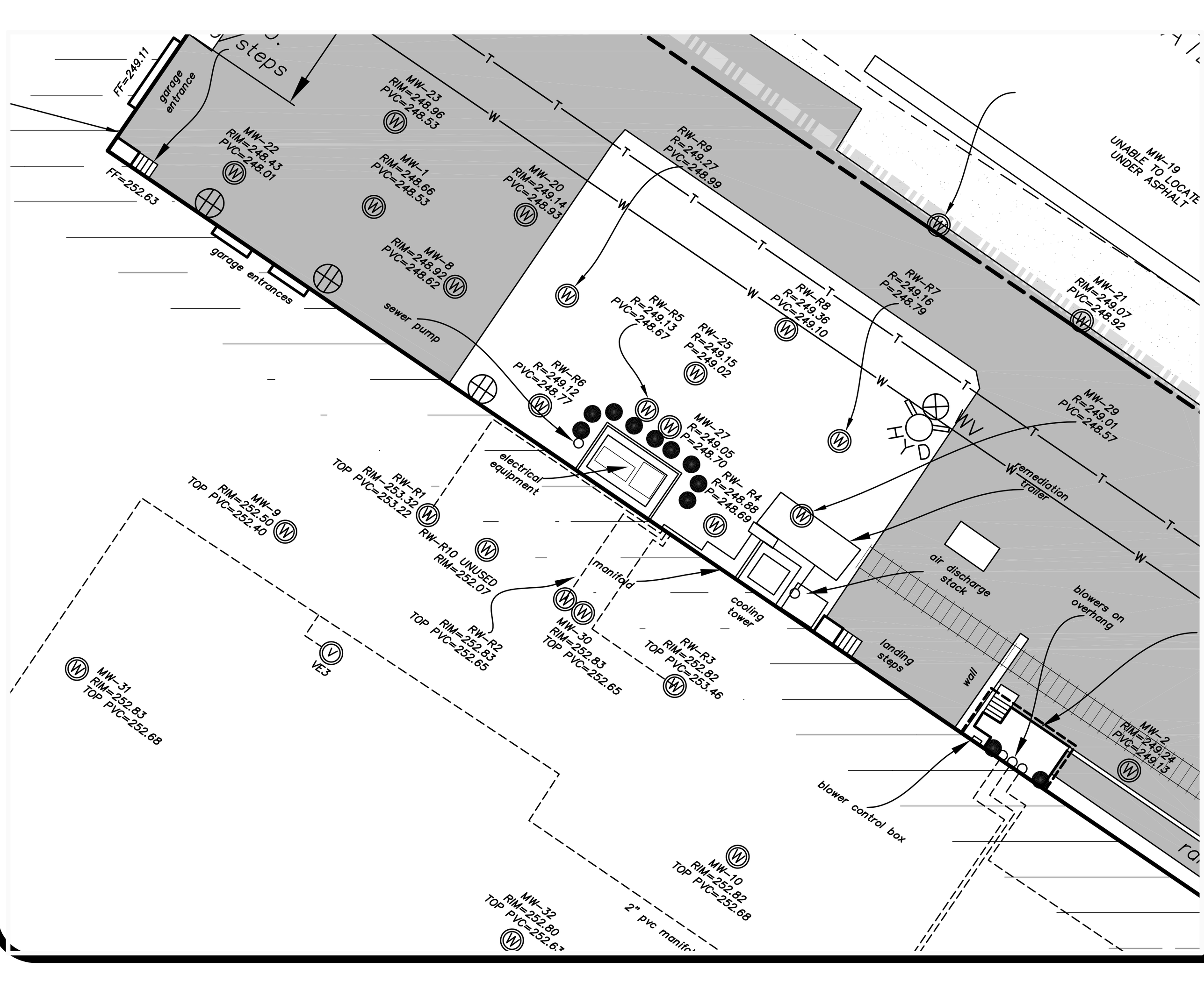
DATE: 3/17/2012 .

SIGNED: [signature]
Registration No. 49441

STATE OF NEW YORK · FRANCIS G. McCLOSKEY · No. 049441 · LICENSED LAND SURVEYOR

TAX MAP PARCEL INFORMATION

THE TAX MAP NUMBER FOR THE PARCEL WAS CHANGED IN 2011 WHEN THE SURROUNDING AREA WAS COMBINED INTO WHAT IS NOW KNOWN AS TAX MAP 53.00. SUBJECT PARCEL TAX ID NUMBER WAS CHANGED FROM THE DEFUNCT TAX MAP NUMBER 52.8–2–1 TO THE EXISTING TAX MAP NUMBER 053.00–1–47 WHEN THE MULTIPLE TAX MAPS WERE COMBINED.



FLOOD NOTE: By graphic plotting only, this property is in Zone(s) C of the Flood Insurance Rate Map, Community Panel No. 360010 0002 C, which bears an effective date of APRIL 15, 1980 and is not in a Special Flood Hazard Area. By telephone call dated 3/29/2012 to the National Flood Insurance Program (800–638–6620) we have learned this community does/~~does not~~ currently participate in the program. No field surveying was performed to determine this zone and an elevation certificate may be needed to verify this determination or apply for a variance from the Federal Emergency Management Agency.

ZONE "C" AREA OF MINIMAL FLOODING

GRAPHIC SCALE
60 | 0 | 30 (9.14 METERS) | 60 (18.29 METERS) | 120 (36.58 METERS) | 240 (73.15 METERS)
(IN FEET)
1 inch = 60 ft.

ENVIRONMENTAL EASEMENT AREA ACCESS

THE DEC OR THEIR AGENT MAY ACCESS THE ENVIRONMENTAL EASEMENT AREA AS SHOWN HEREON THROUGH ANY EXISTING STREET ACCESS OR BUILDING INGRESS/EGRESS ACCESS POINT

THIS ENGINEERING AND INSTITUTIONAL CONTROLS for the Easement are set forth in more detail in the Site Management Plan ("SMP"). A copy of the SMP must be obtained by any party with an interest in the property. The SMP may be obtained from the New York State Department of Enviornmental Conservation, Division of Enviornmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12203 or at derweb@gw.dec.state.ny.us.

ENGINEERING/INSTITUTIONAL CONTROLS

LAND USE – The use and development of the site is limited to Commercial and Industrial uses only.

THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL EASEMENT HELD BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION PURSUANT TO TITLE 36 OF ARTICLE 71 OF THE NEW YORK ENVIRONMENTAL CONSERVATION LAW.

HERSHBERG & HERSHBERG
Consulting Engineers and Land Surveyors
18 Locust Street
Albany, New York 12203
Ph. (518) 459–3096
Fax (518) 459–5683
E–mail: hhershberg@aol.com

ALTA/ACSM LAND TITLE SURVEY

MAP SHOWING LOCATION OF BUILDINGS AND IMPROVEMENTS WITH REFERENCE TO PROPERTY LINES OF

No.136 FULLER ROAD
BCP SITE #C401055

CITY OF ALBANY, TOWN OF GUIDERLAND, COUNTY OF ALBANY, STATE OF NEW YORK

ALTERATION OF THIS DOCUMENT, EXCEPT BY A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, IS ILLEGAL.

REVISIONS: 3/4/2013 (REVISED ENVIRONMENTAL EASEMENT AREA DESCRIPTION)

DATE: 3/17/2012 | SCALE: 1"=60' | BY: AVC | CHK: GRT | MAP No.: 120036

THE Chazen COMPANIES
Engineers/Surveyors
Planners
Environmental Scientists
Landscape Architects

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

Office Locations:
Dutchess County Office: 21 Fox Street, Poughkeepsie, New York 12601, Phone: (845) 454-3980
Capital District Office: 547 River Street, Troy, New York 12180, Phone: (518) 273-0055
North Country Office: 100 Glen Street, Glens Falls, New York 12801, Phone: (518) 812-0513
Connecticut: 914 Hartford Turnpike, Waterford, CT. 06385, Phone: (860) 440-2690

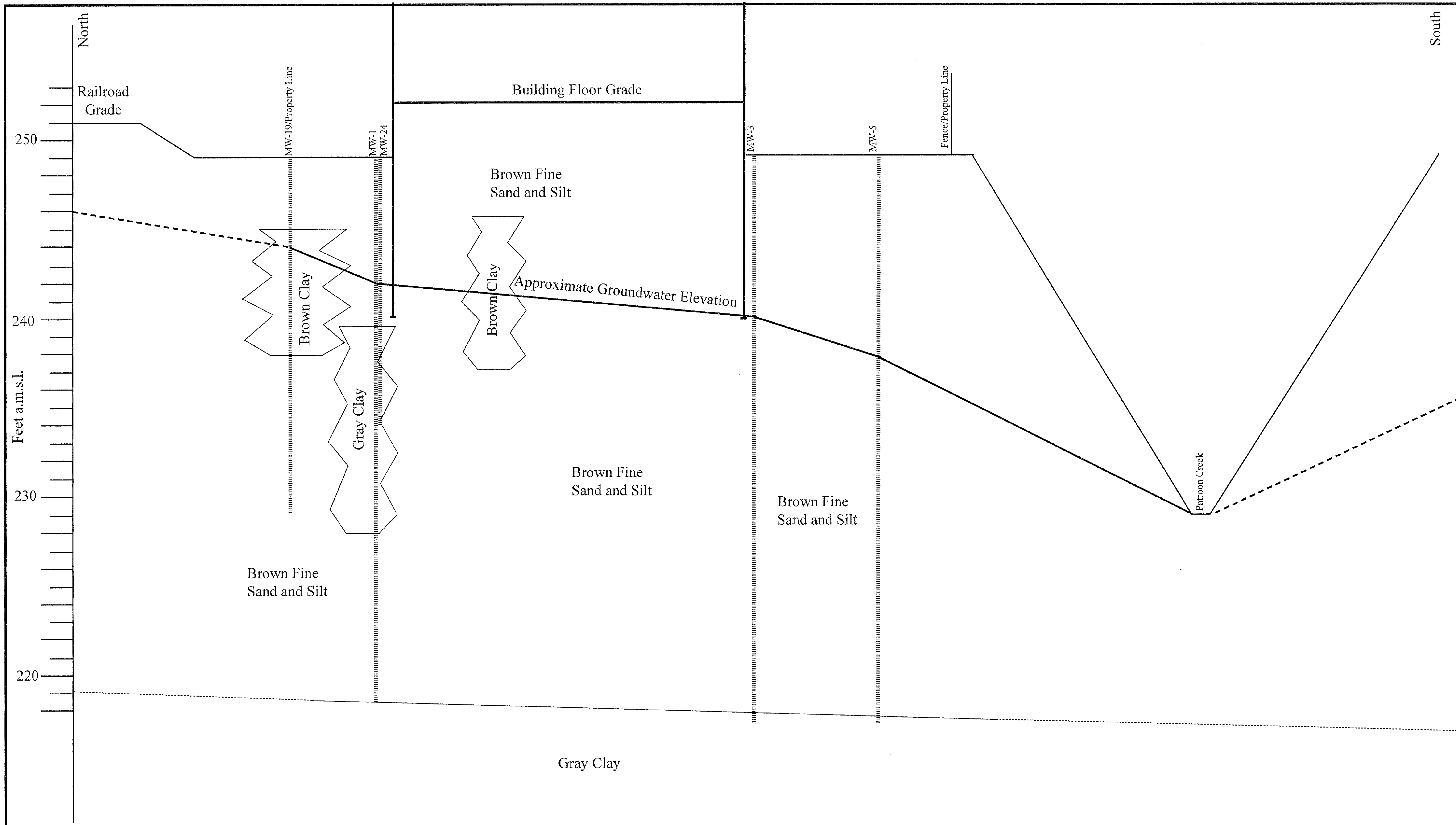
rev.	date	description

FORMER FULLER BRUSH FACILITY

BORING AND MONITORING WELL MAP WITH PRE-IRM GROUNDWATER CONTOURS 136 FULLER ROAD

CITY OF ALBANY, ALBANY CO., NEW YORK

drawn	checked
CSD	ASM
date	scale
9/25/12	1" = 40'
project no.	
90618.00	
sheet no.	
FIG. 3A	



THE Chazen COMPANIES

ENGINEERS/SURVEYORS
PLANNERS
ENVIRONMENTAL SCIENTISTS

Dutchess County Office:
21 Fox St. Poughkeepsie, NY 12601
Phone: (845) 454-3980

Orange County Office:
263 Route 17K Newburgh, NY 12550

Capital District Office:
20 Gurley Avenue, Troy, NY 12182

Glens Falls Office:
110 Glen Street Glens Falls, NY 12801

FIGURE 3B-CROSS SECTION

136 Fuller Road
City of Albany, Albany County, New York

Date:	2007
Horz. Scale:	1"=70'
Project #:	90618.00

THE Chazen COMPANIES
Engineers/Surveyors
Planners
Environmental Scientists
Landscape Architects

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Connecticut: 914 Hartford Turnpike, Waterford, CT 06385, Phone: (860) 440-2690

rev.	date	description

FORMER FULLER BRUSH FACILITY

BORING AND MONITORING WELL MAP

136 FULLER ROAD

CITY OF ALBANY, ALBANY CO., NEW YORK

drawn CSD	checked ASM
date 9/27/12	scale 1" = 40'
project no. 90618.00	
sheet no. FIG. 4	

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\FIGURES_90618-00 B.dwg
Xrefs Attached: XLAYOUT_90618-00; XBASE_90618-00_ARCHITECT; XIMAGE_90618-00_SURVEY; XTB_90618-00; XTB_90618.00_H11x17; INFO-11x17; XTB_XXXX-XX_H8x11; 3TB-24X36
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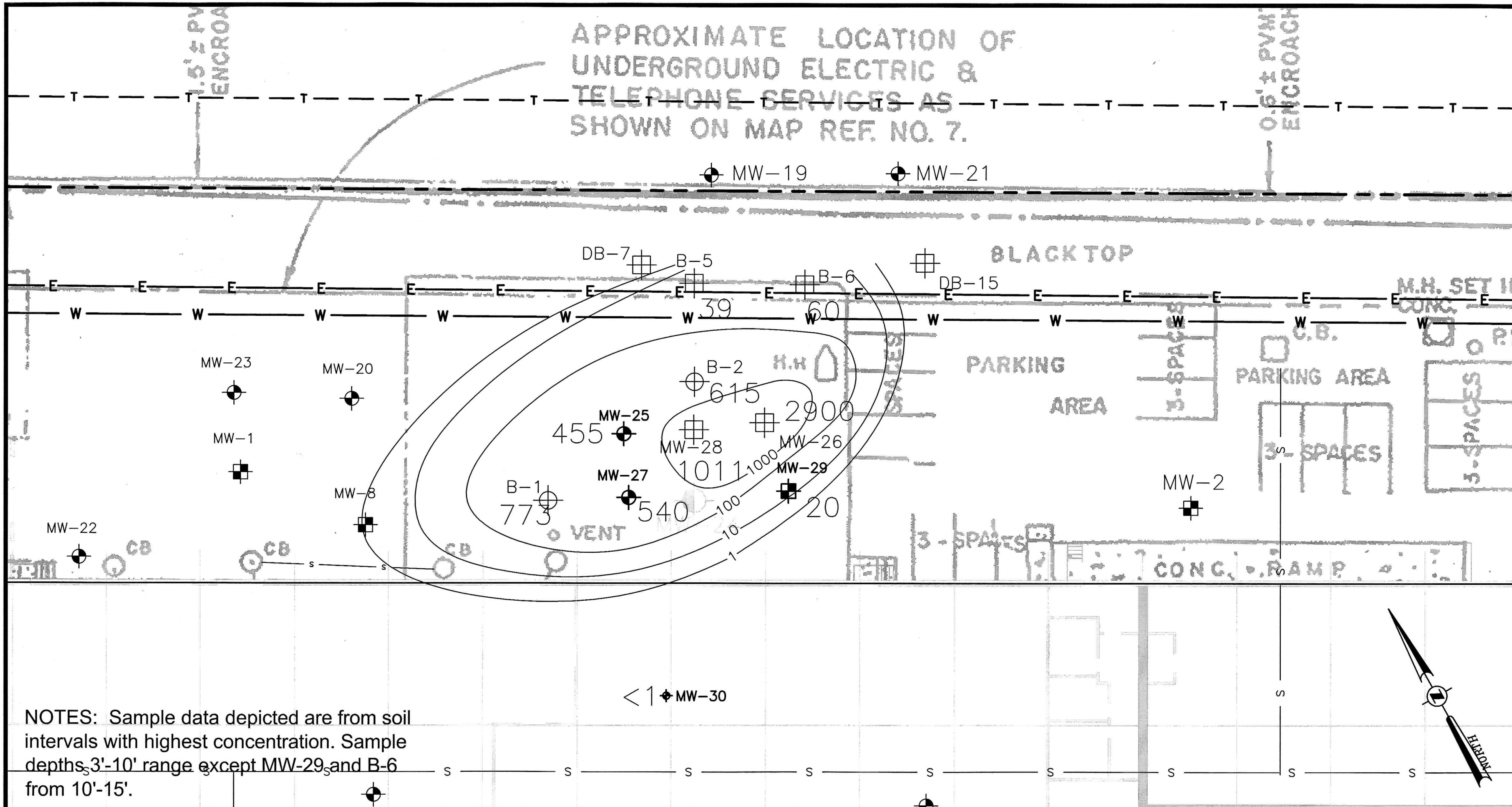

NOTES: Sample data depicted are from soil intervals with highest concentration. Sample depths 3'-10' range except MW-29 and B-6 from 10'-15'.

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

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North Country Office: 100 Glen Street, Glens Falls, New York 12801, Phone: (518) 812-0513

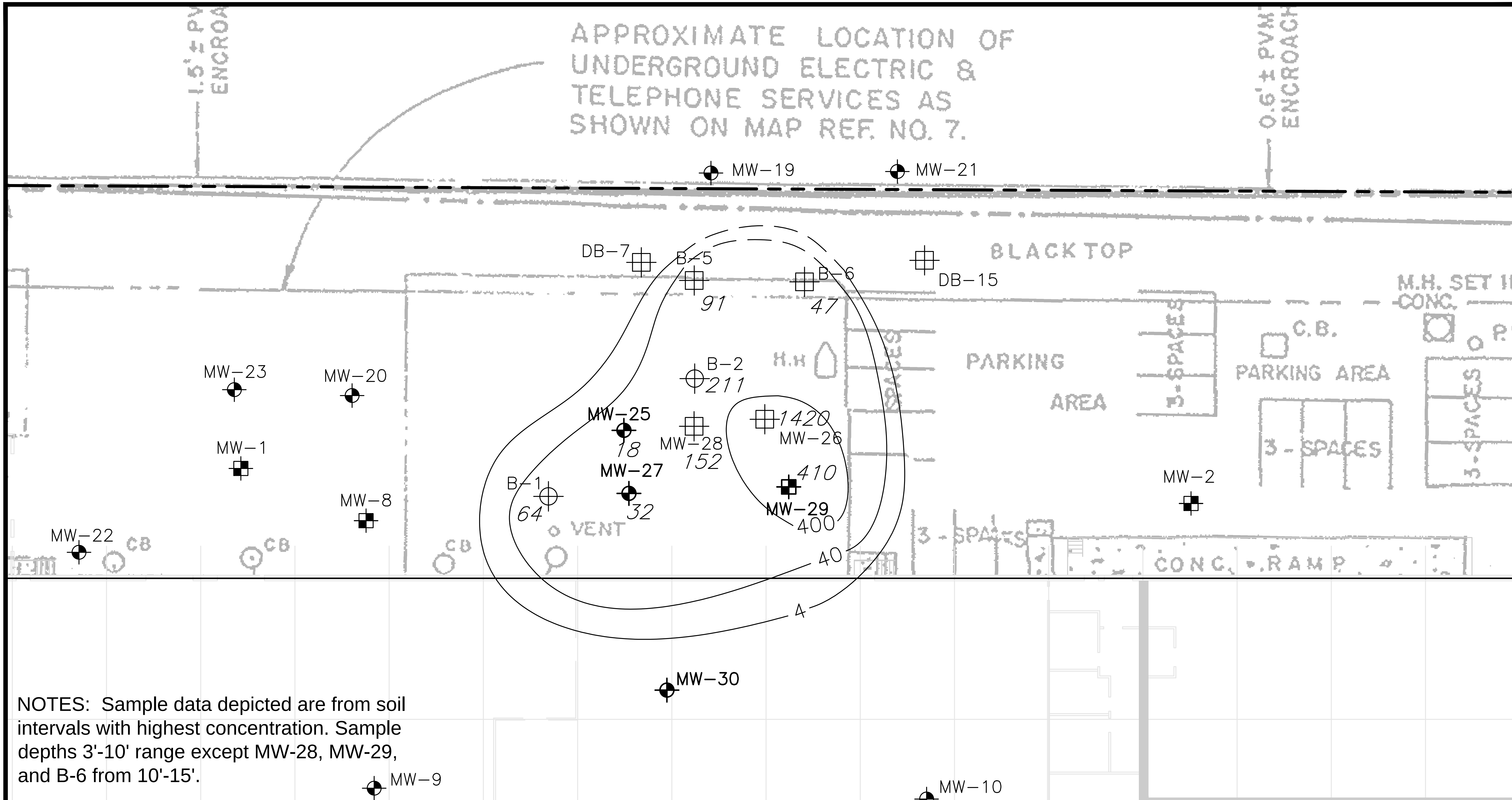
FORMER FULLER BRUSH FACILITY

TOTAL PETROLEUM VOCS IN SOIL IN PARTS PER MILLION 136 FULLER ROAD

CITY OF ALBANY, ALBANY CO., NEW YORK

drawn	checked
CSD	ASM
date 9/27/12	scale 1"=20'
project no. 90618.00	
sheet no. FIG. 5	

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\FIGURES_90618-00.DWG Date Printed: Sep 27, 2012, 10:59am



NOTES: Sample data depicted are from soil intervals with highest concentration. Sample depths 3'-10' range except MW-28, MW-29, and B-6 from 10'-15'.

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

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Dutchess County Office: 21 Fox Street, Poughkeepsie, New York 12601, Phone: (845) 454-3980

Capital District Office: 547 River Street, Troy, New York 12180, Phone: (518) 273-0055

North Country Office: 100 Glen Street, Glens Falls, New York 12801, Phone: (518) 812-0513

FORMER FULLER BRUSH FACILITY

TOTAL CVOCs IN SOIL
IN PARTS PER MILLION
136 FULLER ROAD

CITY OF ALBANY, ALBANY CO., NEW YORK

drawn	checked
CSD	ASM
date 2/13/13	scale 1"=20'
project no. 90618.00	
sheet no. FIG. 6	

THE Chazen COMPANIES
Engineers/Surveyors
Planners
Environmental Scientists
Landscape Architects

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

Office Locations:
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Capital District Office: 547 River Street, Troy, New York 12180, Phone: (518) 273-0055
North Country Office: 100 Glen Street, Glens Falls, New York 12801, Phone: (518) 812-0513
Connecticut: 914 Hartford Turnpike, Waterford, CT. 06385, Phone: (860) 440-2690

rev.	date	description

FORMER FULLER BRUSH FACILITY

TOLUENE, ETHYLBENZENE AND XYLENES IN GW IN PARTS PER BILLION 136 FULLER ROAD

CITY OF ALBANY, ALBANY CO., NEW YORK

drawn	checked
CSD	ASM
date 9/27/12	scale 1" = 40'
project no. 90618.00	
sheet no. FIG. 7	

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\FIGURES_90618-00.DWG
Xref's Attached: XLAYOUT_90618-00; XBASE_90618-00_ARCHITECT; XIMAGE_90618-00_SURVEY; XTB_90618-00; XTB_90618.00_H11x17; INFO-11x17; XTB_XXXX-XX_H8x11; 3TB-24X36
Date Printed: Sep 27, 2012, 11:24am

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North Country Office: 100 Glen Street, Glens Falls, New York 12801, Phone: (518) 812-0513
Connecticut: 914 Hartford Turnpike, Waterford, CT. 06385, Phone:(860) 440-2690

rev.	date	description

FORMER FULLER BRUSH FACILITY

TOTAL CVOCs IN GROUNDWATER IN PARTS PER BILLION (FEBRUARY 2012)
136 FULLER ROAD

CITY OF ALBANY, ALBANY CO., NEW YORK

drawn	checked
CSD	ASM
date 9/27/12	scale 1" = 40'
project no. 90618.00	
sheet no. FIG. 8	

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\FIGURES_90618-00.DWG
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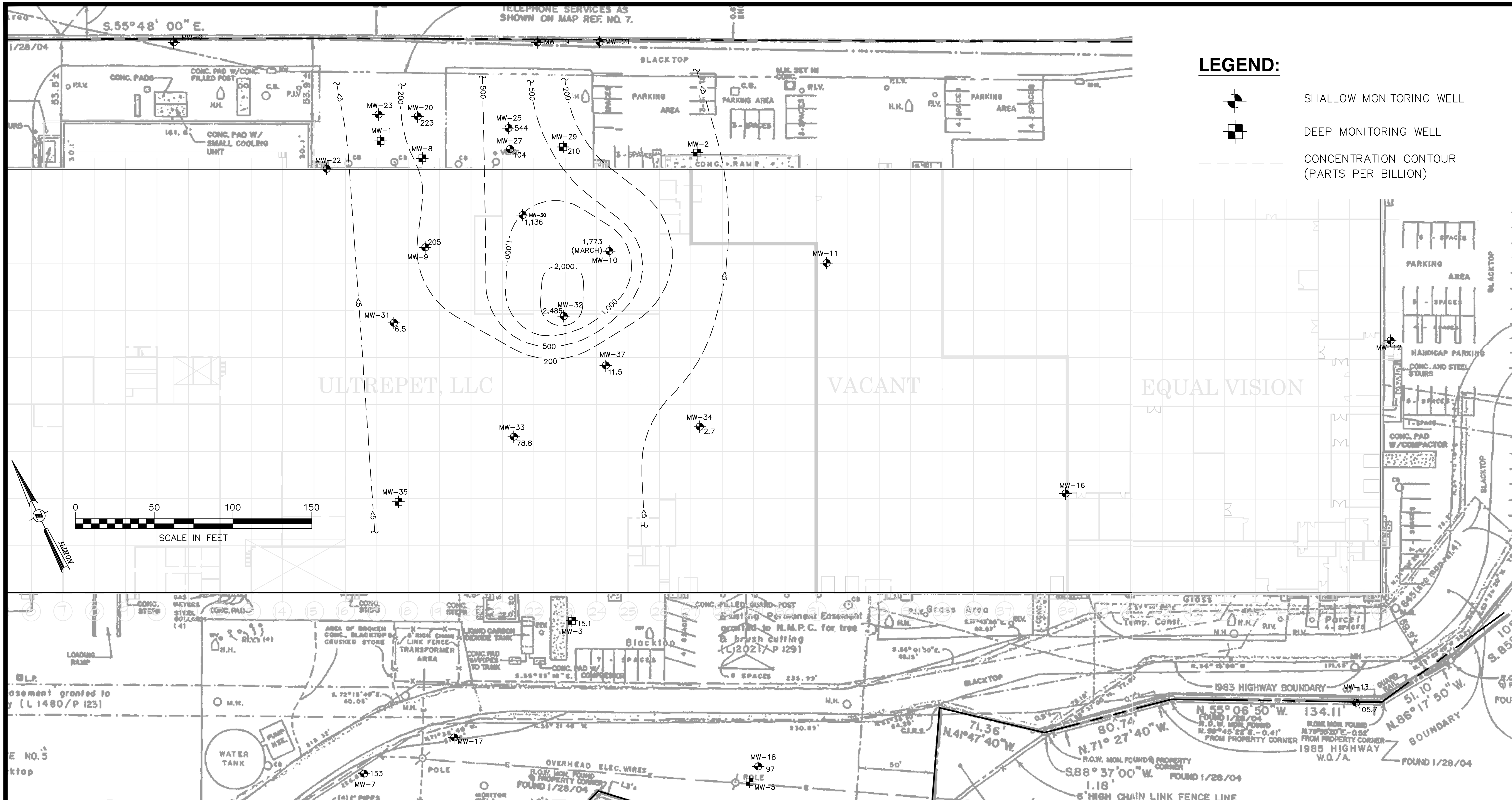


CHAZEN ENGINEERING, LAND SURVEYING
& LANDSCAPE ARCHITECTURE CO., D.P.C.

Office Locations:

Dutchess County Office:
21 Fox Street
Poughkeepsie, New York 12601
Phone: (845) 454-3980

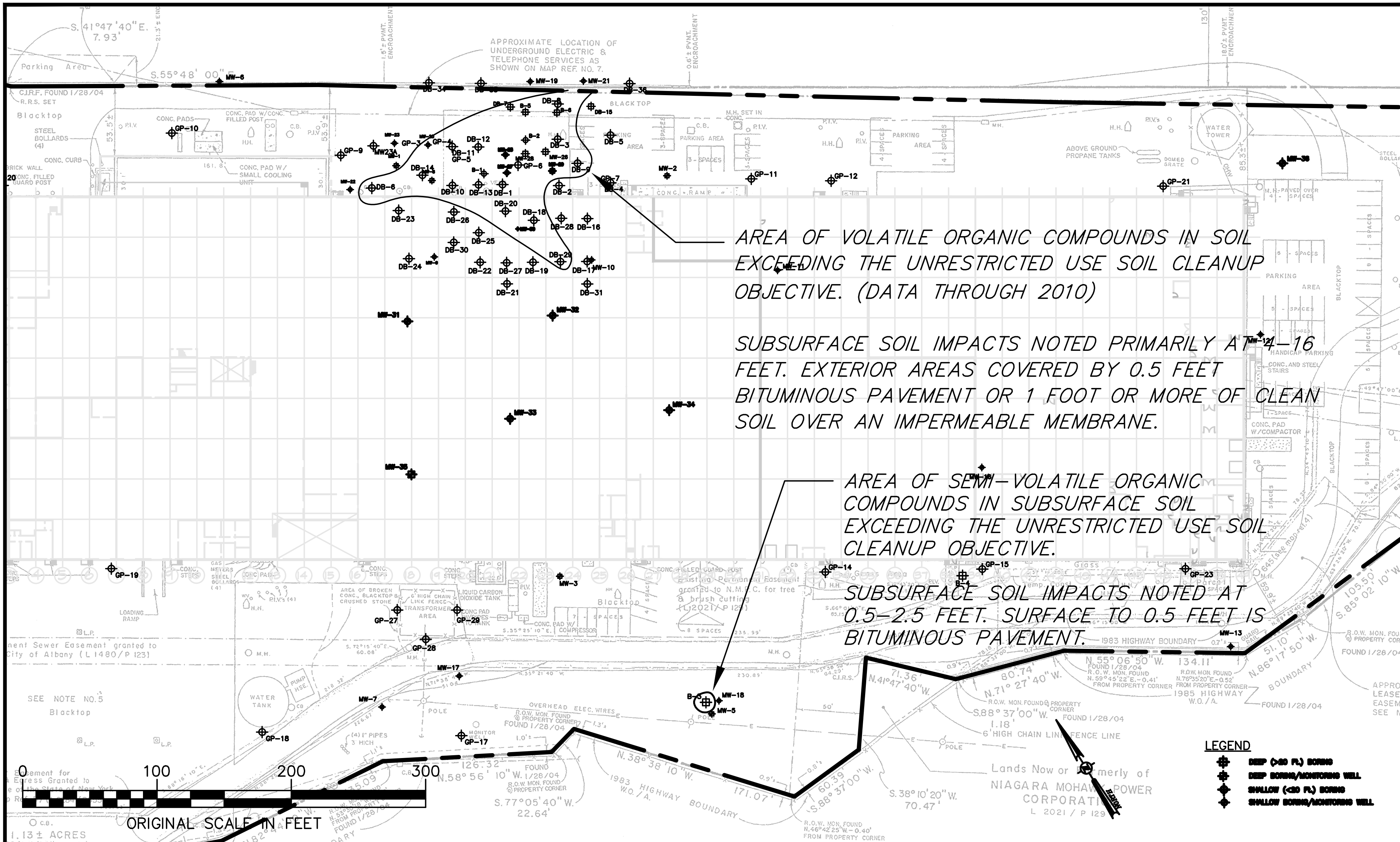
Capital District Office:
547 River Street
Troy, New York 12180
Phone: (518) 273-0055

North Country Office:
375 Bay Road
Queensbury, New York 12804
Phone: (518) 812-0513

TOTAL CVOCs IN GROUNDWATER IN PARTS PER BILLION (JUNE 2018) 136 FULLER ROAD

designed	checked
SEM	WGO
date	scale
06/13/18	1"=60'
project no.	
90618.00	
sheet no.	
FIG.8b	

Drawing Name: Z:\projects\90600-90699\90618_00 FullerRD\ENG\DWG\90618.00_PPB_2018-JUNE.dwg Date Printed: Aug 28, 2018, 9:20am



CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

THE Chazen COMPANIES

Engineers/Surveyors
Planners
Environmental Scientists

Dutchess County Office:
21 Fox Street Poughkeepsie, NY 12601
Phone: (845) 454-3980

Capital District Office:
547 River Street Troy, NY 12182
Phone: (518) 235-8050

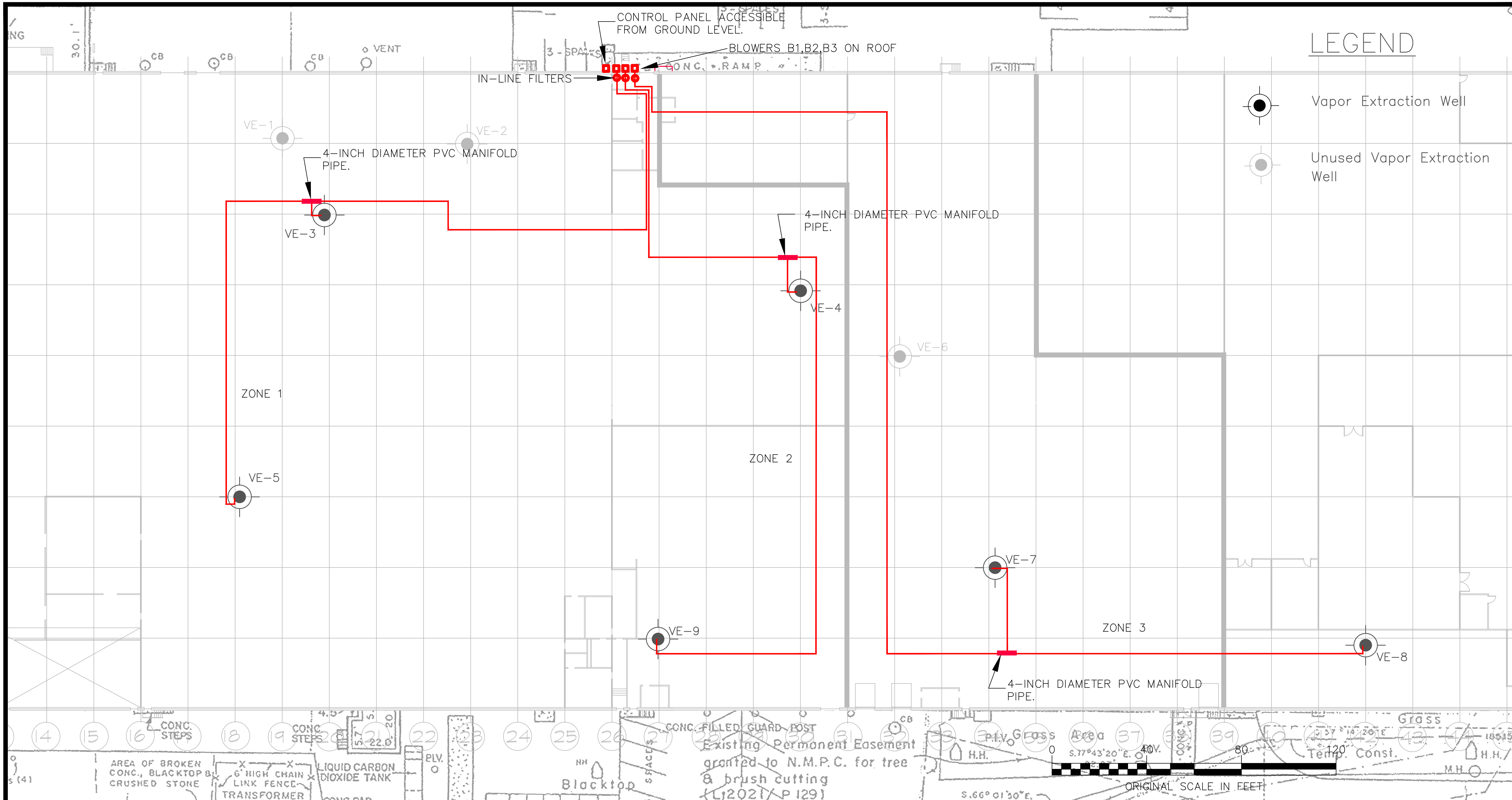
North Country Office:
100 Glen Street Glens Falls, NY 12801
Phone: (518) 812-0513

FORMER FULLER BRUSH FACILITY

SUBSURFACE SOIL EXCEEDING UNRESTRICTED USE SOIL CLEANUP OBJECTIVE
136 FULLER ROAD

CITY OF ALBANY, ALBANY CO. NEW YORK

designed	checked
CSD	ASM
date	scale
9/10/2012	1"=100'
project no.	
90618.00	
sheet no.	
FIG. 9	



CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

Office Locations:

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21 Fox Street
Poughkeepsie, New York 12601
Phone: (845) 454-3980

Capital District Office:
547 River Street
Troy, New York 12180
Phone: (518) 273-0055

North Country Office:
100 Glen Street
Glens Falls, New York 12801
Phone: (518) 812-0513

136 FULLER ROAD PROPERTY

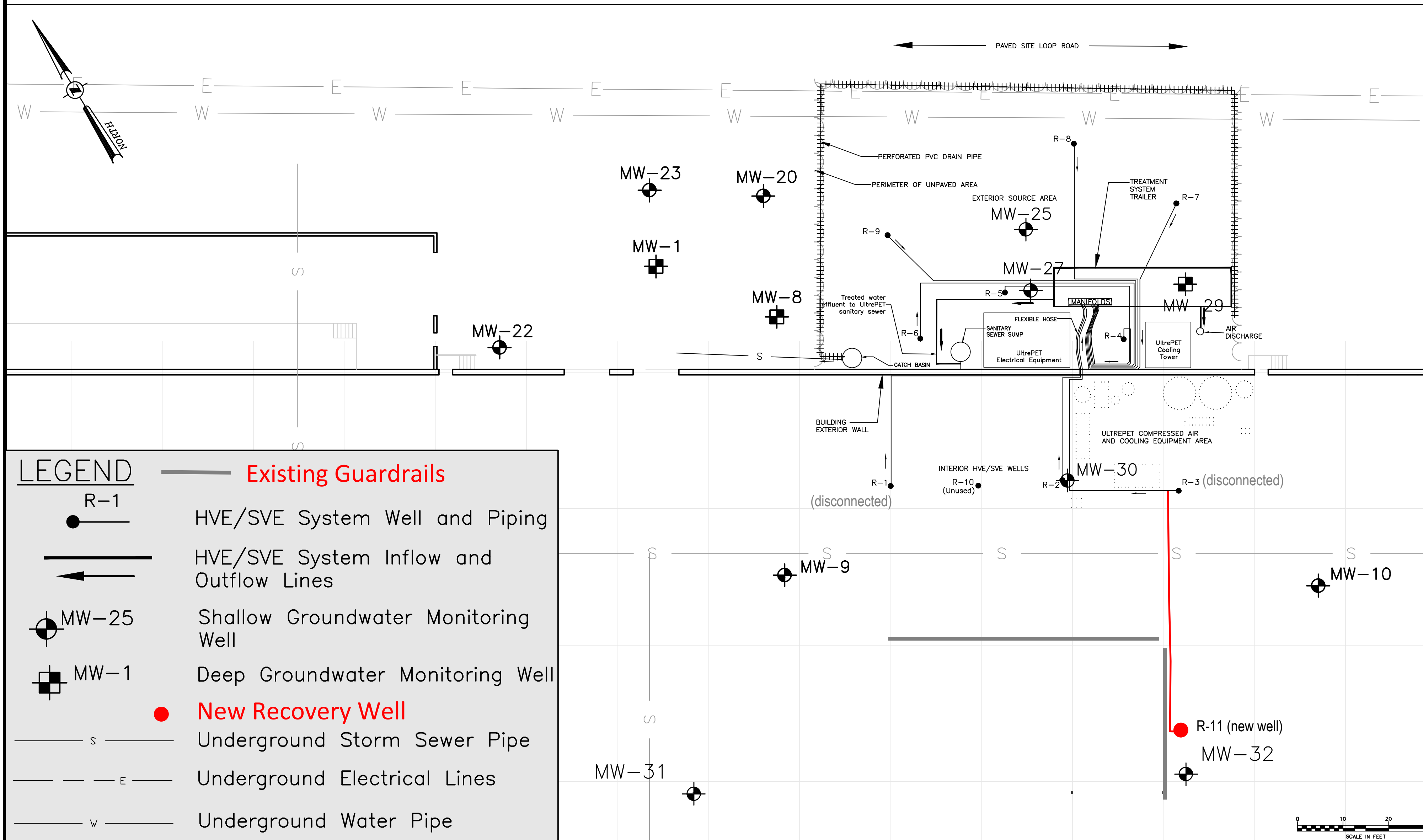
SSDS PIPE AND MANIFOLD ROUTING PLAN

CITY OF ALBANY, ALBANY CO. NEW YORK

drawn	checked
CSD	DPM
date 8/22/11	scale 1"=40'
project no. 90618.00	
sheet no. FIG. 10	

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\SSDS_FIGS_90618-00.DWG Date Printed: Sep 27, 2012, 11:54am

Drawing Name: Z:\projects\90600-90699\90618_00 FullerRD\ENG\DWG\IRM FIGURES_90618-00(SD).dwg Date Printed: Mar 15, 2018, 1:41pm



CHAZEN ENGINEERING, LAND SURVEYING
& LANDSCAPE ARCHITECTURE, CO., D.P.C.

Office Locations:

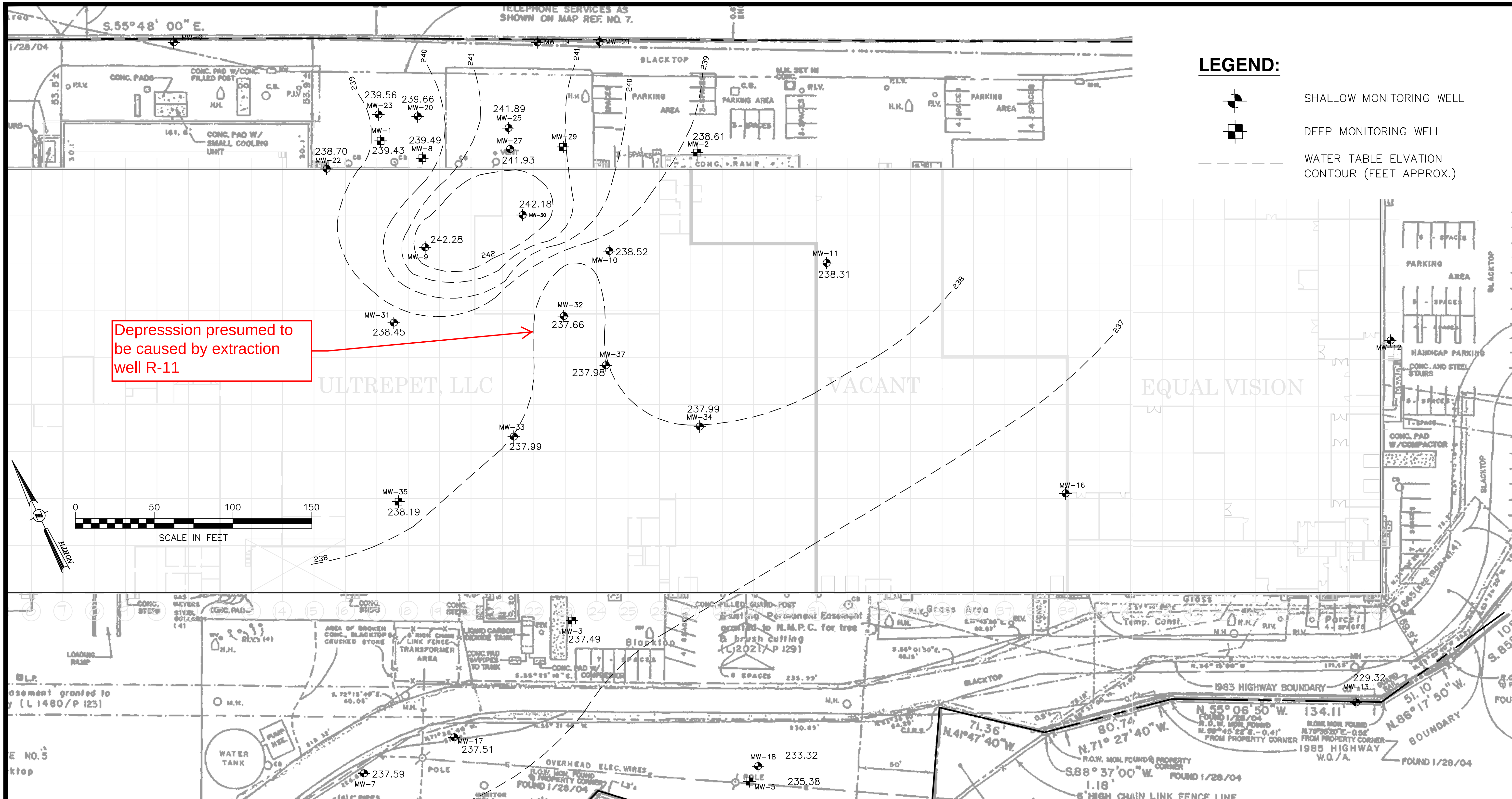
- ☐ Hudson Valley Office: 21 Fox Street, Poughkeepsie, New York 12601, Phone: (845) 454–3980
- ☐ Capital District Office: 547 River Street, Troy, New York 12180, Phone: (518) 273–0055
- Tennessee Office: 1705 Division Street, Nashville, Tennessee 37203, Phone: (615) 953–4909
- ☒ North Country Office: 375 Bay Road, Queensbury, New York 12804, Phone: (518) 812–0513
- ☐ Westchester NY Office: 1 North Broadway, Suite 803, White Plains, New York 10601, Phone: (914) 997–8510

FULLER PARTNERS□LLC SITE

□VE□SVE S□STEM Component Map (2018)

136 FULLER ROAD
CITY OF ALBANY, ALBANY COUNTY, NY

design	chked
CSD	ASM
date	scale
6/7/18	1"=30'
project no.	
90618.00	
sheet no.	
FIG. 11	



Drawing Name: Z:\projects\90600-90699\90618_00 FullerRD\ENG\DWG\90618.00_GW CONTOURS 2018-JUNE.dwg Date Printed: Sep 27, 2018, 10:41am

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., D.P.C.

Office Locations:

Dutchess County Office: 21 Fox Street, Poughkeepsie, New York 12601, Phone: (845) 454-3980

Capital District Office: 547 River Street, Troy, New York 12180, Phone: (518) 273-0055

North Country Office: 375 Bay Road, Queensbury, New York 12804, Phone: (518) 812-0513

GROUNDWATER CONTOUR MAP
JUNE 2018

designed	checked
SEM	WGO
date	scale
06/13/18	1"=60'
project no.	
90618.00	
sheet no.	
FIG.12	

Appendix A

Excavation Work Plan

APPENDIX A – EXCAVATION WORK PLAN

A-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the Department. Currently, this notification will be made to:

Mr. Kyle Forster, P.E.
Environmental Engineer
Remedial Bureau B, Section B
625 Broadway, 12th Floor
Albany NY 12233-7016

This notification will include:

- A detailed description of the work to be performed, including the location and aerial extent, plans for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control,
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work,
- A summary of the applicable components of this EWP,

If planned excavation consists of a small volume of soil from above the water table that is reused on the site or directly loaded for off-site disposal, these activities would not require the stockpiling or fluids management provisions. Site soil may be regraded or excavated as part of construction activities and will, to the extent feasible, be reused on the site within the same location. Saturated soil in contact with contaminated groundwater will not be relocated to the ground surface. If excavated, saturated soil will be reused at that excavation location or disposed of off-site.

- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120,
- A copy of the contractor's health and safety plan, in electronic format, if it differs from the HASP provided in Appendix C of this document,
- Identification of disposal facilities for potential waste streams,
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

A-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based soil screening will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (remaining contamination). When there is a realistic potential for contaminated soil, soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC. A photoionization detector (PID) will be used to screen soil for VOCs during excavation activities.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing, material that can be returned to the subsurface, and material that can be used as cover soil.

A-3 STOCKPILE METHODS

Soil stockpiles of potentially contaminated soil will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles of potentially contaminated soil will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles of potentially contaminated soil will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC.

A-4 MATERIALS EXCAVATION AND LOAD OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

To the extent that there is a realistic probability that truck tires will come in contact with contaminated soil, a truck wash will be operated on-site. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental person will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

A-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials classified as industrial solid waste under 6 NYCRR Part 364 will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site with potentially contaminated soil will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

The site is located in an industrial and developed area that regularly receives truck traffic. The site is situated along Fuller Road and the I-90 corridor and highway ramp. As such truck transport routes are anticipated to be on these mains roads commonly used for trucks and will not involve transport through residential neighborhoods. Therefore, no specific truck routes are warranted.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

A-6 MATERIALS DISPOSAL OFF-SITE

All soil/fill/solid waste excavated and removed from the source and plume areas of the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from these areas of the site is proposed for unregulated off-site disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

A-7 MATERIALS REUSE ON-SITE

The owner anticipates that some excavated site soil may be reused as fill material on the property, for the same excavation or excavations containing similar contaminants under the predetermined beneficial use determination (BUD) in 6 NYCRR 360.15(b)(8).

Chemical criteria for on-site reuse of material have been approved by NYSDEC and consist of Target Compound List (TCL) of VOCs via EPA method 8260. Consistent with DER-10: soil that meets the Unrestricted Use SCOs can be reused without restrictions both on and off-site, soil that meets the Commercial Use SCOs can be reused on the site in the general area that they were excavated from. No saturated soil will be used in the unsaturated zone.

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for re-use on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site suspected of containing asbestos will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior notice to NYSDEC.

A-8 FLUIDS MANAGEMENT

Liquids generated at the site, including excavation dewatering and groundwater monitoring well purge and development waters, may be processed through the HVE/SVE system. If this is planned, some onsite storage (e.g., frac or other temporary storage tank) may be needed to temporarily store the water so that HVE/SVE system flows are maintained.

Should liquids be removed from the site, including excavation dewatering and groundwater monitoring well purge and development waters, they will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, but will be managed off-site.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed in accordance with state and local law.

A-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the decision document. The demarcation layer, consisting of orange snow fencing material or equivalent material will be replaced to provide a visual reference to the top of the ‘Remaining Contamination Zone’, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this Site Management Plan. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the 'Remaining Contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the Site Management Plan.

A-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

A-11 STORMWATER POLLUTION PREVENTION

Future development plans and activities will be based on actual planned projects, and any legally required Stormwater Pollution Prevention Plan (SWPPP) will be implemented. The SWPPP will conform to the requirements of NYSDEC Division of Water guidelines and NYS regulations.

A-12 CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities in the potentially impacted area will be suspended until sufficient equipment is mobilized to address the condition.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the periodic reports prepared pursuant to Section 5 of the SMP.

A-13 COMMUNITY AIR MONITORING PLAN

Community air monitoring will be performed in accordance with the Site Health and Safety Plan (Section 6.0 Air Monitoring) and the NYSDOH Generic CAMP, both in Appendix C of this SMP. Exceedences of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

A-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site for tenants on the property. Specific odor control methods to be used on a routine basis may include limiting exposed soil area, covering exposed soil, the application of odor control foam or other products applied directly to the exposed soil, or odor neutralizing. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

A-15 DUST CONTROL PLAN

A dust suppression plan that addresses dust management during invasive on-site work in the source and/or plume areas may include to the extent necessary, one or more of the items listed below:

- Dust suppression may be achieved through the use of a dedicated on-site water truck for road wetting.
- Clearing and grubbing of larger sites could be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel could be used on roadways to provide a clean and dust-free road surface.
- On-site roads may be limited in total area to minimize the area required for water truck sprinkling.

Appendix B

Environmental Easement (including Metes and Bounds)

Albany County Clerk
16 Eagle St. Rm 128
Albany, NY 12207

Return to:
YOUNG SOMMER LLC
5 PALISADES DR
ALBANY NY 12205

Instrument Deed, Easement

Document Number: 11244801 **Book:** 3045 **Page:** 946

Grantor

FULLER PARTNERS LLC

Grantee

PEOPLE OF STATE OF NEW YORK

Number of Pages: 13

Recorded Date/Time 10/02/2012 at 2:04 PM

Receipt Number 726141

Transfer Tax Receipt
Albany County Clerk Received:
Trans Tax # 1171
.........$0.00

Note: ** DO NOT REMOVE - THIS PAGE IS PART OF THE DOCUMENT **

THIS PAGE CONSTITUTES THE CLERK'S ENDORSEMENT, REQUIRED BY SECTION 316-a(5) & 319 OF THE REAL PROPERTY LAW OF THE STATE OF NEW YORK.

Thomas G. Clingan

Thomas G. Clingan, County Clerk

KM
12.0

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 24th day of September, 2012 between Owner(s) FULLER PARTNERS LLC, having an office at 1133 State Route 295, East Chatham, New York 12060, (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233.

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 136 Fuller Road in the City of Albany Town of Guilderland, County of Albany and State of New York, known and designated on the tax map of the County Clerk of Albany as tax map parcel numbers: Section 53.00 Block 1 Lot 47, and designated on the tax map of the Town of Guilderland as tax map parcel numbers: Section 53.05 Block 1 Lot 17 being the same as that property conveyed to Grantor by deed dated December 21, 2006 and recorded in the Albany County Clerk's Office in Book 2870 at Page 18. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 15.72 +/- acres, and is hereinafter more fully described in the Land Title Survey dated March 17, 2012 prepared by Hershberg & Hershberg Consulting Engineers and Land Surveyors, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: A4-0618-02-09, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP.

(4) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(5) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(6) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(7) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP.

(8) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP.

(9) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential or Restricted Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i) and (ii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall annually, or such time as NYSDEC may allow, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5 the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C401055
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed

by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Grantor: FULLER PARTNERS LLC

By: ______________________

Print Name: Edward L. Hoe

Title: manager Date: 9/12/12

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Columbia)

On the 12th day of September, in the year 20 12, before me, the undersigned, personally appeared Edward L. Hoe, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Mary Deyerle Hack
Notary Public - State of New York

Mary Deyerle Hack
Notary Public, State of New York
No. 31-5025612
Qualified in Columbia County
Commission Expires April 4, 2014

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner.

By: ______________________________

Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 24th day of September, in the year 2012, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2012

SCHEDULE "A" PROPERTY DESCRIPTION

Property Address: 136 Fuller Road, City of Albany, Town of Guilderland, County of Albany, State of New York

Tax Map Number: 53.00-1-47 [Albany County]; 53.05-1-17[T/O Guilderland]

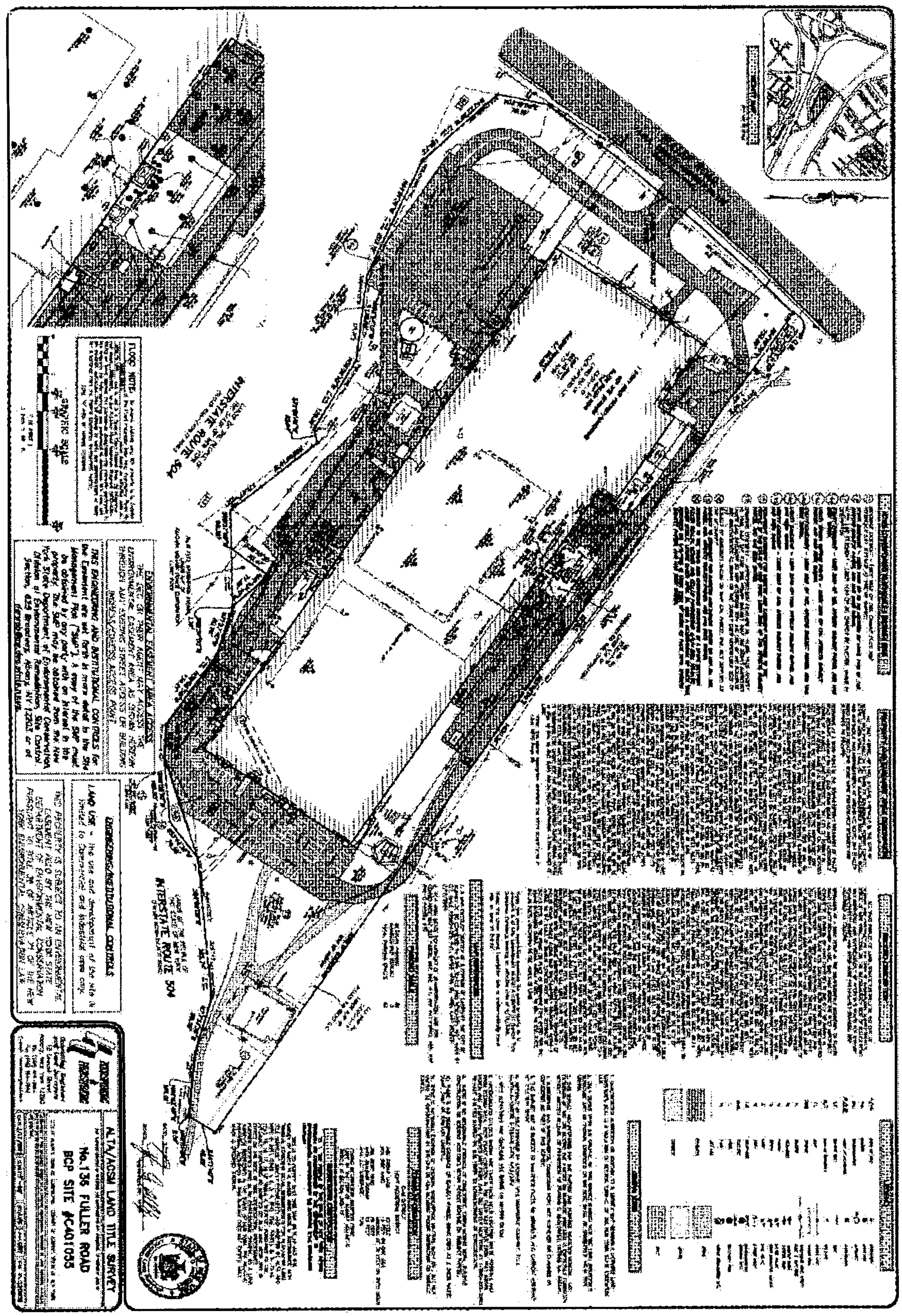
LEGAL DESCRIPTION
ENVIRONMENTAL EASEMENT
No.136 FULLER ROAD
BCP SITE #C401055
CITY OF ALBANY, TOWN OF GUILDERLAND,
COUNTY OF ALBANY, STATE OF NEW YORK

ALL THAT PARCEL OF LAND, SITUATE PARTIALLY IN THE CITY OF ALBANY AND PARTIALLY IN THE TOWN OF GUILDERLAND, ALBANY COUNTY, STATE OF NEW YORK, LYING ON THE SOUTHEASTERLY SIDE OF FULLER ROAD AND NORTHERLY AND NORTHEASTERLY OF INTERSTATE ROUTE 504 (FULLER ROAD-EVERETT ROAD) AND BEING MORE PARTICULARLY BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A BEND POINT IN THE SOUTHEASTERLY BOUNDARY OF FULLER ROAD (COUNTY HIGHWAY No.156), SAID POINT BEING THE MOST NORTHERLY CORNER OF A PARCEL OF LAND CONVEYED TO THE CITY OF ALBANY IN LIBER 2046 OF DEEDS, PAGE 679, SAID POINT ALSO BEING ON THE REPUTED CITY LINE BETWEEN THE TOWN OF GUILDERLAND ON THE NORTHEAST AND CITY OF ALBANY ON THE SOUTHWEST; RUNNING THENCE FROM SAID POINT OF BEGINNING ALONG SAID REPUTED CITY LINE. SOUTH 54 DEG. 48 MIN. 50 SEC. EAST, 153.89 FEET TO A POINT ON THE SOUTHWESTERLY BOUNDARY OF LANDS NOW OR FORMERLY OF CONSOLIDATED RAIL CORPORATION; THENCE ALONG SAID SOUTHWESTERLY BOUNDARY THE FOLLOWING TWO COURSES: SOUTH 41 DEG. 47 MIN. 40. SEC. EAST, 7.93 FEET TO A POINT; SOUTH 55 DEG. 48 MIN. 00 SEC. EAST, 1420.25 FEET TO A POINT; THENCE THROUGH THE LANDS NOW OR FORMERLY OF THE CITY OF ALBANY , SOUTH 34 DEG. 11 MIN. 40 SEC. WEST, 48.29 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF INTERSTATE ROUTE 504 (FULLER ROAD-EVERETT ROAD); THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING FOUR COURSES: NORTH 68 DEG. 51 MIN. 20 SEC. WEST, 2.51 FEET TO A POINT; NORTH 84 DEG. 23 MIN. 40 SEC. WEST, 101.01 FEET TO A POINT; NORTH 73 DEG. 34 MIN. 30 SEC. WEST, 89.55 FEET TO A POINT; AND NORTH 84 DEG. 50 MIN. 00 SEC. WEST, 225.74 FEET TO ITS INTERSECTION WITH THE EASTERLY LINE OF PROPERTY DEEDED TO THE CITY OF ALBANY BY THE PEOPLE OF THE STATE OF NEW YORK; THENCE ALONG SAID HIGHWAY BOUNDARY AND ALONG THE EASTERLY AND SOUTHERLY LINE OF SIAD PREMISES DEEDED TO THE CITY OF ALBANY BY THE PEOPLE OF THE STATE OF NEW YORK, THENCE ALONG SAID HIGHWAY BOUNDARY AND ALONG THE EASTERLY AND SOUTHERLY LINE OF PROPERTY DEEDED TO THE CITY OF ALBANY THE FOLLOWING FIVE COURSES; SOUTH 53 DEG. 44 MIN. 30 SEC. WEST, 70.28 FEET TO A POINT; SOUTH 85 DEG. 02 MIN. 10 SEC. WEST, 105.50 FEET TO A POINT; NORTH 86 DEG. 17 MIN 50 SEC. WEST, 51.10 FEET TO A POINT; NORTH 55 DEG. 06 MIN. 50 SEC. WEST, 134.11 FEET TO A

POINT; NORTH 71 DEG. 27 MIN. 40 SEC. WEST. 80.74 FEET TO A POINT ON THE NORTHERLY HIGHWAY BOUNDARY OF SAID INTERSTATE ROUTE 504; THENCE ALONG SAID HIGHWAY BOUNDARY SOUTH 88 DEG. 37 MIN. 00 SEC. WEST, 1.18 FEET TO ITS INTERSECTION WITH THE DIVISION LINE BETWEEN THE LANDS NOW OR FORMERLY OF THE CITY OF ALBANY ON THE NORTHEAST AND THE LANDS NOW OR FORMERLY OF NIAGARA MOHAWK POWER CORP. ON THE SOUTHWEST AS DESCRIBED IN LIBER 2021 OF DEEDS AT PAGE 129; THENCE ALONG THE ABOVE LAST MENTIONED DIVISION LINE, NORTH 41 DEG. 47 MIN. 40 SEC. WEST, 71.36 FEET TO ITS INTERSECTION WITH THE DIVISION LINE BETWEEN SAID LANDS NOW OR FORMERLY OF THE CITY OF ALBANY ON THE NORTHWEST AND THE LANDS NOW OR FORMERLY OF SAID NIAGARA MOHAWK POWER CORP. ON THE SOUTHEAST; THENCE ALONG THE ABOVE LAST MENTIONED DIVISION LINE, SOUTH 38 DEG. 10 MIN. 20 SEC. WEST, 70.47 FEET TO ITS INTERSECTION WITH THE SAID INTERSTATE ROUTE 504 HIGHWAY BOUNDARY; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: SOUTH 88 DEG. 37 MIN. 00 SEC. WEST, 60.39 FEET TO A POINT; NORTH 38 DEG. 38 MIN. 10 SEC. WEST, 171.07 FEET TO A POINT; AND SOUTH 77 DEG. 05 MIN. 40 SEC. WEST, 22.64 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY THE FOLLOWING THREE COURSES: NORTH 58 DEG. 56 MIN. 10 SEC. WEST, 126.32 FEET TO A POINT; NORTH 82 DEG. 44 MIN. 10 SEC. WEST, 135.09 FEET TO A POINT; NORTH 64 DEG. 51 MIN. 30 SEC. WEST, 203.12 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY NORTH 42 DEG. 22 MIN. 20 SEC. WEST 156.73 FEET; THENCE ALONG SAID HIGHWAY BOUNDARY NORTH 12 DEG. 16 MIN. 00 SEC. EAST, 78.16 FEET TO ITS INTERSECTION WITH THE ABOVE MENTIONED SOUTHEASTERLY BOUNDARY OF FULLER ROAD; THENCE ALONG SAID SOUTHEASTERLY BOUNDARY, ALONG A CURVE TO THE RIGHT OF RADIUS 3,779.72 FEET, AN ARC DISTANCE OF 501.65 FEET, TO THE POINT OR PLACE OF BEGINNING (THE CHORD FOR THE ABOVE DESCRIBED CURVE BEING, NORTH 41 DEG. 19 MIN. 10 SEC. EAST, 501.28 FEET) CONTAINING 15.72± ACRES OF LAND.

SURVEY


ALTA/ACSM LAND TITLE SURVEY
No.136 FULLER ROAD
BCP SITE #C401055
INTERSTATE ROUTE 504
GRAPHIC SCALE

Appendix C

Health and Safety Plan and Community Air Monitoring Plan

Health and Safety Plan
136 Fuller Road Site
Brownfield Cleanup Program
NYSDEC Site No. C401055

City of Albany and Town of Guilderland
Albany County, New York

June 2010

THE Chazen COMPANIES®
Engineers
Environmental Professionals
Land Surveyors
Landscape Architects
Planners

Prepared for:

Fuller Partners, LLC
PO Box 370
133 Route 395
East Chatham, NY 12060

New York State Department of Environmental Conservation – Region 4
1130 N. Westcott Road
Schenectady, New York

Prepared by:

Capital District Office:
The Chazen Companies
547 River Street
Troy, New York 12180

Hudson Valley Office
(845) 454-3980

North Country Office
(518) 812-0513

Table of Contents

TABLES

1.0 INTRODUCTION AND OBJECTIVES

The Chazen Companies (Chazen) have prepared this Health and Safety Plan (HASP) for employees of Chazen for the Former Fuller Brush Manufacturing Facility (herein after referred to as the 136 Fuller Road Site) located primarily in the City of Albany, Albany County, New York. A small portion of the property is located in the Town of Guilderland, Albany County, New York. This HASP is applicable to the remedial investigation as described in the Work Plan and has been prepared to specifically address potential hazards associated with the proposed scope of work.

The activities, equipment, and procedures described in this plan are designed to provide personal protection against potential environmental hazards which may be present on the work site. This plan includes a preliminary evaluation of site characteristics; establishes an emergency chain-of-command; details the use of basic safety equipment, personal protective equipment, and air monitoring devices, and describes equipment decontamination procedures.

The objectives of this HASP are to:

- Identify the physical, chemical, and biological hazards which may be present during the proposed site investigative activities
- Specify the protective measures necessary to control those hazards
- Define emergency procedures.
- Specify training and medical qualification criteria for personnel.

This HASP must be read and understood by all Chazen personnel who perform field activities at the 136 Fuller Road Site.

2.0 PROJECT PERSONNEL & EMERGENCY RESPONSE CONTACTS

The personnel and emergency response contacts associated with the proposed scope of work at the site are presented below.

DIAL 911 FOR EMERGENCY IN ALBANY COUNTY

Title/Project Responsibility	Name	Main Phone	Mobile/Other Phone
Project Personnel			
Project Manager Assistant PM	Kim L. Baines Arlette Meader	(518) 783-1700 (518) 266-7328	(518) 495-0054469-2355 (518)260-1811
Field Operations Leader	Scott Dietzel	(518) 266-7314	(518) 469-2726
Health & Safety Officer	Kimberly Cuppett	(845) 454-3980	
UltrePet Emergency Contact	Leigh Peritz, PE	(781) 275-6400	
Equal Vision Contact	Steve Raddy	(518) 458-8250	
Emergency Personnel – DIAL 911 In Albany County			
Hospital St. Peter's Hospital 315 South Manning Boulevard Albany, New York (Hospital Route Map Attached On Next Page)		Emergency-Dial 911	(518) 525-1550 non-emergency
City of Albany Fire Dept.		Dial 911	(518) 447-7879
City of Albany Police Department		Dial 911	(518) 458-5660
NYSDEC Spills Hotline		(800) 457-7362	
NYSDEC Regional Office		(518) 357-2045	
Poison Control Center		(800) 336-6997	
National Response Center		(800) 424-8802	

Hospital St. Peter's Hospital 315 South Manning Boulevard Albany, New York (Hospital Route Map Attached On Page 4)	**Emergency-Dial 911**

2.1 Hospital Route

St. Peters Hospital is located approximately 5 miles from the subject site. The travel time from the site to St. Peters Hospital is approximately eleven minutes. Directions are provided below and a route plan map is shown on the following page.

Directions to St. Peters Hospital:

1.	Turn LEFT onto FULLER ROAD.	0.4 miles
2.	Turn LEFT onto WASHINGTON AVENUE.	0.3 miles
3.	Turn LEFT onto I-90E Ramp.	<0.1 miles
4.	Merge onto I-90 E	0.8 miles
5.	Take the Route 85 exit [exit 4] – toward SLINGERLANDS/VOORHEESVILLE.	0.3 miles
6.	Merge onto NY-85 S.	1.6 miles
7.	Take the exit toward MARIA COLLEGE/KRUMKILL ROAD.	0.2 miles
8.	Turn LEFT onto BUCKINGHAM DRIVE.	0.4 miles
9.	Turn LEFT onto NEW SCOTLAND AVENUE.	0.3 miles
10.	Turn RIGHT onto S MANNING BOULEVARD.	0.2 miles
11.	End at 315 MANNING BOULEVARD.	
	Total estimated time = 11 minutes	4.98 miles

1. Hospital Route Map

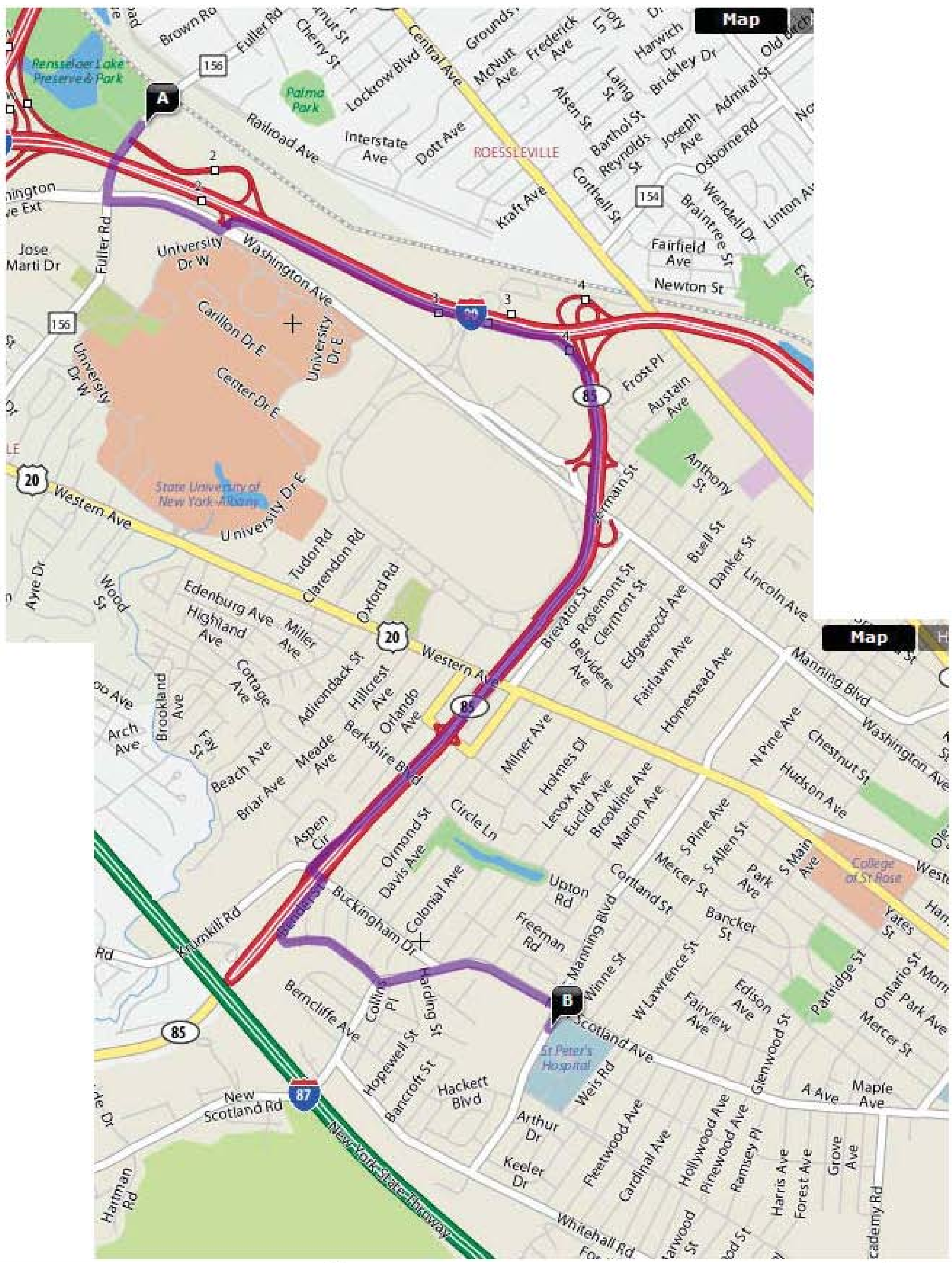


FIGURE 1-HOSPITAL ROUTE MAP

Former Fuller Brush Manufacturing Facility
136 Fuller Road
City of Albany, Albany County, New York

THE Chazen COMPANIES
ENGINEERS/SURVEYORS
PLANNERS
ENVIRONMENTAL SCIENTISTS

Date:	2009
Scale:	Not to Scale
Project #:	90618.00

3.0 SITE CHARACTERIZATION

3.1 Site Location & Description

The site is a 15.72-acre property located at 136 Fuller Road in the City of Albany and Town of Guilderland, Albany County, New York. The site is currently developed with a 266,000-square foot commercial/industrial, single-story building which is predominately occupied by UltrePet LLC, recyclers of plastic polyethelene (PET) bottles and manufacturer of PET plastic resins. The site is also occupied by Equal Vision, a T-shirt silk screening printer. The remaining portion of the site building is vacant and unused warehouse space. Crown Castle International currently leases a 0.06 ± acre portion of the northeastern site area for the location and operation of cellular telecommunications tower, antenna and associated equipment (Crown Castle Site # 806676).

3.2 Historic Site Uses

The site was developed circa 1955 as the Mohawk Brush Company which produced brushes for the Fuller Brush Company. The Mohawk Brush Company/Fuller Brush Company owned and operated at the site for approximately 20 years until the mid-1970s. From the mid-1970s, Star Textiles activities at the site included manufacturing poly-fill material and plastic resin from recycling plastic. In 1990, wTe Recycling Corp. acquired Star Textiles and operated a plastics recycling business. In 1999, wTe Recycling Corp. entered into a partnership agreement with Tomra of North America called UltrePET LLC. UltrePET LLC continues to operate a plastics recycling business at the site.

3.3 Proposed Project Scope/Site Investigation Activities

The investigative activities proposed at the site include the following:

- Drilling with Geoprobe and a hollow-stem auger (HSA) rigs and sampling
- Installation of monitoring wells
- Soil sample collection
- Groundwater sample collection/monitoring well sampling
- Vapor extraction point installation and testing

4.0 SITE HAZARD EVALUATION AND CONTROL

The potential for exposure to chemical, physical, and mechanical hazards at the site is considered to be minimal. Hazards which may be encountered at the site are summarized in Table 1. Additional information pertaining to these hazards is provided in later sections of this HASP.

Table 1: Potential Hazards at the Site

Hazard Type	Hazard Anticipated	Associated Investigative Activities	Comments	Hazard Control Methods
Chemical	Chlorinated Solvents and Petroleum Compounds in Soil and Groundwater Sudan IV (Red Azo Dye)	Drilling with Hollow stem augers or Geoprobe®, installation of groundwater monitoring wells, soil/groundwater/ surface water/sediment sample collection, vapor intrusion sampling, PID headspace screening Field Soil Screening	Considered minimal	PPE Training on Identification of Potential COCs Safety Training & Standard Safety Operations
Physical	Slip, Trip & Fall	Any site work	Construction and Industrial equipment on-site	Safety Training & Standard Safety Operations
Biological	Tick, insect bites, poisonous plants, heat/ cold-related disorders	Any site work	Considered minimal	Safety Training & Standard Safety Operations
Electrical	Working around utilities	Drilling with auger or Geoprobe®, soil sample collection	Considered minimal	Utility Check, Safety Training & Standard Safety Operations

4.1 Hazard Evaluation

4.1.1 Chemical Hazards

Based on available historical information, the primary chemicals of concern (COCs) present at the site include volatile organic compounds (VOCs) tetrachloroethlyene (PCE) and degradation products and some petroleum-related constituents.

Table 2 lists the potential health hazards that may be encountered and recommended exposure limits.

Table 2: COCs & Established Permissible Airborne Exposure Limits

COC	Time Weighted Average Airborne Limits			Short-Term Exposure Limit (ppm)	IDLH (ppm)	Primary Routes Of Exposure On Site
	OSHA PEL	NIOSH REL	ACGIH TLV			
VOCs (PCE)[1]	100 ppm	--	25	300 ppm	150 Ca	Inhalation, ingestion, dermal
VOC TCE	100 ppm	--	--	300 ppm	1,000 Ca	Inhalation, ingestion, dermal
VOC DCE	200 ppm	200 ppm	--	--	1,000	Inhalation, ingestion, dermal
Benzene	1.0	0.1	0.5	5.0 (1.0 NIOSH)	500 Ca	Inhalation
Ethylbenzene	100	100	100	125	800	Inhalation
Toluene	200	100	50	150	500	Inhalation
Xylenes	100	100	100	150	900	Inhalation

1. Numerous VOCs; PCE permissible exposure limit information noted as a conservative example of VOCs. A conservative permissible exposure limit of 5 ppm for VOCs will be used in the field as measured continuously using a portable photoionization detector (PID)

3. Air concentrations listed in http://www.cdc.gov/niosh/npg/npgd0368.html, accessed August 14, 2009.

Ca: NIOSH has identified the compounds as a potential occupational carcinogen

C: Ceiling value. Typically a 15-minute TWA that must not be exceeded at any point during the workday

IDLH: Immediately Dangerous to Life & Health

Skin designation indicates the potential for dermal absorption

OSHA PELs are legally enforceable.

RELs and TLVs are published as recommended guidelines

COCs present on the subject property are expected to vary based on location (e.g., source or plume area).

Project investigation activities will involve potential exposure to soil and groundwater. Given the nature of the proposed project activities, the potential for site personnel to encounter the site COCs during performance of the activities outlined in the scope of work is considered to be minimal as specified PPE and air monitoring (described later in this plan) will be utilized.

Symptoms of exposure to the COCs are summarized in Table 3.

Table 3: General Signs and Symptoms of Exposure to COCs

Compound	Signs & Symptoms of Exposure
VOCs (general)	Irritation eyes, skin, nose, respiratory system; headache, nausea; fatigue, anorexia
Petroleum Hydrocarbons	Irritation to eyes, skin, nose, respiratory system; headache, nausea, staggered gait; fatigue, anorexia, lassitude (weakness, exhaustion); dermatitis

Field screening of soil may include the use of Sudan IV, a Red Azo Dye, in the Oil-In-Soil Test Kit. The material safety data sheet (MSDS) for this test kit is attached to the QAPP. Gloves will be worn when using the test kits and the dye cube will not be crushed.

4.1.2 Physical Hazards

Site work which occurs in the vicinity of drilling and/or excavating equipment and machinery presents a general safety hazard. Uneven ground surfaces and the presence of debris on the site presents a concern for slip, trip, and fall incidents.

The potential for heat-related stress during site work exists. Heat stress may occur even in moderate temperatures and may present any or all of the following symptoms:

***Heat Rash* –** Result of continuous exposure to hot humid air and chafing clothes. Heat rash is uncomfortable and decreases the ability to tolerate heat.

***Heat Cramps* –** Result of the inadequate replacement of body electrolytes lost through perspiration. Sign include severe spasms and pain in the extremities and abdomen.

***Heat Exhaustion* –** Result of the increased stress on the vital organs of the body in the effort to meet the body's cooling demands. Signs include shallow breathing, pale, cool, moist skin, profuse sweating, dizziness, and listlessness.

***Heat Stroke* –** Result of overworked cooling system. Heat stroke is the most serious form of heat stress. Body surfaces must be cooled and medical help must be obtained immediately to prevent severe injury and/or death. Signs of heat stroke include red, hot, dry skin, absence of perspiration, nausea, dizziness, confusion and strong rapid pulse. Coma and death can result from heat stroke.

The following any or a combination of the following actions can be taken to prevent heat stress:

- Replace body fluids (water and electrolytes) lost through perspiration. Solutions may include a 0.1% salt and water solution or commercial mixes such as Gatorade and Squench. A fluid/electrolyte replacement will be used as necessary to minimize fluid loss.

- Provide cooling devices to aid in the natural body ventilation. Cooling occurs through evaporation of perspiration and limited body contact with heat absorbing protective clothing. Fans and air conditioners can assist in evaporation.

- Provide hose-down mobile shower facilities, where feasible, to cool protective clothing and reduce body temperature.

- Conduct activities early in the morning or evening during very hot weather.

- Provide shelter against heat and direct sunlight to protect personnel.

The potential for cold stress during site work exists. Working outside in cold temperatures presents a concern for cold-related disorders as described below:

Hypothermia – Symptoms of hypothermia include shivering, slurred speech, disorientation, and loss of coordination. Advance stages of hypothermia include feelings of warmth and reckless behavior.

Frost Bite – Symptoms of frostbite include cold feelings, red color to the skin, tingling, swelling, and pain. In advanced stated of frostbite, the skin will appear white in color.

To avoid cold stress, take the following precautions:

- Provide a shelter area where warmth is available.

- Wear thermal clothing applied in layers.

- Remain active in order to maintain blood circulation throughout the body.

- Maintain warm/hot drinks in the support zone.

Physical hazards are anticipated to be a concern for all site activities.

4.1.3 Biological Hazards

It is anticipated that the site field work will be performed in the fall, winter and spring months which presents some potential for biological hazards to be present. Biological hazards include poison ivy, snakes, ticks, mosquitoes, and other pests. Given the developed nature of the site, biological hazards are expected to be low, but may still be present during site activities.

4.1.3.1 Tick-Borne Disease

Ticks can carry a number of diseases. In the United States, these diseases include:

- Lyme Disease
- Ehrlichiosis
- Rocky Mountain Spotted Fever (throughout the United States but most prevalent in the east)

Lyme Disease - The disease commonly occurs in New York State in the spring and summer and is transmitted by the bite of infected ticks. Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, swelling and pain in the joints, and eventually, arthritis.

Ehrlichiosis - The disease also commonly occurs in New York State in the summer and is transmitted by the bite of infected ticks. Symptoms of ehrlichiosis include muscle aches, joint aches, and flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) - This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (*Rickettsia rickettsii*) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for 2 to 3 weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

4.1.3.2 Other Biological Hazards

Poisonous plants, such as poison ivy and sumac, maybe present on the site and present a hazard for site personnel. Signs and symptoms of exposure to such poisonous plants include itching, burning, redness, rash, blistering and swelling.

Snakes may be present on the site property and present the potential for snake bites. Poisonous snakes are not expected to be present on the site, however, even bites from non-poisonous snakes can cause adverse health symptoms such as redness, swelling, and allergic reaction.

Site personnel may be exposed to mosquitoes and/or black flies during site work. While the presence of mosquitoes and/or black flies is not anticipated to be a significant health and safety concern, bites can cause adverse health symptoms such as redness, swelling, and allergic reaction.

4.1.4 Electrical Hazards

Drill rigs will be used on the site to install soil borings. The presence of overhead utilities and underground obstacles poses a hazard if equipment contacts them. As indicated in Table 1, electrical hazards are considered to be a concern for the installation of borings on the site.

4.2 Hazard Control

4.2.1 Hazards Associated With Soil Sampling

Soil sampling consists of the installation of soil borings using a hydraulic, direct-push drilling rig or hollow stem auger rig and the collection of soil samples from the soil borings for analysis. The hazards associated with the collection of soil samples are considered to be minimal and include dermal exposure to soil contaminants, inhalation exposure to VOCs and slip, trip, and fall hazards from scattered debris and irregular walking surfaces.

All drillers must possess required state or local licenses. The driller is responsible for the safe operation of the drill rig as well as adherence to the requirements of this HASP. The driller is responsible for ensuring that the drill rig is in proper condition and is properly used. Rig conditions will be evaluated daily prior to the start of work.

Prior to any subsurface sampling or remedial activities, underground utilities must be located using facility plans and the Dig Safely NY Program (1-800-962-7962). These protective measures will be taken to minimize the potential health and safety risks associated with investigation activities near underground utility lines.

If drilling activities are conducted in the vicinity of overhead power lines, the rig will be positioned such that no part of the drilling rig is within OSHA's maximum clearance distance of 25 feet.

To control dermal exposure during soil, sediment, groundwater and surface water sampling activities, a minimum of Modified Level D PPE will be worn as described in Section 6.0 of this HASP.

Based on available information, volatile organic compounds (VOCs) are present the site subsurface and therefore the potential for inhalation exposure to airborne VOCs will be evaluated and controlled during site activities as a general safety precaution.

Air monitoring will be performed during site work to evaluate airborne concentrations of chemical contaminants to which site workers may be exposed. Air monitoring control measures are discussed in Section 6.0 of this HASP.

General safety precautions will be employed on-site to control for slip, trip, and fall hazards.

4.2.5 Physical Hazards

4.2.5.1 Biological Hazards

Ticks

The best way to prevent tick borne diseases is to avoid tick bites. Preventative measures to reduce the potential for tick bites include, but are not limited to, the following:

- Wearing long pants and long sleeved shirts
- Tucking shirts into pants. Tucking pants into socks or boots, or using tape to close the opening where they meet.
- Using an EPA approved insect repellant or arachnicide (pesticide) which is effective for ticks, such as DEET (N,N-diethyl-m-toluamide) or pyrethrin. Be sure to heed all precautionary information, and be aware that some people are sensitive to these chemicals.
- Wearing light colored clothing so that a tick can be seen more easily.
- Changing clothes when you return from an area where ticks may be located.
- Showering to wash off any loose ticks.
- Throughout the work day, perform Tick Checks and Removal Procedures as follows:
  - Check clothing for ticks. If you find a tick, do a more thorough tick check.
  - Inspect parts that bend (back of knee, between fingers and toes, underarms), pressure points where clothing presses against skin (underwear elastic, belts, neck); other common areas (belly button, around or in ear, hairline, and top of head).
  - Once indoors, do a final tick check and change clothes.
  - If you are in a tick infested area or an area known to have disease carrying ticks, perform checks on a more regular basis
  - Remove unattached ticks promptly.
  - Remove attached ticks are removed using fine pointed tweezers:
    1. The mouth parts of the tick are grasped with the tweezers as close to the skin as possible
    2. Apply firm steady pressure upward until the tick releases - do not jerk, twist, squash or squeeze the tick

3. Clean the wound and the tweezers with an antiseptic

Do not use petroleum jelly, nail polish remover, or prick or burn the tick. These actions can cause infected secretions to enter the wound.

Plants

Preventative measures will be implemented to avoid contact with poisonous plants on the site property. These measures will include, but are not limited to, the following activities:

- Wear clothing that covers arms and hands if possible
- Frequently wash exposed skin
- Avoid skin contact with objects or protective clothing that have touched the plants
- Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance
- If skin contact is made, the area should be washed immediately with soap and water and observed for signs of reddening.

Snakes

All personnel walking through vegetated areas must be aware of the potential for encountering snakes. If a snake bite occurs, apply a constriction band and wash the area around the wound to remove any unabsorbed venom.

4.2.5.2 Heat Stress

When feasible, the most stressful site activities should be performed during the coolest parts of the day. Site workers will be instructed to stay hydrated throughout the day. An intake of 5 to 7 ounces of fluids every 15 to 20 minutes is recommended.

Site workers will be monitored for the signs and symptoms of heat stress during work activities. The signs and symptoms of heat stress are dizziness, vomiting, hot, dry skin, rapid heartbeat, throbbing headache, rash, cramps, chest pain, muscle spasms, pain in the hands, feet, or abdomen, loss of coordination, and decreased cognitive ability.

Site workers expressing or demonstrating any of these symptoms will be immediately excused of their duties and instructed to rest in a cool environment. Site work/rest cycles will be determined based on ambient conditions and based on guidance pertaining to heat stress provided by OSHA and NIOSH.

4.2.6 General Health and Safety Controls

4.2.6.1 Communications System

Telephones will be available on site and both on-site and off-site project personnel will be accessible for communication. If there is a lack of cell phone signal at the site, then personnel should locate the closest public payphone prior to work commencement. Personnel should also be trained in the use of standard hand signals for health and safety. Personnel in the work zone will use the following standard hand signals:

- Hand gripping throat ----- Can't breathe
- Grip partner's wrist or both hands around waist ----- Leave area immediately
- Hands on top of head ----- Need assistance
- Thumbs up ----- OK, I am all right, I understand
- Thumbs down ----- No, negative

4.2.6.2 Basic Safety Equipment

Safety equipment will be kept on site for monitoring and responding to emergency situations. Basic safety equipment will include, but is not limited to, the following:

- ABC type fire extinguishers
- First Aid kits
- Air Monitoring Equipment
- Reference books containing basic first-aid procedures and information

4.2.6.3 Safe Work Practices

All Chazen personnel and all subcontractors working on site are expected to follow established safe work practices for their specialties (i.e. excavators, surveying, etc.). The need to exercise caution in the performance of specific work tasks is frequently made more acute due to:

- Weather conditions
- Restricted mobility and reduced peripheral vision caused by protective gear
- The need to maintain the integrity of the protective equipment

Work at the 136 Fuller Road site will be conducted in accordance with established protocols and guidelines for the safety and health of all involved. General safety practices employed at the site will include but are not limited to the following:

- No smoking, eating, or drinking in an exclusion zone or before personnel decontamination. Ingestion of contaminants is the second most likely means of introducing toxic substances into the body.

- In any unknown situation, always assume the worst conditions and plan responses accordingly.

- Personal protective equipment is never 100% effective, so all personnel must minimize contact with potentially contaminated material. Do not place equipment on potentially contaminated ground. Do not sit or kneel on potentially contaminated material. Avoid standing in or walking through puddles or stained soil.

- Avoid heat and other work stresses related to the wearing of protective equipment and clothing. Work breaks should be scheduled *(and actually taken)* to prevent stress-related accidents or fatigue.

- As often as possible, the handling of contaminated materials should be done remotely. Every effort should be made to identify the contents of containers found on-site before they are handled.

- Personnel must be observant of not only their own immediate surroundings, but also of others.

- Rigorous contingency planning and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.

- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid field work while feeling ill. Company policies prohibit use of alcohol while working.

The site Health and Safety Officer or their designee will maintain project Health and Safety records in a safe and secure manner. The Health and Safety records will remain on site for the duration of the project so that any designated replacement can update and maintain the records. At the conclusion of field work, the records will be included with the overall project file.

5.0 PERSONAL PROTECTIVE EQUIPMENT

Site workers will be provided with the appropriate personal protective equipment (PPE) and will be trained on the use of this equipment. PPE will be selected to provide an appropriate level of protection against known and reasonably anticipated site hazards. Given the available data, the level of PPE selected for the 136 Fuller Road Site is a modified Level D which will include the items listed in Table 4.

Table 4: Site-Specific PPE Components

Area	PPE Item
Head	Hard Hat (OSHA approved)
Feet	Work Boots (steel-toed, unless conducting electromagnetic survey)
Skin	Nitrile Gloves
Hearing	Ear Plugs/Hearing Protection
Vision	Safety Glasses

The level of PPE will be continually evaluated and will be modified as necessary, depending on site conditions. If necessary, the level of PPE will be upgraded to one of, or a combination of the following levels:

Level C protection consists of:

(a) Full-face air-purifying respirator

(b) Tyvek or Poly-tyvek coveralls

(c) Chemical-resistant gloves taped to coveralls

(d) Chemical-resistant boots taped to coveralls

Level B protection consists of:

(a) Level C protection for the body, plus

(b) Positive pressure Self-contained Breathing Apparatus (SCBA) or a tethered cascade breathing system.

It will be the responsibility of the on-site Health and Safety Officer to insure that all personnel and subcontractors are knowledgeable of the level of personal protection required in all work situations. Further, it is the obligation of the Health and Safety Officer to see that proper equipment is worn and work rules are observed. All subcontractors are responsible for supplying their personnel with the necessary equipment.

6.0 AIR MONITORING

Air monitoring for volatile organic compounds in ambient air will be performed during outdoor site activities with a hand-held photoionization detector (PID). Ambient concentrations of volatile organic compounds will be measured at the downwind perimeter of the work zone. Upwind concentrations are measured at the start of the workday, and periodically thereafter throughout the workday.

If VOC concentrations are above the recommended threshold of 5 ppm, work activities will be halted and monitoring continued. If organic vapor levels are greater than 5 ppm sustained (15-minute average) over background but less than 25 ppm over background at the perimeter of the work area, activities will 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. If air sampling indicates airborne concentrations of volatile organic compounds above the permissible exposure limits, then site operations will cease and personnel will leave the immediate work area. Work will resume when ambient monitoring indicates that airborne concentrations have stabilized below the permissible exposure limits.

If organic levels persist at least 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial structure, then air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure. If efforts to abate the emission are unsuccessful and if the levels in the 20 foot zone are approaching 5 ppm above background for more than 30 minutes or are greater than 10 ppm, then the following Major Vapor Emission Response Plan shall be placed into effect:

1.) All emergency response contacts listed in this Health and Safety Plan will go into effect and the local police will be contacted and advised of the situation.

2.) Air monitoring will be conducted at 30 minute intervals within the 20 foot zone. If two consecutive readings are below action levels, air monitoring will be halted or modified by the Safety Officer.

Fugitive dust is unlikely to be generated by the proposed investigation activities. If fugitive dusts are generated during outdoor site activities, ambient concentrations of airborne dusts will be measured during the site activities which generate fugitive dust. Particulate levels will be monitored upwind, downwind and within the work area at temporary monitoring stations using an MIE *personal* DataRam® handheld dust/aerosol monitor. The instrument is sensitive to particulates which range in size from 0.1 - 10µm, which include both respirable[1] and non-respirable dusts. If the downwind particulate levels exceed the OSHA PEL for total dusts of 15-mg/m^3 or the PEL for respirable dusts of 5-mg/m^3, then dust suppression techniques will be employed or the work process will be modified to further reduce dust generation. All readings will be recorded and available for State (DEC and DOH) personnel to review.

[1] Respirable dust refers to dust particles that are invisible to the human eye, settle deep within the lungs, and that are not ejected by exhaling, coughing, or expulsion by mucus. Respirable dusts are typically <0.5µm in size.

As the majority of indoor site activities are expected to take place within an active plastic recycling facility, the ambient air quality will be assessed using a PID prior to the start of indoor work. Periodic air sampling will be conducted within the work zone and compared to the ambient concentrations.

7.0 TRAINING & MEDICAL SURVEILLANCE

7.1 Personnel Safety Training

The site is not an uncontrolled hazardous waste site; however, as part of Chazen policies, field personnel shall have received a minimum of 40 hours of comprehensive health and safety training (29 CFR 1910.120) and an annual 8 hour refresher course.

All workers must recognize and understand the potential hazards to health and safety that are associated with the investigation activities and must be thoroughly familiar with programs and procedures contained in the safety plan.

The objectives of Chazen training program, for employees involved in hazardous site activities are:

- To make workers aware of the potential hazards they may encounter.
- To provide the knowledge and skills necessary to perform the work with minimal risk to the health and safety of the workers.
- To make workers aware of the purpose and limitations of safety equipment.
- To ensure that workers can safely avoid or escape from emergencies.

7.2 Medical Surveillance

All Chazen personnel are currently involved in a medical monitoring program in accordance with 29 CFR 1910.120.

Based on the proposed scope of work, the potential for exposure to site COCs is considered to be negligible following the heath and safety procedure described herein. Medical monitoring for common COCs is performed as part of the existing Chazen medical monitoring program. Any provisions for alterations to the existing medical surveillance program will be made by the Health & Safety Officer based on the site characterization and job hazard analysis.

8.0 WORKING ZONE

8.1 Exclusion Zone

An Exclusion Zone will be established in areas where work activities will occur. The Exclusion Zone will be cordoned off while work is in progress. Entry to and exit from this area will be provided only to those persons directly involved in the work activities and only if the prescribed level of personal protection is worn.

The personnel working in the Exclusion Zone will be the health and safety officer, work crews, and specialized personnel. All personnel within the Exclusion Zone must wear the level of protection required by the site safety plan. All personnel in the Exclusion Zone will be health and safety trained.

8.2 Contamination Reduction Zone

If needed, the Contamination Reduction Zone (CRZ) will be established at the perimeter of the exclusion zone, where personal decontamination will take place. The CRZ is a transition zone between contaminated and uncontaminated areas of the site.

When personnel, equipment, or materials suspected to be contaminated are taken out of the exclusion zone, they will be properly contained, or decontaminated in the CRZ.

8.3 Support Zone

The Support Zone is considered the area outside the CRZ. The Support Zone will be reserved for the support vehicle and for clean equipment storage. It is separated from the CRZ, and is considered a "Clean" area. Only uncontaminated or decontaminated personnel or materials may enter this zone from the CRZ.

The support vehicle serves as the communications center, clean storage area, and source of emergency assistance for field operations. Certain safety equipment (i.e. fire extinguisher, first aid kit, etc.) are stored in the support vehicle.

9.0 DECONTAMINATION

Standard operating procedures are in place to minimize worker contact with site contaminants. However, procedures may be necessary to remove and/or minimize contaminants that have accumulated on equipment and personnel.

9.1 Personnel and Equipment Decontamination

All personnel and equipment leaving the work zone must be decontaminated. Decontamination procedures prior to leaving Level "D" areas will consist of brushing loose soil from clothing and equipment, washing equipment and clothing with water and a mild detergent. Disposable gloves, scoops, paper towels and Tyvek suits will be discarded in trash receptacles provided within these areas. All wastes generated in Level "D" areas will be bagged and disposed of on site without any additional restrictions.

The decontamination for Level "C", if needed, will involve a plastic liner to "catch" wash solutions and contaminated soil. When exiting the work zone, workers will enter the decontamination zone. Instruments, sample containers, and reusable equipment will be placed on a plastic covered table. These items will be cleaned with the appropriate cleaning solutions. The workers will then decontaminate their protective clothing. Disposable items will be discarded in trash receptacles which will be provided within the decontamination area.

10.0 EMERGENCY/CONTINGENCY PLAN

10.1 Personnel Roles, Lines of Authority, and Communication

The Health & Safety Officer (HSO) or the on-site designee is the primary authority for directing site operations under emergency conditions. All Health and Safety related emergency communications both on and off site will be directed through the Health and Safety Officer.

10.2 Site Evacuation

The emergency response capabilities of the local authorities and agencies will be assessed prior to the initiation of work.

Prior to the evacuation of any off site area, the Exclusion Zone and the CRZ will be expanded. Monitoring of the expanded CRZ will be conducted to determine if offsite evacuation is truly necessary.

When the HSO determines that conditions may actually warrant the evacuation of downwind residences and commercial operations, local agencies will be notified and assistance requested. Designated personnel will initiate evacuation of the immediate off site area without delay.

All work crews should be aware of surrounding conditions including the wind conditions while working outdoors. When conditions warrant moving away from a work site, the field crew will relocate up wind. If site access is restricted, or limited in any way, the crew may be instructed by the HSO to evacuate the site rather than move upwind, especially if an upwind withdrawal moves the field crew away from an acceptable escape route.

If conditions warrant a site evacuation, the field crew will proceed upwind of the work site and will notify the HSO or their designated representative. If the decontamination area is upwind and more than 500 feet from the work site, the crew will pass through the decontamination area to remove their outer suits. Following decontamination, the field crew will proceed to the support vehicle and an assessment of the situation will be made by the HSO, or their designated representative. As soon as it is practical, and as additional information about site conditions is received from the field crew, the situation will be communicated to the Health and Safety Supervisor, Health and Safety Manager, the project manager, and if applicable the appropriate local emergency response agencies.

10.3 Emergency Medical Treatment and First Aid

First aid will be available to any person injured. A First Aid Kit will be on hand. The injured person may be transported to a medical center for further examination and treatment. The preferred transport method is a professional emergency transportation service; however, if this option is not readily available or would result in excessive delay, other transport is authorized.

> *Under no circumstances should an injured person transport themselves to a medical facility for treatment, no matter how minor the injury may appear.*

If an injury occurs in the Exclusion Zone, provisions for decontamination of the victim will be made. However, if injuries are deemed life-threatening, then normal decontamination procedures may be dispensed with. In such cases arrangements will be made with the emergency response personnel to provide the necessary containment or decontamination.

10.4 Spill Response

The proposed site activities do not involve the use, storage, or generation of bulk quantities of petroleum, chemicals or hazardous wastes (i.e. drums, containers, etc.) which would present a potential for spill hazards.

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

June 20, 2000

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Appendix D1

Groundwater Monitoring Data

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location	6 NYCRR Part 703.5	MW8					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)		FRMW-MW8-X25 (15-25')					
Sample Date		07/15/10	5/31/2011	7/21/2011	9/29/2011	12/13/2011	2/22/2012
Lab Sample ID		10G0511-06	11F0120-01	11G0750-01	11J0038-01	11L0632-01	12B0883-01
Groundwater Elevation		240.11	N/A	241.30	242.38	242.00	241.42
Analyte	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	1.6 J	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethane	5*	1.5 J	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 5.0	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 5.0	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
2-Butanone	NS	ND< 5.0	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10
Acetone	50	ND< 10 J	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10
Benzene	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromoform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromomethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon disulfide	60	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon tetrachloride	5	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chlorobenzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroform	7	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloromethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dibromochloromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dichlorodifluoromethane	5*	2.8 J	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Isopropylbenzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methylene chloride	5*	ND< 5.8	ND< 10	ND< 10	2.3	ND< 10	2.7 J,B
o-Xylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
p- & m- Xylenes	5*	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Tetrachloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Toluene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichlorofluoromethane (freon 11)	5*	4.2 J	ND< 5.0	ND< 5.0	ND< 5.0	1.4 J	ND< 5.0
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Total VOC concentration	NS	10.1	0.0	0.0	2.3	1.4	2.7
Total CVOC concentration	NS	10.1	0.0	0.0	2.3	1.4	2.7
Total Petro-VOC concentration	NS	0	0	0	0	0	0
Other VOC concentration	NS	0	0	0	0	0	0
	Location of screen	Just beneath WT surface					

NOTES:
All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)
NS indicates that there is no listed standard for that analyte
Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum
+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene
ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.
Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW9					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW9-X12 (7-12')**					
Sample Date		7/19/2010	5/31/2011	7/21/2011	9/29/2011	12/13/2011	2/22/2012
Lab Sample ID		10G0579-14	--	--	--	--	--
Groundwater Elevation		245.21	--	--	--	--	--
Analyte	ppb	ppb	--	--	--	--	--
1,1,1-Trichloroethane	5*	**830**					
1,1,2,2-Tetrachloroethane	5*	ND< 50					
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 50					
1,1,2-Trichloroethane	1	ND< 50					
1,1-Dichloroethane	5*	**900**					
1,1-Dichloroethylene	5*	**140**					
1,2,4-Trichlorobenzene	5*	ND< 100					
1,2-Dibromo-3-chloropropane	0.04	ND< 50					
1,2-Dibromoethane	NS	ND< 50					
1,2-Dichloroethane	0.6	ND< 50					
1,2-Dichloropropane	1	ND< 50					
2-Butanone	NS	ND< 50					
2-Hexanone	NS	ND< 50					
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 100					
Acetone	50	ND< 50 J					
Benzene	1	ND< 50					
Bromodichloromethane	NS	ND< 50					
Bromoform	NS	ND< 50					
Bromomethane	5*	ND< 50 J					
Carbon disulfide	60	ND< 50					
Carbon tetrachloride	5	ND< 50					
Chlorobenzene	5*	ND< 50			WELL DRY - NOT SAMPLED		
Chloroethane	5*	**8.1 J**					
Chloroform	7	ND< 50					
Chloromethane	NS	ND< 50					
cis-1,2-Dichloroethylene	5*	**1,100**					
cis-1,3-Dichloropropylene	0.4+	ND< 50					
Dibromochloromethane	5*	ND< 50					
Dichlorodifluoromethane	5*	**170**					
Ethyl Benzene	5*	**580**					
Isopropylbenzene	5*	**13 J**					
Methyl tert-butyl ether (MTBE)	10**	ND< 50					
Methylene chloride	5*	ND< 52 J					
o-Xylene	5*	**760**					
p- & m- Xylenes	5*	**2,500**					
Styrene	5*	ND< 50					
Tetrachloroethylene	5*	**510**					
Toluene	5*	**850**					
trans-1,2-Dichloroethylene	5*	ND< 50					
trans-1,3-Dichloropropylene	0.4+	ND< 50					
Trichloroethylene	5*	**330**					
Trichlorofluoromethane (freon 11)	5*	**2,200**					
Vinyl Chloride	2	ND< 50					
Total VOC concentration	NS	10,891	--	--	--	--	--
Total CVOC concentration	NS	6,188	--	--	--	--	--
Total Petro-VOC concentration	NS	4703	--	--	--	--	--
Other VOC concentration	NS	0	--	--	--	--	--
	Location of screen	Across WT on top of shallow clay					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW10					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW10-X15 (10-15')**					
Sample Date		7/19/2010	5/31/2011	7/21/2011	9/29/2011	12/14/2011	2/22/2012
Lab Sample ID		10G0579-15	11F0120-02	11G0750-02	11J0038-02	11L0632-02	12B0883-02
Groundwater Elevation		239.15	241.24	240.56	241.54	241.21	240.65
Analyte	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	**670**	**260**	**65 J**	**300**	**280**	**8.2**
1,1,2,2-Tetrachloroethane	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
1,1,2-Trichloroethane	1	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
1,1-Dichloroethane	5*	**310**	**47 J**	**17**	**97**	**55 J**	0.86 J
1,1-Dichloroethylene	5*	**87 J**	**31 J**	**14**	**50**	ND< 250	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 500	ND< 10	ND< 10	ND< 10	ND< 500	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 250	ND< 10	ND< 10	ND< 10	ND< 500	ND< 10
1,2-Dibromoethane	NS	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
1,2-Dichloroethane	0.6	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
1,2-Dichloropropane	1	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
2-Butanone	NS	ND< 250	ND< 10	ND< 10	ND< 10	ND< 500	ND< 10
2-Hexanone	NS	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 500	ND< 10	ND< 10	ND< 10	ND< 500	ND< 10
Acetone	50	ND< 270 J	ND< 10	ND< 10	ND< 10	ND< 500	ND< 10
Benzene	1	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Bromodichloromethane	NS	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Bromoform	NS	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Bromomethane	5*	ND< 250 J	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Carbon disulfide	60	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Carbon tetrachloride	5	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Chlorobenzene	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Chloroethane	5*	ND< 250	3.2 J	1.3 J	2.2	ND< 250	ND< 5.0
Chloroform	7	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Chloromethane	NS	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
cis-1,2-Dichloroethylene	5*	**8,700**	**3,300**	**830**	**3,800**	**2,900**	**67**
cis-1,3-Dichloropropylene	0.4+	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Dibromochloromethane	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Dichlorodifluoromethane	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Ethyl Benzene	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Isopropylbenzene	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 250	0.39 J	1.0 J	ND< 5.0	ND< 250	ND< 5.0
Methylene chloride	5*	ND< 430 J	ND< 10	ND< 10	2.8	ND< 500	ND< 10
o-Xylene	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
p- & m- Xylenes	5*	**46 J**	ND< 10	ND< 10	ND< 10	ND< 250	ND< 10
Styrene	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Tetrachloroethylene	5*	**670**	**480**	**140 J**	**190**	**230 J**	**200**
Toluene	5*	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 250	**17**	3.5 J	**10**	ND< 250	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Trichloroethylene	5*	**440**	**110**	**26**	**55**	**130 J**	**71**
Trichlorofluoromethane (freon 11)	5*	ND< 250	3.5 J	3.2 J	2.3	ND< 250	ND< 5.0
Vinyl Chloride	2	ND< 250	ND< 5.0	ND< 5.0	ND< 5.0	ND< 250	ND< 5.0
Total VOC concentration	NS	10,923	4,252	1,101	4,509	3,595	347
Total CVOC concentration	NS	10,877	4,252	1,100	4,509	3,595	347
Total Petro-VOC concentration	NS	46	0	1	0	0	0
Other VOC concentration	NS	0	0	0	0	0	0
	Location of screen	Across WT					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW20					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW20-X18 (8-18')**					
Sample Date		07/15/10	05/31/11	07/21/11	09/29/11	12/13/11	02/22/12
Lab Sample ID		10G0511-05	11F0120-03	11G0750-03	11J0038-03	11L0632-03	12B0883-03
Groundwater Elevation		240.28	242.31	241.48	242.65	242.29	241.74
Analyte	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	**190**	**61**	**73**	**81**	**43**	**51**
1,1,2,2-Tetrachloroethane	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,1,2-Trichloroethane	1	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,1-Dichloroethane	5*	**690**	**220**	**260**	**200**	**100**	**160**
1,1-Dichloroethylene	5*	**25 J**	**9.8**	**19**	**14**	**10 J**	**11**
1,2,4-Trichlorobenzene	5*	ND< 50	ND< 10	ND< 10	ND< 10	ND< 50	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 50	ND< 10	ND< 10	ND< 10	ND< 50	ND< 10
1,2-Dibromoethane	NS	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,2-Dichloroethane	0.6	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,2-Dichloropropane	1	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
2-Butanone	NS	ND< 50	ND< 10	ND< 10	ND< 10	ND< 50	ND< 10
2-Hexanone	NS	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 100	ND< 10	ND< 10	ND< 10	ND< 50	ND< 10
Acetone	50	ND< 36 J	ND< 10	ND< 10	4.7	ND< 50	3.3 JB
Benzene	1	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Bromodichloromethane	NS	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Bromoform	NS	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Bromomethane	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Carbon disulfide	60	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Carbon tetrachloride	5	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chlorobenzene	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chloroethane	5*	ND< 50	1.3 J	2.5 J	1.3	ND< 25	**8.2**
Chloroform	7	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chloromethane	NS	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
cis-1,2-Dichloroethylene	5*	**54**	**21**	**30**	**36**	**25**	**33**
cis-1,3-Dichloropropylene	0.4+	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Dibromochloromethane	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Dichlorodifluoromethane	5*	**29 J**	ND< 5.0	ND< 5.0	4.2	ND< 25	2.2 J
Ethyl Benzene	5*	**85**	**39**	**54**	**59**	**42**	**58**
Isopropylbenzene	5*	ND< 50	1.3 J	2.1 J	1.8	ND< 25	1.6 J
Methyl tert-butyl ether (MTBE)	10**	ND< 50	0.64 J	1.4 J	ND< 5.0	ND< 25	ND< 5.0
Methylene chloride	5*	**ND< 63**	ND< 10	ND< 10	3.2	ND< 50	2.7 J,B
o-Xylene	5*	**160**	**79**	**89**	**73**	**32**	**58**
p- & m- Xylenes	5*	**500**	**280**	**330**	**340**	**280**	**340**
Styrene	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Tetrachloroethylene	5*	**67**	**38**	**40 J**	**76**	**56**	**59**
Toluene	5*	**100**	**19**	**17**	**10**	**3.8 J**	**12**
trans-1,2-Dichloroethylene	5*	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Trichloroethylene	5*	ND< 50	**8.4**	**9.6**	**15**	**9.4 J**	**13**
Trichlorofluoromethane (freon 11)	5*	**220**	**86**	**94**	**120**	**68**	**84**
Vinyl Chloride	2	ND< 50	ND< 5.0	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Total VOC concentration	NS	2,120	864	1,022	1,039	669	897
Total CVOC concentration	NS	1,275	446	528	551	311	424
Total Petro-VOC concentration	NS	845	419	494	484	358	470
Other VOC concentration	NS	0	0	0	5	0	3.3
	Location of screen	Across WT					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW25					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW25-X10 (5-10')**					
Sample Date		7/19/2010	5/31/2011	7/21/2011	9/29/2011	12/13/2011	2/22/2012
Lab Sample ID		10G0579-07	11F0120-04	11G0750-04	11J0038-04	--	--
Groundwater Elevation		245.63	240.08	240.09	241.86	239.43	DRY
Analyte	ppb	ppb	ppb	ppb	ppb	--	--
1,1,1-Trichloroethane	5*	**1,400**	**76**	**100**	**130**		
1,1,2,2-Tetrachloroethane	5*	ND< 120	ND< 5.0	ND< 50	ND< 250		
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 120	ND< 5.0	ND< 50	68 250		
1,1,2-Trichloroethane	1	ND< 120	ND< 5.0	ND< 50	ND< 250		
1,1-Dichloroethane	5*	**340**	**70**	**76**	**160**		
1,1-Dichloroethylene	5*	ND< 120	**7.0**	ND< 50	ND< 250		
1,2,4-Trichlorobenzene	5*	ND< 250	ND< 10	ND< 100	ND< 500		
1,2-Dibromo-3-chloropropane	0.04	ND< 120	ND< 10	ND< 100	ND< 500		
1,2-Dibromoethane	NS	ND< 120	ND< 5.0	ND< 50	ND< 250		
1,2-Dichloroethane	0.6	ND< 120	ND< 5.0	ND< 50	ND< 250		
1,2-Dichloropropane	1	ND< 120	ND< 5.0	ND< 50	ND< 250		
2-Butanone	NS	ND< 120	ND< 10	ND< 100	ND< 500		
2-Hexanone	NS	ND< 120	ND< 5.0	ND< 50	ND< 250		
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 250	ND< 10	ND< 100	ND< 500		
Acetone	50	ND< 160 J	ND< 10	ND< 100	5.6		
Benzene	1	ND< 120	ND< 5.0	ND< 50	ND< 250		
Bromodichloromethane	NS	ND< 120	ND< 5.0	ND< 50	ND< 250		
Bromoform	NS	ND< 120	ND< 5.0	ND< 50	ND< 250		
Bromomethane	5*	ND< 120	ND< 5.0	ND< 50	ND< 250		
Carbon disulfide	60	ND< 120	ND< 5.0	ND< 50	ND< 250		
Carbon tetrachloride	5	ND< 120	ND< 5.0	ND< 50	ND< 250		
Chlorobenzene	5*	ND< 120	ND< 5.0	ND< 50	ND< 250	WELL DRY - NOT SAMPLED	
Chloroethane	5*	ND< 120	3.6 J	ND< 50	ND< 250		
Chloroform	7	ND< 120	ND< 5.0	ND< 50	ND< 250		
Chloromethane	NS	ND< 120	ND< 5.0	ND< 50	ND< 250		
cis-1,2-Dichloroethylene	5*	**3,500**	**170**	**280**	**1600**		
cis-1,3-Dichloropropylene	0.4+	ND< 120	ND< 5.0	ND< 50	ND< 250		
Dibromochloromethane	5*	ND< 120	ND< 5.0	ND< 50	ND< 250		
Dichlorodifluoromethane	5*	**62 J**	**290**	**130**	**2100**		
Ethyl Benzene	5*	**380**	**38**	**24 J**	**100**		
Isopropylbenzene	5*	ND< 120	4.2 J	ND< 50	ND< 250		
Methyl tert-butyl ether (MTBE)	10**	ND< 120	ND< 5.0	ND< 50	ND< 250		
Methylene chloride	5*	ND< 230	ND< 10	**16 J,B**	**3.7**		
o-Xylene	5*	**490**	**21**	**14 J**	**86**		
p- & m- Xylenes	5*	**2,000**	**89**	**51 J**	**320**		
Styrene	5*	ND< 120	ND< 5.0	ND< 50	ND< 250		
Tetrachloroethylene	5*	**2,800**	**140**	**350**	**790**		
Toluene	5*	**580**	**15**	**13 J**	ND< **250**		
trans-1,2-Dichloroethylene	5*	ND< 120	ND< 5.0	ND< 50	ND< 250		
trans-1,3-Dichloropropylene	0.4+	ND< 120	ND< 5.0	ND< 50	ND< 250		
Trichloroethylene	5*	**810**	**16**	**18 J**	**85**		
Trichlorofluoromethane (freon 11)	5*	**1,200**	**330**	**480**	**9800**		
Vinyl Chloride	2	ND< 120	ND< 5.0	ND< 50	ND< 250		
Total VOC concentration	NS	13,562	1,270	1,552	15,248	--	--
Total CVOC concentration	NS	10,112	1,103	1,450	14,737	--	--
Total Petro-VOC concentration	NS	3450	167	102	506	--	--
Other VOC concentration	NS	0	0	0	6	--	--
	Location of screen	On top of shallow clay					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW27					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW27-X10 (5-10')**					
Sample Date		07/16/10	05/31/11	07/21/11	09/29/11	12/13/2011	2/22/2012
Lab Sample ID		10G0511-14	11F0120-05	11G0750-05	11J0038-05	--	--
Groundwater Elevation		245.56	240.02	240.02	242.01	239.25	DRY
Analyte	ppb	ppb	ppb	ppb	ppb	--	--
1,1,1-Trichloroethane	5*	**8,500 J**	**250**	**1700 J**	2.7		
1,1,2,2-Tetrachloroethane	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
1,1,2-Trichloroethane	1	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
1,1-Dichloroethane	5*	**720 J**	**10 J**	**320**	ND< 5.0		
1,1-Dichloroethylene	5*	ND< 2,500	ND< 50	**67**	ND< 5.0		
1,2,4-Trichlorobenzene	5*	ND< 2,500	ND< 100	ND< 100	ND< 10		
1,2-Dibromo-3-chloropropane	0.04	ND< 2,500	ND< 100	ND< 100	ND< 10		
1,2-Dibromoethane	NS	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
1,2-Dichloroethane	0.6	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
1,2-Dichloropropane	1	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
2-Butanone	NS	ND< 2,500	ND< 100	ND< 100	ND< 10		
2-Hexanone	NS	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 5,000	ND< 100	ND< 100	ND< 10		
Acetone	50	ND< 5,000 J	ND< 10 B	ND< 10 B	3.7		
Benzene	1	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Bromodichloromethane	NS	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Bromoform	NS	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Bromomethane	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Carbon disulfide	60	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Carbon tetrachloride	5	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Chlorobenzene	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0	WELL DRY - NOT SAMPLED	
Chloroethane	5*	ND< 2,500	ND< 50	**23 J**	ND< 5.0		
Chloroform	7	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Chloromethane	NS	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
cis-1,2-Dichloroethylene	5*	**1,200 J**	**21 J**	**280**	**19**		
cis-1,3-Dichloropropylene	0.4^{+}	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Dibromochloromethane	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Dichlorodifluoromethane	5*	ND< 2,500	ND< 50	**94**	ND< 5.0		
Ethyl Benzene	5*	**1,800 J**	**110**	**48 J**	ND< 5.0		
Isopropylbenzene	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Methyl tert-butyl ether (MTBE)	10**	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Methylene chloride	5*	**ND< 2,500 J**	ND< 10 B	ND< 10 B	3.1		
o-Xylene	5*	**2,300 J**	**180**	**100**	ND< 5.0		
p- & m- Xylenes	5*	**7,100 J**	**650**	**280**	1.6		
Styrene	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Tetrachloroethylene	5*	**22,000 J**	**6,700**	**10,000**	**66**		
Toluene	5*	**1,900 J**	**56**	**180**	ND< 5.0		
trans-1,2-Dichloroethylene	5*	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
trans-1,3-Dichloropropylene	0.4^{+}	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Trichloroethylene	5*	ND< 2,500	**15 J**	**150**	**5.2**		
Trichlorofluoromethane (freon 11)	5*	**880 J**	**34 J**	ND< 2500	1.1		
Vinyl Chloride	2	ND< 2,500	ND< 50	ND< 50	ND< 5.0		
Total VOC concentration	NS	46,400	8,026	13,242	102	--	--
Total CVOC concentration	NS	33,300	7,030	12,634	97	--	--
Total Petro-VOC concentration	NS	13100	996	608	2	--	--
Other VOC concentration	NS	0	0	0	4	--	--
	Location of screen	On top of shallow clay					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		**MW29**						
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW29-X27 (27-32')**						
Sample Date		07/16/10	7/16/2010 (DUP)	05/31/11	07/21/11	09/29/11	12/14/11	02/22/12
Lab Sample ID		10G0511-12	10G0511-15	11F0120-06	11G0750-06	11J0038-06	11L0632-04	12B0883-04
Groundwater Elevation		239.37	239.37	241.49	240.61	241.92	241.43	240.83
Analyte	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	ND< 2,500	ND< 2,500	**200 J**	ND< 5000	**56**	ND< 2500	**79**
1,1,2,2-Tetrachloroethane	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
1,1,2-Trichloroethane	1	ND< 2,500	ND< 2,500	ND< 1000	**18**	ND< 120	ND< 2500	**12 J**
1,1-Dichloroethane	5*	**6,400**	**9,300**	**5,900**	ND< 5	**7,200**	**6,300**	**3,900**
1,1-Dichloroethylene	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	**150**	ND< 2500	**220**
1,2,4-Trichlorobenzene	5*	ND< 2,500	ND< 2,500	ND< 2000	ND< 10	ND< 250	ND< 5000	ND< 100
1,2-Dibromo-3-chloropropane	0.04	ND< 2,500	ND< 2,500	ND< 2000	ND< 10	ND< 250	ND< 5000	ND< 100
1,2-Dibromoethane	NS	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
1,2-Dichloroethane	0.6	ND< 2,500	ND< 2,500	ND< 1000	**20**	ND< 120	ND< 2500	**10 J**
1,2-Dichloropropane	1	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
2-Butanone	NS	ND< 2,500	ND< 2,500	ND< 2000	9.3 J	ND< 250	ND< 5000	ND< 100
2-Hexanone	NS	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 5,000	ND< 5,000	ND< 2000	ND< 10	ND< 250	ND< 5000	ND< 100
Acetone	50	ND< 5,000 J	ND< 5,000 J	3.4 B, J	ND< 10	8.8	ND< 5000	130 B
Benzene	1	ND< 2,500	ND< 2,500	ND< 1000	**6.1**	ND< 120	ND< 2500	ND< 50
Bromodichloromethane	NS	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Bromoform	NS	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Bromomethane	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Carbon disulfide	60	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Carbon tetrachloride	5	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Chlorobenzene	5*	ND< 2,500	ND< 2,500	ND< 1000	2.3 J	ND< 120	ND< 2500	ND< 50
Chloroethane	5*	ND< 2,500	ND< 2,500	ND< 1000	**5.2**	ND< 120	ND< 2500	ND< 50
Chloroform	7	ND< 2,500	ND< 2,500	ND< 1000	3.2 J	ND< 120	ND< 2500	ND< 50
Chloromethane	NS	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
cis-1,2-Dichloroethylene	5*	ND< 2,500	ND< 2,500	ND< 1000	**10**	ND< 120	ND< 2500	ND< 50
cis-1,3-Dichloropropylene	0.4+	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Dibromochloromethane	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Dichlorodifluoromethane	5*	ND< 2,500	ND< 2,500	ND< 1000	**23**	ND< 120	ND< 2500	ND< 50
Ethyl Benzene	5*	ND< 2,500	ND< 2,500	ND< 1000	**11**	ND< 120	ND< 2500	**11 J**
Isopropylbenzene	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Methyl tert-butyl ether (MTBE)	10**	ND< 2,500	ND< 2,500	ND< 1000	1.4 J	ND< 120	ND< 2500	ND< 50
Methylene chloride	5*	**ND< 1,800**	**ND< 2,500**	3.7 B,J	4.1 B,J	4	ND< 5000	**37 J,B**
o-Xylene	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5000	**65**	ND< 2500	**81**
p- & m- Xylenes	5*	ND< 5,000	ND< 2,500	ND< 2000	ND< 10000	**41**	**480 J**	**60 J**
Styrene	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Tetrachloroethylene	5*	**23,000**	**38,000**	**19,000**	**18,000**	**22,000**	**25,000**	**13,000**
Toluene	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5000	**72**	ND< 2500	**86**
trans-1,2-Dichloroethylene	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
trans-1,3-Dichloropropylene	0.4+	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Trichloroethylene	5*	**520 J**	**780 J**	**440 J**	ND< 5000	**700**	**460 J**	**940**
Trichlorofluoromethane (freon 11)	5*	ND< 2,500	ND< 2,500	ND< 1000	ND< 5	ND< 120	ND< 2500	ND< 50
Vinyl Chloride	2	ND< 2,500	ND< 2,500	ND< 1000	**34**	ND< 120	ND< 2500	**13 J**
Total VOC concentration	NS	29,920	48,080	25,547	18,148	30,297	32,240	18,579
Total CVOC concentration	NS	29,920	48,080	25,544	18,120	30,110	31,760	18,211
Total Petro-VOC concentration	NS	0	0	0	19	178	480	238
Other VOC concentration	NS	0	0	3	9	9	0	130
	Location of screen	On top of deep clay						

NOTES:
All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)
NS indicates that there is no listed standard for that analyte
Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**
* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum
+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene
ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.
Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW30					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW30-X20 (10-20')**					
Sample Date		7/19/2010	05/31/11	07/21/11	09/29/11	12/14/11	02/22/12
Lab Sample ID		10G0579-10	11F0120-07	11G0750-07	11J0038-07	11L0632-05	12B0883-05
Groundwater Elevation		245.66	238.15	238.71	241.62	240.31	238.75
Analyte	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	**13,000 J**	**3,900**	**580 J**	**9,500**	**2,100**	**2,800**
1,1,2,2-Tetrachloroethane	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
1,1,2-Trichloroethane	1	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	**9.2 J**
1,1-Dichloroethane	5*	**2,300 J**	**1,400**	**460 J**	**970**	**940 J**	**2,500**
1,1-Dichloroethylene	5*	ND< 500	**360**	**140**	**160**	ND< 1000	**950**
1,2,4-Trichlorobenzene	5*	ND< 1000	ND< 100	ND< 100	ND< 250	ND< 1000	ND< 100
1,2-Dibromo-3-chloropropane	0.04	ND< 500	ND< 100	ND< 100	ND< 250	ND< 2000	ND< 100
1,2-Dibromoethane	NS	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
1,2-Dichloroethane	0.6	ND< 500	**13 J**	ND< 50	ND< 120	ND< 1000	**27 J**
1,2-Dichloropropane	1	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
2-Butanone	NS	ND< 500	ND< 100	ND< 100	ND< 250	ND< 2000	ND< 100
2-Hexanone	NS	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 1000	ND< 100	ND< 100	ND< 250	ND< 2000	ND< 100
Acetone	50	ND< 1000 J	ND< 10 B	ND< 100	8.4	ND< 2000	210 B
Benzene	1	ND< 500	**9.7 J**	ND< 50	ND< 120	ND< 1000	**18 J**
Bromodichloromethane	NS	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Bromoform	NS	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Bromomethane	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Carbon disulfide	60	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Carbon tetrachloride	5	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Chlorobenzene	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Chloroethane	5*	**250 J**	**410**	**310**	**110**	ND< 1000	**1,400**
Chloroform	7	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Chloromethane	NS	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
cis-1,2-Dichloroethylene	5*	**2,600 J**	**3,700**	**880 J**	**1,800**	**4,600**	**15,000**
cis-1,3-Dichloropropylene	0.4+	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Dibromochloromethane	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Dichlorodifluoromethane	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	**26 J**
Ethyl Benzene	5*	**420 J**	**170**	**100**	**39**	**72 J**	**310**
Isopropylbenzene	5*	ND< 500	**9.1 J**	**5.7 J**	ND< **120**	ND< 1000	**9.8 J**
Methyl tert-butyl ether (MTBE)	10**	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Methylene chloride	5*	ND< 660	1.2 B,J	**13 B,J**	**4.2**	ND< 2000	**34 J,B**
o-Xylene	5*	**810 J**	**620**	**250**	**49**	**130 J**	**780**
p- & m- Xylenes	5*	**2,400 J**	**1,500**	**240 J**	**110**	**320 J**	**1,700**
Styrene	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Tetrachloroethylene	5*	**12,000 J**	**9,100**	**3,500**	**1400**	**2500**	**15,000**
Toluene	5*	**920 J**	**650**	**270**	**84**	**150 J**	**830**
trans-1,2-Dichloroethylene	5*	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	**19 J**
trans-1,3-Dichloropropylene	0.4+	ND< 500	ND< 50	ND< 50	ND< 120	ND< 1000	ND< 50
Trichloroethylene	5*	**320 J**	**990**	**360**	**110**	**540 J**	**2,600**
Trichlorofluoromethane (freon 11)	5*	**94 J**	**18 J**	ND< 50	ND< 120	ND< 1000	ND< 50
Vinyl Chloride	2	ND< 500	**16 J**	**13 J**	ND< **120**	ND< 1000	**200**
Total VOC concentration	NS	32,264	22,867	7,122	14,345	11,352	44,423
Total CVOC concentration	NS	27,714	19,908	6,256	14,054	10,680	40,565
Total Petro-VOC concentration	NS	4550	2959	866	282	672	3648
Other VOC concentration	NS	0	0	0	8	0	210
	Location of screen	Just beneath WT surface					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 1
Summary of Laboratory Results
VOCs in Groundwater Samples - Primarily Source Area Wells
136 Fuller Road, Albany, New York

Sample Location	6 NYCRR Part 703.5	MW32					
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)		FRMW-MW32-X25 (15-25')					
Sample Date		7/19/2010	05/31/11	07/21/11	09/29/11	12/14/11	02/22/12
Lab Sample ID		10G0579-09	11F0120-08	11G0750-08	11J0038-08	11L0632-06	12B0883-06
Groundwater Elevation		238.84	240.47	239.98	240.75	240.43	239.98
Analyte	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	**46**	**25**	**31**	**72**	ND< 500	**6.2**
1,1,2,2-Tetrachloroethane	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
1,1,2-Trichloroethane	1	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
1,1-Dichloroethane	5*	**11 J**	**32**	**43**	**11**	ND< 500	2.6 J
1,1-Dichloroethylene	5*	**6.7 J**	4.7 J	**8.5**	**6.8**	ND< 500	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 50	ND< 10	ND< 10	ND< 10	ND< 1000	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 25	ND< 10	ND< 10	ND< 10	ND< 1000	ND< 10
1,2-Dibromoethane	NS	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
1,2-Dichloroethane	0.6	ND< 25	ND< 5.0	0.76 J	ND< **5.0**	ND< 500	ND< 5.0
1,2-Dichloropropane	1	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
2-Butanone	NS	ND< 25	ND< 10	ND< 10	ND< 10	ND< 1000	ND< 10
2-Hexanone	NS	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 50	ND< 10	ND< 10	ND< 10	ND< 1000	ND< 10
Acetone	50	ND< 25 J	ND< 10	ND< 10	5	ND< 1000	ND< 10
Benzene	1	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Bromodichloromethane	NS	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Bromoform	NS	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Bromomethane	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Carbon disulfide	60	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Carbon tetrachloride	5	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Chlorobenzene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Chloroethane	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Chloroform	7	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Chloromethane	NS	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
cis-1,2-Dichloroethylene	5*	**92**	**190**	**100 J**	**130**	ND< 500	**9.2**
cis-1,3-Dichloropropylene	0.4+	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Dibromochloromethane	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Dichlorodifluoromethane	5*	ND< 25	ND< 5.0	5.7	ND< **5.0**	ND< 500	ND< 5.0
Ethyl Benzene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Isopropylbenzene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 25	2.2 J	2 J	2.2	ND< 500	1.2 J
Methylene chloride	5*	ND< 43	ND< 10	ND< 10	2.8	ND< 1000	2.6 J,B
o-Xylene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
p- & m- Xylenes	5*	ND< 50	ND< 10	ND< 10	ND< 10	ND< 1000	ND< 10
Styrene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Tetrachloroethylene	5*	**670**	**1200**	**520**	**200**	**280 J**	**270**
Toluene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Trichloroethylene	5*	**36**	**92**	**120**	**41**	ND< 500	**18**
Trichlorofluoromethane (freon 11)	5*	**6.4 J**	**7.1**	**8.3**	**8.3**	ND< 500	**6.4**
Vinyl Chloride	2	ND< 25	ND< 5.0	ND< 5.0	ND< 5.0	ND< 500	ND< 5.0
Total VOC concentration	NS	868	1,553	839	479	280	316
Total CVOC concentration	NS	868	1,551	837	472	280	315
Total Petro-VOC concentration	NS	0	2.2	2.0	2.2	0	1.2
Other VOC concentration	NS	0	0	0	5.0	0	0
	Location of screen	Just beneath WT surface					

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW3			
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	6 NYCRR Part 703.5	FRMW-MW3-X35 (30-35')			
Sample Date		7/16/2010	9/30/2011	12/13/2011	2/22/2012
Lab Sample ID		10G0579-04	11J0038-10	11L0633-01	12B0883-07
Groundwater Elevation		238.19	239.73	239.44	239.06
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 5.0	ND< 10	ND< 10	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
2-Butanone	NS	ND< 5.0	ND< 10	ND< 10	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 10 J	ND< 10	ND< 10	ND< 10
Acetone	50	ND< 5.0	ND< 10	ND< 10	ND< 10
Benzene	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromoform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromomethane	60	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon disulfide	5	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon tetrachloride	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chlorobenzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroethane	7	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,2-Dichloroethylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,3-Dichloropropylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dibromochloromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dichlorodifluoromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Isopropylbenzene	NS	ND< 10	ND< 5.0	ND< 5.0	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	0.83 J	ND< 5.0	0.54 J	ND< 5.0
Methylene chloride	5*	ND< 5.0	2.7 J,B	ND< 10	2.7 J,B
o-Xylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
p- & m- Xylenes	5*	ND< 10	ND< 10	ND< 10	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Tetrachloroethylene	5*	**14**	**17**	**17**	**16**
Toluene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichloroethylene	5*	ND< 5.0	ND< 5.0	0.79 J	ND< 5.0
Trichlorofluoromethane (freon 11)	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Total VOC concentration	NS	14.8	19.7	18.33	18.70
Total CVOC concentration	NS	14.0	19.7	17.79	18.70
Total Petro-VOC concentration	NS	0.8	0	0.54	0
Other VOC concentration	NS	0	0	0	0
	Location of screen	Top of deep clay			

NOTES:
All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW7			
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	**6 NYCRR Part 703.5**	**FRMW-MW7-X18 (8-18')**			
Sample Date		07/15/10	9/29/2011	12/13/2011	2/22/2012
Lab Sample ID		10G0511-04	11J0038-11	11L0633-02	12B0883-08
Groundwater Elevation		238.10	239.55	239.2	238.88
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	**9.8**	**110**	**75**	**27**
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
1,1-Dichloroethane	5*	**16**	**170**	**160**	**60**
1,1-Dichloroethylene	5*	ND< 5.0	4.6 J	ND< 50	2.3 J
1,2,4-Trichlorobenzene	5*	ND< 5.0	1.1 J	ND< 100	0.91 J
1,2-Dibromo-3-chloropropane	0.04	ND< 5.0	ND< 10	ND< 100	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
2-Butanone	NS	ND< 5.0	ND< 10	ND< 100	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 10 J	ND< 10	ND< 100	ND< 10
Acetone	50	ND< 5.0	4.9 B,J	ND< 50	ND< 10
Benzene	1	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Bromoform	NS	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Bromomethane	60	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Carbon disulfide	5	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Carbon tetrachloride	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Chlorobenzene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Chloroethane	7	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Chloroform	NS	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Chloromethane	5*	3.2 J	ND< 5.0	ND< 50	ND< 5.0
cis-1,2-Dichloroethylene	0.4+	ND< 5.0	**30**	**28 J**	**16**
cis-1,3-Dichloropropylene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Dibromochloromethane	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Dichlorodifluoromethane	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Isopropylbenzene	NS	ND< 10	ND< 5.0	ND< 50	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Methylene chloride	5*	**ND< 6.4**	3.3 J,B	ND< 50	3.1 J,B
o-Xylene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
p- & m- Xylenes	5*	ND< 10	ND< 10	ND< 50	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Tetrachloroethylene	5*	**21**	**38**	**48 J**	**47**
Toluene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Trichloroethylene	5*	2.6 J	3.9 J	ND< 50	**5.5**
Trichlorofluoromethane (freon 11)	5*	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 50	ND< 5.0
Total VOC concentration	NS	52.6	365.8	311.0	161.8
Total CVOC concentration	NS	52.6	360.9	311.0	161.8
Total Petro-VOC concentration	NS	0	0	0	0
Other VOC concentration	NS	0	5	0	0
	Location of screen	Across WT			

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location	6 NYCRR Part 703.5	MW13			
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)		FRMW-MW13-X20 (10-20')			
Sample Date		7/19/2010	9/30/2011	12/13/2011	2/22/2012
Lab Sample ID		10G0579-08	11J0038-12	11L0633-03	12B0883-09
Groundwater Elevation		229.48	231.33	230.93	230.64
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	0.99 J	0.96 J	ND< 25	ND< 5.0
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,1-Dichloroethane	5*	2.4 J	3.2 J	4.2 J	2.1 J
1,1-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 10	ND< 10	ND< 50	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 5.0	ND< 10	ND< 50	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
2-Butanone	NS	ND< 5.0	ND< 10	ND< 50	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 10 J	ND< 10	ND< 50	ND< 10
Acetone	50	ND< 5.0	3.7 J,B	ND< 25	ND< 10
Benzene	1	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Bromoform	NS	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Bromomethane	60	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Carbon disulfide	5	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Carbon tetrachloride	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chlorobenzene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chloroethane	7	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chloroform	NS	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Chloromethane	5*	**53 J**	ND< 5.0	ND< 25	ND< 5.0
cis-1,2-Dichloroethylene	0.4^{+}	ND< 5.0	**82**	**60**	**45**
cis-1,3-Dichloropropylene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Dibromochloromethane	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Dichlorodifluoromethane	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Isopropylbenzene	NS	ND< 10	ND< 5.0	ND< 50	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Methylene chloride	5*	ND< 5.0 J	3.4 J,B	ND< 25	2.9 J,B
o-Xylene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
p- & m- Xylenes	5*	ND< 10	ND< 10	ND< 50	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Tetrachloroethylene	5*	**34 J**	**52**	**56**	**63**
Toluene	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
trans-1,2-Dichloroethylene	5*	1.4 J	1.4 J	ND< 25	ND< 5.0
trans-1,3-Dichloropropylene	0.4^{+}	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Trichloroethylene	5*	2.7 J	**14**	**9.4 J**	**12**
Trichlorofluoromethane (freon 11)	5*	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 25	ND< 5.0
Total VOC concentration	NS	94.5	160.7	129.6	125.0
Total CVOC concentration	NS	94.5	157.0	129.6	125.0
Total Petro-VOC concentration	NS	0	0	0	0
Other VOC concentration	NS	0	3.7	0	0
	Location of screen	Across WT			

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	6 NYCRR Part 703.5	MW17 FRMW-MW17-X18 (8-18')			
Sample Date		07/15/10	09/30/11	12/13/11	02/22/12
Lab Sample ID		10G0511-03	11J0038-13	11L0633-04	12B0883-10
Groundwater Elevation		238.16	239.61	239.32	238.93
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	1.5 J	1.1 J	ND< 5.0	ND< 5.0
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethane	5*	0.84 J	ND< 5.0	0.77 J	ND< 5.0
1,1-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
2-Butanone	NS	ND< 5.0	ND< 10	ND< 10	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 3.3 J	ND< 10	ND< 10	ND< 10
Acetone	50	ND< 5.0	4.6 J,B	ND< 10	ND< 10
Benzene	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromoform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromomethane	60	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon disulfide	5	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon tetrachloride	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chlorobenzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroethane	7	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,2-Dichloroethylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,3-Dichloropropylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dibromochloromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dichlorodifluoromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Isopropylbenzene	NS	ND< 10	ND< 5.0	ND< 5.0	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methylene chloride	5*	**ND< 6.6**	3.4 J,B	ND< 5.0	2.7 J,B
o-Xylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
p- & m- Xylenes	5*	ND< 10	ND< 10	ND< 10	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Tetrachloroethylene	5*	4.2 J	**5.8**	4.9 J	5.0
Toluene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichlorofluoromethane (freon 11)	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Total VOC concentration	NS	6.5	14.9	5.7	7.7
Total CVOC concentration	NS	6.5	10.3	5.7	7.7
Total Petro-VOC concentration	NS	0	0	0	0
Other VOC concentration	NS	0	4.6	0	0
	Location of screen	Across WT			

NOTES:
All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

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J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	6 NYCRR Part 703.5	MW18 FRMW-MW18-X19 (9-19')			
Sample Date		07/15/10	09/30/11	12/13/11	02/22/12
Lab Sample ID		10G0511-02	11J0038-14	11L0633-05	12B0883-11
Groundwater Elevation		233.14	234.59	234.62	234.26
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethane	5*	**6**	**8.8**	**10**	**7.4**
1,1-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2,4-Trichlorobenzene	5*	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
2-Butanone	NS	ND< 10	ND< 10	ND< 5.0	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 10 J	ND< 10	ND< 10	ND< 10
Acetone	50	ND< 5.0	4.8 J,B	ND< 5.0	3.5 J,B
Benzene	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromoform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromomethane	60	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon disulfide	5	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon tetrachloride	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chlorobenzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroethane	7	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloromethane	5*	**18**	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,2-Dichloroethylene	0.4+	ND< 5.0	**18**	**20**	**16**
cis-1,3-Dichloropropylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dibromochloromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dichlorodifluoromethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Isopropylbenzene	NS	ND< 10	ND< 5.0	ND< 10	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methylene chloride	5*	**ND< 6.6**	3.8 J,B	ND< 5.0	3.1 J,B
o-Xylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
p- & m- Xylenes	5*	ND< 10	ND< 10	ND< 10	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Tetrachloroethylene	5*	4.8 J	**6.5**	**5.2**	**5.4**
Toluene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichloroethylene	5*	4 J	3.4 J	**5.8**	3.6 J
Trichlorofluoromethane (freon 11)	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Total VOC concentration	NS	32.8	45.3	41.0	39.0
Total CVOC concentration	NS	32.8	40.5	41.0	35.5
Total Petro-VOC concentration	NS	0	0	0	0
Other VOC concentration	NS	0	4.8	0	3.5
	Location of screen	Across WT			

NOTES:

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NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

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J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

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Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location	6 NYCRR Part 703.5	MW31			
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)		FRMW-MW31-X22 (15-23')			
Sample Date		7/19/2010	9/30/2011	12/14/2011	2/22/2012
Lab Sample ID		10G0579-12	11J0038-15	11L0633-06	12B0883-12
Groundwater Elevation		239.02	240.86	240.54	240.11
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	2.3 J	1.3 J	1.9 J	2.5 J
1,1,2,2-Tetrachloroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1,2-Trichloroethane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,1-Dichloroethane	5*	**61**	**8.4**	**77**	**38**
1,1-Dichloroethylene	5*	4 J	ND< 5.0	3.1 J	2.3 J
1,2,4-Trichlorobenzene	5*	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 10	ND< 10	ND< 10	ND< 10
1,2-Dibromoethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloroethane	0.6	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
1,2-Dichloropropane	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
2-Butanone	NS	ND< 5.0	ND< 10	ND< 10	ND< 10
2-Hexanone	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 10 J	ND< 10	ND< 10	ND< 10
Acetone	50	0.98 J	3.6 J,B	ND< 10	ND< 10
Benzene	1	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromodichloromethane	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Bromoform	NS	ND< 5.0 J	ND< 5.0	ND< 5.0	ND< 5.0
Bromomethane	60	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon disulfide	5	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Carbon tetrachloride	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chlorobenzene	5*	1.5 J	ND< 5.0	ND< 5.0	ND< 5.0
Chloroethane	7	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloroform	NS	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Chloromethane	5*	**18**	ND< 5.0	ND< 5.0	ND< 5.0
cis-1,2-Dichloroethylene	0.4+	ND< 5.0	**5.5**	**13**	**10**
cis-1,3-Dichloropropylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Dibromochloromethane	5*	**6.8**	ND< 5.0	ND< 5.0	ND< 5.0
Dichlorodifluoromethane	5*	4.8 J	ND< 5.0	ND< 5.0	ND< 5.0
Ethyl Benzene	5*	ND< 5.0	ND< 5.0	0.56 J	1.1 J
Isopropylbenzene	NS	ND< 10	ND< 5.0	0.61 J	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Methylene chloride	5*	ND< 5.0 J	3.6 J,B	3.6 J,B	2.6 J,B
o-Xylene	5*	**9.8**	ND< 5.0	ND< 5.0	ND< 5.0
p- & m- Xylenes	5*	**19**	ND< 10	ND< 10	ND< 10
Styrene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Tetrachloroethylene	5*	**13**	2.0 J	3.2 J	3.4 J
Toluene	5*	8.6	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,2-Dichloroethylene	5*	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Trichloroethylene	5*	1.9 J	0.88 J	2.3 J	2.4 J
Trichlorofluoromethane (freon 11)	5*	**25**	ND< 5.0	ND< 5.0	2.5 J
Vinyl Chloride	2	ND< 5.0	ND< 5.0	ND< 5.0	ND< 5.0
Total VOC concentration	NS	176.7	25.3	105.3	64.8
Total CVOC concentration	NS	138.3	21.7	104.1	63.7
Total Petro-VOC concentration	NS	37.4	0	1.2	1.1
Other VOC concentration	NS	1.0	3.6	0	0
	Location of screen	Beneath WT surface			

NOTES:

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* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

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B indicates the analyte is found in the associated analysis batch blank.

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Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Table 2
Summary of Laboratory Results
VOCs in Groundwater Samples - Plume Area Wells
136 Fuller Road, Albany, New York

Sample Location		MW33			
Sample ID: FRMW (Fuller Rd Monitoring Well)-Well ID# (approx depth to well screen) (Screen Interval)	6 NYCRR Part 703.5	FRMW-MW33-X25 (15-25')			
Sample Date		7/19/2010	9/30/2011	12/14/2011	2/22/2012
Lab Sample ID		10G0579-11	11J0038-16	11L0633-07	12B0883-13
Groundwater Elevation		238.68	240.31	240.22	239.81
Analyte	ppb	ppb	ppb	ppb	ppb
1,1,1-Trichloroethane	5*	**26**	**23**	ND< 500	**85**
1,1,2,2-Tetrachloroethane	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
1,1,2-Trichloroethane	1	ND< 25	ND< 5.0	ND< 500	2.8 J
1,1-Dichloroethane	5*	**660**	**29**	**550**	**310**
1,1-Dichloroethylene	5*	**28**	**21**	ND< 500	**120**
1,2,4-Trichlorobenzene	5*	ND< 50	ND< 10	ND< 1000	ND< 10
1,2-Dibromo-3-chloropropane	0.04	ND< 25	ND< 10	ND< 1000	ND< 10
1,2-Dibromoethane	NS	ND< 25	ND< 5.0	ND< 500	ND< 5.0
1,2-Dichloroethane	0.6	ND< 25	1.2 J	ND< 500	**6.6**
1,2-Dichloropropane	1	ND< 25	ND< 5.0	ND< 500	ND< 5.0
2-Butanone	NS	ND< 25	ND< 10	ND< 500	ND< 10
2-Hexanone	NS	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Methyl isobutyl ketone (4-Methyl-2-pentanone)	NS	ND< 25 J	ND< 10	ND< 1000	ND< 10
Acetone	50	ND< 25	5.5 J,B	ND< 500	ND< 10
Benzene	1	ND< 25	0.92 J	ND< 500	2.0 J
Bromodichloromethane	NS	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Bromoform	NS	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Bromomethane	60	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Carbon disulfide	5	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Carbon tetrachloride	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Chlorobenzene	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Chloroethane	7	ND< 25	1.5 J	ND< 500	3.6 J
Chloroform	NS	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Chloromethane	5*	**63**	ND< 5.0	ND< 500	ND< 5.0
cis-1,2-Dichloroethylene	0.4+	ND< 25	**45**	**420 J**	**410**
cis-1,3-Dichloropropylene	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Dibromochloromethane	5*	**31**	ND< 5.0	ND< 500	ND< 5.0
Dichlorodifluoromethane	5*	**25**	**22**	ND< 500	**6.3**
Ethyl Benzene	5*	ND< 25	**32**	ND< 500	**12**
Isopropylbenzene	NS	ND< 50	ND< 5.0	ND< 1000	ND< 5.0
Methyl tert-butyl ether (MTBE)	10**	ND< 25	2.9 J	ND< 500	3.0 J
Methylene chloride	5*	ND< 43	2.9 J,B	ND< 500	3.1 J,B
o-Xylene	5*	**4.8 J**	2.2 J	ND< 500	3.2 J
p- & m- Xylenes	5*	**46 J**	1.2 J	ND< 1000	**8.0 J**
Styrene	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Tetrachloroethylene	5*	**85**	**120**	**780**	**1,000**
Toluene	5*	**7.1 J**	0.95 J	ND< 500	4.8 J
trans-1,2-Dichloroethylene	5*	ND< 25	ND< 5.0	ND< 500	ND< 5.0
trans-1,3-Dichloropropylene	0.4+	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Trichloroethylene	5*	**12 J**	**27**	**80 J**	**200**
Trichlorofluoromethane (freon 11)	5*	**72**	**66**	ND< 500	**22**
Vinyl Chloride	2	ND< 25	ND< 5.0	ND< 500	ND< 5.0
Total VOC concentration	NS	1,059.9	404.3	1,830	2,202
Total CVOC concentration	NS	1,002	358.6	1,830	2,169
Total Petro-VOC concentration	NS	57.9	40.2	0	33.0
Other VOC concentration	NS	0	5.5	0	0
	Location of screen	Just beneath WT surface			

NOTES:

All data are reported in micrograms per liter (ug/L) = parts per billion (ppb)

NS indicates that there is no listed standard for that analyte

Results which exceed 6 NYCRR Part 703.5 ambient groundwater standards and guidance values have been **bolded**

* = Guidance Value; ** Value listed in TOGS 1.1.1 April 2000 Addendum

+ Applies to the sum of trans-1,3-Dichloropropene and cis-1,3-Dichloropropene

ND < = indicates the compound was not detected at or above the listed laboratory method reporting limit

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL. The concentration given is an approximate value.

B indicates the analyte is found in the associated analysis batch blank.

Bolded cells indicate values that are greater than the standard; Shaded cells indicate values that are greater than the standard and which were not identified as a laboratory contaminant

Italics indicate laboratory method reporting limit is greater than the groundwater quality standard

Appendix D2

Monitoring Well Boring and Construction Logs

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-1**
Total Depth: 20 ft.

Contractor: Drilex
Drill Rig: Geoprobe 6620DT
Driller: Mike Joice
Inspector: Will Olsen

Start Date: 6/25/2010
Finish Date: 6/27/2010
El. Datum: NAVD88
G.S. Elevation: 249

Northing: ---
Easting: ---
Longitude: ---
Latitude: ---

Borehole Dia.: 2.25 in.
Depth to Water: ~4 ft.
Depth to Rock: >20 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			1		4		SP	grass, dark brown sandy soil	
1	248				12		SM	brown fine SAND and crushed stone	
2	247				20		SM	grey (stained) fine SAND, silty, strong odor, wet 4-5 feet; Edelman Oil-In-Soil Score: (+) for 4-5 feet	
3	246								
4	245					1,782			
5	244		2		50		SM	greyish-brown fine SAND, silty, saturated, odor present; Edelman Oil-In-Soil Score: (+) for 5-10 feet	
6	243								
7	242					2,032			
8	241								
9	240								
10	239		3		6		SM	same as above, minimal to no odor	
					52		CL	grey CLAY, moist, moderately stiff, no odor present, uniform	
11	238								
12	237					158			
13	236								
14	235								
15	234		4		60		CL	grey CLAY, softer with depth, 1/8 inch high angle fine SAND inclusion at 16-17 feet, no odor	
16	233								
17	232					66			
18	231								
19	230							End of boring at 20 feet bgs. Refusal not encountered.	

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Boring grouted with Portland/Gel-X slurry; casing driven to depth, slurry added while pulling casing

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: B-2
Total Depth: 20 ft.

Contractor: Drilex
Drill Rig: Geoprobe 6620DT
Driller: Mike Joice
Inspector: Will Olsen

Start Date: 6/22/2010
Finish Date: 6/22/2010
El. Datum: NAVD88
G.S. Elevation: 249

Northing: ---
Easting: ---
Longitude: ---
Latitude: ---

Borehole Dia.: 2.25 in.
Depth to Water: ~4 ft.
Depth to Rock: >20 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			1		6		SP	grass, dark brown sandy soil	
1	248				40		SM	fine SAND, strong odor, 2-5 feet stained dark grey, wet 4-5 feet; Edelman Oil-In-Soil Score: (++) for 2-5 feet	
2	247								
3	246					2,065			
4	245								
5	244		2		56		SM	grey stained fine SAND, silty, strong odor, saturated, sheen present, Edelman Oil-In-Soil Score: (++) for 5-10 feet	
6	243								
7	242					2,400			
8	241								
9	240								
10	239		3		60		CL	grey CLAY, moderately stiff, minimal to no odor, Edelman Oil-In-Soil Score: (-) for 10-15 feet	
11	238								
12	237					464			
13	236								
14	235								
15	234		4		22		CL	grey CLAY, broken rock at 15.5 feet, free product and very strong odor present	
16	233								
17	232								
18	231							bottom 2 feet of soil core empty - no recovery	
19	230								
								End of boring at 20 feet bgs. Refusal not encountered.	

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Boring grouted with Portland/Gel-X slurry; casing driven to depth, slurry added while pulling casing

DRILLING INFORMATION
Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-3**
Total Depth: 48 ft.

Contractor: Drilex	**Start Date:** 6/21/2010	**Northing:**	---	**Borehole Dia.:**	2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/21/2010	**Easting:**	---	**Depth to Water:**	~13 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:**	---	**Depth to Rock:**	>48 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:**	---		

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			1		24			crushed stone	
							SM	dark to light brown silty SAND	
1	248								
2	247								
					6	230	CL	grey CLAY	
					14		SM	brown silty f SAND, dry	
3	246								
4	245								
5	244								
			2		42		SM	brown fine SAND, silty	
6	243								
7	242								
						75			
8	241								
9	240								
								bottom few inches moist	
10	239								
			3		38		SM	brown fine SAND, silty, moisture increasing with depth	
11	238								
12	237								
						125			
13	236								
								wet	
14	235								
15	234								
			4		26		SM	brown fine SAND, silty, saturated	
16	233								
17	232								
					20	150	SM	brown fine SAND, silty, saturated with dark grey discoloration	
18	231								
19	230								

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Boring grouted with Portland/Gel-X slurry; casing driven to depth, slurry added while pulling casing

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-3**
Total Depth: 48 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			5		20		SM	greyish-brown fine SAND, silty, saturated	
21	228								
					8		SM	dark grey-black fine SAND, silty, with traces fine to coarse angular gravel, organic matter present (stem or roots), saturated	
22	227					121			
					26		SM	greyish brown fine SAND, silty, saturated	
23	226								
24	225								
25	224								
			6		38		SM	grey to dark grey fine SAND, silt content increasing with depth, trace amount organic matter, saturated	
26	223								
27	222					210			
28	221								
					8		CL	dark grey silty CLAY, moist, stiff, moderate organic matter	
					12		OL	dark grey to black organic matter (Peat), with silt and clay, moisture decreasing with depth	
29	220								
30	219								
			7					(Very soft to 33 feet, no recovery, probable peat layer)	
31	218								
32	217								
33	216								
					20		SM	brownish grey fine SAND, silty, saturated, traces of organic matter	
34	215					130			
35	214								
			8				SM	grey fine SAND, silty, finer with depth, saturated	
					30				
36	213								
37	212					295			
38	211								
39	210								
40	209								
			9		36		SM	grey fine SAND, silty, saturated, grading to grey SILT, dense, moist	
41	208								
42	207					70			
43	206								
44	205								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-3**
Total Depth: 48 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			10				ML	grey SILT, dense, grading to very dense silty CLAY, moisture decreasing with depth	
46	203					56	CL		
47	202								
48	201							Refusal encountered at 48 feet bgs. End of boring.	
49	200								
50	199								
51	198								
52	197								
53	196								
54	195								
55	194								
56	193								
57	192								
58	191								
59	190								
60	189								
61	188								
62	187								
63	186								
64	185								
65	184								
66	183								
67	182								
68	181								
69	180								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-4**
Total Depth: 50 ft.

Contractor: Drilex	**Start Date:** 6/22/2010	**Northing:**	---	**Borehole Dia.:**	2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/22/2010	**Easting:**	---	**Depth to Water:**	15 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:**	---	**Depth to Rock:**	>50 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:**	---		

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			1		2			asphalt	
					32		SP	brown fine SAND, some silt	
1	248								
2	247								
						0			
3	246								
4	245								
5	244								
			2		44		SP	brown fine SAND, trace silt	
6	243								
7	242								
						550			
8	241								
9	240								
10	239								
			3		38		SP	brown fine SAND, trace silt	
11	238								
12	237								
						256			
13	236								
14	235								
								moist	
15	234								
			4		24		SM	brown fine SAND, silty, saturated	
16	233					205			
17	232								
					24		SM	greyish brown fine SAND, silty, saturated, dark grey discoloration present	
18	231					184			
19	230								

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Boring grouted with Portland/Gel-X slurry; casing driven to depth, slurry added while pulling casing

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618

Test Boring No.: **B-4**
Total Depth: 50 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			5		8		SM	greyish brown fine SAND, silty, saturated	
21	228				2		SP	dark grey-black medium SAND, fine to coarse angular gravel, some silt, loose and saturated	
22	227				30		SM	greyish brown fine SAND, silty, saturated, trace organic matter near bottom	
23	226					325			
24	225				18		SM	dark grey-brown fine SAND, abundant silt, mottled, wet, trace organic matter	
25	224		6		52		SM	greyish-brown changing to brown fine SAND with variable silt content, saturated	
26	223								
27	222								
28	221					167			
29	220				3		SM	dark grey fine SAND with abundant silt, moist	
30	219		7						30-35 feet top of soil core damaged: only recovered bottom 34 inches
31	218								
32	217				34		SM	greyish-brown fine SAND, silty, fining downwards, wet	
33	216					387			
34	215								
35	214		8		48		SM	greyish-brown fine SAND, silty, wet, no gradation present	
36	213								
37	212					383			
38	211								
39	210								
40	209		9		3		SM	same as above	
41	208				16		ML	changing to grey clayey SILT, wet	
42	207				14		SM	changing to grey fine SAND with abundant silt, wet	
43	206					>500			
44	205								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618

Test Boring No.: **B-4**
Total Depth: 50 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			10		45		ML	grey SILT changing to grey fine silty SAND, wet	
46	203								
47	202								
						266			
48	201								
49	200								
					15		CL	abrupt change to grey CLAY, stiff, slightly moist	
50	199								
								End of boring at 50 feet bgs. Refusal not encountered.	
51	198								
52	197								
53	196								
54	195								
55	194								
56	193								
57	192								
58	191								
59	190								
60	189								
61	188								
62	187								
63	186								
64	185								
65	184								
66	183								
67	182								
68	181								
69	180								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-5a,b**
Total Depth: 35 ft.

Contractor: Drilex	**Start Date:** 6/25/2010	**Northing:** ---	**Borehole Dia.:** 2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/25/2010	**Easting:** ---	**Depth to Water:** N/A ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >35 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:** ---	

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			1		10			grass, dark brown soil, crushed stone, dry	
1	248				3		SP	brown fine SAND, trace silt, dry, loose	
					30		CL	brown CLAY, very stiff, minimal moisture, slight odor present	
2	247								
3	246								
4	245					128			
5	244		2		36		CL	brown/grey mottled CLAY, very stiff, minimal moisture, slight odor present	
6	243								
7	242					380			
8	241				2		SM	seam of fine silty SAND, wet, slight odor	
					12		CL	brown CLAY, changing to grey, moderately stiff, minimal to no odor, slightly moist	
9	240					247			
10	239		3		58		CL	grey CLAY, moderately soft, moist, no odor present	start B-5b virgin hole due to no recovery in B-5a 10-15 foot sample
11	238								
12	237								
13	236					373			
14	235								
15	234		4		28		CL	same as above	
16	233								
17	232							significant change in consistency	
					16		CL	grey CLAY, moderately stiff	
18	231					325		1/2 inch wide high angle fine grey sand inclusion present at 4 inches from sample bottom.	
19	230								

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618

Test Boring No.: **B-5a,b**
Total Depth: 35 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			5		38		CL	grey CLAY, moderately stiff, slightly moist, no odor	
21	228								
22	227					254			
23	226							high angle fractures present spaced 20 inches apart, filled with fine silty sand (also grey), orientations dissimilar.	
24	225								
25	224								
			6		60		CL	grey CLAY, moderately soft, moist	
26	223								
27	222								
						265			
28	221								
29	220						SP	low angle 1/4 inch grey fine SAND inclusion at approximately 29 feet, saturated.	
							CL		
30	219								
			7		43		CL	grey CLAY, moderately soft to moderately stiff, moist	
31	218								
						141			
32	217							high angle fracture at approximately 32 feet, filled with fine grey SAND	
33	216								
34	215				7	135	SP	angled seam of fine grey SAND, saturated	
					2		CL	grey CLAY, same as above.	
35	214							End of boring at 35 feet bgs. Refusal not encountered.	
36	213								
37	212								
38	211								
39	210								
40	209								
41	208								
42	207								
43	206								
44	205								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **B-6**
Total Depth: 39.75 ft.

Contractor: Drilex	**Start Date:** 7/8/2010	**Northing:** ---	**Borehole Dia.:** 2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/8/2010	**Easting:** ---	**Depth to Water:** ~4 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >39.75 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:** ---	

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			1		12			grass, dark brown soil, crushed stone, dry	
1	248								
					28		SP	brown fine to medium SAND, trace silt, odor present Edelman Oil-In-Soil score (+) for 1-3 feet changes to dark grey (staining)	
2	247								
3	246								
4	245					1,991			
5	244								
			2		16		SM	brownish-grey/dark grey, fine to medium SAND, fining with depth, some silt, saturated, odor present, black staining	
6	243					2,765		Edelman Oil-In-Soil score (+) for 5-6 feet	
7	242								
					38		CL	brown CLAY, stiff, moist	
8	241					336			
9	240								
					2		SM	greyish-brown fine SAND, wet, silty, strong odor present, staining	
10	239								
			3		40		SP	greyish-brown, fine SAND, trace silt, saturated, changing to red-brown, odor and sheen present top 30", dark grey to black staining	
11	238								
12	237							Edelman Oil-In-Soil score (++) for 10-15 feet	
						3,340			
13	236								
14	235								
15	234								
			4		58		SP	reddish-brown fine SAND, trace silt, saturated, running	
16	233								
17	232								
						328			
18	231								
19	230								

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618

Test Boring No.: **B-6**
Total Depth: 39.75 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			5		58		SP	same as above	
21	228								
22	227								
						230			
23	226								
24	225								
25	224		6		58			brown, fine SAND, trace silt, saturated	
26	223							black staining present 26-29 feet, odor present, bottom 3 inches black, marble staining above	
27	222								
						643		Edelman Oil-In-Soil score (+/-) for 26-29 feet	
28	221								
29	220								
30	219		7		58			grey CLAY, moderately soft, odor present	
31	218								
32	217								
						479			
33	216								
34	215							1/16 inch wide high angle (60 degrees) fracture filled with fine sand at 34 feet	
35	214		8		46			grey CLAY, moderately soft to stiff, moist	
36	213								
37	212					396			
38	211							low angle fracture at 38.5 feet filled with fine sand	
39	210				10	298	GW	grey sand, silt, fine to coarse gravel, poorly sorted wet, crumbly and hard (GLACIAL TILL)	
40	209							Refusal encountered at 39.75 feet. End of boring.	
41	208								
42	207								
43	206								
44	205								

ADDITIONAL NOTES:
Bore hole grouted to grade with portland/gel-x slurry

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **DB-7A**
Total Depth: 39 ft.

Contractor:	Drilex	**Start Date:**	7/9/2010	**Northing:**	---
Drill Rig:	Geoprobe 6620DT	**Finish Date:**	7/9/2010	**Easting:**	---
Driller:	Mike Joice	**El. Datum:**	NAVD88	**Longitude:**	---
Inspector:	Eric Orlowski	**G.S. Elevation:**	249	**Latitude:**	---

Borehole Dia.: 2.25 in.
Depth to Water: <15 ft.
Depth to Rock: >39 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
1	248								
2	247							No samples collected; 0-15 feet geology already noted in adjacent DB-7 soil boring.	
3	246								
4	245								
5	244								
6	243								
7	242								
8	241								
9	240								
10	239								
11	238								
12	237								
13	236								
14	235								
15	234		1		60		CL	grey CLAY, wet, plastic	
16	233								
17	232					0			
18	231						SP	2 inch thick layer grey fine to medium SAND at 18 feet.	
19	230								

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
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Troy, NY 12180
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **DB-7A**
Total Depth: 39 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			2		60		SP	brown fine to medium SAND, saturated	
21	228								
22	227					10.1			
23	226								
24	225								
25	224		3		60		SP	same as above, grey-brown, saturated	
26	223								
27	222					0			
28	221								
29	220								
30	219		4		36		SP	same as above, saturated	
31	218								
32	217					0			
33	216								
34	215								
35	214		5		24		CL	grey CLAY with little sand, wet	
36	213					0			
37	212				10	0	SP	dark grey fine to medium SAND, wet	
38	211				14	0	CL	grey CLAY with silt, little gravel, moist	
39	210							Refusal encountered at 39 feet bgs. End of boring.	
40	209								
41	208								
42	207								
43	206								
44	205								

ADDITIONAL NOTES:

TEST BORING LOG

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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: DB-15A
Total Depth: 40 ft.

Contractor: Drilex	**Start Date:** 7/9/2010	**Northing:** ---	**Borehole Dia.:** 2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/9/2010	**Easting:** ---	**Depth to Water:** <15 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >40 ft.
Inspector: Eric Orlowski	**G.S. Elevation:** 249	**Latitude:** ---	

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
1	248								
2	247							No sampling 0-15 feet, geology previously logged. Reoccupied existing DB-15 hole.	
3	246								
4	245								
5	244								
6	243								
7	242								
8	241								
9	240								
10	239								
11	238								
12	237								
13	236								
14	235								
15	234		1		60		SP	brown fine to medium SAND, wet	
16	233								
17	232					0			
18	231								
19	230								

STANDARD NOTES:
1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
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PH: (518) 273-0055
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **DB-15A**
Total Depth: 40 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			2		60		SP	brown, silty, fine SAND, saturated	
21	228								
22	227								
						0			
23	226								
24	225								
25	224								
			3		16		SP	grey, fine SAND, little silt, saturated	
26	223								
					8		ML	light gray SILT, little clay, saturated	
27	222								
					36	0	SP	gray fine SAND, little silt, saturated	
28	221								
29	220								
30	219								
			4		54		SP	same as above	
31	218								
32	217								
						0			
33	216								
34	215								
					6		SP	6" grey fine SAND and light gray silt	
35	214								
			5		24		CL	grey silty CLAY	
36	213								
37	212								
					8	0	SP	grey fine SAND, saturated	
38	211								
					12		CL	grey silty CLAY, saturated	
					4		SP	grey fine SAND, saturated	
39	210								
					12		CL	grey silty CLAY, trace gravel, moist	
40	209								
								Refusal encountered at 40 feet bgs. End of boring.	
41	208								
42	207								
43	206								
44	205								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
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PH: (518) 273-0055
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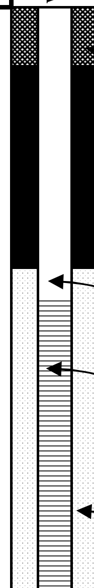
PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-25**
Total Depth: 20 ft.

Contractor: Drilex	**Start Date:** 6/23/2010	**Northing:**	---	**Borehole Dia.:** 3.25/2.25	in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/23/2010	**Easting:**	---	**Depth to Water:** 4	ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:**	---	**Depth to Rock:** >20	ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:**	---	**Depth of Well:** 10	ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Well Notes, Comments:
			1		5		SP	grass, dark brown sandy soil	Well Type:
					14		SM	brown fine silty SAND, slight odor	1-inch diameter PVC;
1	248							abrupt color change to grey (staining)	flush mounted cover
2	247								Concrete
3	246				22		SM	dark grey fine SAND, silty, strong odor present, bottom 16 inches saturated, Edelman Oil-In-Soil Score: (+/-) for 3-5 feet	Bentonite clay hole plug
4	245					1,716			
5	244		2		48		SM	grey-dark grey fine silty SAND, saturated, stained, odor present, Edelman Oil-In-Soil Score: (-) for 5-10 feet	solid PVC riser pipe
6	243								
7	242					80			10-slot PVC well screen
8	241								
9	240								#1 silica filter sand
10	239		3		56		CL	grey CLAY, moderately stiff, moist, minimal to no odor, Edelman Oil-In-Soil Score: (-) for 10-15 feet	bottom of well
11	238								
12	237					52			
13	236								
14	235								
15	234		4		56		CL	grey CLAY, moderately stiff, moist, no odor present	
16	233								
17	232					71		some water from above between plastic and drill rod 1/2 inch fine SAND inclusion at approximately 18.5 feet	
18	231								
19	230							End of boring at 20 feet bgs. Refusal not encountered.	



STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Well installed immediately adjacent to soil boring. Casing driven to 10 ft.

Soil boring grouted to grade with portland/gel-x slurry.

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
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PH: (518) 273-0055
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-26a**
Total Depth: 40 ft.

Contractor:	Drilex	**Start Date:**	6/24/2010	**Northing:**	---
Drill Rig:	Geoprobe 6620DT	**Finish Date:**	6/24/2010	**Easting:**	---
Driller:	Mike Joice	**El. Datum:**	NAVD88	**Longitude:**	---
Inspector:	Will Olsen	**G.S. Elevation:**	249	**Latitude:**	---

Borehole Dia.:	2.14	in.
Depth to Water:	~4	ft.
Depth to Rock:	>40	ft.

Depth *(Feet)*	**Elevation** *(Feet)*	**Casing Data**	**Sample No.**	**Sample Data**	**Recovery** *(Inches)*	**PID** *(ppm)*	**Group Symbol**	**Stratum and Field Descriptions:**	**Well diagram**	**Field Notes, Well Notes, Comments:**
			1		6		SP	grass, dark brown sandy soil		
					38		SM	brown changing to darker brown fine SAND, silty, bottom 12 inches wet, odor present (bottom 20 inches), Edelman Oil-In-Soil Score: (++) for 3-5 feet.		
1	248									
2	247									
3	246									
4	245					2,343				
5	244									
			2		24		SM	same as above, saturated, odor present, Edelman Oil-In-Soil Score: (-) for 5-7 feet		
6	243					1,271				
7	242									
					36		CL	grey CLAY (first 4 inches brown), moderately stiff, odor present		
8	241									
9	240					284				
10	239									
			3		52		CL	grey CLAY, same as above, no odor present, stiffens with depth, moisture content minimal		
11	238									
12	237									
						417				
13	236									
14	235									
					0			bottom 6 inches of soil core empty		
15	234									
			4		3		CL	brown CLAY, moderately soft		
					40		SP	fine SAND, trace silt, saturated, odor present (stronger near top)		
16	233									
						225				
17	232									
18	231									
19	230									
								brown		
						195				

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method:

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

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547 River Street
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-26a**
Total Depth: 40 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		10		ML	brown SILT, moderately stiff, very moist, minimal to no odor		
21	228									
					30		SM	brown fine silty SAND, saturated, minimal to no odor		
22	227									
						172				
23	226									
24	225				6		ML	greyish-brown SILT, clayey, moist, no odor present		
25	224									
			6		4		ML	same as above		
26	223				3		SM	greyish-brown fine silty SAND, saturated		
					8		ML	greyish-brown clayey SILT		
27	222				26		SM	greyish-brown fine silty SAND, saturated		
						186				
28	221									
29	220				4		ML	greyish-brown clayey SILT		
					3		SM	greyish-brown fine silty SAND, saturated		
30	219				8		ML	greyish-brown SILT		
			7		46		ML	greyish-brown SILT, trace clay, trace fine sand, some very thin laminations of fine silty sand present, no odor, moist to wet		
31	218									
32	217									
						210				
33	216									
34	215									
					5		SM	greyish-brown fine SAND, silty, saturated		
35	214				8		CL	grey CLAY, silty, stiff, slightly moist, no odor		
			8		26		CL	grey CLAY, stiff, moist		
36	213									
37	212									
					24		SM	brown silty SAND, saturated, sheen and odor present		Based on subsequent soil borings MW-26b and MW-26c, the impacts in this boring observed at 35-40 feet are not representive and resulted from shallower impacts entering the soil core while extracting the drill rods.
38	211									
						2152				
39	210									
40	209									
								End of boring at 40 feet bgs. Refusal not encountered.		
41	208									
										Per Brad Brown (NYSDEC), bore hole was immediately grouted with portland/gel-x slurry from 40 feet to grade.
42	207									
43	206									
44	205									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
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PH: (518) 273-0055
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-26b**
Total Depth: 41.5 ft.

Contractor: Drilex	**Start Date:** 7/8/2010	**Northing:** ---	**Borehole Dia.:** 2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/8/2010	**Easting:** ---	**Depth to Water:** ~4 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >40.5 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:** ---	

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well diagram	Field Notes, Well Notes, Comments:
1	248									
2	247							Direct Push to 39' First Sample at 39'		
3	246									
4	245									
5	244									
6	243									
7	242									
8	241									
9	240							See MW-26a for lithology		
10	239									
11	238									
12	237									
13	236									
14	235									
15	234									
16	233									
17	232									
18	231									
19	230									

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Boring located immediately adjacent to MW-26a (about 6" away)

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
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PH: (518) 273-0055
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-26b**
Total Depth: 41.5 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
21	228							Direct Push to 39 feet		
22	227									
23	226									
24	225									
25	224									
26	223									
27	222									
28	221									
29	220									
30	219							See MW-26a for lithology		
31	218									
32	217									
33	216									
34	215									
35	214									
36	213									
37	212									
38	211									
39	210		1		24		GW	grey sand, silt, fine to coarse GRAVEL, poorly sorted, hard, moist: Glacial Till		
40	209					70				
41	208									
42	207							Refusal encountered at 41.5 feet bgs. End of boring. hole grouted to grade with Portland/Gel-X slurry		
43	206									
44	205									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
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Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-26c**
Total Depth: 39.5 ft.

Contractor: Drilex	**Start Date:** 7/8/2010	**Northing:**	---	**Borehole Dia.:**	2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/8/2010	**Easting:**	---	**Depth to Water:**	~4 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:**	---	**Depth to Rock:**	>39.5 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:**	---		

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well diagram	Field Notes, Well Notes, Comments:
1	248									
2	247							Direct Push to 35 feet		
3	246									
4	245									
5	244									
6	243									
7	242									
8	241									
9	240							See MW-26a for lithology		
10	239									
11	238									
12	237									
13	236									
14	235									
15	234									
16	233									
17	232									
18	231									
19	230									

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
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PH: (518) 273-0055
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PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-26c**
Total Depth: 39.5 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
21	228									
22	227									
23	226									
24	225									
25	224									
26	223									
27	222									
28	221									
29	220									
30	219							See MW-26a for lithology		
31	218									
32	217									
33	216									
34	215									
35	214		1		58		CL	grey CLAY, medium soft, moist		
36	213									
37	212					93				
38	211									
39	210							low angle fractures present from 39-39.5 feet, sand present in fracture		
40	209							End of boring at 39.5 feet bgs. Refusal not encountered.		
41	208									
42	207									
43	206									
44	205									

ADDITIONAL NOTES:

bore hole grouted to grade with Portland/Gel-X slurry

TEST BORING LOG

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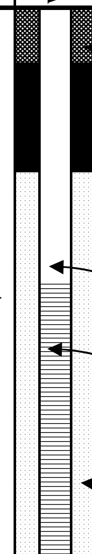
PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-27a,b**
Total Depth: 42 ft.

Contractor: Drilex	**Start Date:** 7/6/2010	**Northing:** ---	**Borehole Dia.:** 3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/7/2010	**Easting:** ---	**Depth to Water:** 3.14 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >42 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:** ---	**Depth of Well:** 10 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions
			1		2			grass, dark brown soil
					14		SM	brown silty SAND, crushed stone present
1	248							
2	247							
3	246				28		SP	dark grey to brownish grey fine SAND, strong odor present, bottom 16 inches wet, Edelman Oil-In-Soil Score: (++) for 3-5 feet
4	245					1,656		
5	244		2		54		SP	grey-brown fine SAND, slight odor present, saturated, Edelman Oil-In-Soil Score: (-) for 7-9 feet
6	243							
7	242							
8	241					765		
9	240				6		CL	greyish-brown CLAY, medium-soft
10	239		3		56		CL	grey CLAY, medium soft, moist
11	238							
12	237					72		
13	236							
14	235							
15	234		4		58		CL	grey CLAY, medium soft, moist
16	233							
17	232					15		
18	231							
19	230							clay broken at approximately 19 feet, water and sand present water bearing inclusion?

Well diagram



Field Notes, Well Notes, Comments:

Well Type:
1-inch diameter PVC; flush mounted cover
Concrete
Bentonite clay hole plug
solid PVC riser pipe
10-slot screen 5-10 feet
#1 Sand Pack
bottom of well at 10 feet

Well installed in virgin hole next to MW-27a, b
sand pack added while pulling casing

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

DRILLING INFORMATION
Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618

Test Boring No.: **MW-27a,b**
Total Depth: 42 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		23		CL	grey CLAY, medium soft, moist, fine to coarse sub-rounded Gravel present in bottom 4 inches		
21	228					46				
22	227									
					0			No recovery in bottom 32 inches (change in geology?)		
23	226							(inside of plastic core wet with silty sand--odor present)		
24	225									
25	224									
			6		51		CL	grey CLAY, soft, moist (sand present at top of sample)		
26	223							slight odor present		
27	222									
						31				
28	221									
29	220									
30	219									end MW-27a at 30 feet, hole grouted to grade
			7		38		CL	grey CLAY, soft to medium soft, moist		MW-27b begins at 30 feet, next to MW-27a
31	218									
32	217					46				
33	216									
					8		SP	grey fine-medium SAND, wet		
					8		CL	grey CLAY, medium soft, moist		MW-27b grouted to grade with Portland/Gel-X slurry
34	215					102				
35	214									
			8		58		CL	grey CLAY, medium soft, moisture decreases with depth		
36	213									
37	212							at 36.5 feet: 1.25 inch dark-grey sub-rounded stone (shale) embedded in clay		
						124				
38	211							at 38 feet: two high angle fractures (45-60 degrees) present, 1/16 inch wide, filled with f-m SAND, wet		
39	210									
40	209									
			9		10		GC	grey sand, silt, fine to coarse Gravel, poorly sorted, hard (Till), slightly moist		
41	208					55				
42	207							Refusal encountered at 42 feet bgs. End of boring.		
43	206									
44	205									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: MW-28 a,b,c,d
Total Depth: 35 ft.

Contractor: Drilex	**Start Date:** 6/23/2010	**Northing:**	---	**Borehole Dia.:**	2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/24/2010	**Easting:**	---	**Depth to Water:**	~4 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:**	---	**Depth to Rock:**	>35 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:**	---		

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Well diagram	Field Notes, Well Notes, Comments:
			1		6		SP	grass, dark brown sandy SOIL		
					34	1,981	SM	brown to grey stained fine SAND, silty, fining with depth, odor present, stronger with depth, bottom 12 inches moist to wet, Edelman Oil-In-Soil score: (+/-) for 0-5 feet		
1	248									
2	247									
3	246									
4	245									
5	244		2		52	1,824	SM	grey (stained) fine SAND, silty, saturated		
6	243							sheen present, odor present, Edelman Oil-In-Soil Score: (++) for 5-10 feet		
7	242									
8	241									
9	240									
10	239		3		52	615	CL	grey CLAY, moderately stiff, moist, minimal to no odor, Edelman Oil-In-Soil Score: (-) for 10-15 feet		
11	238									
12	237									
13	236							trace fine SAND present at bottom of CLAY		
14	235							bottom 6 inches of soil core empty		
15	234		4		58	210	CL	Grey CLAY, soft, stiffens with depth, moist, no odor present		No recovery 15-20 feet moved 1foot away to 28b
16	233									
17	232									
18	231									
19	230							loose wet sand in tip		

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:
Borings MW-28a through MW-28d grouted to grade with portland/gel-x slurry. Casing driven to depth. Slurry added while pulling casing.
No monitoring well installed at this location.

DRILLING INFORMATION
Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES **547 River Street** **Troy, NY 12180** **PH: (518) 273-0055** **FX: (518) 273-8391**	**PROJECT:** 136 Fuller Road **LOCATION:** Albany, New York **CLIENT:** Fuller Partners, LLC **PROJECT NO.:** 90618	**Test Boring No.:** **MW-28 a,b,c,d** **Total Depth:** 35 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			5		60		CL		Start virgin hole adjacent to MW-28a: MW-28c
21	228							grey CLAY, variable consistency (moderately soft to moderately stiff with depth), moist	
22	227							bottom 8", trace silt	
						84			
23	226								
24	225								
25	224		6		58		CL	grey CLAY, stiff, very uniform, moist	Start virgin hole adjacent to MW-28a: MW-28d
26	223								
27	222								
						99			
28	221								
29	220								
30	219		7		58		CL	grey CLAY (same as above)	
31	218							some water (from above) present between plastic and soil core with odor	
32	217								
						45			
33	216								
34	215								
35	214							End of boring at 35 feet bgs. Refusal not encountered.	
36	213								
37	212								
38	211								
39	210								
40	209								
41	208								
42	207								
43	206								
44	205								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-29**
Total Depth: 40.1 ft.

Contractor: Drilex	**Start Date:** 7/7/2010	**Northing:** ---	**Borehole Dia.:** 3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/8/2010	**Easting:** ---	**Depth to Water:** ~4 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >40.1 ft.
Inspector: Will Olsen	**G.S. Elevation:** 249	**Latitude:** ---	**Depth of Well:** 32 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Well Notes, Comments:
0	249		1		16		SP	grass, brown soil, crushed stone	Well Type: 1-inch diameter PVC; flush mounted cover
1	248								
2	247								Concrete
3	246				24			brown to grey fine SAND, silty, odor and staining present, bottom 12 inches wet, Edelman Oil-In-Soil Score: (++) for 3-5 feet	Bentonite clay hole plug
4	245					2,250			
5	244		2		40		SM	brownish-grey fine SAND, silty, saturated, odor present	solid PVC riser pipe
6	243								
7	242							Edelman Oil-In-Soil Score: (+/-) for 7-9 feet	
8	241					533			
9	240				12		CL	grey CLAY, stiff, moist, odor present	Portland/Gel-X slurry
10	239		3		26		CL	grey CLAY, stiff, moist	
11	238							changing to	
12	237				28	260	CL	brown CLAY, stiff, moist, high angle fractures present, filled with fine SAND.	
13	236								
14	235								
15	234		4		30		SP	greyish brown fine SAND, trace silt, saturated	
16	233								
17	232				10	93	ML	brown SILT, moist	
18	231								
19	230				8		SM	brown very fine SAND, abundant silt, saturated, running	
					4		ML	brown SILT, moist	

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Well installed in virgin hole adjacent to soil boring. Soil boring bore hole grouted to grade w/Portland/Gel-X slurry.

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

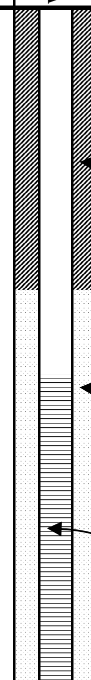
THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618

Test Boring No.: **MW-29**
Total Depth: 40.1 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Well Notes, Comments:
			5		38			brown fine SAND, abundant silt, saturated, running	
21	228								
22	227					143			
23	226				18			grey SILT, abundant clay, trace fine sand, wet	Portland/Gel-X slurry
24	225								
25	224		6		0			Top 18 inches no recovery (core broke, jammed in extruder)	
26	223								
27	222				40			grey very fine to fine SAND, abundant silt, saturated	#1 silica filter sand
28	221					186			
29	220								
30	219				2			grey SILT, slightly moist, crumbly	10-slot PVC well screen
			7		20			grey fine SAND, silty, saturated	
31	218					37			
32	217				32			grey clayey SILT, fractures present, wet	bottom of well
33	216								
34	215					31			
35	214		8		34			grey CLAY, stiff, fractures present filled with fine sand, wet	
36	213								
37	212					48			
38	211				24			grey CLAY, stiff-very stiff, moist	
39	210								
40	209		9		1		GC	Refusal encountered at 40.1 feet bgs. End of boring. Glacial till and rock fragment in tip.	
41	208								
42	207								
43	206								
44	205								

Well Diagram



ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES

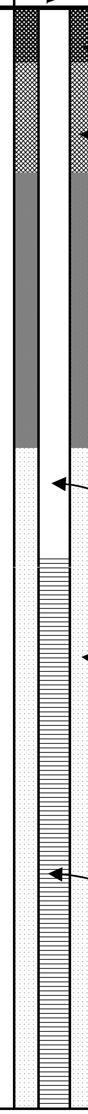
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT:	136 Fuller Road	**Test Boring No.:**	**MW-30**
LOCATION:	Albany, New York		
CLIENT:	Fuller Partners, LLC		
PROJECT NO.:	90618.00	**Total Depth:**	49.5 ft.

Contractor:	Drilex	**Start Date:**	6/30/2010	**Northing:**	---	**Borehole Dia.:**	3.25/2.25 in.
Drill Rig:	Geoprobe 6620DT	**Finish Date:**	6/30/2010	**Easting:**	---	**Depth to Water:**	8 ft.
Driller:	Mike Joice	**El. Datum:**	NAVD88	**Longitude:**	---	**Depth to Rock:**	>49.5 ft.
Inspector:	Will Olsen	**G.S. Elevation:**	252.5	**Latitude:**	---	**Depth of Well:**	20 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:
			1		6			concrete slab (4 inch hole cored with diamond tooth hole saw)
					35		SP	brown fine SAND, trace silt, loose and dry
1	251.5							
2	250.5					0		
3	249.5							
					8		CL	brown CLAY, very stiff, slightly moist
4	248.5							
5	247.5							
			2		13		CL	same as above
6	246.5							
					10		CL	brown CLAY, soft, changing to brown fine SAND and silt, wet
7	245.5							
8	244.5							
					20		SP	color change to greyish-brown fine SAND, trace silt, saturated, slight odor present
9	243.5					0		
10	242.5							
			3		56		SP	greyish-brown fine SAND, trace silt, saturated, slight odor present
11	241.5							
12	240.5							
						20		
13	239.5							
14	238.5							
15	237.5							
			4		0			No recovery.
								Driller indicated that material is very soft (weight of casing alone pushed into material)
16	236.5							
17	235.5							
18	234.5							
19	233.5							

Well diagram



Field Notes, Well Notes, Comments:

Well Type:
1-inch diameter PVC; flush mounted cover
Concrete
Crushed stone
Bentonite clay hole plug
solid PVC riser pipe
#1 silica filter sand
10-slot PVC well screen
Bottom of well at 20 feet.

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Well Location: Inside Building. / Weather: sunny, dry, mild. / Hole grouted with Portland/Gel-X slurry 20-50 feet, well screen installed 10-20 feet using 3.25 inch casing; sand pack installed while pulling casing.

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-30**
Total Depth: 49.5 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			4		58	45	CL	grey CLAY, soft to medium soft, moist		
21	231.5									
22	230.5									
23	229.5									
24	228.5									
25	227.5		5		20	67	CL	same as above		
26	226.5									
27	225.5				6		CL	grey silty CLAY with sub-angular to sub-rounded fine gravel, moist		
					34		CL	grey CLAY, soft, moist		
28	224.5									
29	223.5									
30	222.5		6		4	62	CL	grey CLAY and silt, moist		
31	221.5				8		SP	grey fine SAND, trace silt, saturated		
					2		CL	grey CLAY		
32	220.5				10		SP	grey fine-medium SAND, trace silt, saturated		
					26		CL	grey CLAY, soft-medium soft, moist		
33	219.5									
34	218.5						GP	fine gravel at approximately 34 feet		
35	217.5		7		56	29	SP/CL	grey fine SAND, saturated, with interbedded CLAY layers (3-12 inches thick at 36, 37.5, 38.5 and 40 feet)		
36	216.5									
37	215.5							1 inch quartz pebble at 37 feet		
38	214.5							high angle fractures present in clay, top and bottom of clay layers at high angles		
39	213.5									
40	212.5		8		58	101	CL	grey CLAY, soft, moist		
41	211.5									
42	210.5									
43	209.5									
44	208.5									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-30**
Total Dept 49.5 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			9		22		CL	grey CLAY, medium soft, moist	
46	206.5								
47	205.5								
					18		SP	grey fine SAND, trace silt, saturated, Edelman Oil-In-Soil score: (-) for 47.5-49 feet	
48	204.5								
						0			
49	203.5				12		ML	grey SILT, very stiff, changing to grey CLAY, stiff, moist	
							CL		
50	202.5							Refusal encountered at 49.5 feet. End of boring.	
51	201.5								
52	200.5								
53	199.5								
54	198.5								
55	197.5								
56	196.5								
57	195.5								
58	194.5								
59	193.5								
60	192.5								
61	191.5								
62	190.5								
63	189.5								
64	188.5								
65	187.5								
66	186.5								
67	185.5								
68	184.5								
69	183.5								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

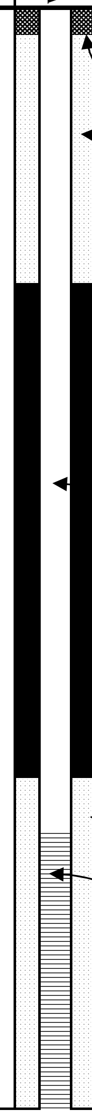
PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-31**
Total Depth: 25 ft.

Contractor: Drilex	**Start Date:** 6/29/2010	**Northing:** ---	**Borehole Dia.:** 3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/29/2010	**Easting:** ---	**Depth to Water:** 14 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >25 ft.
Inspector: Will Olsen	**G.S. Elevation:** 252.5	**Latitude:** ---	**Depth of Well:** 23 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:
			1		6			6 inch concrete slab (4 inch hole cored with diamond tooth hole saw
					40		SP	brown fine SAND, trace silt, loose and dry
1	251.5							
2	250.5							
						0		
3	249.5							
4	248.5							
5	247.5							
			2		2		CL	brown clay
					28		SP	light-brown fine SAND, trace silt, loose and dry
6	246.5							
7	245.5					0		
8	244.5							
9	243.5							
					10		CL	brown CLAY, stiff, minimal moisture
10	242.5							
			3		2		CL	dark brown silty CLAY
11	241.5							
12	240.5							
13	239.5							
					24		SP	brown fine SAND, trace silt, bottom 12 inches moist to wet
14	238.5							
						240		
15	237.5							
			4		42		SP	brownish-grey fine SAND, trace silt, saturated
16	236.5							
17	235.5							
						186		
18	234.5							
19	233.5							

Well diagram



Field Notes, Well Notes, Comments:

Well Type:
1-inch diameter PVC;
flush mounted cover
Concrete
#1 silica filter sand
Bentonite clay
hole plug
solid PVC riser
pipe
#1 silica filter sand
10-slot PVC
well screen
screened interval:
15-23 feet

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Well Location: Inside Building. / Weather: sunny, mild. / Well install: 3.25 inch casing driven to 23 feet, casing pulled with sand inside to create sand pack.

DRILLING INFORMATION

Method: Direct Push

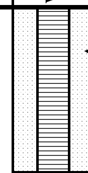
	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-31**
Total Depth: 25 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		38		SM	greyish-brown fine SAND grading to brown SILT, saturated		
21	231.5									Silica filter sand
22	230.5					1220				
23	229.5									
					6		ML	brown SILT, moist to wet		
24	228.5								hole collapse	
25	227.5									
								End of boring at 25 feet bgs. Refusal not encountered.		
26	226.5									
27	225.5									
28	224.5									
29	223.5									
30	222.5									
31	221.5									
32	220.5									
33	219.5									
34	218.5									
35	217.5									
36	216.5									
37	215.5									
38	214.5									
39	213.5									
40	212.5									
41	211.5									
42	210.5									
43	209.5									
44	208.5									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

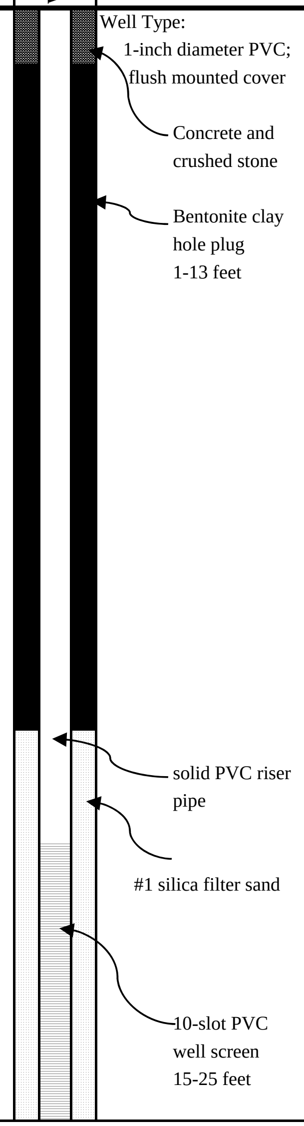
PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-32**
Total Depth: 54 ft.

Contractor: Drilex	**Start Date:** 7/1/2010	**Northing:**	---	**Borehole Dia.:**	3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/1/2010	**Easting:**	---	**Depth to Water:**	15 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:**	---	**Depth to Rock:**	>54 ft.
Inspector: Will Olsen	**G.S. Elevation:** 252.5	**Latitude:**	---	**Depth of Well:**	25 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:
			1		0			4 inch concrete slab cored with diamond tooth hole saw.
								No recovery. Liner jammed in spoon.
1	251.5							
2	250.5							
3	249.5							
4	248.5							
5	247.5							
			2		18		SP	fine to medium brown SAND, trace silt, moist
6	246.5							
					16		CL	grey-brown CLAY, moist, stiff
7	245.5							
					10	0	SP	brown fine SAND, trace silt, moist
8	244.5							
9	243.5							
10	242.5							
			3		18		SP	brown fine SAND, trace silt, moist
11	241.5							
12	240.5							
						0		
13	239.5							
14	238.5							
15	237.5							
			4		60		SP	brown fine to medium SAND, trace silt, wet
16	236.5							
17	235.5							
						0		
18	234.5							
19	233.5							

Well diagram / **Field Notes, Well Notes, Comments:**



STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Well Location: Inside Building. / Weather: sunny, dry, mild. / Hole grouted with Portland/Gel-X slurry 25-54 feet, well screen installed 15-25 feet using 3.25 inch casing; sand pack installed while pulling casing.

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-32**
Total Depth: 54 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		60		SP	same as above, saturated, running		
21	231.5									10-slot PVC well screen
22	230.5					0				
23	229.5									#1 silica filter sand
24	228.5									
25	227.5									
			6		46		SP	greyish-brown fine to medium SAND, trace silt, saturated, runnning		bottom of well: 25 feet
26	226.5									
27	225.5					0				
28	224.5									
29	223.5									
30	222.5									
			7		42		SP	same as above, grey-brown to brown, saturated, running		
31	221.5									
32	220.5					0				
33	219.5									
34	218.5									
35	217.5									
			8		60		SP	same as above, brown, saturated, running.		
36	216.5									
37	215.5					0				
38	214.5									
39	213.5									
40	212.5									
			9		28		SP	same as above, wet, running, grey-brown		
41	211.5									
42	210.5									
					32	0	CL	grey CLAY, little silt, wet, plastic		
43	209.5									
44	208.5									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-32**
Total Depth: 54 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			10		30		CL	same as above	
46	206.5								
47	205.5					0			
48	204.5								
49	203.5								
50	202.5								
			11		48		CL	same as above	
51	201.5								
52	200.5					0			
53	199.5								
							GC	hard gravelly grey TILL in tip of spoon	
54	198.5							Refusal encountered at 54 feet bgs. End of boring.	
55	197.5								
56	196.5								
57	195.5								
58	194.5								
59	193.5								
60	192.5								
61	191.5								
62	190.5								
63	189.5								
64	188.5								
65	187.5								
66	186.5								
67	185.5								
68	184.5								
69	183.5								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

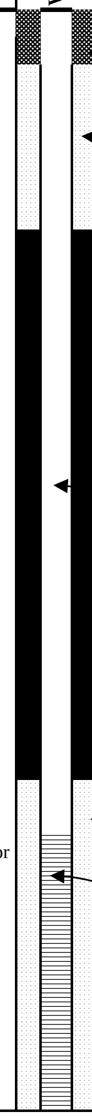
PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-33**
Total Depth: 25 ft.

Contractor: Drilex	**Start Date:** 6/29/2010	**Northing:** ---	**Borehole Dia.:** 3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/30/2010	**Easting:** ---	**Depth to Water:** 14 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >25 ft.
Inspector: Will Olsen	**G.S. Elevation:** 252.5	**Latitude:** ---	**Depth of Well:** 25 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:
			1		6			concrete slab (4 inch hole cored with diamond tooth hole saw)
					40		SP	brown fine SAND, trace silt, loose, bottom slightly moist.
1	251.5							
2	250.5					0		
3	249.5							
4	248.5							
5	247.5							
			2		0			
6	246.5							soil core stuck in casing
7	245.5							drilling very hard at 8 feet
8	244.5							
9	243.5							
					4		CL	brown CLAY, stiff, in tip
10	242.5		3		18		CL	same as above
11	241.5							
					26		SP	brown fine SAND, trace silt, loose
12	240.5							
								bottom 12 inches wet
13	239.5							
14	238.5					0		
15	237.5		4		40		SP	brown to brownish-grey fine SAND, trace silt, saturated, very faint odor (grey water?)
16	236.5							
17	235.5					106		
18	234.5							
19	233.5							

Well diagram



Field Notes, Well Notes, Comments:

Well Type:
1-inch diameter PVC; flush mounted cover

Concrete
#1 silica filter sand

Bentonite clay hole plug

solid PVC riser pipe

#1 silica filter sand

10-slot PVC well screen

screened interval: 15-25 feet

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Well Location: Inside Building. / Weather: sunny, mild. / Well install: 3.25 inch casing driven to 25 feet, casing pulled with sand inside to create sand pack.

DRILLING INFORMATION
Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-33**
Total Dept 25 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		42		SP	greyish-brown to brown fine SAND, fining downwards, trace silt		
21	231.5									#1 silica filter sand
22	230.5					0				
23	229.5									
24	228.5									
25	227.5							End of boring at 25 feet bgs. Refusal not encountered.		bottom of well at 25 feet
26	226.5									
27	225.5									
28	224.5									
29	223.5									
30	222.5									
31	221.5									
32	220.5									
33	219.5									
34	218.5									
35	217.5									
36	216.5									
37	215.5									
38	214.5									
39	213.5									
40	212.5									
41	211.5									
42	210.5									
43	209.5									
44	208.5									

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-34**
Total Depth: 52 ft.

Contractor: Drilex	**Start Date:** 7/1/2010	**Northing:** ---	**Borehole Dia.:** 3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 7/2/2010	**Easting:** ---	**Depth to Water:** ~14 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >52 ft.
Inspector: Will Olsen	**G.S. Elevation:** 252.5	**Latitude:** ---	**Depth of Well:** 26 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Well Notes, Comments:
			1		40		SP	fine to medium brown SAND, trace silt, dry	Well Type: 1-inch diameter PVC; flush mounted cover
1	251.5								
2	250.5					0			Concrete
3	249.5								
4	248.5								sand and crushed stone
5	247.5		2		34		SP	same as above, dry, brown	
6	246.5					0			Bentonite clay hole plug
7	245.5								
8	244.5				8	0	CL	brown silty CLAY, moist, very stiff	
9	243.5								
10	242.5		3		12		CL	same as above	
11	241.5				25	0	SP	brown moist SAND, trace silt	
12	240.5							bottom 12 inches wet	
13	239.5					0			solid PVC riser pipe
14	238.5								
15	237.5		4		38		SP	same as above, saturated, running	#1 silica filter sand
16	236.5								
17	235.5					0			
18	234.5								10-slot PVC well screen 16-26 feet
19	233.5								

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: Hole grouted from 26-52 feet ; well installed using 3.25 inch casing, sand pack installed while pulling casing.

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-34**
Total Dept 52 ft.

Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		34		SP	same as above, saturated, running		
21	231.5									10-slot PVC well screen
22	230.5									
						0				
23	229.5									#1 silica filter sand
24	228.5									
25	227.5									
			6		60		SP	same as above, saturated, running		
26	226.5									
								changing to grey-black		bottom of well: 26 feet
27	225.5									
						0				
28	224.5									
29	223.5									
30	222.5									
			7		48		SM	greyish brown fine SAND, abundant silt, grading to SILT, saturated		
31	221.5									
32	220.5									
						0				
33	219.5									
34	218.5									
					8		ML	greyish-brown SILT, trace very fine sand, moist to wet		
35	217.5									
			8		30		SM	greyish-brown fine SAND, abundant silt		
36	216.5									
37	215.5									
						29				
38	214.5				2		ML	greyish-brown SILT, wet		
					21		SM	greyish-brown fine SAND, abundant silt		
39	213.5									
					3		ML	greyish brown SILT, moist, stiff		
40	212.5		9		2		ML	same as above		
					36		ML	grey SILT, sandy, saturated		
41	211.5									
42	210.5					57				
					3			grey SILT, moist		
43	209.5				6			grey SILT, sandy, saturated		
							ML			
44	208.5				10		SM	grey SILT, changing to grey CLAY		
							ML			

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-34**
Total Depth: 52 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			10		48		CL	grey CLAY, stiff, moist	
46	206.5								
								(top 20 inches: fractures filled with saturated silty fine sand present)	
47	205.5					68			
48	204.5								Stopped driving at 49 feet due to stiff material.
49	203.5								
			11		26		CL	grey CLAY, stiff, moist	
50	202.5							change in lithology	
						58			
51	201.5				28		GM	grey SILT, trace sand, fine gravel (15-20%), stiff, moist (Till)	
52	200.5							Refusal encountered at 52 feet bgs. End of boring.	
53	199.5								
54	198.5								
55	197.5								
56	196.5								
57	195.5								
58	194.5								
59	193.5								
60	192.5								
61	191.5								
62	190.5								
63	189.5								
64	188.5								
65	187.5								
66	186.5								
67	185.5								
68	184.5								
69	183.5								

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-35**
Total Depth: 50 ft.

Contractor: Drilex	**Start Date:** 6/28/2010	**Northing:** ---	**Borehole Dia.:** 3.25/2.25 in.
Drill Rig: Geoprobe 6620DT	**Finish Date:** 6/29/2010	**Easting:** ---	**Depth to Water:** ~13.5 ft.
Driller: Mike Joice	**El. Datum:** NAVD88	**Longitude:** ---	**Depth to Rock:** >50 ft.
Inspector: Will Olsen	**G.S. Elevation:** 252.5	**Latitude:** ---	**Depth of Well:** 43.5 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well diagram	Field Notes, Well Notes, Comments:
			1		3			6 inch concrete slab (cored 4 inch hole with diamond tooth hole saw)		Well Type:
					38		SM	brown fine SAND, silty, loose and dry		1-in diameter PVC; flush mounted cover
1	251.5									
2	250.5									Concrete
						142				
3	249.5									
4	248.5									
5	247.5		2		36		SM	brown fine SAND, silty, loose and dry		
6	246.5									Bentonite clay hole plug
7	245.5					142				
8	244.5									
9	243.5									
10	242.5		3		42		SM	brown fine SAND, silty, bottom 16 inches saturated, no odors present, Edelman Oil-In-Soil Score: (-) for 10-15 feet		
11	241.5									
12	240.5					175				
13	239.5									
14	238.5									
15	237.5		4		54		SM	greyish-brown fine SAND, silty, saturated, very-slight odor present, Edelman Oil-In-Soil Score: (-) for 15-20 feet		Portland/Gel-X grout slurry
16	236.5									solid PVC riser pipe
17	235.5					190				
18	234.5									
19	233.5									

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES: high humidity day: 6/28/2010; well located inside building.

DRILLING INFORMATION

Method: Direct Push

	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-35**
Total Depth: 50 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Well Diagram	Field Notes, Well Notes, Comments:
			5		58		SM	same as above		Portland/Gel-X grout
21	231.5							fining downwards to 32.5 feet		
22	230.5									
						152				
23	229.5									
24	228.5									
25	227.5									
			6		58		SM	grey brown fine SAND, saturated, silt content increases with depth		
								no odor present		
26	226.5						ML			
							SP	at approximately 27 feet: SILT with fine sand and fine to coarse angular gravel (sandstone)		
27	225.5									
						97	SM			
28	224.5									
29	223.5									
30	222.5									
			7				SM	greyish-brown fine SAND, silty, saturated, no odor present		
31	221.5				58					
32	220.5							fining upwards 32.5-35 feet		
						95				
33	219.5									
34	218.5									
35	217.5									
			8		12		SM	same as above		
36	216.5				4		SM	greyish-brown clayey SILT, moist		
37	215.5				18		SM	greyish-brown fine SAND, abundant silt, saturated		
						105				
38	214.5				4		SM	greyish-brown SILT, saturated		
39	213.5				20		SM	greyish-brown fine SAND, abundant silt, saturated		
40	212.5									
			9		2		SM	same as above		# 1 silica filter sand
41	211.5				42		SM	greyish brown fine SAND, abundant silt, saturated		
42	210.5									10-slot PVC well screen 38.5-43.5 feet
						101				
43	209.5									
44	208.5									bottom of well at 43.5'
					11		ML	greyish brown SILT, moist, stiff		Portland/Gel-X slurry

ADDITIONAL NOTES:

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

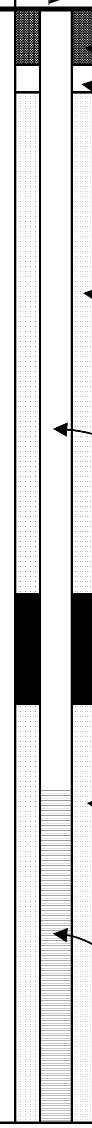
Test Boring No.: **MW-35**
Total Depth: 50 ft.

Depth *(Feet)*	Elevation *(Feet)*	Casing Data	Sample No.	Sample Data	Recovery *(Inches)*	PID *(ppm)*	Group Symbol	Stratum and Field Descriptions:	Field Notes, Comments:
			10		26		CL	grey CLAY, moderately stiff, moist	
46	206.5								
47	205.5				28		SM	grey fine SAND, silty, saturated, no odor present	Portland/Gel-X slurry
48	204.5					540			
49	203.5								
50	202.5							End of boring at 50 feet bgs. Refusal not encountered.	
51	201.5								
52	200.5								
53	199.5								
54	198.5								
55	197.5								
56	196.5								
57	195.5								
58	194.5								
59	193.5								
60	192.5								
61	191.5								
62	190.5								
63	189.5								
64	188.5								
65	187.5								
66	186.5								
67	185.5								
68	184.5								
69	183.5								

ADDITIONAL NOTES: Casing driven to 50 feet for to grout hole with Portland/Gel-X slurry.

TEST BORING LOG

THE Chazen COMPANIES **547 River Street** **Troy, NY 12180** **PH: (518) 273-0055** **FX: (518) 273-8391**	**PROJECT:** 136 Fuller Road **LOCATION:** Albany, New York **CLIENT:** Fuller Partners, LLC **PROJECT NO.:** 90618.00		**Test Boring No.:** **MW-36** **Total Depth:** 25 ft.
Contractor: Drilex **Drill Rig:** Geoprobe 6620DT **Driller:** Mike Joice **Inspector:** Will Olsen	**Start Date:** 6/22/2010 **Finish Date:** 6/22/2010 **El. Datum:** NAVD88 **G.S. Elevation:** 249	**Northing:** --- **Easting:** --- **Longitude:** --- **Latitude:** ---	**Borehole Dia.:** 3.25/2.25 in. **Depth to Water:** 12.5 ft. **Depth to Rock:** >25 ft. **Depth of Well:** 24 ft.

Depth *(Feet)*	**Elevation** *(Feet)*	**Casing Data**	**Sample No.**	**Sample Data**	**Recovery** *(Inches)*	**PID** *(ppm)*	**Group Symbol**	**Stratum and Field Descriptions:**	**Well diagram**	**Field Notes, Well Notes, Comments:**
			1		2			grass and soil		Well Type:
1	248				40		SP	brown fine SAND, loose		1-inch diameter PVC; flush mounted cover
2	247									Concrete seal
3	246					126				native soil
4	245									
5	244		2		30		SP	brown fine SAND, loose		
6	243									#1 silica filter sand
7	242					125				
8	241									solid PVC riser pipe
9	240									
10	239		3		14		SP	brown fine SAND		
11	238									
12	237									Bentonite clay hole plug
13	236				28		SM	brown fine SAND, silty (bottom 20 inches saturated)		
14	235					100				
15	234		4		40		SM	brown fine SAND, silty, saturated		#1 silica filter sand
16	233									
17	232					96				
18	231									10-slot PVC well screen 14-24 feet
19	230									

STANDARD NOTES: 1. Refer to the "Interpretation of Subsurface Logs" for additional symbology and abbreviation definitions.
2. Samples classified in accordance with ASTM D-2488 unless otherwise noted.
3. Test Boring Log Page 1: 0 - 20 feet Each subsequent page: Additional 25 feet.

ADDITIONAL NOTES:

DRILLING INFORMATION

Method: Direct Push

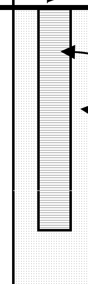
	Casing	Sample	Core
Type:			
Diam.:			
Weight:			
Fall:			

TEST BORING LOG

THE Chazen COMPANIES
547 River Street
Troy, NY 12180
PH: (518) 273-0055
FX: (518) 273-8391

PROJECT: 136 Fuller Road
LOCATION: Albany, New York
CLIENT: Fuller Partners, LLC
PROJECT NO.: 90618.00

Test Boring No.: **MW-36**
Total Depth: 25 ft.



Depth (Feet)	Elevation (Feet)	Casing Data	Sample No.	Sample Data	Recovery (Inches)	PID (ppm)	Group Symbol	Stratum and Field Descriptions:	Field Notes, Well Notes, Comments:
			5		38		SM	brown fine SAND, silty, saturated	
21	228								10-slot PVC well screen
22	227					87			#1 silica filter sand
23	226								
24	225								bottom of well: 24 feet bgs
25	224							End of boring at 25 feet bgs. Refusal not encountered.	
26	223								
27	222								
28	221								
29	220								
30	219								
31	218								
32	217								
33	216								
34	215								
35	214								
36	213								
37	212								
38	211								
39	210								
40	209								
41	208								
42	207								
43	206								
44	205								

ADDITIONAL NOTES:

Project: **136 Fuller Road**	Log of Boring MW-37(BA-1)
Project Location: **Albany, NY**	**Sheet 1 of 1**
Project Number:	

Date(s) Drilled **April 25, 2018**	Logged By **Baines**	Checked By
Drilling Method **HSA**	Drill Bit Size/Type **2" - Macrocore/HSA**	Total Depth of Borehole **25 feet bgs**
Drill Rig Type **Geoprobe**	Drilling Contractor **Cascade**	Approximate Surface Elevation
Groundwater Level and Date Measured **15 - Feet**	Sampling Method(s)	Hammer Data
Borehole Backfill **Monitoring Well**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0				Concrete		5-inch Factory Floor Slab	
							Crushed stone Agregate Gravel Beneath Slab	
					SM		Fine Lt Brown Sand - Dry	
	5				SM		Fine Brown Sand - Dry	
	10				SM		Same - Silty Dense lense @ 14' to 14'-2" then same. Damp from 14-15'	
	15				SM		Fine Brown Sand - Saturated	
	20				SM		Same	After MacroCore Sampling, Augered 0-25' with 3.25" HSA and set 1" PVC Monitoring well. Screened 0,010" slotted screen 15-25', silica sand to 2' above screen then hydrated bentonite to top of boring and set 4" flush MH at floor surface with concrete.
	25						End of Boring	
	30							

Macintosh HD:Users:Earth:Earth-Env:Projects:136-BCP:TFE-O&M:New-Rem-Wells:Drilling:136Fuller-Wells-042518.bg4[(master 0 lab).tpl]

Project: **136 Fuller Road**
Project Location: **Albany, NY**
Project Number:

Key to Log of Boring
Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9

COLUMN DESCRIPTIONS

1. Elevation (feet): Elevation (MSL, feet).
2. Depth (feet): Depth in feet below the ground surface.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Sample Number: Sample identification number.
5. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6. Material Type: Type of material encountered.
7. Graphic Log: Graphic depiction of the subsurface material encountered.
8. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9. REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
Portland Cement Concrete
Gravel
Clayey SAND (SC)
Silty SAND (SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
? Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Figure B-1

Appendix E

Groundwater Monitoring Well Sampling Log Form

FIELD DATA SHEET

SAMPLE INFORMATION:

Sample ID: ____________
Well ID: ____________
Project Name: ____________
Sample Location: ____________

Sample Time: ____________
Sample Date: ____________
Sample Tech(s): ____________
Project & Task #: ____________
Project Manager: ____________

Sample Matrix *(circle)*:
Groundwater Soil
Surface Water Air
Drinking Water Other:

WELL INFORMATION:

Well Condition: ____________

Lock Type: ____________ Key #: ____________

PURGE DATA:

Measuring Point: ____________
Depth to Bottom: ____________
Depth to Water: ____________
Water Column Height: ***(A)*** ____________
(depth to bottom - depth to water)

# of Volumes to be Purged: ***(C)***
____

Gal. to be Purged: ***(AxBxC)***
____

(B)

Pipe Width	Gal/Foot
1.0"	0.037
1.5"	0.092
2.0"	0.163
2.5"	0.255
3.0"	0.367
4.0"	0.653
6.0"	1.469
8.0"	2.611

Purge Method: ____________
Start Date: ____________
Start Time: ____________
Stop Time: ____________
Purge Rate (gpm): ____________
Elapsed Time (min): ____________
Well Vol. Purged (#): ____________
Purge Vol. (gal): ____________
Well went dry? No Yes
Conditions: No Odor Odor
Clear Slightly-Turbid Turbid

FIELD RESULTS:

Gals. Purged	Sample Depth	Temp.	Spec. Cond.	Cond	TDS	Sal.	DO	pH	ORP	Turbidity	
	ft	deg C	mS/cm	mS/cm	g/L	ppt	mg/L	--	mV		

SAMPLE INFORMATION:

Sample Method: ____________ *(Peristaltic, Submersible, Dedicated or Disp. Bailer, Waterra, Dir. Instrument Reading, etc.)*
Sample Type: Grab Composite
Sample Depth: ____________
Weather: ____________
Barometric Pres.: ____________
Wind: ____________
Air Temp.(^{o}F): ____________

Notes: ____________

LAB REQUESTS:

Laboratory Name: Analysis/Method: Turn Around Time:

QA/QC: Duplicate Equip. Blank Field Blank Trip Blank

The Chazen Companies

Appendix F

Site-Wide Inspection Form

THE Chazen COMPANIES®

ANNUAL SITE INSPECTION FORM
136 Fuller Road BCP Site C401055
City of Albany & Town of Guilderland, Albany County, NY

Page ____ of ____

Performed by: ______________________________ Date:____________ Time:____________

Part 1 - Engineering Controls - Sub-Slab Depressurization System (SSDS) (circle noted condition)

1A - Describe SSDS function: explain if not normal:	normal	decreased function	non-functioning

1B - Is there any damage or defect to the foundation that reduces or has the potential to reduce the effectiveness of the SSDS? (circle one)

No Yes If yes, describe needed repairs:

If yes, owner to notify DEC within 48 hours. Attached documentation of notification.

1C - Describe blower conditions:(circle one)	normal	decreased function	non-functioning	
Excess wear:	none	minimal (no change to system function)	non-functioning	
Visual damage:	none	minimal (no change to system function)	non-functioning	
Listen for smooth blower operation:	normal	inconsistent (describe)	non-functioning	
Measure vacuum pressure:	________________	is it within design parameters?	yes	no
Measure air flow:	________________	is it within design parameters?	yes	no

1D - Is system functioning as designed to continue to be protective of human health and the environment?

Yes No **If no**, describe needed modifications:

If no, owner to notify DEC within 48 hours. Attach documentation of notification.

Part 2 - Engineering Controls - HVE/SVE System (circle noted condition)

2A - Is system functioning as designed to continue to be protective of human health and the environment?

Yes No

If no, describe needed modifications:

If no, owner to notify DEC within 48 hours. Attach documentation of notification.

2B - Review prior progress report - Do system effluent samples meet action levels?

Yes No **If no**, note system modifications made to meet action levels.

THE Chazen COMPANIES

ANNUAL SITE INSPECTION FORM

136 Fuller Road BCP Site C401055
City of Albany & Town of Guilderland, Albany County, NY

Part 3 - Engineering Controls - Cover System [asphalt at B-3 area and at least one foot of clean soil and/or building slab in source area] (circle noted condition)

3A - Describe Cover Condition: asphalt at B-3: intact damaged not present

explain if not intact:

soil/slab: intact damaged not present

explain if not intact:

3B - Is system functioning as designed to continue to be protective of human health and the environment?

Yes No

If no, describe needed modifications:

If no, owner to notify DEC within 48 hours. Attach documentation of notification.

3C - Is Site Cover in-tact (per Track 4)? Yes No

If No, explain:

Part 4 - Institutional Controls (circle one)

4A - Site usage:	Commercial Other:_______________________	Industrial (inconsistent with Environmental Easement, must be reported to DEC)
4B - Has the site been used for vegetable gardens or farming ? (circle one)	No	Yes, Explain inconsistency with Environmental Easement
4C - Is site water source from a municipal source? (circle one)	Yes	No Explain inconsistency with Environmental Easement
4D - Is site groundwater being used for any purpose? (circle one)	No	Yes, Explain inconsistency with Environmental Easement, or groundwater treatment system implemented
4E - Has contaminated subsurface material been disturbed? (circle one)	No	Yes, explain activities and whether they were performed consistent with the Site Management Plan
4F - Have new buildings been developed in the source or groundwater plume areas? (circle one)	No	Yes, explain how potential impacts were monitored or mitigated

Part 5 - General Site Conditions

5A - Describe changes since last inspection

5B - Describe condition of monitoring wells and note changes or NYSDEC-approved closures since last inspection by entering data in table below (wells in sequence but not listed below were closed or destroyed prior to implementation of the SMP, or were not installed during site boring investigation activities):

Well ID (show on site map)	Intact	Damaged	Closed	Replaced	Explanation
MW-1 (west of HVE/SVE system)					
MW-2 (east of HVE/SVE system)					
MW-3 (south of building)					
MW-5 (south of southern driveway)					

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ANNUAL SITE INSPECTION FORM

136 Fuller Road BCP Site C401055
City of Albany & Town of Guilderland, Albany County, NY

Well ID (show on site map)	Intact	Damaged	Closed	Replaced	Explanation
MW-6 (northwest of HVE/SVE system)					
MW-7 (south of southern driveway)					
MW-8 (west of HVE/SVE system)					
MW-9 (inside building, northern side of UltrePet)					
MW-10 (inside building, northern side of UltrePet)					
MW-11 (inside building, northern side of UltrePet)					
MW-12 (east of building)					
MW-13 (southeastern corner of site)					
MW-16 (inside Equal Vision space)					
MW-17 (south of southern driveway)					
MW-18 (south of southern driveway)					
MW-19 (under asphalt north of HVE/SVE system)					
MW-20 (west of HVE/SVE system)					
MW-21 (under asphalt north of HVE/SVE system)					
MW-22 (west of HVE/SVE system)					
MW-23 (west of HVE/SVE system)					
MW-25 (exterior HVE/SVE treatment area)					
MW-27 (exterior HVE/SVE treatment area)					
MW-29 (exterior HVE/SVE treatment area)					
MW-30 (inside building, northern side of UltrePet)					
MW-31 (inside building, northern side of UltrePet)					
MW-32 (inside building, northern side of UltrePet)					
MW-33 (inside building, southern side of UltrePet)					
MW-34 (inside building, southern side of UltrePet)					
MW-35 (inside building, southern side of UltrePet)					
MW-36 (outside northeastern corner of building)					
MW-37 (inside building, northern side of UltrePet)					
RW-1 (interior HVE/SVE treatment area) Not In Use					
RW-2 (interior HVE/SVE treatment area)					
RW-3 (interior HVE/SVE treatment area) No In Use					
RW-4 (exterior HVE/SVE treatment area)					
RW-5 (exterior HVE/SVE treatment area)					
RW-6 (exterior HVE/SVE treatment area)					
RW-7 (exterior HVE/SVE treatment area)					
RW-8 (exterior HVE/SVE treatment area)					
RW-9 (exterior HVE/SVE treatment area)					
RW-10 (interior HVE/SVE treatment area) Not In Use					
RW-11 (interior HVE/SVE treatment area)					

ANNUAL SITE INSPECTION FORM

136 Fuller Road BCP Site C401055
City of Albany & Town of Guilderland, Albany County, NY

Part 6 - Compliance with Excavation Work Plan and Operations & Maintenance Plan
6A - Describe site construction activities that have been conducted since last inspection (see SMP for soil management criteria)
6B - Describe soil excavation and disposition (on site/off site). Map excavation areas and on site placement.

Part 7 - Monitoring Program			
7A - Groundwater sampling event status (for four quarters preceding this inspection)	1st Quarter for Year ______	was completed on (date): ______	
	2nd Quarter for Year ______	was completed on (date): ______	
	3rd Quarter for Year ______	was completed on (date): ______	
	4th Quarter for Year ______	was completed on (date): ______	
7B - Attach sampling reports for prior four quarterly sampling events.			
7C- DEC determination that monitoring can be terminated (circle one):	not yet requested	requested (date)/pending ______	granted (date): ______

Part 8 - Confirm that site records are up to date			
No	Yes		8A - Are there any changes that need to be documented in site records (e.g., change of ownership, site usage)
No	Yes	NA	8B - Has DEC received 15-day advanced notice of any proposed ground intrusive activities?
No	Yes	NA	8C - Has DEC received notification within 48 hours of any damage or defect to the foundation that reduces or has the potential to reduce the effectiveness of the SSDS?
No	Yes (Attached)		8D - Has site owner or remedial party submitted a written statement to NYSDEC certifying that (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP?

Appendix G

Sub-Slab Depressurization System Operation, Maintenance, and Monitoring Plan

THIS PLAN TO BE RETAINED AT THE CONTROL PANEL

Sub-Slab Depressurization System
Operation, Maintenance, and Monitoring Plan

136 Fuller Road Site
Brownfield Cleanup Program
NYSDEC Site No. C401055

City of Albany
Albany County, New York

February 2012

Chazen Project No. 90618.00

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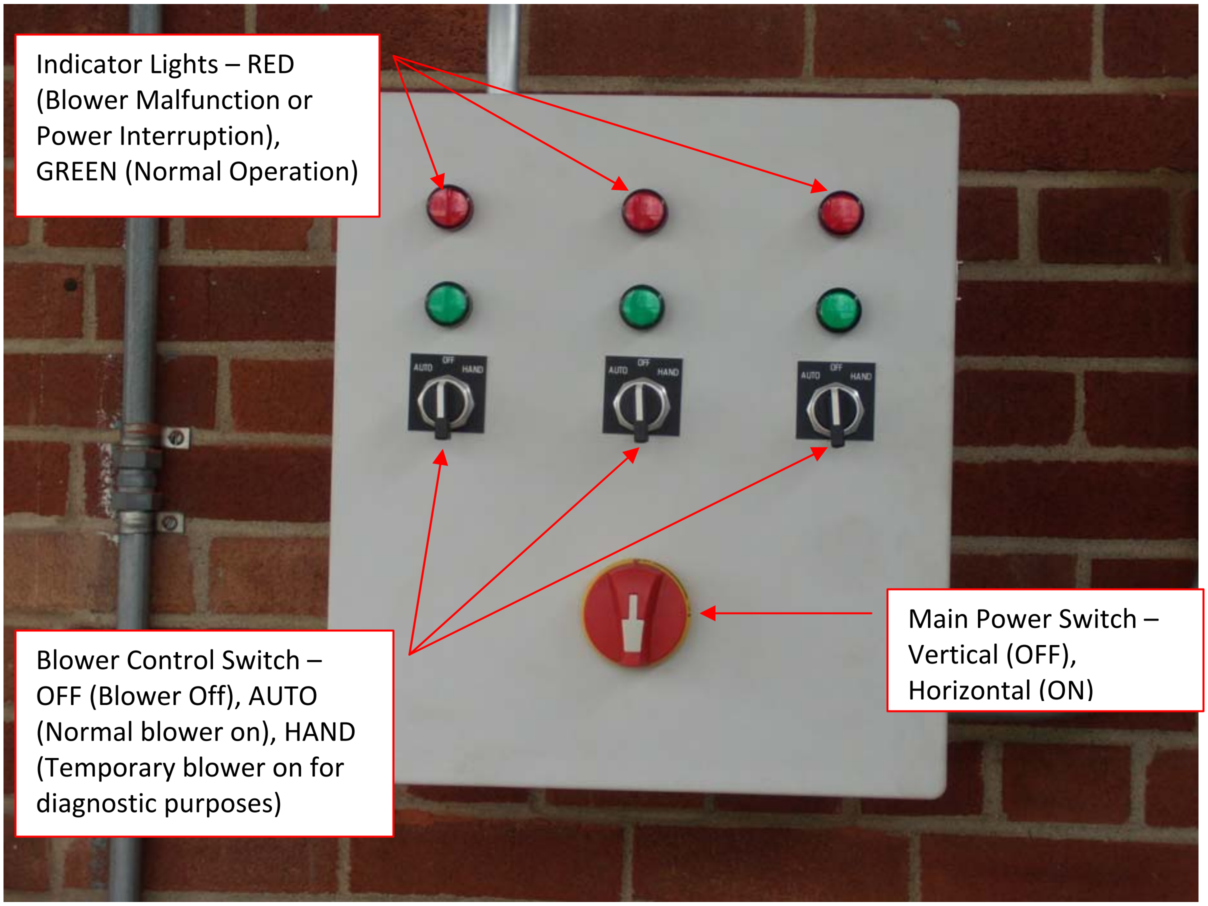
TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

Quick Reference Guide

SSDS Control Panel Diagram/Photograph



Note: This picture shows the control panel with switches in the OFF positions.
On three-phase control panels, the "Hand" position is typically used to override a remote relay to turn on the blower. Since no remote relay is present on this system, the "Hand" position has no practical use.
For ease of use, this photograph shows the control panel before the locking metal cage was installed. A picture showing the current control panel with the locking cage is in Section 2.1.

Troubleshooting Guide for the Sub-Slab Depressurization System (SSDS)

Problem:	Action:
Blower is not running:	The most probable cause of a system shutdown is an interruption to the electrical service. Each blower is powered by a three-phase electric motor. When power is interrupted, the blowers will shut down. After the power is restored, the red indicator lights on the control panel should be illuminated until the blowers are restarted. Turn each blower control switch to the “OFF” position, and then return the switch to the “AUTO” position to restart the blower. The red indicator light should go out and the green indicator light should illuminate. If the blower does not start, refer to “Blower will not start” below.
Blower will not start:	Check that main power switch is in the “ON” position (horizontal). Check for open circuit breaker. The breaker box is located in a locked electrical closet within the central building tenant space. Enter through the door to the left of the control panel. The closet is in the room on the left as you enter the door. Each blower is equipped with overload protection. If a blower cannot be restarted, it may indicate that shutdown was due to an overload/overheating condition. Turn the blower control switch to the “OFF” position, and wait for the blower to cool (two to three hours) which will reset its internal overload protection. After the blower has cooled, return the switch to the “AUTO” position to restart the blower. The red indicator light should go out and the green indicator light should illuminate. Do not continue to operate the blower without first checking the current draw to determine the cause of the overload condition. Starting at the VEWs, check the vacuum pressure readings for normal pressures (about 35 in W.C.) and for gauge needles that do not bounce. If vacuum pressures are normal, check the discharge stack for strong, smooth airflow (no pressure gauges are present on the discharge piping). Do not operate blower if vacuum pressure or airflow discrepancy cannot be resolved. See Influent Blockage and Effluent Blockage below. If the blower does not start or continue to operate normally, contact The Chazen Companies Environmental Services Division (518) 273-0055.

The blower feels very hot to the touch:	Air flowing through a blower has a cooling effect. A hot blower indicates a restriction to the airflow. Check vacuum pressure at each vapor extraction well for irregularities to determine the source of the restriction. See Influent Blockage and Effluent Blockage below.
Influent blockage (indicated by a <u>low discharge pressure</u> at blower exhaust and low airflow):	Reduced airflow could occur from a dirty air filter element. To correct this, turn the blower off by turning the control panel's blower control switch to the "OFF" position and inspect the filter elements. Clean or replace dirty elements and then restart the system and recheck pressure gauges for normal pressure readings. If the problem is not solved, shut down the blower by returning the blower control switch to the "OFF" position and contact The Chazen Companies Environmental Services Division (518) 273-0055. Reduced airflow could occur from the accumulation of groundwater in the system. To correct this, turn the blower off using the control panel's main power switch, and allow the system to rest for three hours. This will allow accumulated water to drain from the influent piping. After three hours, restart the blower and recheck the pressure gauges for normal pressure readings (about 35 in W.C.). If the problem is not solved, return the blower control switch to the "OFF" position and contact The Chazen Companies Environmental Services Division (518) 273-0055.
Effluent blockage (indicated by a <u>high discharge pressure</u> at blower exhaust and low airflow):	Check for a break or blockage in the discharge pipe. If line is blocked, turn off the blower, disconnect the pipe from the threaded fitting on the blower and remove the blockage. If problem is not solved, shut down the unit and contact The Chazen Companies Environmental Services Division (518) 273-0055.
Vacuum pressure irregularity (indicated by a <u>high gauge pressure</u> at the vapor extraction well)	If the vacuum gauge pressure measured at the extraction well is inconsistent and higher than previous measurements, it indicates a system malfunction. Check the ball valve positions for each vapor extraction well to ensure they are all in the full open position. If the gauge needle appears to be bouncing, it may indicate water in the extraction well. To correct this, turn the blower off using the control panel's main power switch, and allow the system to rest for three hours. This will allow accumulated water to drain from the influent piping. After three hours, restart the blower and recheck the pressure for a normal reading. If the problem is not solved, shut down the blower by turning the blower control panel switches to the "OFF" position and contact The Chazen Companies Environmental Services Division (518) 273-0055.

Vacuum pressure irregularity (indicated by a <u>low gauge pressure</u> at the vapor extraction well)	If the vacuum gauge pressure measured at each extraction well is inconsistent and lower than previous measurements, it indicates a system malfunction. Examine the piping system for leaks or breaks. If a line break or leak is observed, stop the application of vacuum pressure to the affected line by either closing the ball valve at the extraction well, or if the break is above the valve, turn off the blower to the affected zone at the control panel. Replace broken or leaking section of PVC pipe, minimizing the use of rubber fittings, if possible. Restart the system and check the pressure. Reduced airflow could occur from a dirty air filter element. To correct this, turn the blower off by turning the blower control panel switch to the "OFF" position and inspect the filter element. Clean or replace dirty elements and then restart the system and recheck the pressure in the effluent stack by checking the airflow. If the problem is not solved, shut down the blower by turning the control panel switch to the "OFF" position and contact The Chazen Companies Environmental Services Division (518) 273-0055.
System appears to be running normally, but the control panel light is not on.	If the blowers are operating normally, the green indicator lights will be illuminated, otherwise the red indicator lights should be illuminated. If neither light is illuminated, there may be a power outage, or a control panel light bulb may need to be replaced. Temporarily swap a known functioning light bulb with the one that is not operating. If swapped bulb functions, purchase a replacement for the burned-out bulb. If no lights are operating, it is most likely a power outage to the system. Check that the main power switch is in the "ON" position. Check for tripped breakers in the electrical closet. If the cause of the power outage is known, restart the blowers when power is restored. If the cause of non-functioning lights is still unknown, contact The Chazen Companies Environmental Services Division (518) 273-0055.
System appears to be operating normally, but the vacuum pressure gauge has a sticky needle or the gauge has been broken	Replace vacuum pressure gauge. Grainger Item No. 5MLJ6.

1.0 Introduction

This Operation, Maintenance and Monitoring (OM&M) Plan describes the measures necessary to operate, monitor, and maintain the mechanical components of the sub-slab depressurization system (SSDS) for this site.

This OM&M Plan:

- Includes the steps necessary to allow individuals unfamiliar with the site to operate and maintain the SSDS,
- Includes an OM&M contingency plan, and
- Will be updated as needed to reflect changes in site conditions or the manner in which the SSDS is operated and maintained.

A copy of this OM&M Plan will be kept in the locked SSDS control panel cage at the site.

2.0 Engineering Control System Operation and Maintenance

In response to elevated sub-slab air concentrations of perchloroethylene (PCE) and other volatile organic compounds (VOCs) beneath the site building at the 136 Fuller Road Brownfield Cleanup Program (BCP) site, an SSDS was designed and installed in 2010 and 2011. The system includes six operating sub-slab vapor extraction wells (VEWs) located above an area of known groundwater impacts. The wells are piped to three vacuum blower units positioned above an overhang along the north-central side of the site building (Figure 1). System components are shown in Figure 2, and a typical VEW detail is shown in Figure 3. A troubleshooting guide is present in the Quick Reference Guide located at the beginning of this document.

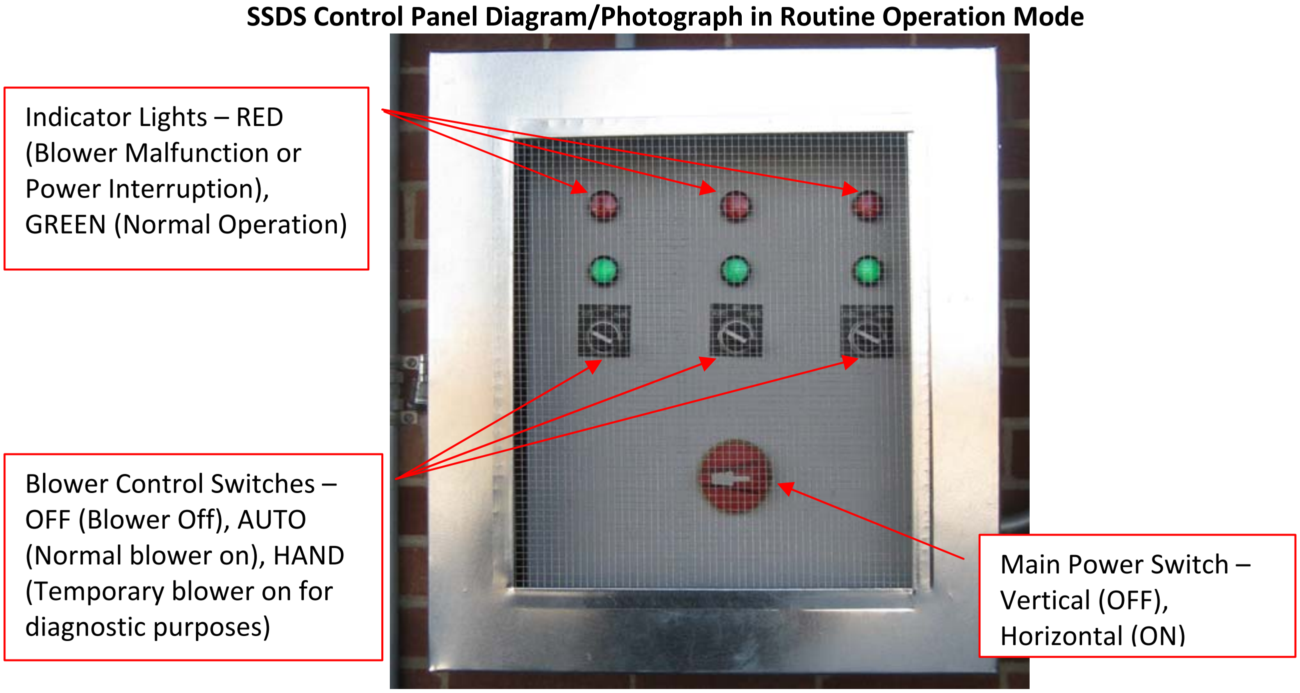
The SSDS is planned for continual operation during active site interim remedial measures and/or remedial actions. SSDS operation may be terminated following approval by NYSDEC and NYSDOH.

2.1 System Operation: Routine Operation Procedures

The SSDS contains three EG&G Rotron explosion-proof regenerative blowers Model DR454R72M. The blower cut sheet is included as Appendix A. Operation of the blower units requires ensuring that a continuous power source is applied to the blower motor. The operator must also ensure that SSDS piping does not leak and that there are no blockages. Blockages and leaks may be diagnosed by assessing line pressure at the vapor extraction wells and the blower exhaust lines. Vacuum pressure gauges are installed at each vapor extraction well.

The control panel is used to assess whether power is being supplied to the blowers (see control panel diagram/photograph below). Power is supplied when the main power switch is in the ON position (horizontal), the three blower control switches are on AUTO (the left-most setting), and the green indicator lights are illuminated.

SSDS Control Panel Diagram/Photograph in Routine Operation Mode



Should irregularities be detected in the line pressures, or the system becomes non-functional, a troubleshooting guide is provided prior to Section 1.0 to assist in diagnosing and restarting the system. Repairs and adjustments should be performed by a qualified service technician.

2.2 System Operation: Routine Equipment Maintenance

This system is designed to require minimal routine equipment maintenance, limited to the three in-line vacuum filtration units. A cut sheet for the filtration units is attached as Appendix B.

During periodic site inspections (quarterly at a minimum), the site owner/operator (as the case may be) or consultant will ensure that the system is operating appropriately and will visually inspect the air filters. The filter elements should be cleaned according to manufacturer's instructions or replaced annually (at a minimum) with Solberg Element No. 849. According to the manufacturer, the recommended filters utilize a polyester filtration material which may be cleaned and reused. The polyester element may be washed in warm soapy water, vacuumed, or gently blown out. The element should be dry before reinstallation. The element should be replaced after a maximum of three cleanings. No cleaning frequency is specified.

The in-line filters are located at ceiling level inside the building on the opposite side of the wall from the blowers. In order to access the filters, the owner/operator will need a man lift or ladder.

2.3 System Operation: Non-Routine Equipment Maintenance

Should a non-routine condition occur, the site owner/operator (as the case may be) or consultant will ensure that the system is operating appropriately. Examples of non-routine maintenance activities would be restarting the blowers after a power outage or diagnosing a 10% or greater change in line pressure.

If there is a disruption to the power supply to a blower, the red indicator light will be illuminated and the blower will not be running. The site owner/operator (as the case may be) will restart the blower following the instructions in the troubleshooting guide.

Pressure irregularities of more than 10% at the vapor extraction well gauges would be evidence of some other type of system failure. In this instance, the site owner/operator (as the case may be) will refer to the troubleshooting guide as the starting point to assess the problem. If the pressure irregularity cannot be rectified, or if the system cannot be restarted and run continuously, the owner/operator work with their SSDS design engineer to remedy the failure and discuss the scenario with NYSDEC.

Some diagnostic measures may require that the PVC piping, blowers, or exhaust stacks be physically examined. The PVC piping extends up from ground level up to the ceiling level (about 20 feet above the floor) and then horizontally towards the blowers. It is reasonable to assume that most damage to the piping would occur within 10 feet of the floor, affecting the vertical pipes which are visible from the ground level and accessible with a ladder. Should a significant vacuum pressure change indicate pipe damage that is not visible from the ground level, a more intensive inspection may be needed. A man lift or ladder will be required to access the piping.

The blowers and exhaust stacks are located on an entry roof overhang (see Figure 2). To access this location, a ladder or man lift is required. The exhaust stacks extend above the roofline of the main building, and it is recommended for safety, that the stacks not be examined by standing on the main building but instead accessed via a ladder/lift from the ground or roof overhang.

3.0 Engineering Control System Performance Monitoring

3.1 SSDS Effectiveness Monitoring

A pilot test was performed to assess system effectiveness during the design phase by measuring the capture radius via a network of vacuum monitoring points installed through the floor slab. Results of the pilot test are included in the SSDS Design Report.

Per USEPA, NYSDOH, and NYSDEC vapor intrusion guidance, the SSDS's radius of influence (ROI) is defined as “Acceptable” for areas experiencing a pressure drop of at least 0.004 inches water column (inWC) at the most distant monitoring points with respect to the location of the extraction well. ROI pressure testing results indicated a ROI range between 75 and 200 feet beyond the EWs at this site. EWs were tested during the pilot study and have been incorporated into the final system design; therefore, ROI testing is not scheduled to be repeated.

System effectiveness can be indirectly assessed routinely by assuring that the gauge vacuum readings are normal (within 10% of normal ranges).

3.2 Monitoring Schedule

Monitoring will be performed periodically according to the schedule in Table 1. Inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or non-routine maintenance may take place when a suspected power disruption or failure of the SSDS has been reported or some condition occurs within the building that is deemed likely to affect the operation of the system.

Table 1 Monitoring Schedule for the SSDS

Action	Frequency
Routine inspection and system readings (extraction well pressure)	Quarterly during active site interim remedial measures and/or remedial actions. Annually after active remedial activities are terminated.

3.3 General Equipment Monitoring

A visual inspection of the complete system will be conducted during periodic monitoring events. SSDS components to be monitored include, but are not limited to, the following:

- vacuum blower,
- in-line filters
- controls, and
- general system piping.

A complete list of components to be checked is provided in the Inspection Checklist presented in Appendix C. If any equipment readings are not within their typical range, equipment is observed to be malfunctioning, or the system is not performing within specifications, then maintenance and repair as per this OM&M Plan are required immediately. Following maintenance or repair, the SSDS will be restarted.

3.4 System Monitoring Devices and Alarms

The SSDS control panel contains red and green indicator lights (see photograph in the Quick Reference Guide). A green "System On" light for each blower is illuminated during normal operation. If a red indicator light is on, it indicates that a blower is not operating. If any red lights are illuminated or no lights are illuminated, the contingency response plan is that the site owner/operator (as the case may be) will check and inspect the SSDS to determine if it is functioning and/or if any light bulbs need replaced. If no lights are illuminated, it potentially means that the main power switch is off at the control panel or power is not reaching the control panel.

If the system is non-functional, the site owner/operator (as the case may be) will refer to the troubleshooting guide at the beginning of this document to attempt to diagnose and restart the system. If the system remains non-functional, the site owner/operator will work with their SSDS design engineer to assess and repair the system. Operational problems will be noted in the subsequent BCP progress report or Periodic Review Report, as appropriate.

There are no audible alarms on this SSDS system. If a blower is not functioning in the AUTO position, the red indicator light will illuminate on the control panel. The control panel must be visually inspected and pressure readings manually taken at the vapor extraction wells to determine if the system is functioning properly.

3.5 Sampling Event Protocol

Extraction wells will be checked to confirm that pressure readings are 35± inWC at each well. Readings that deviate greater than 10% from 35 inWC should be compared to historical data to verify consistent operational pressures and to identify possible maintenance issues (e.g. dirty filter).

4.0 Maintenance and Performance Monitoring Reporting Requirements

Maintenance reports and any other information generated during regular operations at the site will be kept on-file on site. Table 2 presents a maintenance schedule for the SSDS. All reports, forms, and other relevant information generated will be available upon request to the NYSDEC.

Table 2 Maintenance Schedule for the SSDS

Action	Frequency
Clean Exhaust Stack	As Needed
Replace Indicator Light Bulb	As Needed
Clean/Service Blower	As Needed
Clean or Replace Air Filter Elements	As needed, Annually

4.1 Routine Maintenance Reports

Checklists or forms will be completed during each routine maintenance event. Checklists/forms will include, but not be limited to the following information:

- Date;
- Name, company, and position of person(s) conducting maintenance activities;
- Maintenance activities conducted;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc. (attached to the checklist/form).

4.2 Non-Routine Maintenance Reports

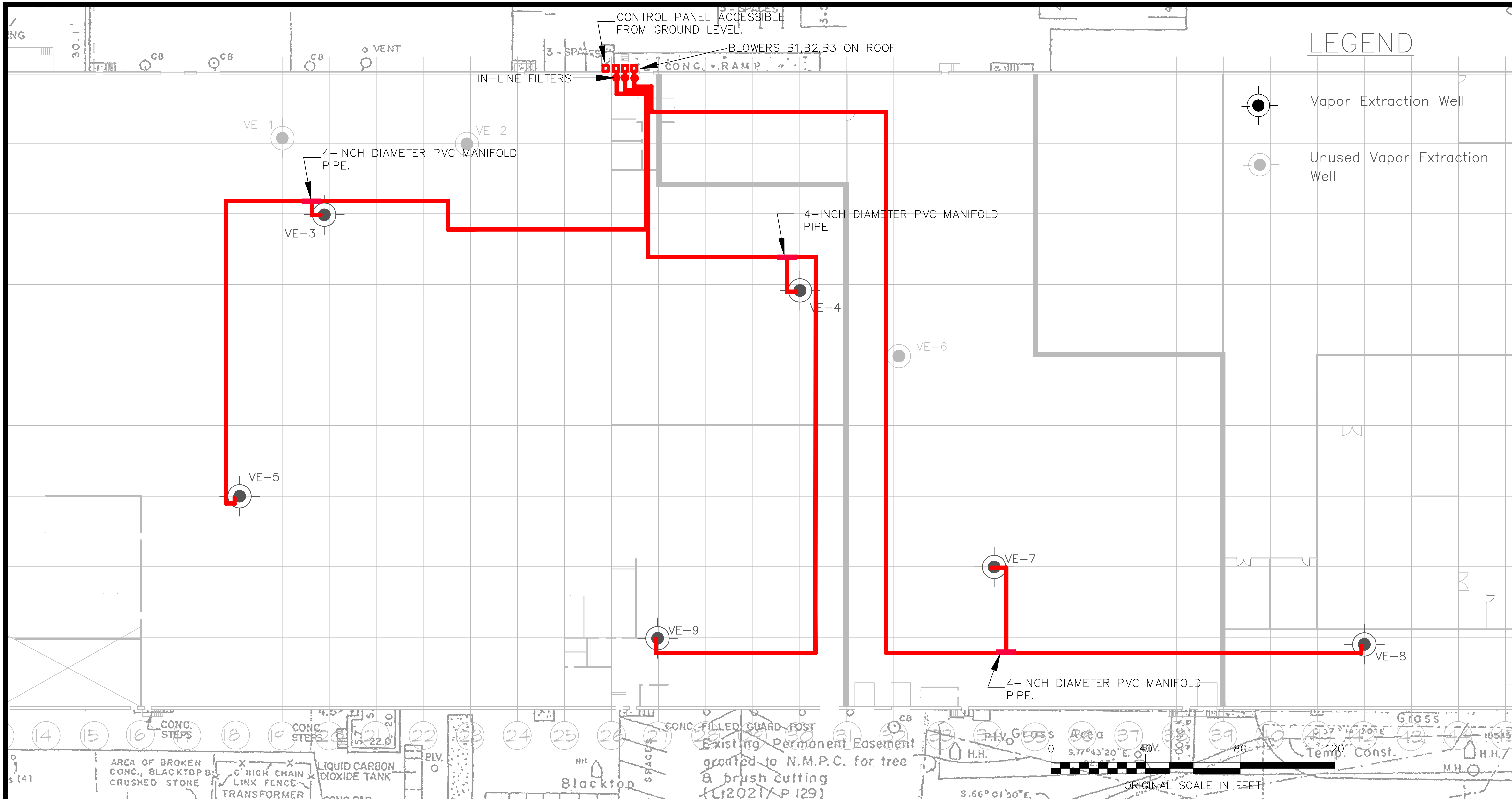
During each non-routine maintenance event, a form will be completed which will include, but not be limited to, the following information:

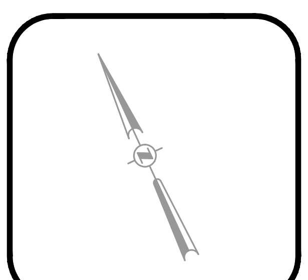
- Date;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Presence of leaks;
- Date of leak repair;

- Other repairs or adjustments made to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Figures

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\SSDS_FIGS_90618-00.DWG   Date Printed: Aug 22, 2011, 4:32pm





CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

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Troy, New York 12180
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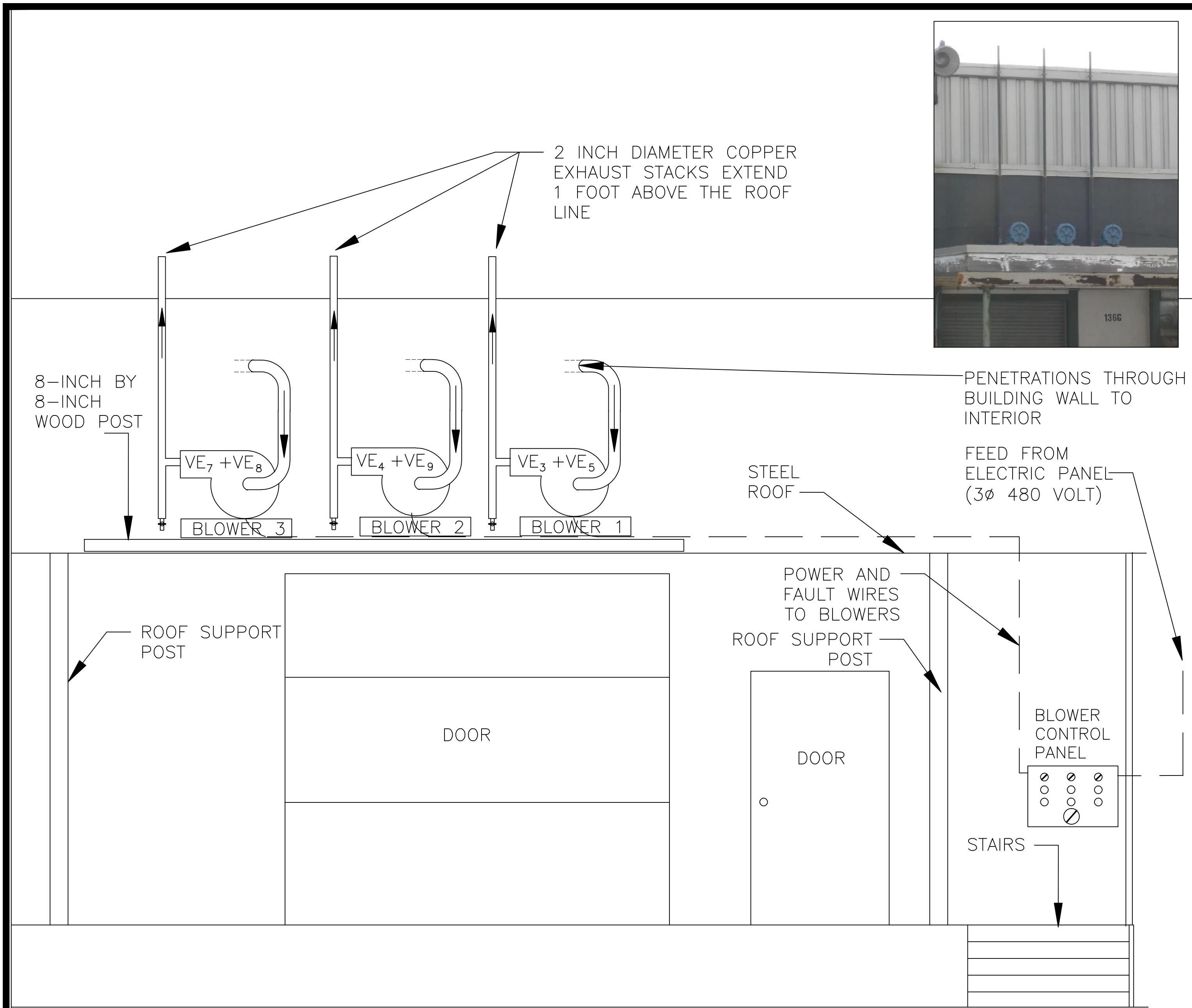
North Country Office:
100 Glen Street
Glens Falls, New York 12801
Phone: (518) 812-0513

136 FULLER ROAD PROPERTY

SSDS PIPE AND MANIFOLD ROUTING PLAN

CITY OF ALBANY, ALBANY CO. NEW YORK

drawn	checked
CSD	DPM
date	scale
8/22/11	1"=40'
project no.	
90618.00	
sheet no.	
FIGURE 1	



NOTES:

- BLOWER CONTROL PANEL INCLUDES "ON" / "OFF" / "AUTO" CONTROLS.
- FAULT LIGHTS LOCATED ON THE BLOWER CONTROL PANEL ARE WIRED TO ILLUMINATE IF FAULT OCCURS.
- ◄—— AIRFLOW DIRECTION

ALTERATION OF THIS DRAWING, EXCEPT BY A LICENSED P.E. IS ILLEGAL. ANY ALTERATION BY A P.E. MUST BE INDICATED AND BEAR THE APPROPRIATE SEAL, SIGNATURE AND DATE OF ALTERATION.

NOTE: FIGURE IS NOT TO SCALE

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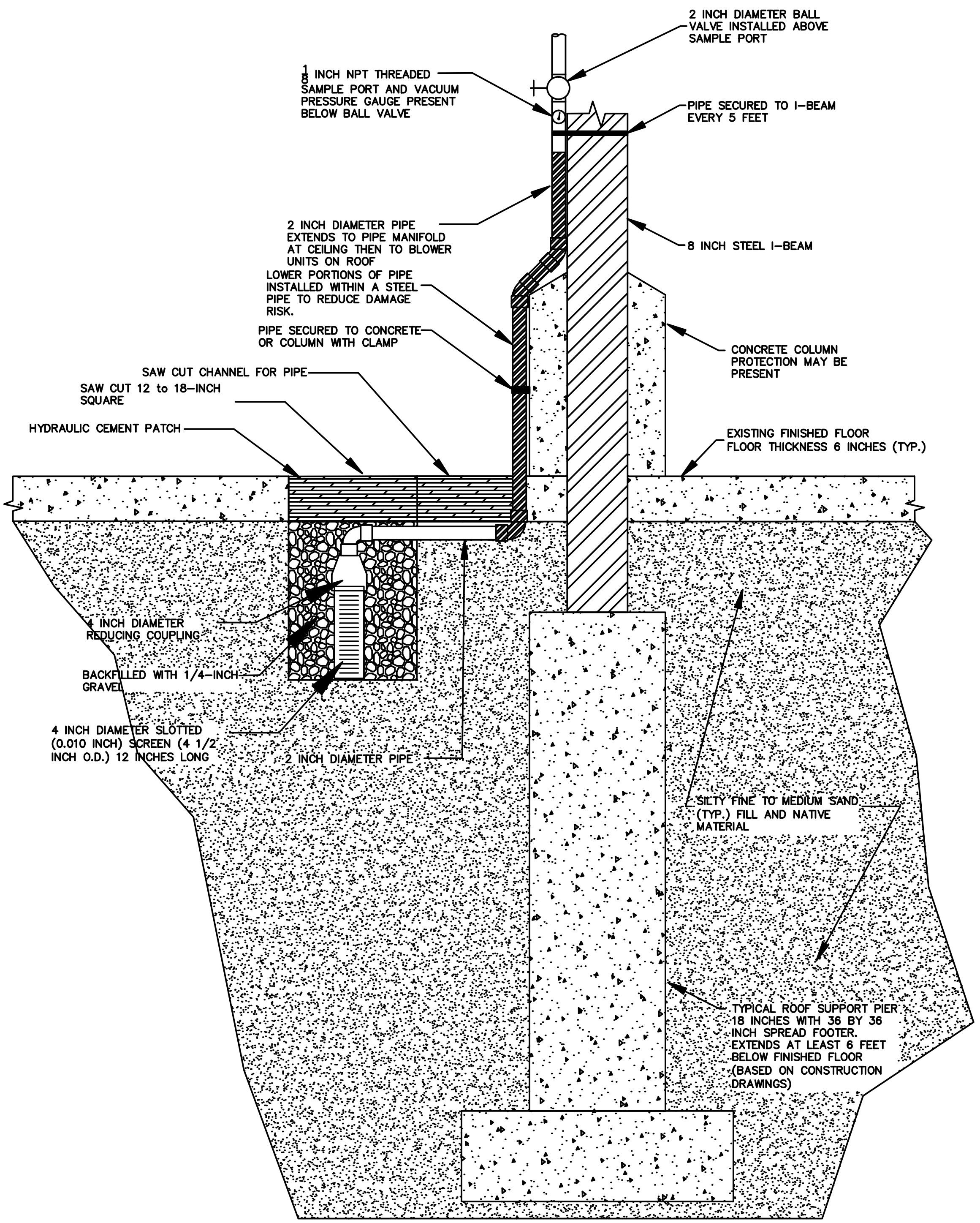
136 FULLER ROAD PROPERTY

BLOWER AND CONTROLS SCHEMATIC

CITY OF ALBANY, ALBANY COUNTY, NEW YORK

drawn	checked
CSD	ASM
date	scale
2/20/12	N.T.S
project no. 90618.00	
sheet no. FIGURE 2	

Drawing Name: S:\9\90600-90699\90618_00\ENV\RI Work Plan\Draft RI AAR Work Plan\HASP and IRM Backup files\FIG04_90618-00_As Built piping.dwg Date Printed:



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136 FULLER ROAD PROPERTY

TYPICAL VAPOR EXTRACTION POINT CONSTRUCTION DETAIL

CITY OF ALBANY, ALBANY CO., NY

drawn	checked
CSD	DPM
date	scale
6/23/11	NTS
project no.	
90618.00	
sheet no.	
FIGURE 3	

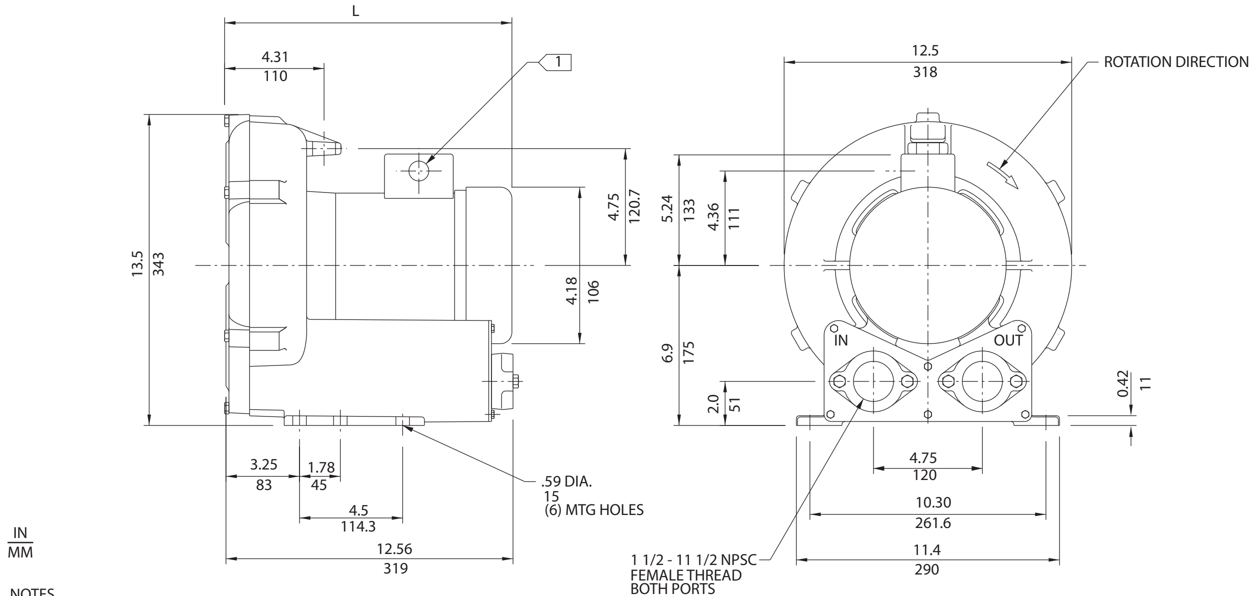
Drawing Name: S:\9\90600-90699\90618_00\ENV\RI Work Plan\Draft RI AAR Work Plan\HASP and IRM Backup files\FIG02-VAPOR WELL DETAIL as built.dwg Date Printed:

Appendix A:

Ametek Rotron 1.5-HP Blower Cut Sheet

DR 454 & CP 454

1.5 HP Regenerative Blower



NOTES
1. TERMINAL BOX CONNECTOR HOLE .88 (22) DIA.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

MODEL	L (IN/MM)
DR454R58M	14.47/367
DR454R72M	13.31/338

		Part/Model Number			
		DR454R58M	DR454R72M	DR454R86M	CP454EZ72MLR
Specification	Units	080481	080480	080482	080491
Motor Enclosure - Shaft Mtl.	-	TEFC - CS	TEFC - CS	TEFC - CS	Chem TEFC -SS
Horsepower	-	1.5	1.5	1.5	1.5
Voltage	AC	115/230	230/460	575	230/460
Phase - Frequency	-	Single - 50/60 Hz	Three - 50/60 Hz	Three - 50/60 Hz	Three - 50/60 Hz
Insulation Class	-	F	F	F	F
NEMA Rated Motor Amps	Amps (A)	15.6/7.8	4.6/2.3	1.8	4.6/2.3
Service Factor	-	1.15	1.15	1.15	1.15
Max. Blower Amps	Amps (A)	18/9	5.2/2.6	2.1	5.2/2.6
Locked Rotor Amps	Amps (A)	84/42	32/16	12.8	32/16
NEMA Starter Size	-	1/0	00/00	00	00/00
Shipping Weight	Lbs	73	60	60	60
	Kg	33.1	27.2	27.2	27.2

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

AMETEK TECHNICAL & INDUSTRIAL PRODUCTS
75 North Street, Saugerties, NY 12477
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Customer Service Fax: +1 215.256.1338
www.ametektip.com

AMETEK® TECHNICAL & INDUSTRIAL PRODUCTS

Industrial / Chemical Processing Blowers

DR 454 & CP 454

ROTRON®

1.5 HP Regenerative Blower

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- CE compliant - Declaration of Conformity on file
- Maximum flow: 120 SCFM
- Maximum pressure: 65 IWG
- Maximum vacuum: 60 IWG
- Standard motor: 1.5 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

MOTOR OPTIONS

- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

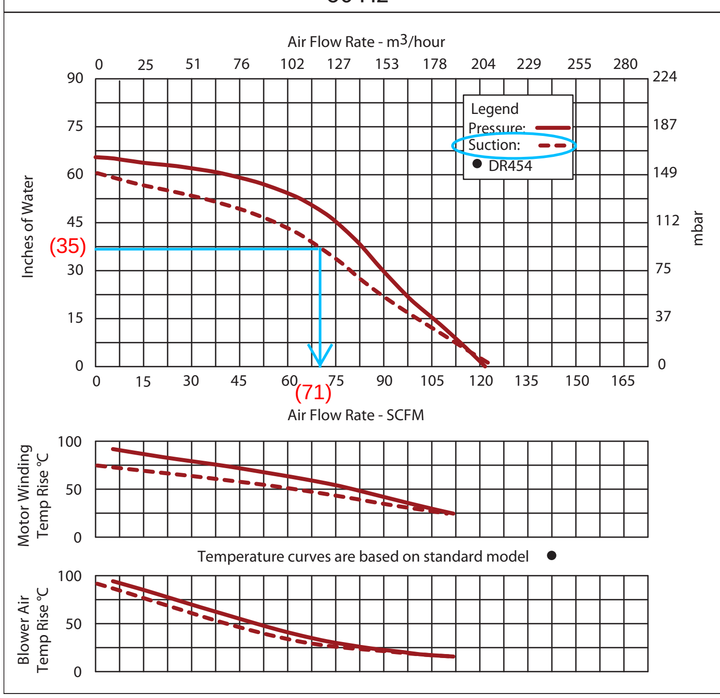
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES

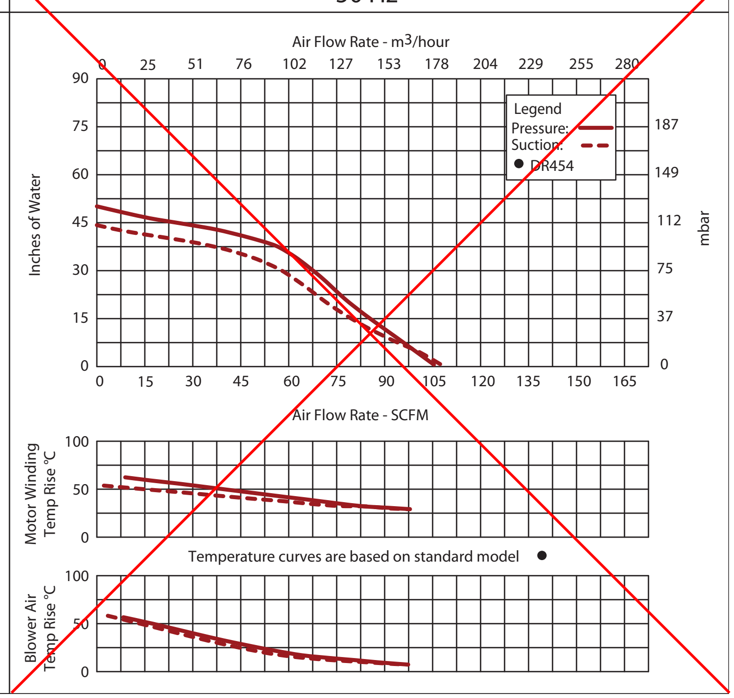
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

Blower Performance at Standard Conditions

60 Hz



50 Hz



This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

Appendix B:

Solberg Inlet Vacuum Filter Cut Sheet

Small Compact Inlet Vacuum Filters

"CSL" Series 3/8" - 3" FPT

APPLICATIONS & EQUIPMENT

- Vacuum Pumps & Systems – P.D., Side Channel, Rotary Vane, Screw, Piston
- Vacuum Packaging Equipment
- Vacuum Lifters
- Blowers - Side Channel & P.D.
- Intake Suction Filters
- Pneumatic Conveying Systems
- Soil Venting/Remediation
- Remote Installations for Piston & Screw Compressors
- Printing Industry
- Factory Automation Equip
- Leak Detection Systems
- Woodworking
- Medical Industry

FEATURES & SPECIFICATIONS

- **Vacuum level**: Typically $1x10^{-3}$ mmHg ($1.3x10^{-3}$ mbar)
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Brazed fittings for **High** vacuum duty
- Stainless steel torsion clips for durability
- Low pressure drop
- Positive engagement O-ring seal system
- Seamless drawn housings
- **Large** dirt holding capacity and **Easy** field cleaning, especially when mounted horizontally or inverted
- Rugged all steel construction w/baked enamel finish
- Various media
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10" - 15" H_2O over initial delta P
- Pressure drop graphs available upon request

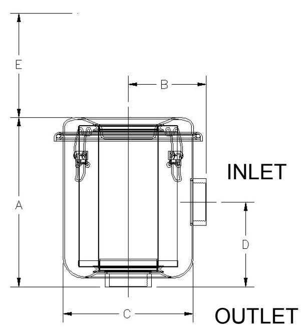
INLET VACUUM FILTERS
CSL, ST, CT, VL, VS, LRS Series

OPTIONS (Inquiries Encouraged)

- Vacuum gauge available
- Dome hood for high holding capacity
- Available in ***Stainless Steel***
- Epoxy coated housings
- Activated carbon prefilter for odor
- Support brackets
- Alternate top-to-canister fastening system for low pressure or pulsating systems

CONFIGURATION

DRAWING



Dimension tolerance ± 1/4"

I = Industrial Duty   S = Severe Duty

	with Polyester Element	with Paper Element	FPT Inlet & Outlet	DIMENSIONS - inches A	B	C	D	E	Rated Flow SCFM Nominal Rating	Element Rating	Approx. Wt. lbs
I	CSL-825-039HC	CSL-824-039HC	3/8"	3 5/8	2 1/4	3 3/4	1 7/8	3	18	25	0.88
I	CSL-825-050HC	CSL-824-050HC	1/2"	3 5/8	2 1/4	3 3/4	1 7/8	3	18	25	0.88
I	CSL-843-050HC	CSL-842-050HC	1/2"	4 3/8	3	5 7/8	2 1/2	3 1/4	20	55	3
I	CSL-825-075HC	CSL-824-075HC	3/4"	3 3/4	2 1/4	3 3/4	1 7/8	3	24	25	0.88
S	CSL-843-075HC	CSL-842-075HC	3/4"	4 3/8	3	5 7/8	2 1/2	3 1/4	25	55	3
I	CSL-843-100HC	CSL-842-100HC	1"	4 3/8	3 1/4	5 7/8	2 5/8	3 1/4	35	55	3
S	CSL-849-100HC	CSL-848-100HC	1"	6 3/4	4 1/8	7 5/16	4 1/2	5 1/4	40	115	5
I	CSL-843-125HC	CSL-842-125HC	1 1/4"	4 3/8	3 1/4	5 7/8	2 5/8	3 1/4	55	55	3
S	CSL-849-125HC	CSL-848-125HC	1 1/4"	6 3/4	4 1/8	7 5/16	4 1/2	5 1/4	60	115	5
I	CSL-849-150HC	CSL-848-150HC	1 1/2"	6 3/4	4 1/8	7 5/16	4 1/2	5 1/4	80	115	5
I	CSL-851-200HC	CSL-850-200HC	2"	10 1/4	4 9/16	8 3/4	5	9 1/4	175	290	15
I	CSL-851-250HC	CSL-850-250HC	2 1/2"	10 1/2	5 1/8	8 3/4	5 1/2	9 1/4	210	290	15
I	CSL-239-300C*	CSL-238-300C*	3"	15 3/4	8 7/8	13 1/4	8 3/4	11	300	570	33

*1/4" taps standard on inlet and outlet

Note: Model offerings and design parameters may change without notice.

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E-mail: sales@solbergmfg.com • Web Site: www.solbergmfg.com

Appendix C:

SSDS Inspection Checklist

136 Fuller Road BCP Site
SSDS Inspection Worksheet

Date:	**Inspector:**		
Company:	**Title:**		
	Yes	**No**	**General Comments/Notes**
Is the system running normally?			
Is the indicator light functioning?			
Is the electrical/ control panel secure (locked)?			
Do the inlet pipes feel cool/cold to the touch?			
Do the outlet pipes feel warm but not hot?			
Are the stacks clear and evenly discharging air?			
Is there any water being exhausted from the stacks?			
Does the effluent air have any noticeable odor?			
Do the blowers feel warm but not hot?			
Do the blowers sound as if they are running smoothly?			
Is there any damage to the PVC piping visible from ground level?			

System Readings

	Blower 1			***Blower 2***			***Blower 3***		
	VE-3	VE-5	Blower 1	VE-4	VE-9	Blower 2	VE-7	VE-8	Blower 3
Time									
Pressure (inWC)			--			--			--
Within 10% of 35 inWC (31.5 - 38.5)?			--			--			--
Change in pressure from previous monitoring event			--			--			--
In-line filter element condition									

List and describe any maintenance activities performed (note any system repairs, modifications):

Attach, where appropriate, photographs and/or sketches showing the approximate location of any problems or incidents noted.

Attach, where appropriate, other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc.

Appendix H

High Vacuum Extraction (HVE) System Operation, Maintenance, and Monitoring Plan

High Vacuum Extraction (HVE) System/Soil Vapor Extraction (SVE) System Operation, Maintenance, and Monitoring Plan

136 Fuller Road Site

Brownfield Cleanup Program

NYSDEC Site No. C401055

City of Albany

Albany County, New York

February 2013

Chazen Project No. 90618.00

Engineers
Environmental Professionals
Land Surveyors
Landscape Architects
Planners

Prepared for:

Fuller Partners, LLC
PO Box 370
133 Route 395
East Chatham, NY 12060

New York State Department of Environmental Conservation – Region 4
1130 N. Westcott Road
Schenectady, New York

Prepared by:

Capital District Office:
The Chazen Companies
547 River Street
Troy, New York 12180

TABLE OF CONTENTS

1.0 COMPONENT MONITORING AND MAINTENANCE

As indicated in Section 4: Operation and Maintenance Plan of the Site Management Plan (SMP), this HVE/SVE Operation, Maintenance and Monitoring (OM&M) Plan is not intended as a stand-alone document, but as a component document (Appendix H) of the SMP. Documents in the SMP that support this HVE/SVE OM&M Plan include the Health and Safety Plan, Emergency Contact List, QA Project Plan (sampling), and related maintenance of the source cover/perimeter drain system.

This Operation, Maintenance and Monitoring (OM&M) Plan describes the measures necessary to operate, monitor, and maintain the mechanical components of High Vacuum Extraction (HVE) and Soil Vapor Extraction (SVE) contaminant recovery system installed at this site.

This OM&M Plan:

- Will be updated as needed to reflect changes in site conditions or the manner in which the HVE/SVE is operated and maintained.
- A copy of this OM&M Plan will be kept in the HVE/SVE trailer at the site.

The HVE/SVE contaminant recovery system is in place on the site in the contaminant volatile organic compound (VOC) source area, and was installed to extract the VOCs from the subsurface soil and shallow groundwater matrices in this area. The May, 2011 Design Report for this IRM was approved by NYSDEC and NYSDOH on May 20, 2011. Construction of the HVE/SVE system at the site was completed in March 2011 in conformance with the design specifications. Following NYSDEC's verbal approval of the Work Plan, the HVE/SVE system pilot test phase was started on March 10, 2011. This plan provides typical operational information and a monitoring plan for the system efficiency and the cleanup progress in the source area as an addendum to the Site Management Plan.

The system was installed and operated in two steps. An initial "pilot system" was installed and operated from March of 2011 through August of 2011 and was consistently monitored and maintained to determine the effectiveness of this type of on-site, in-situ system. The pilot system was discontinued in November of 2011 following the failure of the HVE pump during a series of storms. A second treatment system with a larger vacuum recovery pump and a shallow tray air stripping tower in place of the original liquid phase carbon final water treatment system was installed in November of 2011 and has been operating since mid-November of 2011, with a few short-term interruptions for repair and maintenance. This plan is updated with information specific to the system currently in place, which supersedes the original pilot system used for the approved engineering design.

1.1 General System Maintenance

The extraction system consists of two general treatment processes, a total fluids extraction system (referred to as an HVE system in the remainder of this report) and an SVE System. The main components and controls for the system are contained within a 20-foot long and 8-foot wide fully enclosed steel cargo trailer. Air (or vapor), groundwater and non-aqueous phase liquid (NAPL) contaminants present within the subsurface are drawn through a series of 4-inch diameter drilled recovery wells (locations and configuration of recovery wells are depicted on Figures 1, 2 and 3), separated into vapor and aqueous phases, and treated and discharged. The vapor phase is discharged through a common 6-inch diameter discharge stack that extends above the building roofline. The aqueous phase is treated until it becomes clean to moderately clean water, and is then discharged to the sanitary sewer. Aqueous phase treatment includes an oil/water separator, then a bag filter, and then a shallow tray air stripper before being discharged to the sanitary sewer for final treatment and disposal through the Albany County Wastewater Treatment Plant. System influent and effluent water and effluent air/vapor quality is monitored monthly to measure and document changes in contaminant recovery rates and to ensure compliance with approved discharge limits.

This system is typically inspected, monitored and maintained two to three times per week by a systems operator. Remote telemetry access is provided through telephone data lines and through a PLC (programmable logic controlled) programmable operating system interface. The telemetry allows for monitoring and remote observation of the system status (e.g., alarm conditions such as high water limits in the separator tanks or air stripper sump, pressures above set limits, and low oil conditions in the liquid ring pump). The telemetry connection also allows for a remote shut down of the system as a safety when problems are indicated.

Critical operating conditions within the treatment system are monitored continuously via pressure and temperature sensors that are connected to the PLC controller. If system critical conditions such as water levels reaching a pre-set High High Limit in the separator tanks or excessively high or low pressures in the air stripper (suggesting a clogged condition or a leak or blower failure), or low oil in conditions in the liquid ring pump, the system is programmed to automatically initiate a controlled system shut down and send a warning fax to the system operator. The operator then visits the system, determines why the critical limits were reached and repairs or maintains the system before re-starting it. These system controls ensure that contaminated liquid levels do not reach overflow conditions and also protect the various pumps within the system from failing when operating at critical levels. Re-starting of the system is initiated by the system operator in a controlled re-start through the PLC controller.

The trailer is a fully enclosed steel box unit with locked entry doors. All exterior components including the system controls and vacuum manifolds are secured within locked enclosures to prevent tampering or accidental contact with electrical or high vacuum pump connections. An emergency trailer power disconnect is located on the building exterior wall near the control end of the trailer. If there is some type of condition where the operator can not get to the trailer in time to shut it down through normal controls, the electrical disconnect can be used by others to immediately power down the entire trailer system, resulting in a complete system shutdown. Ancillary piping is secured underground or within sealed wooden surface enclosures to protect it from the elements and provide security from tampering or accidental damage. Exterior recovery wells are secured in steel road boxes with bolted lids. Interior recovery wells are located in the UltrePET manufacturing area which is secured from public access.

1.2 HVE and SVE System Monitoring and Maintenance

1.2.1 SVE System O&M

The SVE system consists of an intake manifold and piping, an in-line particulate filter and a 3-Horsepower regenerative vacuum blower. The only maintenance required on this system is periodic inspection of the in-line filter and to change it if it becomes fouled. Repair of broken piping or of the blower, if it fails, are the other possible system maintenance items.

1.2.2 HVE System O&M

The HVE system produces high levels of vacuum within the configured recovery wells by means of an oil-filled liquid ring vacuum pump, to remove a combination of groundwater, NAPL and soil vapor from the high vacuum (Hi-VAC) wells. Along with groundwater, the system also evacuates both dense and light NAPL that may be initially present or later accumulate in the recovery wells, and a steady flow of air or VOC-contaminated soil vapor from the unsaturated soil around the recovery wells.

The extracted liquid/water phase is initially pumped through an oil/water separator to separate and contain suspended solids and NAPL (un-dissolved petroleum oils and chlorinated solvents), then a 25-micron bag filter is used to remove very fine suspended solids. The filtered water is then pumped through a shallow tray air stripper to reduce dissolved VOC contaminant concentrations. From the air stripper, treated water is then discharged to the municipal sanitary sewer. The air or vapor phase from this system is discharged to the atmosphere through a common discharge stack which extends approximately 27 feet above the ground and also between 2 and 3 feet above the site building's roofline.

The HVE system consists of the following general components, which are also depicted, in a piping and instrumentation diagram included as Figure 4 and a treatment trailer system layout drawing included as Figure 5. Appendix A provides more detailed information about the system components. Item numbers indicated below are consistent with the item ID numbers indicated on these two figures.

Recovery wells, piping and manifolds (exterior to trailer):

The recovery wells are connected to intake manifolds at the trailer using flexible hoses and camlock fittings, that are accessed within a locked/enclosed exterior enclosure on the trailer. The manifold system is designed with shut-off valves and connections for both the HVE and SVE for each of the nine recovery wells. At any time, a flexible hose can be disconnected and moved from one side of the manifold to the other side, thereby converting SVE wells to HVE wells or HVE wells to SVE wells. Additional efforts to complete the change between HVE and SVE systems in the exterior well configuration are also necessary, and include removal or placement of a drop tube when the system is set up for HVE (drop tube removed for SVE operations). Interior recovery wells (RW-1 and RW-3) are set up as SVE wells and interior well RW-2 is set up as an HVE well. Additional minor hard plumbing changes would be required to convert these three wells.

Maintenance for these system components is minimal and consists only of general observation/inspection on a routine basis and repair, if any of the components are damaged or become fatigued from wear. No other maintenance is required on these items.

Cyclone Phase separator/silencer (01): A cyclone separator/silencer exists where the influent vacuum manifold from the recovery wells enters the system. Appendix B includes a drawing for the separator/silencer. Liquids are separated from the air component extracted from the recovery wells with the high vacuum created by the HVE liquid ring vacuum pump. This separator unit utilizes cyclonic separation technology to separate liquids and solids from the combined influent of total fluids, solids (silt), groundwater and air/vapor extracted in the combined vacuum flow from the recovery wells. Liquids and solids are separated by cyclonic action and settle into a sump in the separator and are then pumped in batched intervals to the oil/water separator. Vapor/air is constantly evacuated from the top of the separator via the vacuum flow created by the liquid ring vacuum pump.

> **Maintenance**: The phase separator tank is checked weekly for proper operation. Maintenance on this tank may include cleaning the sight tube and level control sensor assembly, if fouled by NAPL, sediments, or bacterial growth. Fouling material, if present are removed via manual cleaning methods and placed in waste drums for disposal. No other routine maintenance of this separator unit is normally required.

A Liquid Ring Pump (02) creates the vacuum to extract liquids and vapors from the recovery wells. The liquid ring vacuum pump used in this system is a Travaini oil liquid ring pump (LRP), which is powered by a 25-Hp electric motor. A system vacuum of between 10 and 12 inches of mercury at an air flow rate of between 400 and 500 cubic feet per minute is used to extract/evacuate vapor, groundwater and NAPL from a series of seven recovery wells. This pump continuously runs to evacuate these media and is only shut down for short term maintenance or repair activities. Appendix C includes manufacturer supplied details on the LRP system and its maintenance.

> **Maintenance**: Maintenance of this LRP includes the following:
> - Periodic addition of synthetic vacuum oil to the pump oil reservoir, as needed (small quantities of the pump oil are consumed over time).
> - Monitoring of motor electrical current draw and pump operating temperatures and pressures,
> - Replacement, if/when necessary of a de-misting filter designed to filter and recover the synthetic pump vacuum oil from the pump air discharge.
> - General monitoring and adjustments to the pump control systems.

Liquid Transfer Pumps (03, 05 and 09) are present to pump the extracted groundwater and NAPL from the phase separator tank into the oil/water separator (OWS), from the OWS through a bag filter assembly and then on to the air stripper, and finally from the air stripper sump to the sanitary sewer.

> **Maintenance:** The transfer pumps are checked at each visit for proper pumping by verifying at least one complete cycle run. Pumps may be periodically adjusted to provide correct system flow rates. Pumps may also lose prime and have to be re-primed if the level controllers do not function properly allowing air into the pump lines. No other normal maintenance is required on the transfer pumps. If pumps fail, they are replaced or repaired.

Oil/Water Separator Tank (04): The OWS separates free phase light and dense NAPL and suspended solids from the water, and retains them within the separator tank while allowing the water phase to pass through. The OWS is a gravity flow-through system in which combined liquid waste is pumped into the inlet of the separator and passes through a series of vertical baffles which separate and detain floating NAPL, and also allow suspended solids and dense NAPL to settle out into the bottom of the primary chamber as a result of reduced flow velocity. A secondary chamber is present at the end of the separator where water from the central/low depth of the primary chamber (below floating NAPL and above settled sediments and DNAPL) is allowed to flow by gravitational head pressure into the final chamber. When water in the secondary chamber reaches a pre-set high limit, a level sensor turns on a transfer pump (map component item 05) and pumps the water through a bag filter to the shallow tray air stripping unit.

Maintenance: The primary chamber sump areas and baffle plates in the OWS are routinely cleaned (weekly) to remove accumulated sediment, bacterial accumulation and light or dense NAPL. These wastes are removed from the OWS using manual cleaning methods and are placed in drums as maintenance waste for off-site disposal.

Bag Filter (06): Water from the OWS is pumped through a bag filter unit. This filter contains a 7-inch diameter by 31-inch long 25-micron polyester fabric filter bag, which is used to filter/remove residual suspended solids, which may still be suspended in water after it passes through the OWS.

Maintenance: The filter bags are removed and replaced as necessary, which is dependent on the clarity of the water that flows from the OWS. Typically, the filter bags are replaced between two and four times per month. Filter bags contain oily and bacterial waste, which may also have a chlorinated VOC component, and so are containerized in drums with the oil/water waste removed from the OWS. These wastes are characterized for off-site disposal. Periodically, this filter assembly is completely evacuated and cleaned to ensure proper operation. A pressure gauge showing the inlet pressure to the filter is monitored to evaluate when the filter should be serviced, as the inlet pressure increases when the filter begins to accumulate waste and become increasingly fouled.

Shallow Tray Air Stripper and Blower (07 and 08): The final water/aqueous phase treatment component of the trailer system is a shallow tray air stripper (AS), which is used to remove as much of the dissolved VOC contaminants as possible from the contaminated liquid before it is discharged to the sanitary sewer. Water that has passed through the OWS and the bag filter is then pumped into the top tray of a shallow tray air stripper unit. The unit is configured with four 10-inch deep stripping trays that are 2-feet wide by 4-feet long with small diameter holes in the tray bottoms. Appendix D includes a drawing of the air stripper system. A demisting filter is at the top discharge point and a sump basin for treated water is at the bottom. A regenerative blower (map component item 07) supplying approximately 300 - 350 CFM of clean ambient air is used to create a flow of pressurized clean air into the bottom tray/sump area of the AS unit. The air is forced up through the system trays as the influent water cascades down through holes in the tray bottoms. This process creates a frothed water condition with maximizes surface area of the water over which air is forced under pressure to volatilize VOCs from the aqueous dissolved phase to the vapor/air phase. The volatized vapor phase VOCs are then forced out of the AS through a vent on the top of the stripper unit and discharged from the trailer with other VOCs to the atmosphere, through a combined air discharge stack.

As the water cascades through the shallow trays to a bottom sump area, it is treated step-by-step in a series of trays by incrementally and continuously increased removal of dissolved VOCs from the water with additional removal in each descending tray. Treated water (which may contain trace levels of

VOCs) accumulates in the AS sump and is pumped from the AS sump and discharged to the sanitary sewer for final treatment and disposal through the Albany County Wastewater Treatment Plant. To date, the AS process has effectively removed VOCs in groundwater to well below the approved limit for discharge to the sewer.

Maintenance: Weekly maintenance of this system generally includes cleaning the liquid level sensors in the sump basin to ensure proper electrical contact with the water, cleaning the sight tube chamber and repairing or replacing fatigued or damaged gasket seals between tray sections.

In general, this air stripper tower will be cleaned on average, twice per year. This frequency is based on the observed performance conditions to date.
Routine maintenance of this air stripper will be performed to ensure the proper operation and air pressure output of the blower unit, to clean and maintain the sump water level sensors and sight tube which control the pumping of the sump basin, and to monitor air flow and air pressure within the tower to ensure that it is free of excessive blockage from the contaminant and mineral residue and settlement of particulates.

Cleaning and maintenance of the shallow tray air stripper is covered in the Appendix D O&M Manual and generally includes the separation of tray sections and the manual removal of residue within the trays and mist filter and sump area. Solid and liquid wastes from the stripper are drummed with other system waste removed from the oil/water separator and bag filter systems. Accumulated waste is then characterized for disposal and removed from the site by a licensed hauler to a licensed off-site treatment or disposal facility.

2.0 O&M WASTE STORAGE and DISPOSAL

Waste generated as a result of the operations and maintenance of the HVE/SVE system is secured in sealed 55-gallon drums and is periodically sampled for characterization and off-site disposal. This waste contains groundwater with dissolved VOCs, petroleum NAPL, waste bag filters, and sediment, bacterial and mineral deposits from within the oil/water separator, the bag filter assembly and the shallow tray air stripper. Characterization of all waste generated to date has indicated that it is not a characteristic hazardous waste and it has therefore been treated and disposed of as solid waste at an off-site licensed treatment/disposal facility. Copies of waste disposal manifest information for wastes generated and disposed of to date is included in Appendix E.

3.0 SYSTEM QUALITY MONITORING

The system vapor flow is monitored at least once per week for the following:

- Air flow rate (cubic feet per minute) will be measured using an anemometer airflow gauge.
- Vacuum pressure

- Pump operating temperatures, oil levels and general operating conditions
- Functionality of level control sensors (cleaned as needed)
- Vapor concentrations from influent and effluent transfer pipes with a PID
- Average groundwater flow rates and the quantity of groundwater extracted and treated since the prior monitoring visit.

Field data sheets are maintained and used to generate a monthly system status report which, combined with laboratory sample analysis data, is used to evaluate the extraction performance of the system and to ensure that discharge concentrations are maintained at or below the approved limits.

Once per month, samples are collected for laboratory analysis of total fluids influent and effluent, and of the air effluent at the discharge stack. Descriptions of these samples and their collection methods are provided in Sections 3.1 and 3.2. The results of system monitoring and sampling are also evaluated to optimize the performance of the extraction system and to make decisions about configuring recovery wells to balance conditions in the treatment area. Configurations of the HVE and SVE well locations and flow rates may be periodically changed based on observed performance. System changes are recorded in field records.

3.1 Off-Gas Treatment Monitoring

Effluent air stream samples are collected from sampling ports in the vapor treatment system piping and screened for VOCs using a photoionization detector (PID). PID monitoring will continue to be conducted during weekly monitoring events while the system is operating. In addition, a monthly effluent air sample is collected from the effluent pipe at the discharge stack. The sample is collected using a Tedlar sampling bag and submitted to an ELAP-certified environmental testing laboratory for analysis of total VOCs by Method TO-15. Sample results are compared to the 0.5 pounds per hour action level established for this project to ensure compliance with this discharge limit. The laboratory data is also used to confirm the results of field screening, to demonstrate changes in the removal rates, and ultimately to determine when the system has sufficiently reduced VOC concentrations in the source area, to the extent practicable, so that the system operations can be discontinued when the source area is sufficiently mitigated.

3.2 Liquid Treatment Monitoring

Water treatment monitoring is performed by collecting influent and effluent water samples. These data are used to demonstrate the constituents being removed from the site subsurface (influent) and the quality of water being discharged to the sanitary sewer system (effluent).

The influent sample is collected from HVE transfer piping (between the cyclone phase separator and the OWS). The treated effluent water is sampled before it is discharged to the sanitary sewer. These liquid/water samples are submitted to an ELAP-certified analytical testing laboratory and are analyzed for total VOCs by EPA Method 8260. Sample results are compared to the 5 parts per million discharge concentration limit established for this project.

3.3 Groundwater Monitoring

Consistent with the Site Management Plan, selected productive monitoring wells in the treatment area are gauged quarterly and groundwater samples are collected and submitted to an analytical laboratory for VOC analysis via EPA Method 8260. Groundwater monitoring quality results document the progress of the treatment and will ultimately be used to determine when the system is no longer beneficial for gross removal of contaminants in the source area. Monitoring frequency may be modified, if approved by the NYSDEC.

3.4 Monitoring Schedule

When groundwater monitoring and remedial system discharge monitoring results indicate that contaminants are no longer being extracted at productive levels, suggesting that the source area has been substantially remediated, termination of this remedial action will be assessed according to the Site Management Plan (SMP) and terminated accordingly following approval from NYSDEC.

Monitoring requirements are set forth in and controlled by the SMP. To the extent of any inconsistency between this document and the SMP, the SMP's requirements shall prevail. Monitoring will be performed periodically according to the schedule in Table 1. Inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or non-routine maintenance may take place when a suspected power disruption or failure of the HVE/SVE system has been reported.

Monitoring Schedule for the HVE/SVE System

Action	Frequency
- Air flow rate - Vacuum pressure - Pump operating temperatures, oil levels and general operating conditions - Functionality of level control sensors - Vapor concentrations from influent and effluent transfer pipes with a PID - Average groundwater flow rates and the quantity of groundwater extracted and treated since the prior monitoring visit.	Weekly
System air effluent and water influent and effluent sampling	Monthly
Groundwater Monitoring	Quarterly

Monitoring and maintenance of the remediation system will continue while the HVE/SVE system remains in operation. This remedial activity will be considered complete when source area VOC contaminants have been substantially removed and/or are no longer being reduced by the system at a rate of effectiveness or efficiency that allows for the practical continued operation of this system.

4.0 Maintenance and Performance Monitoring Reporting Requirements

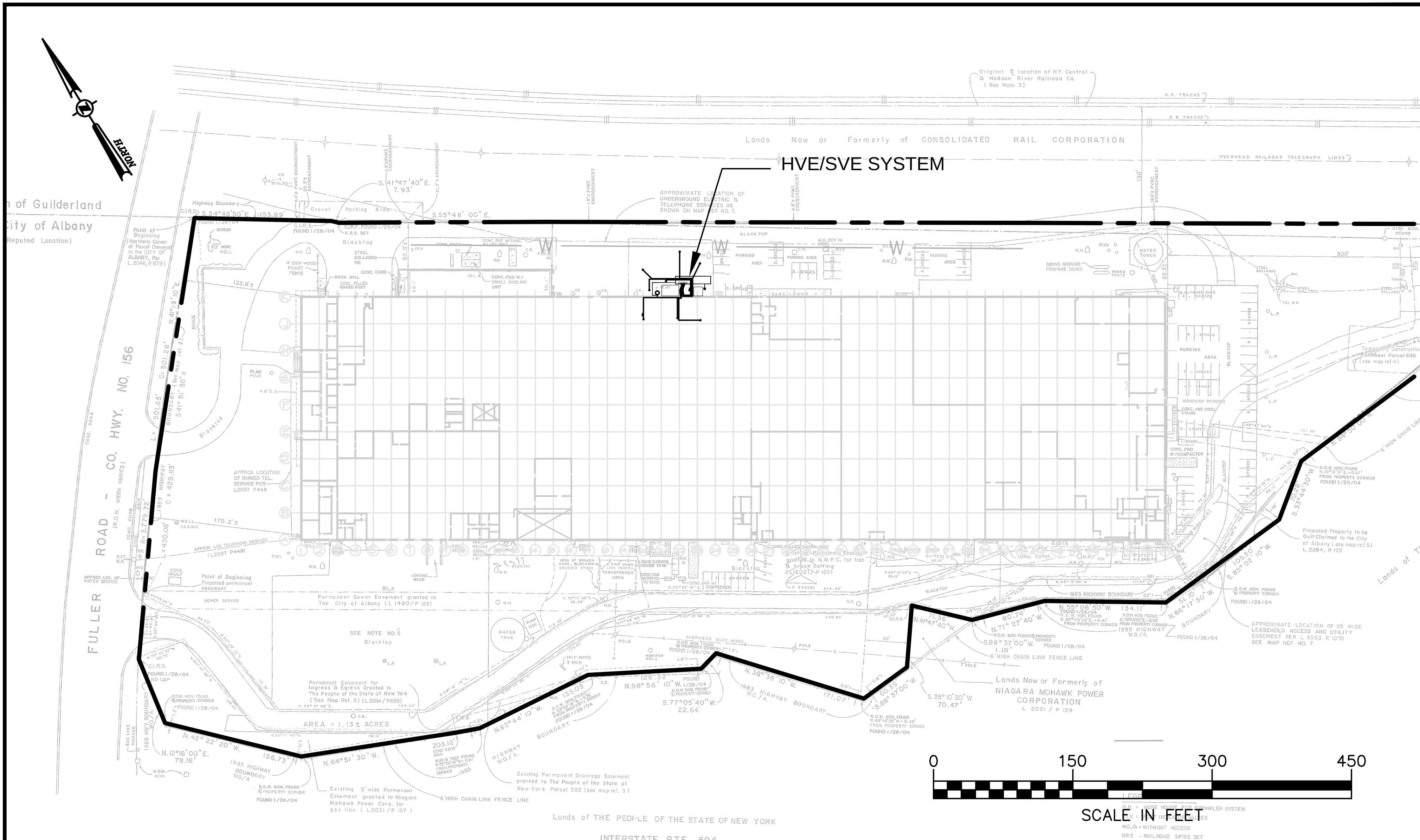
Remedial system monitoring will be documented using to the field data sheet included in Appendix F. Monthly field data will be compared with concurrent laboratory sampling and analysis results and submitted to NYSDEC (similar to Tables 1 and 2 provided in Appendix G) to demonstrate contamination removal rates, efficiencies and discharge quality goals. These results will be compared with the approved SMP to assess an appropriate point to discontinue operation of the existing SVE/HVE remediation

Monitoring requirements are set forth in and controlled by the SMP. Maintenance reports and any other information generated during regular operations at the site will be submitted to NYSDEC on a schedule consistent with the SMP, summarized below, but which may be changed if approved by NYSDEC.

Schedule of Monitoring/Inspection Reports for the HVE/SVE System

Action	Reporting Frequency
Monthly HVE/SVE system effluent monitoring	Quarterly, within six weeks of completing third sampling event
Quarterly groundwater monitoring	Quarterly, within six weeks of completing field work

Figures



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CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., P.C.

THE Chazen COMPANIES
Engineers/Surveyors
Planners
Environmental Scientists

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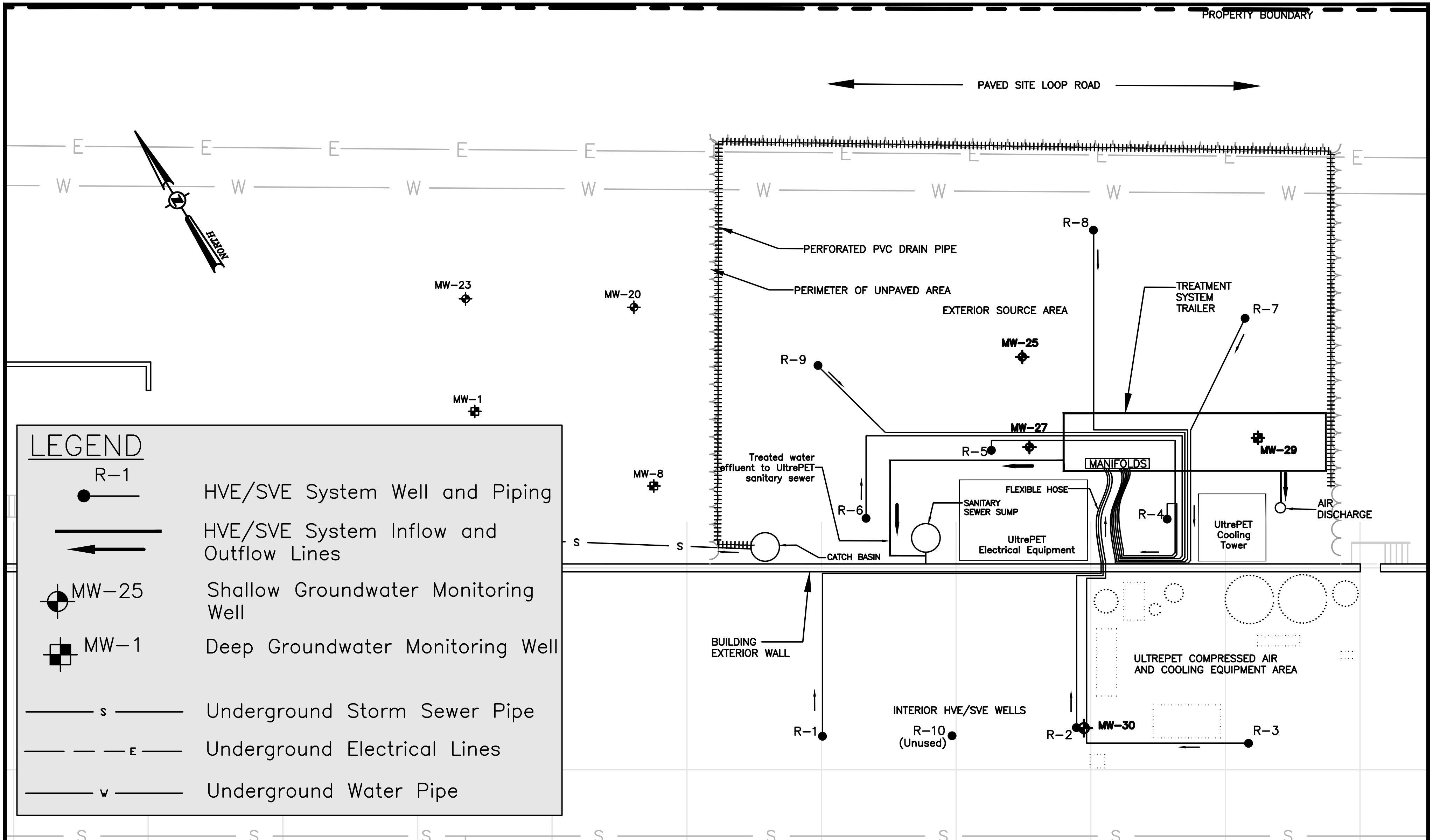
Capital District Office:
547 River Street Troy, NY 12182
Phone: (518) 235-8050
North Country Office:
100 Glen Street Glens Falls, NY 12801
Phone: (518) 812-0513

FULLER PARTNERS, LLC SITE

HVE/SVE SYSTEM LOCATION MAP

136 FULLER ROAD
ALBANY, ALBANY CO., NEW YORK

designed CSD	checked ASM
date 1/31/13	scale 1"=150'
project no. 90618.00	
sheet no. FIGURE 1	



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Phone: (518) 812-0513

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HVE/SVE SYSTEM COMPONENT MAP

136 FULLER ROAD
ALBANY, ALBANY CO., NEW YORK

designed CSD	checked ASM
date 11/7/12	scale 1"=20'
project no. 90618.00	
sheet no. FIGURE 2	

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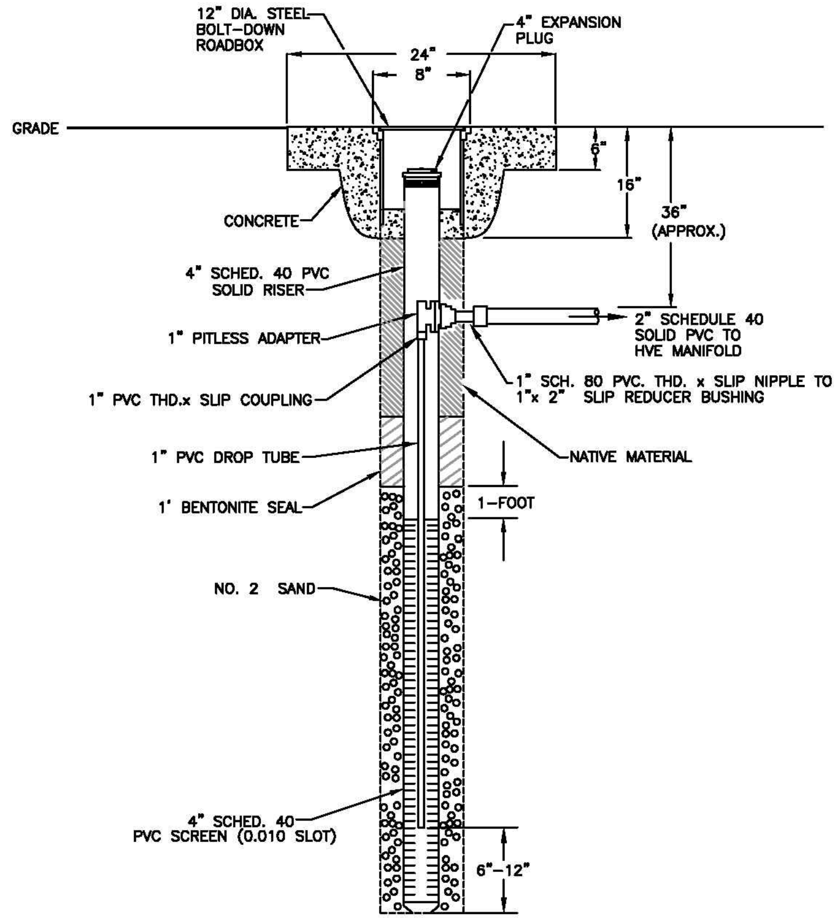
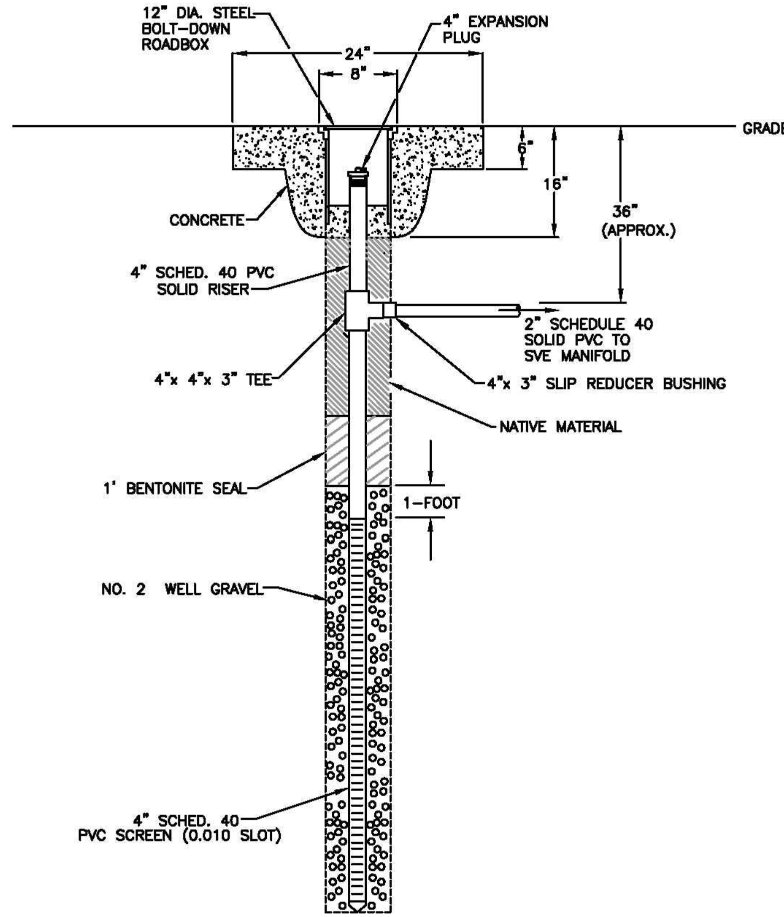


HVE WELL CONSTRUCTION DETAIL

NOT TO SCALE



SVE WELL CONSTRUCTION DETAIL

NOT TO SCALE

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North Country Office:
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Phone: (518) 812-0513

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HVE/SVE TYPICAL WELL DIAGRAMS

136 FULLER ROAD
ALBANY, ALBANY CO., NEW YORK

designed	checked
CSD	ASM
date 6/6/12	scale NTS
project no. 90618.00	
sheet no. FIGURE 3	

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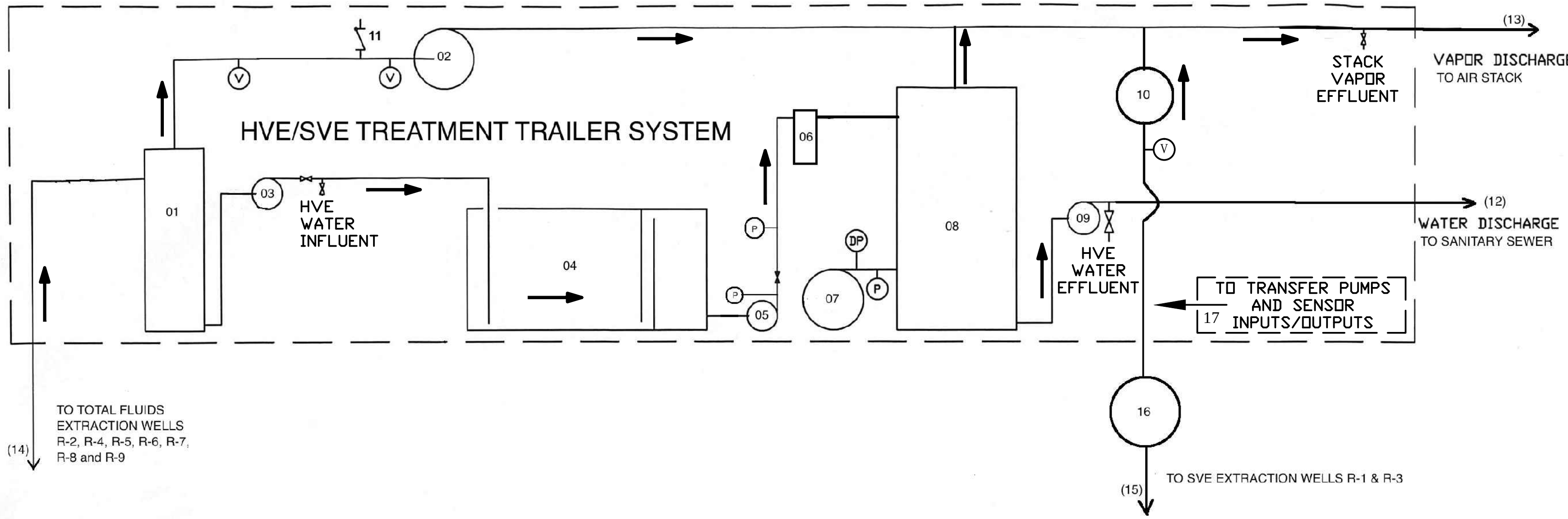

ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	CYCLONE PHASE SEPARATOR	09	TRANSFER PUMP
02	HVE/TFE LIQUID RING PUMP	10	SVE BLOWER
03	TRANSFER PUMP	11	HVE RELIEF VALVE
04	OIL/WATER SEPARATOR	12	DISCHARGE TO SEWER
05	TRANSFER PUMP	13	AIR STACK DISCHARGE
06	BAG FILTER ASSEMBLY	14	TOTAL FLUIDS INLET MANIFOLD
07	AIR STRIPPER BLOWER	15	SVE INLET MANIFOLD
08	SHALLOW TRAY AIR STRIPPER UNIT	16	SVE PARTICULATE FILTER
		17	SYSTEM PLC CONTROLS

DP DIFFERENTIAL PRESSURE SWITCH

P PRESSURE GAUGE

SAMPLING PORT

V VACUUM GAUGE

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HVE/SVE PIPING AND INSTRUMENTATION DIAGRAM

136 FULLER ROAD
ALBANY, ALBANY CO., NEW YORK

designed	checked
CSD	ASM
date 1/31/13	scale NTS
project no. 90618.00	
sheet no. FIGURE 4	

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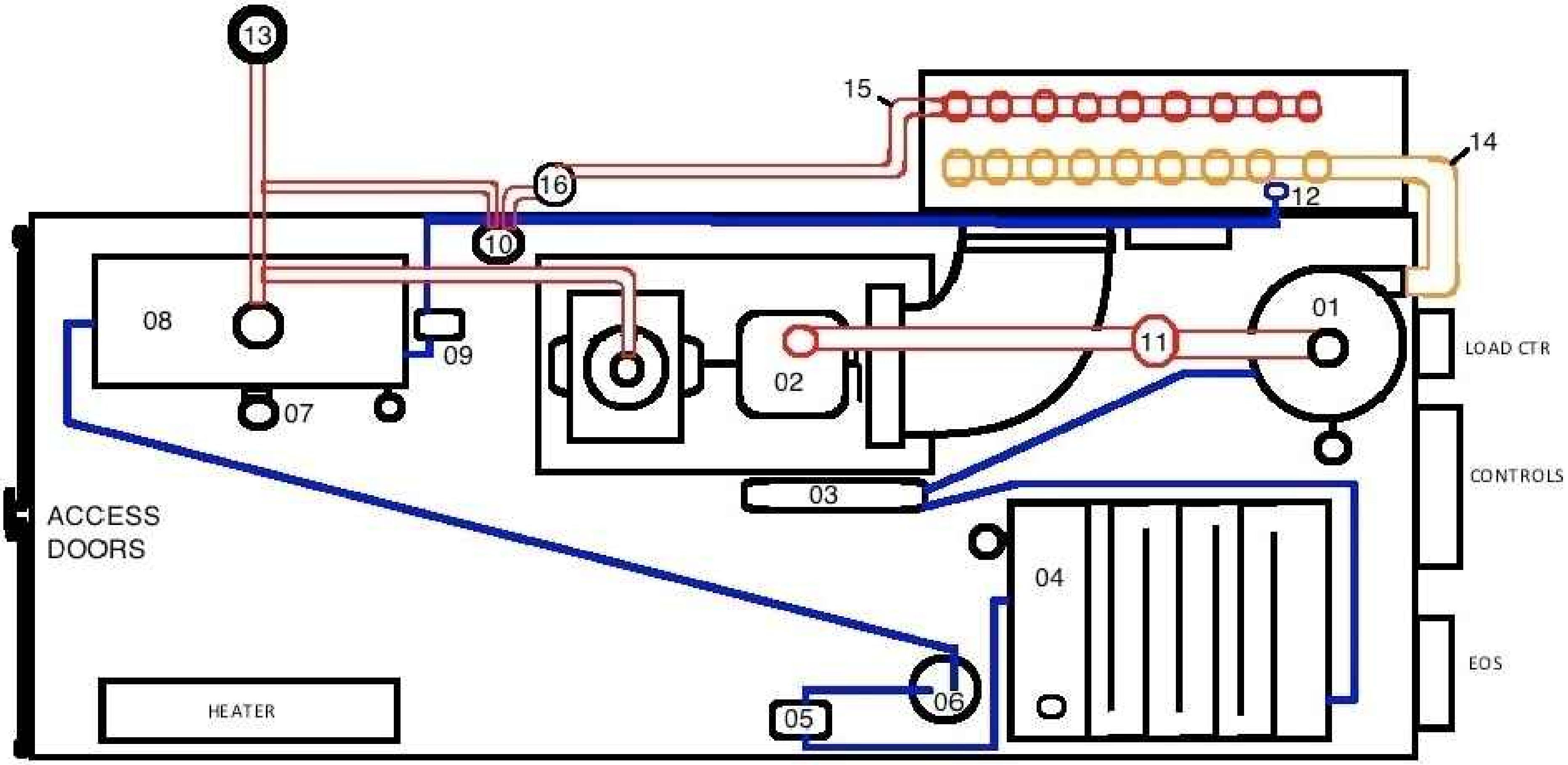

ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	CYCLONE PHASE SEPARATOR	09	TRANSFER PUMP
02	HVE/TFE LIQUID RING PUMP	10	SVE BLOWER
03	TRANSFER PUMP	11	HVE RELIEF VALVE
04	OIL/WATER SEPARATOR	12	DISCHARGE TO SEWER
05	TRANSFER PUMP	13	AIR STACK DISCHARGE
06	BAG FILTER ASSEMBLY	14	TOTAL FLUIDS INLET MANIFOLD
07	AIR STRIPPER BLOWER	15	SVE INLET MANIFOLD
08	SHALLOW TRAY AIR STRIPPER UNIT	16	SVE PARTICULATE FILTER

AIR / VAPOR
AQUEOUS / WATER
TOTAL FLUIDS

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Phone: (518) 812-0513

FULLER PARTNERS, LLC SITE

HVE/SVE Trailer Components

136 FULLER ROAD
ALBANY, ALBANY CO., NEW YORK

designed	checked
CSD	ASM
date 6/6/12	scale NTS
project no. 90618.00	
sheet no. FIGURE 5	

Drawing Name: S:\9\90600-90699\90618_00\ENG\DWG\HVE O&M Plan Figure 5.dwg Date Printed: Jan 31, 2013, 8:55am

Appendix A:

HVE/SVE Trailer System Details

Total Fluids Extraction Unit Package Basic Description

Container – 20' Insulated, interior sheathed freight box fitted with light, thermostatically controlled heat and thermostatically controlled ventilation.

Vacuum Source – Travaini Dyna Seal oil sealed liquid ring pump package, fitted with external cooling air ducting, high temperature, low and high oil level switches and plc controlled bleed air solenoid.

Vapor / Liquid separator – Aztech engineered cyclonic separator with 60 gallon pump down sump. Fitted with sight tube and liquid level controls for low, high and high – high level. Fitted with vacuum transmitter.

Transfer Pump – Transfer liquid from vapor / liquid separator to surge tank. Will be either a Gorman Rupp close coupled centrifugal (for moderate vacuum level) or Liberty Process progressive cavity (for high vacuum).

Oil Water Separator – 247 gallon unit, 6 gpm continuous flow, 15 gpm intermittent flow, 57 gallon oil storage.

Transfer Pump – Transfer liquid from surge tank to bag filters and optional carbon units. Goulds bronze fitted, cast iron close coupled centrifugal pump. Fitted with discharge pressure transducer.

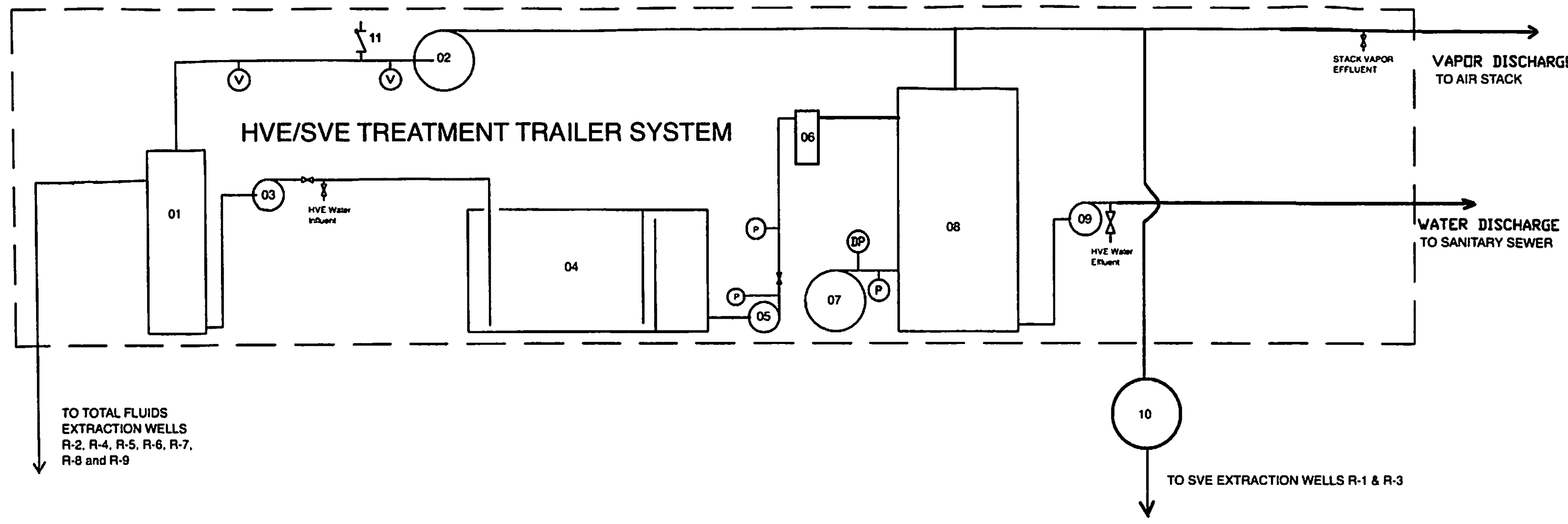
Bag Filters – One #2 size carbon steel bag filter units.

Optional Carbon Units – Two 500# Siemens (formerly US Filter) Pressure rated steel carbon units. Filled with 8x30 mesh carbon. Fitted with pressure transducer.

Discharge flow sensor – paddlewheel type flow transducer.

Power distribution – 3 phase, 230 volt, 200 amp 3R disconnect mounted on external end of freight container. Conduits run in steel with liquid tite whips to each motor.

Control Panel – PLC based centralized control panel. Mounted externally on end of freight container. All motors will have individual DIN rail mounted circuit breakers, contactors and overload relays and H-O-A switches. All analog flow and pressure measurement will be collected, as well as liquid level control. System will have the ability for data collection and remote download, remote start stop and monitoring, via telephone line. Optional cellular two way communication is available. Program will also handle sequential motor startup and pump short cycling control.



ITEM	DESCRIPTION
01	CYCLONE PHASE SEPARATOR
02	HVE/TFE LIQUID RING VACUUM PUMP
03	TRANSFER PUMP
04	OIL/WATER SEPARATOR
05	TRANSFER PUMP
06	BAG FILTER ASSEMBLY
07	AIR STRIPPER BLOWER
08	SHALLOW TRAY AIR STRIPPER UNIT
09	TRANSFER PUMP
10	SVE BLOWER
11	HVE RELIEF VALVE

PIPING & INSTRUMENTATION DIAGRAM DRAWING
HVE/TFE REMEDIATION TRAILER

DRAWN	DRAWING NO. SCHEMATIC	REVISED
CHECKED	SCALE none	DATE

Appendix B:

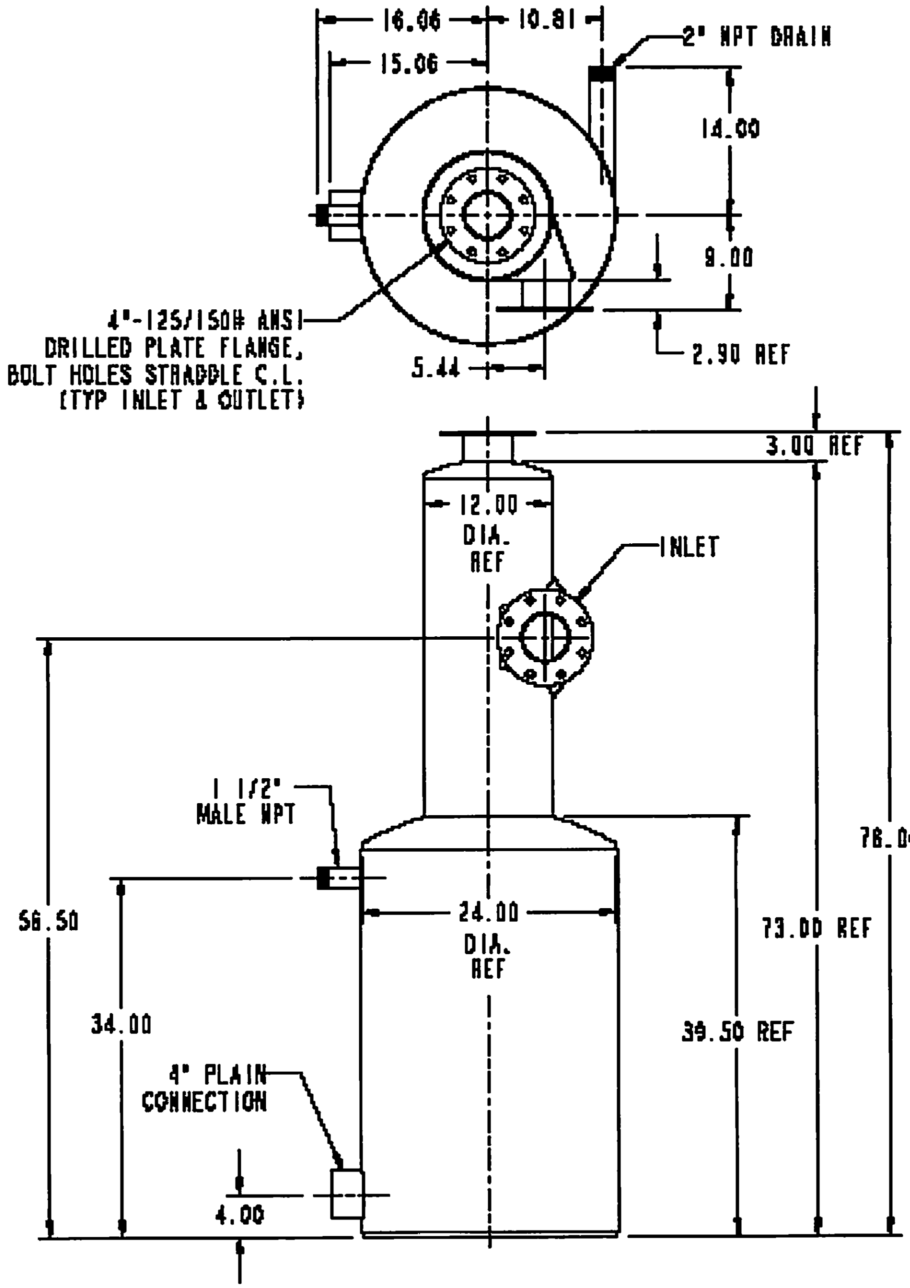
HVE Cyclone Phase Separator Pump Information

Aztech

5 McCrea Hill Road
Ballston Spa
New York 12020
www.aztk.com

SPECIAL UWVS-4
INLET SEPARATOR SILENCER

DATE	1-4-03
SHEET	OF
SCALE	0.060"=1"



PRO/E

DIMENSIONS CERTIFIED FOR:	
P.O. NO:	
U.S. S.O. NO:	
BY	

APPROX WT	175	MATERIAL	STEEL	DRAWN	NCM
FINISH	88-0102 SHOP COAT PRIMER			CHECK	DY 1-5-03

DIMENSIONAL DRAWING NO.	REV.
6U-104-AG	0

DIMENSIONAL DRAWING NO. 6U-104-AG

REV. 0

Appendix C:

Liquid Ring Vacuum Pump Information and O&M Manual

TRAVAINI PUMPS USA, INC.

"Dynaseal" Vacuum Pump System

"The Workhorse of the Industry"

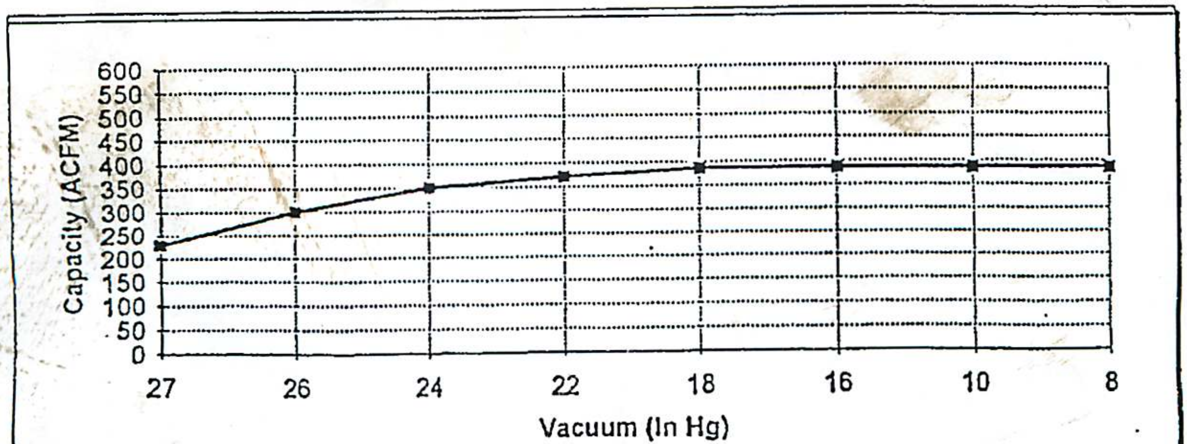
TECHNICAL DATA SHEET

SYSTEM MODEL:	TRO 400S
ROTATIONAL SPEED:	1750 RPM
NOMINAL CAPACITY:	380 ACFM
MAX. VACUUM CAPABILITY:	27 " HG
MOTOR SIZE:	25 HP
NOISE LEVEL @ 3 FT.:	78 dBA
SHIPPING WEIGHT:	1750 #

FEATURES & BENEFITS:

✓ This vacuum pump system performs where others fail (designed for heavy duty operation)
✓ Impeller runs freely in isolated pumping chamber which allows handling of soft solids
✓ Reliability: simplicity and dependability of the Travaini liquidring design.
✓ Continuous operation over the full vacuum range without overheating.
✓ Heavy duty grease lubricated external bearings are isolated from pumping chamber.
✓ Minimal installation cost, system is tested at the factory and ready for operation.
✓ Air cooled design standard, optional water cooling available.
✓ Equipped with exclusive highly efficient long life discharge separator
✓ Low noise level and vibration.
✓ Direct drive means no gears or V-belts
✓ Low maintenance
✓ Supplied with long life seal fluid (10,000 hr service life).
✓ Equipped with automatic temperature control valve and high temperature switch
✓ Equipped with electrical control panel assembled and wired on system.
✓ Full range of optional accessories available.

REFER TO BACK PAGE FOR LISTING OF COMPONENTS



SYS MODEL: TRO400S·1A·XP PUMP MOD.: TRSC100·550/C/F

LIST OF STANDARD DYNASEAL COMPONENTS
TRO 400S - TRO 500H

Travaini high efficiency liquid ring vacuum pump.
Heavy duty flexible coupling and guard
TEFC, motor, 3 phase 60 hz, 230/460 volt, class F, 1.15 service factor
Separator reservoir with level gauge, temperature & pressure gauge and drain valve
High efficiency discharge separator element
Complete charge of long life sealing fluid type TR 1001-22
High efficiency air cooled heat exchanger oversized for ample cooling.
High flow cooling fan mounted on pump shaft extension
Fan shroud & guard
Seal liquid solenoid valve, Y-strainer and stop valve
High temperature switch to protect pump against high temperature operation
Inlet check valve installed on pump suction flange
Vacuum gauge, liquid filled, dual scale
All components mounted on fabricated steel base plate include. interconnecting piping
Systems are painted Travaini gray as standard
All systems are factory tested and checked prior to shipment.

ELECTRICAL CONTROL PANEL:
Standard 460 volt. (other voltages please specify)
Full voltage magnetic starter with 3-phase overload protection
Through the door reset button.
120 volt control circuit transformer with fused primary & secondary
Stop/Start button with running light
Elapsed time meter
NEMA 12 enclosure, skid mounted and wired, UL listed.

Available Options:
Inlet air filter for those applications where a high carry-over of solids can be expected
Vacuum relief valve installed on pump suction to control max. vacuum level.
Inlet isolation valve, isolates pumps operating on a common manifold.
Vacuum receivers, ASME coded, standard, galvanized or epoxy coated.
Flexible pipe connectors to eliminate pipe strain on system components.
Low oil level switch
Hand-Off-Automatic switch
Vacuum switch
Frequent start protection, recommended for automatic operation from vacuum switches.
Warning lights and audible alarms.
Fused disconnects or circuit breakers
Dual control transformers (multiple pump systems).
Programmable controllers (multiple pump systems).
Custom built electrical panels
Automatic temperature control valve set at 170 deg F. pump operating temperature

MULTIPLE PUMP SYSTEMS:
Duplex and Triplex are available, built to your specification.

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OIL MATERIAL SAFETY DATA SHEET FOR DynaSeal™
OIL # 971-0022-A000

PRODUCT INFORMATION:
CHEMICAL NAME: HYDROTREATED, PARAFFINIC MINERAL OIL
CHEMICAL FAMILY: SEMI-SYNTHETIC HYDROCARBON
FORMULA: PROPRIETARY
CAS #: PROPRIETARY

COMPONENTS AND HAZARD STATEMENT:

NOTE: This product is **NON-HAZARDOUS**. The product contains no known carcinogens. No special warning labels are required under OSHA 29 CFR 1910.1200.

SAFE HANDLING AND STORAGE:

NOTE: Do not take internally. Avoid contact with skin, eyes, and clothing. Upon contact with skin, wash with soap and water. Flush eyes with water for 15 minutes and consult physician. Wash contaminated clothing before reuse.

NOTE: Keep container tightly sealed when not in use.

PHYSICAL DATA:
APPEARANCE: CLEAR LIQUID, LIGHT AMBER TINT
BOILING POINT: >300°F
VAPOR PRESSURE: <0.01mmHg @ 20°C
SPECIFIC GRAVITY **(WATER = 1)**: 0.87-0.89
VOLATILES, PERCENT BY VOLUME: 0%
ODOR: SLIGHT
SOLUBILITY IN WATER: INSOLUBLE
EVAPORATION RATE (BUTYL ACETATE = 1): NIL

OIL MATERIAL SAFETY DATA SHEET FOR DynaSeal™ OIL # 971-0022-A000

FIRE AND EXPLOSION HAZARDS:

***FLASH POINT* (BY CLEVELAND OPEN CUP):** 375-500°F
***FLAMMABLE LIMITS*:** NOT ESTABLISHED
***AUTOIGNITION TEMPRATURE*:** NO DATA
***HMIS RATINGS*:**
HEALTH: 0
FLAMMABILITY: 1
REACTIVITY: 0
***NFPA RATINGS*:** NOT ESTABLISHED
***EXTINGUISHING M*EDIA:** DRY CHEMICAL; CO_2 FOAM; WATER SPRAY
***UNUSUAL FIRE AND EXPLOSION HAZARDS*:** NONE

NOTE: Burning fluid may evolve irritating/noxious fumes. Firefighters should use NIOSH/MNSA-approved self-contained breathing apparatus. Use water to cool fire exposed containers. Use water carefully near exposed liquid to avoid frothing and splashing of hot liquid.

REACTIVITY DATA:

***STABILITY*:** STABLE
***HAZARDOUS POLYMERIZATION*:** WILL NOT OCCUR
***INCOMPATABLE MATERIALS*:** STRONG OXIDIZERS
***CONDITIONS TO AVOID*:** EXCESSIVE HEAT
***HAZARDOUS DECOMPOSITION PRODUCTS*:** ANALOGOUS COMPOUNDS EVOLVE CARBON MONOXIDE, CARBON DIOXIDE, AND OTHER UNIDENTIFIED FRAGMENTS WHEN BURNED. SEE SECTION 5.

HEALTH HAZARDS DATA:

***THRESHOLD LIMIT VALUE*:** 5MG/M³ACGIH FOR OIL MISTS
***SITUATIONS TO AVOID*:** AVOID BREATHING OIL MISTS
***FIRST AID PROCEDURES*:**
INGESTION: CONSULT A PHYSICIAN AT ONCE. **DO NOT INDUCE VOMITING.** MAY CAUSE NAUSEA AND DIARRHEA.
INHALATION: PRODUCT IS NOT TOXIC BY INHALATION. IF OIL MIST IS INHALED, REMOVE TO FRESH AIR AND CONSULT PHYSICIAN.

NOTE: To the best of our knowledge the toxicity of this product had not been fully investigated. Analogous compounds are considered to be essentially non-toxic.

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OIL MATERIAL SAFETY DATA SHEET FOR DynaSeal™
OIL # 971-0022-A000

PERSONAL PROTECTION INFORMATION:

RESPIRATORY PROTECTION: USE IN WELL VENTILATED AREA
VENTALATION: LOCAL EXHAUST
PROTECTIVE GLOVES: NOT REQUIRED, BUT RECOMMENDED, ESPECIALLY FOR PROLONGED EXPOSURE.
EYE/FACE PROTECTION: GOGGLES

SPILL OR LEAK PROCEDURES:

NOTE: In case of spill, wear suitable protective equipment, especially goggles. Stop source of spill. Dike spill area. Use absorbent materials to soak up fluid (i.e. sand, sawdust, and commercially available materials). Wash spill area with large amounts of water. Properly dispose of all materials.

WASTE DISPOSAL METHODS:

NOTE: Incinerate this product and all associated wastes in a licensed facility in accordance with Federal, state, and local regulations.

NOTE: The information in this material safety data sheet should be provided to all who use, handle, store, transport, or otherwise exposed to this product. TRAVAINI PUMPS believes the information in this document to be reliable and up to date of publication, but makes no guarantee that it is.

DOC: MATERIAL SAFETY DATA SHEET FOR TRAVAINI, P/N 971-0022-A000
FILE: 9710022.DOC
REV: 7/8/97

NOTICE

YOUR NEW TRAVAINI DYNASEAL™ OR WATER SEALED SYSTEM HAS BEEN FITTED WITH A MANUAL OR AUTOMATIC VACUUM BREAKER VALVE FOR EACH VACUUM PUMP. THE VALVE IS LOCATED IN THE INLET PIPING PRIOR TO OR UPSTREAM OF THE CHECK VALVE. IT IS FITTED WITH A FILTER/SILENCER.

THE PURPOSE OF THIS VALVE IS TO AID IN THE UNLOADING OR VACUUM RELIEF OF THE VACUUM PUMP PRIOR TO START UP AND SHUT DOWN. THIS WILL GUARD THE PUMP FROM BEING STARTED OR SHUT DOWN AGAINST A LOAD OR VACUUM WHICH MAY SUBJECT THE VACUUM PUMP TO UNNECESSARY FORCES FROM TRYING TO START OR STOP AGAINST A HIGH VACUUM.

OPERATING INSTRUCTIONS FOR THE MANUAL VACUUM BREAKER VALVE SHALL BE AS FOLLOWS:

1) PRIOR TO SYSTEM START UP, INSURE THAT THE VALVE IS OPEN.

2) AFTER PUMP HAS RUN FOR A MINIMUM OF TEN SECONDS, THE VALVE SHOULD BE CLOSED. NO FURTHER ACTIVITY IS REQUIRED WITH THE UNLOADING VALVE UNTIL SYSTEM SHUT DOWN.

3) WHEN THE SYSTEM IS READY TO BE SHUT DOWN, OPEN THE VACUUM BREAKER VALVE. ALLOW THE VACUUM PUMP TO RUN FOR A MINIMUM OF TEN SECONDS BEFORE THE VACUUM PUMP IS SHUT OFF.

THERE ARE NO OPERATING INSTRUCTIONS FOR THE AUTOMATIC VACUUM BREAKER VALVE. THE VALVE WILL OPEN AND CLOSE AUTOMATICALLY AS NEEDED DURING SYSTEM OPERATION.

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

Recommended Spare Parts
DynaSeal
TRO400S-1A-XP

QTY	DESCRIPTION	PART#
1	Coupling Element Size 9-JES	752-0900-B000
1	Separator Element 18" DIA 15" LG	680-1215-A001
1	Solenoid 1" N7 NC Brass	855-0100-B001
1	Temp Control Thermo 1" N1 NC 170	864-0100-A000
1	Inlet Check Valve 4" THD C/S Buna	820-0400-B000
1	Y Strainer Screen 1" 20 MSH	660-0100-A001
1	Switch Hi-Temp N7 NC 225F	475-0050-E000
1	Level Switch 1 XP BRS/SS	465-0100-A000
5 gals	Oil (5 gal/pail) Dynalube*	971-0022-A005
5 gals	Oil (5 gal/pail) Food Grade**	974-015F-A005
1 gals	Oil (1 gal/pail) Dynalube*	971-0022-A001

NOTE: Total system requires 14 gallons of oil
*Standard Oil
**Optional Food Grade Oil

Optional Accessory Replacement Parts

QTY	DESCRIPTION	PART#
1	Filter Element 570 SCFM Paper	601-0570-A002
1	Filter Element 570 SCFM Poly	601-0570-A003
1	Filter Element 100 SCFM Poly	601-0100-A003
1	Vacuum Relief Valve 1.25" 316SS	852-0125-C000
1	Discharge Check Valve (HNG) 3"	820-0300-A000
1	High/Low Level Switch 1" XP	465-0100-A000

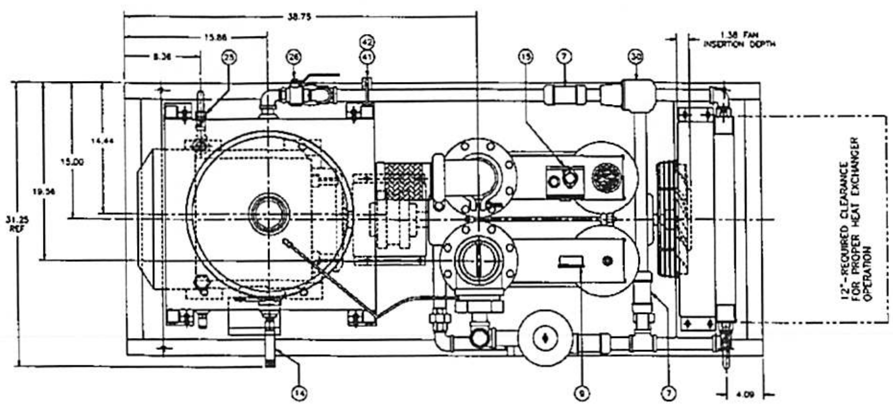
Liquid Ring Vacuum Pump: TRSC100-550/C/F(GH)

Pump Repair Kit Part #: 1100-S100-F550

QTY	DESCRIPTION	PART#
2	Bearing Nut	920050015075
2	Lip Seal	942.055.750.603
2	Mechanical Seal	950.055.SAC.915
1	Ball Bearing	961.006.310.000
1	Roller Bearing	963.NUO.310.000
1	Gasket Set	GUA.B87.210.0CM

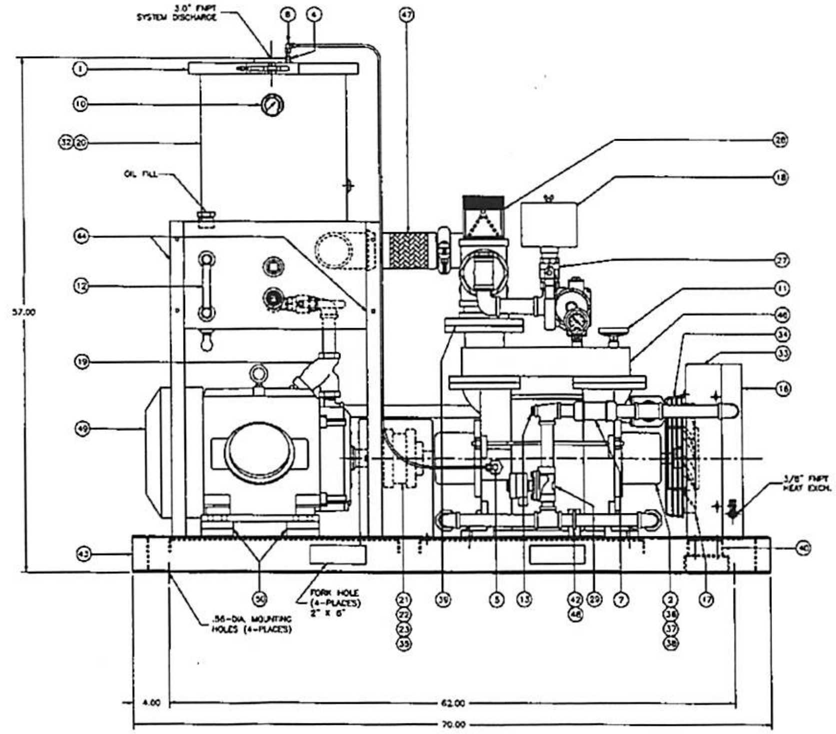
*Please Provide System Serial Number When Ordering

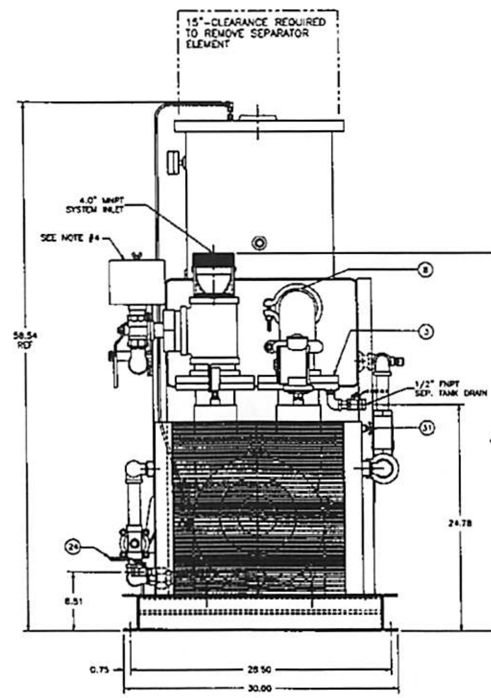
Doc: TRO400S-1A-XP Recommended Spare Parts
File: TRO400SX.DOC
Rev: March 6, 1998



SYSTEM NOTES:

1) LOCATE VACUUM SYSTEM ON A FLAT LEVEL SURFACE.
2) PLUG EMPTY PORTS WITH SQUARE HEAD NPT PIPE PLUGS.
3) TIGHTEN FAN SET SCREWS TO 7 FT/LBS.
4) REQUIRED CLEARANCE TO SERVICE ELEMENT IS 6".





BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	V-CLAMP RETAINER 18.125" X .625"	105-1812-A000
2	1	KEY SHAFT .25" X .25" X 2" LG	110-0202-0917
3	1	FLANGE 4" X 3" 150# RF THD CS	161-1311-7011
4	1	FITTING .25" MNPT X .25" TUB	170-0025-3000
5	1	FITTING .25" TUBE X .25" MNPT 90° ELBOW	170-0025-3001
6	1	UNION ELBOW, BRASS COMPRESSION	170-0025-3002
7	3	FLEX COUPLING 1" CS/NIT	190-0100-B000
8	1	FLEX 90 3" CS/BUNA	190-0300-A001
9	1	GAUGE VACUUM 0-30"HgV BRS 2.5" DIAL	400-0025-F000
10	1	GAUGE PRESSURE 0/15 PSIG BRS	402-0025-F000
11	1	GAUGE TEMP 20/240°F-10/110°C BRS 3" DIAL	410-0050-F001
12	1	GAUGE LEVEL 6" LG X .5" NPT	420-0050-A008
13	1	GAUGE BULLSEYE .50" CS	421-0050-C001
14	1	SWITCH LEVEL 1" XP BRS/SS	465-0100-A000
15	1	SWITCH HI-TEMPERATURE N7 NC 225°F	475-0050-E000
16	1	HEAT EXCHANGER 19" X 25" 1 PASS AIR/LIQ	535-1925-B001
17	1	FAN 12" 10-BLADE 450 RT FIBGLS/ALUM	550-1210-A000
18	1	FILTER SILENCER 1.25" 60 SCFM	602-0125-A001
19	1	Y-STRAINER 1" FNPT CI	660-0100-A001
20	1	SEPARATOR ELEMENT TRO250/300/400	680-1215-A001
21	1	DRIVE COUPLING 9S 1.875"	702-0900-B187
22	1	DRIVE COUPLING 9S 42MM	702-0901-B042
23	1	COUPLING ELEMENT SIZE 9 JES	752-0900-B000
24	1	VALVE BALL .375" THD SP BRS	801-0037-B000
25	1	VALVE BALL .50" THD SP BRS	801-0050-B000
26	1	VALVE BALL 1" FNPT BRS/BRS/PTFE	802-0100-B000
27	1	VALVE BUTTERBALL 1.25" THD	803-0125-A000
28	1	VALVE CHECK HINGE 4" THD CS/BUNA	820-0400-B000
29	1	VALVE SOLENOID 1" N7 NC BRASS 120V	855-0100-B001
30	1	VALVE TEMPERATURE CONTROL 1" 170°F CI	884-0100-A000
31	1	VALVE PETCOCK .25" MNPT BRS	890-0025-A000
32	1	SEPARATOR OIL 3" INLET	904-9610-2910
33	1	SHROUD FOR 12" OD FAN CS	920-9510-2510
34	1	WIRE GAURD FOR 12" O.D. FAN	925-0012-B000
35	1	COUPLING GUARD 25HP & 40HP	930-9811-0520
36	1	SHAFT EXTENSION 50MM X 1.125"	940-0050-A000
37	1	BEARING CAP 90MM BORE	942-0090-A000
38	1	LIP SEAL TRO400/500	942070090603L
39	2	GASKET MANIFOLD 4.125" ID X .094" THK	945106160651
40	1	RISER BLOCK (1.72" TALL)	945-9611-0730
41	1	BRACKET PIPE 3" X 3" X 1"	948-9701-2740
42	2	BRACKET U BOLT 1" PIPE	948-9701-2750
43	1	BASEPLATE DYNASEAL FR 30" X 70" X 4"	950-9610-2540
44	4	LEG SEPARATOR 1.5" X 35"L	955-9611-0430
45	14	OIL DYNALUBE (GALLON) NOT SHOWN	971-0022-A000
46	1	LIQUID RING VACUUM PUMP 1 STD MECH SEAL	TRSC100-550/F
47	1	FLEX CONNECTION 3" X 10.5" SCH 40 SS	195-0300-A001
48	1	BRACKET PIPE .25" X 3" X 4" CS	948-9401-2530
49	1	MOTOR 25 HP 4P XP 284T 3/208-230/460V	260-0250-I000
50	2	MOTOR RISER BLOCK ADJUSTABLE	945-0008-3010

REV	DESCRIPTION	DATE	APPR
	REVISIONS		

TOLERANCES

DECIMAL ± .0625"
FRACTIONAL ± 1/8"
ANGULAR ± 0° 30' 00"
UNLESS OTHERWISE SPECIFIED IN DRAWING

S/N NO.	12825-02
PART NO.	N/A
DWG BY:	RV
CHK BY:	DMO
DATE	2/1/02
APPROVED BY:	DMO
SCALE:	1 = 6

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

DESCRIPTION: DYNASEAL AIR COOLED XP SIMPLEX VACUUM SYSTEM 208V

MODEL NO.	DWG NO.	REV
TRO400S-1A-XP	0202013-D	—

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

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DATE 4/02

Operating & Maintenance Manual *for* Liquid Ring Vacuum Pumps, Compressors & Systems

TRH-TRS-TRM-TRV-SA

Water Sealed & Oil Sealed (DynaSeal™) Systems

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OPERATING MANUAL FOR INSTALLATION, START-UP AND MAINTENANCE FOR LIQUID RING VACUUM PUMPS, COMPRESSORS AND SYSTEMS

This manual applies to TRAVAINI PUMPS USA liquid ring pumps single stage series TRM, TRS, TRV, double stage series TRH, compressors series SA and systems series water sealed and oil sealed (DynaSeal™) Systems, which utilize above pump series. (Please see section 18 or 19 for details pertaining to systems).

NOTE: Unless otherwise specified, the term pump used throughout this manual means also pump/motor assembly or system type water sealed or oil sealed (DynaSeal™).

MANUFACTURER:

TRAVAINI PUMPS USA
200 Newsome Drive
Yorktown, VA 23692
Telephone: (757) 988-3930
Fax: (757) 988-3975
Website: www.travaini.com

WARRANTY:
All products manufactured by TRAVAINI PUMPS USA are guaranteed to meet the conditions listed on the general terms & conditions of sales and/or conditions listed on the order confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual, will void the manufacturer's warranty. Detailed warranty policy can be found in Section 21.

PROPRIETY DOCUMENT:
This document and the information enclosed herein are proprietary to Travaini Pumps USA and must, along with any copies, be returned upon demand. Reproduction or use of any information disclosed herein, or the manufacture of any assembly or part depicted herein is permissible only to the extent expressly authorized in writing by Travaini Pumps USA on and for which this document is provided.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump and/or system. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OUR PRODUCTS

LIQUID RING VACUUM PUMPS

LIQUID RING COMPRESSORS

ROTARY VANE VACUUM PUMPS

ROTARY VANE VACUUM SYSTEMS

MEDICAL SYSTEMS (NFPA99)

PACKAGE VACUUM SYSTEMS WITH PARTIAL OR TOTAL SERVICE RECIRCULATION

CUSTOM ENGINEERED VACUUM SOLUTIONS

"Proven Designs"

1 – GENERAL INSTRUCTIONS

This manual is intended to provide reference to:

- application and operating safety
- installation and maintenance for pump or system
- starting, operating and stopping procedures for pump or system

NOTE: All references made to pumps are also applicable to systems that employ these pumps, unless otherwise specified.

Upon receipt of this manual, the operator should complete the Product Data sheet with the requested data. The manual should then be read **CAREFULLY** and kept in a safe file for future reference. It should always be available to the qualified operating and maintenance personnel responsible for the safe operation of the pump or system. (Qualified personnel should be experienced and knowledgeable of Safety Standards, should be recognized by the safety department manager as being capable to effectively act on safety issues, should the need arise and knowledge of first aid should also be required).

The pump is to be used only for the applications specified on the confirming order for which TRAVAINI PUMPS USA has selected the design, materials of construction and tested the pump to meet the order specifications. Therefore, the pump or system **CANNOT** be used for applications other than those specified on the order confirmation.

In the event the pump is to be used for different applications, please consult TRAVAINI PUMPS USA or a representative of the manufacturer. TRAVAINI PUMPS USA declines to assume any responsibility if the pump is used for different applications without prior written consent. The user is responsible for the verification of the ambient conditions where the pump will be stored or installed. Extreme low or high temperatures may severely damage the pump or system unless proper precautions are taken. TRAVAINI PUMPS USA does not guarantee repairs or alterations done by user or other unauthorized personnel. Special designs and constructions may vary from the information given in this manual. Please contact TRAVAINI PUMPS USA should you have any difficulty or doubt.

NOTE: Drawings appearing in this manual are only schematics. These drawings are not for construction.

2 - SAFETY INSTRUCTIONS

CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS. STRICTLY ADHERE TO THE INSTRUCTIONS LISTED BELOW TO PREVENT PERSONAL INJURIES AND/OR EQUIPMENT DAMAGE.

- **ALWAYS** apply the pump for the conditions outlined on the confirming order.
- Electrical connections on the motor or accessories must **ALWAYS** be carried out by authorized personnel and in accordance to the local codes.
- Any work on the pump should be carried out by at least 2 people.

When approaching the pump **ALWAYS** be properly dressed (avoid use of clothing with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done.

- **ALWAYS** stop the pump prior to touching it, regardless of the reason.
- **ALWAYS** disconnect the power to the motor prior to working or removing the pump from the installation.
- **NEVER** work on the pump when it is hot.
- After completion of the work **ALWAYS** re-install the safety guards previously removed.
- **ALWAYS** be careful when handling pumps that convey acids or hazardous fluids.
- **ALWAYS** has a fire extinguisher in the vicinity of the pump installation.
- **DO NOT** operate the pump in the wrong direction of rotation.
- **NEVER** put hands or fingers in the pump or system openings or cavities.
- **NEVER** step on pump and/or piping connected to the pump.
- Pump or piping (connected to the pump) must **NEVER** be under pressure or vacuum when maintenance or repair is carried out.

NOTE: There are materials in the pump that may be hazardous to people suffering from allergies. Maintenance and operating personnel should consult Table 1 for such materials.

TABLE 1

MATERIAL	USE	POSSIBLE DANGER
Oil and Grease	General lubrication, ball or roller bearings	Skin and eye irritation
Plastic and elastomer components	O-Ring, V-Ring, Splash ring, Oil seals	Release of fumes and vapours when overheated
Teflon & Kevlar fibers	Packing rings	Release of dangerous powders, release of fumes when overheated
Varnishes	Exterior pump surface	Release of powder and fumes in case of rework, flammable
Protective liquid	Pump inside surface	Skin and eye rash
Liquid compound	Gasket between flat surfaces	Skin, eye and breathing organs irritation

3 - IN CASE OF EMERGENCY

Should the pump break down leak gas and/or service liquid, immediately disconnect the electrical power following the instructions given in section 11. Alert the maintenance personnel, at least two people should intervene using precautions, as it is required for the specific installation: pump may be handling dangerous and/or hazardous fluids.

After correction of all the problems that created the emergency situation, it is necessary to carry out all the recommended starting procedures (see section 10).

3.1 - BASIC FIRST AID

In the event dangerous substances have been inhaled and/or have come in contact with the human body, immediately contact the medical staff and follow the instructions given by the company's internal medical safety procedures.

4 - PUMP OUTLINES

The instructions given in this manual are for liquid ring vacuum pumps and compressors and for systems type WATER SEALED or OIL SEALED (DynaSeal™) which utilize said pumps.

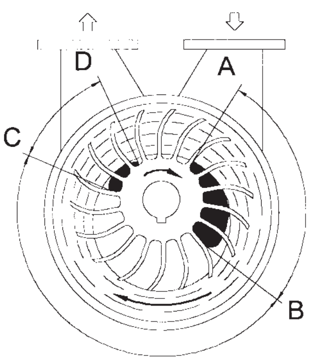
NOTE: Capacities, vacuum and pressures are nominal and are the maximum attainable values under standard operating conditions. Please contact TRAVAINI PUMPS USA for data on liquid ring compressors series TR...

TRM	Single stage liquid ring vacuum pumps Capacity to 210 ACFM, max vacuum 33 mbar (25 Torr)
TRS	Single stage liquid ring vacuum pumps Capacity to 2100 ACFM, max vacuum 150 mbar (100 Torr)
TRV	Single stage vacuum pumps Capacity to 300 ACFM, max vacuum 33 mbar (25 Torr)
TRH	Two stage liquid ring vacuum pumps Capacity to 2100 ACFM, max vacuum 33 mbar (25 Torr)
SA	Double acting liquid ring compressors Capacity to 110 ACFM, pressures to 10 bar–(145 psig)

4.1 - PRINCIPLE OF OPERATION

(See figure at side)

The aspirated gas enters the pump chamber A-B via the pump suction flange. The gas is trapped between two (2) impeller vanes. The impeller rotates eccentrically in relation to the centerline of the liquid ring that, by centrifugal force, assumes the shape of the impeller casing. The progressive change of volume between the two (2) vanes, the impeller hub and the liquid ring first creates a vacuum and then a compression of the gas in the B-C area till the gas is discharged, together with a portion of the liquid, through the discharge port C-D. The lost liquid must then be replenished.



4.2 - SERVICE LIQUID PROPERTIES

For good operation, the liquid ring pumps must be supplied with a service liquid, which is clean, non-abrasive and free of any solids. The service liquid temperature should not exceed 80 °C and the gas handled should be maximum 100 °C; the liquid density should be between 0.8 and 1.2 g/cm3 and the viscosity should be less than 40 °C (the pump performance will change if the service liquid has properties different than those of water at 15°C (60°F). All engineering data is based on the use of 15°C (60°F) as service liquid, see section 17 for additional information. Contact TRAVAINI PUMPS USA before using liquids with properties outside the ranges listed above.

4.3 - PUMP MODELS AND TABLES FOR MATERIAL OF CONSTRUCTION

On the pump nameplate are printed the pump serial number, the year of manufacture and the pump model. Refer to the following example for understanding the coding of the pump model. Every letter or number in the pump model designation has a specific meaning relating to the pump design.

Example of pump model number:

T R H C 80 - 750 / C - M / GH	
T – Manufacturer POMPETRAVAINI	**750** – Nominal capacity in m^3/h
R – Liquid ring pump	**C** – C = Shaft sealing by mechanical seal B = Shaft sealing by stuffing box
H – M and V = Single stage pump with high vacuum S = Single stage pump with medium vacuum H = Two stage pump with high vacuum	**M** – Monoblock design with motor flange (upon request) **GH** – Material of construction GH - F - RZ - RA - A3 (see following table)
C – Revision of hydraulic design	
80 – Ø Flange size (mm)	

STANDARD materials of construction

VDMA	Description	GH	F	RZ	RA	A3
106	Suction casing	Cast iron 1561				
107	Discharge casing					
137	Intermediate plate					
110	Center body	Carbon Steel				
210	Shaft	Stainless steel AISI 420			Stainless steel AISI 316	
147	Manifold	Carbon steel				
357	Bearings & M.S. Hous.	Cast iron 1561				
230	Impeller	Bronze	Ductile iron	Stainless steel AISI 316		

For additional details regarding standard or special materials contact TRAVAINI PUMPS USA.

5 - UNCRATING, LIFTING AND MOVING INSTRUCTIONS

Upon receipt, verify that the material received is in exact compliance with that listed on the packing slip.

When uncrating, follow the instructions listed below:

- check for visible damages on the crate that could have occurred during transport
- carefully remove the packaging material
- check the pump/or accessories such as tanks, piping, valves, etc. to ensure that it is free of visible markings such as dents and damage which may have occurred during transportation
- in the event of damage, report this immediately to the transport company and to TRAVAINI PUMPS USA Customer Service department.

Discard through controlled disposals all packaging materials that may constitute personal injury (sharp objects, nails, etc.).

The pump or assembly must **ALWAYS** be moved and transported in the horizontal position. Prior to moving the unit find the following:

- total weight
- center of gravity
- maximum outside dimensions
- lifting points location.

⚡	For safe lifting to prevent material damages and/or personal injuries is recommended to use ropes, or belts properly positioned on the pump and/or lifting eyebolts and make correct movements. NOTE: Lifting eyebolts fitted on single components of the assembly (pump or motor) should not be used to lift the total assembly.

Avoid lifts whereby the ropes or straps, form a triangle with the top angle over 90° (see fig. 3). The fig. 4 shows several additional examples of lifting to be avoided. Prior to moving the unit from an installation, always drain any pumped fluid from the pump, piping and accessories, rinse and plug all openings to prevent spillage. For instructions to remove the unit from installation see section 15.

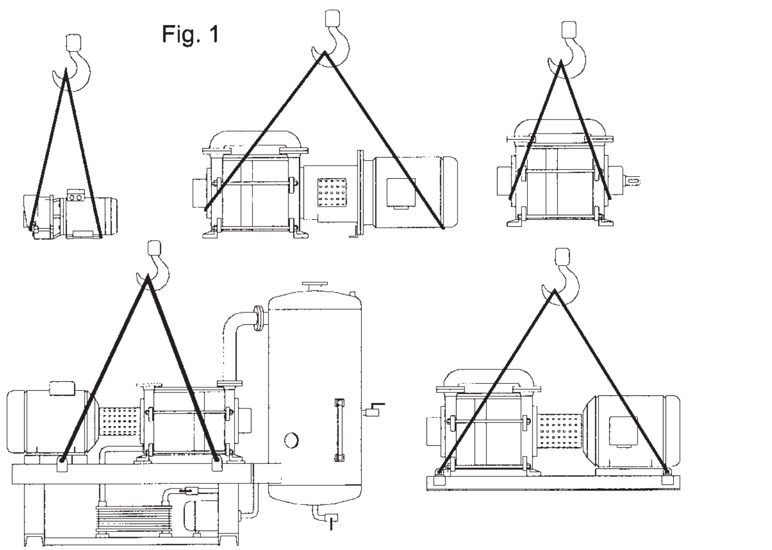


Fig. 1

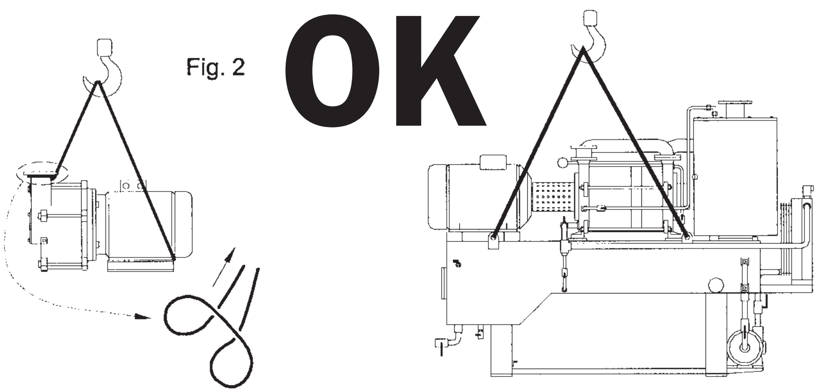


Fig. 2

OK

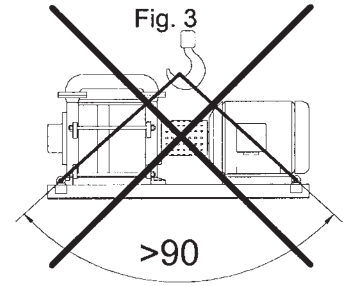


Fig. 3

NO

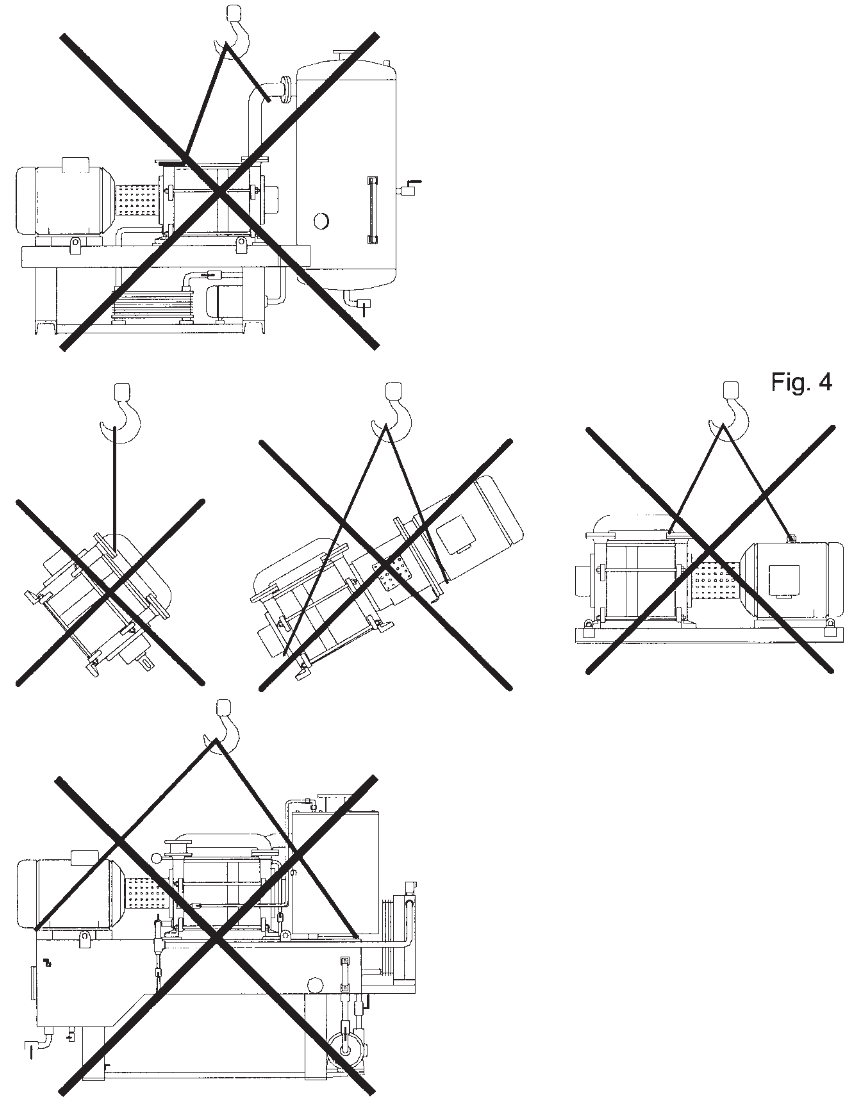


Fig. 4

6 - STORAGE INSTRUCTIONS

After receipt and inspection, if not immediately installed, the unit must be repackaged and stored. For a proper storage proceed as follows:
- store the pump in a location that is closed, clean, dry and free of vibrations
- do not store in areas with less than 5 °C (41 °F) temperature (for lower temperature it is necessary to completely drain the pump of any liquids that are subject to freezing)

FREEZING DANGER!
Where the ambient temperature is less than 5 °C (41°F) it is recommended to drain the pump, piping, separator, heat exchanger, etc. or add an anti-freeze solution to prevent damage to the equipment.

- fill the pump halfway with an anti-rust liquid but compatible with gaskets and elastomers materials, rotate the pump shaft by hand so that all internal parts get wet and then drain the pump of the excessive anti-rust liquid
- plug all openings that connect the pump internals to the atmosphere
- protect all machined surfaces with an anti-rust material (grease, oils, etc.)
- cover the unit with plastic sheet or similar protective material
- rotate pump shaft at least every three months to avoid possible rust build-up which may result in seizing of the pump.
- pump accessories should be subjected to similar procedure.

7 - MOUNTING AND ALIGNMENT INSTRUCTIONS

7.1 - ASSEMBLY OF BASE MOUNTED PUMP UNIT

In some cases such as bare pump orders, pumps are shipped with anti-rust and anti-freeze agents. Ensure pump is thoroughly flushed and these agents are removed prior to installation.

If the pump has been purchased with a free shaft end, a proper baseplate is required to mount the pump/motor assembly. The baseplate must be properly designed for maximum rigidity to prevent vibrations and distortions. It is recommended the use of a fabricated baseplate manufactured with rigid "U" shaped channel (fig. 16 illustrates an example).

When the pump has been purchased without the electric motor, it is then required to select the proper motor before proceeding to the installation of the unit. When selecting a motor the following must be considered:
- maximum power absorbed by the pump over the total operating range
- pump operating speed (RPM)
- available power (Hertz, voltage, etc.)
- motor enclosure type (ODP, TEFC, EX.PR., etc.)
- motor mount (B3, B5, horizontal, vertical, C-flange, D-flange, etc.).

When selecting Flexible couplings the following must be considered:
- nominal motor horsepower
- motor operating speed
- coupling guard must meet safety standards as dictated by OSHA, etc.

Flexible couplings must be properly aligned. Bad alignments will result in coupling failures and damage to pump and motor bearings.

Assembly instructions for MONOBLOCK design are listed on paragraph 7.3 steps 1, 2, 4, 5, 6.
Assembly instructions for PUMP-MOTOR ON BASEPLATE are listed on paragraph 7.3 steps 7, 1, 8, 5, 9, 10, 11.
For pump driven with V-Belt, please consult TRAVAINI PUMPS USA for further information.

7.2 - ALIGNMENT PROCEDURES FOR MONOBLOCK AND FOR PUMP/MOTOR ASSEMBLY ON BASEPLATE.
TRAVAINI PUMPS USA prior to shipment properly aligns the pump/motor assembly. It is however required to verify the alignment prior to the start-up. Misalignment can occur during handling, transportation, grouting of assembly, etc.

For alignment procedures of MONOBLOCK design see paragraph 7.3 steps 3, 4, 5, 6.
For alignment procedure of BASEPLATE design see paragraph 7.3 steps 7, 5, 9, 10, 11.

NOTE: Coupling sizes and permissible coupling tolerances listed in this manual are applicable to the particular coupling brand installed by TRAVAINI PUMPS USA as a standard. For sizes and tolerances of other type of couplings, follow the instructions given by their respective manufacturer.

7.3 - ALIGNMENT INSTRUCTIONS
NOTE: Alignment should be done at ambient temperature, with power to the motor disconnected and following the safety procedures to avoid accidental starting (see section 2).

Should the pump operate at high temperatures that could upset the coupling alignment, it is necessary to check the alignment to secure proper working operation at such operating temperatures. It is recommended the use of proper hand protections such as gloves, when carrying out the operations listed below (schematics for various assemblies are shown).

NOTE: The following points must be followed with the sequence stated above and depending upon the type of operation: alignment assembly or alignment verification.

1 - Thoroughly clean motor/pump shaft ends and shaft keys, place the shaft keys in the proper key way slots and fit the coupling halves in line with the shaft ends. The use of rubber hammers and even pre-heating of the metal half couplings may be required (see fig. 5). Lightly tighten the set screws. Verify that both pump and motor shafts rotate freely.

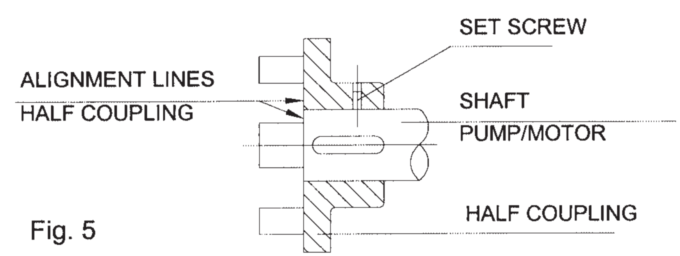


Fig. 5

2 - Insert the perforated metal sheet coupling guard inside the lantern so that the coupling is accessible from one of the lateral openings. Couple the electric motor to the pump lantern engaging the two coupling halves, hands may reach the coupling halves through the lateral opening (see fig. 7) tighten the assembly with bolts supplied with the unit and install the supporting foot, when applicable (see fig. 6).

3 - Applying slight hand pressure to the coupling guard, rotate it so that one opening of the lantern is accessible (see fig. 8).

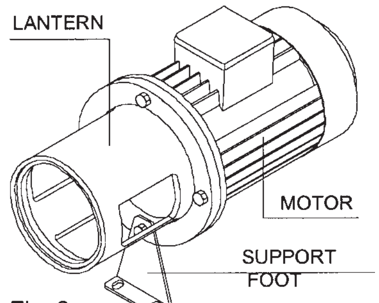


Fig. 6

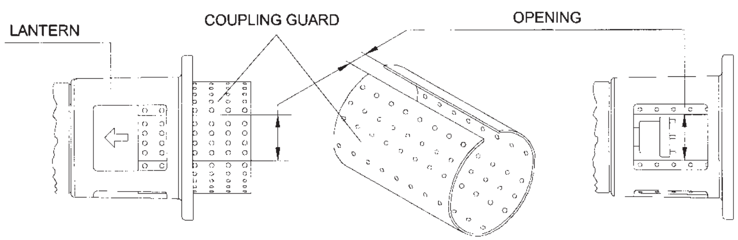


Fig. 7 - PREPARING TO ASSEMBLE THE MONOBLOCK DESIGN

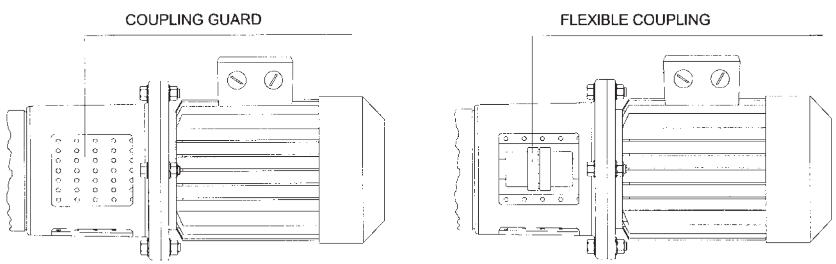


Fig. 8 - CHECKING THE ALIGNMENT 0N MONOBLOCK DESIGN

4 - Rotate by hand the coupling through the lateral opening of the lantern to make sure the pump is free.

5 - With a feeler gauge, check the distance between the two coupling halves. The gap value “S” should be as listed on table 2 or as given by the coupling manufacturer. In the event, an adjustment is necessary, loosen the set screws on the coupling half and with a screw driver move the coupling half to attain the gap “S” (see fig. 12). Then tighten the set screw and rotate the rotor by hand to make sure, once more, that there is no obstruction.

6 - Rotate back the coupling guard by hand through the two openings of the lantern so that both openings are completely covered. This will complete the alignment verification of the MONOBLOCK design.

7 - Remove the coupling guard and its extension (if there is one) attached to the pump, by removing the two locking screws (see fig. 9 and 10).

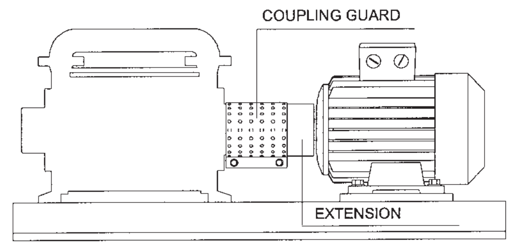


Fig 9 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

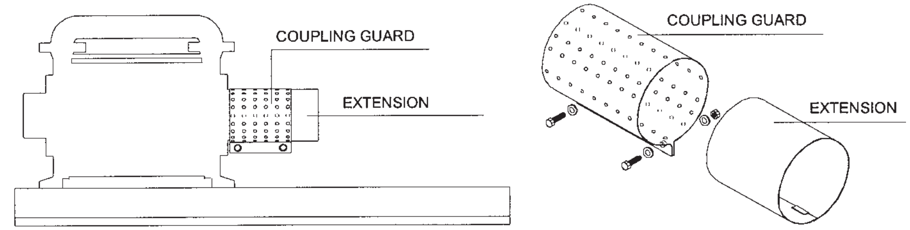


Fig. 10 - ASSEMBLING THE UNIT ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2mm gap between them keeping the motor axially aligned with the pump shaft. In the event the two shaft heights do not align, proper shimming under the pump or motor feet will be required. Mark the motor and/or pump anchoring bolt holes. Remove motor and/or pump, drill and tap the holes, clean and mount pump and/or motor in place and lightly tighten the bolts (see fig. 11).

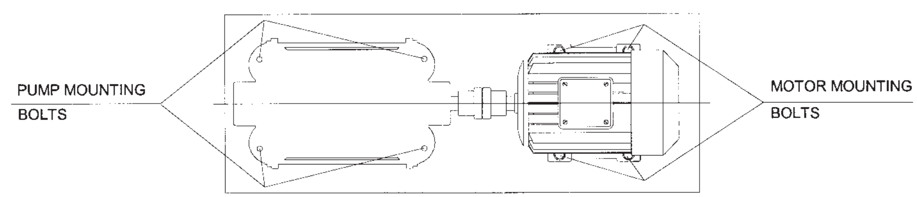


Fig. 11

9 - With a straight edge ruler check the parallelism of the two coupling halves at several points, 90° from each other (see fig. 13).

NOTE: Easier and more accurate readings can be attained with instruments such as Dial Indicators (if readily available).

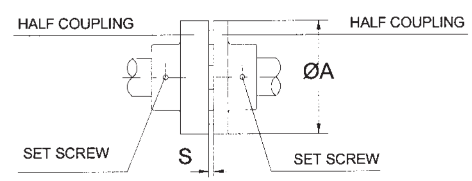


Fig. 12 (Center - Under view)

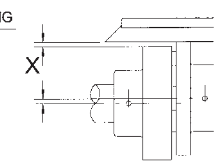


Fig. 13

If the maximum value of “X” is higher than that listed in the table 2 (for the given coupling size) it will be required to correct the alignment by using shims under the pump or motor feet. When the measured values fall within the tolerances (tolerances only given for “S”), the pump and motor mounting bolts can be tightened.

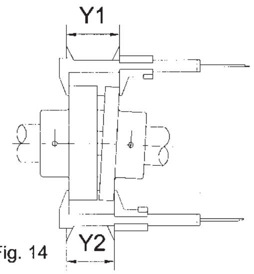


Fig. 14

10 - Angular misalignment can be measured with a Caliper. Measure the outside coupling dimension at several points (see fig. 14). Find the minimum and maximum width of the coupling, the difference between these two readings “Y” (Y1-Y2) should not exceed the value listed in table 2 for the given coupling size. Should this value be greater it will be necessary to correct the alignment by shimming the pump and/or motor. Following this operation it is recommended to check once more the value “X” to make sure that both values are within the allowed tolerance (see point 9). Make sure that both set screws on the coupling halves are properly secured.

Table 2

COUPLING “Ø A” mm	GAP “S” mm	PARALLEL “X” mm	ANGULAR “Y” mm
60	2 to 2.50	0.10	0.20
80	2 to 2.50	0.10	0.20
100	2 to 2.50	0.15	0.25
130	2 to 2.50	0.15	0.25
150	3 to 3.75	0.15	0.30
180	3 to 3.75	0.15	0.30
200	3 to 3.75	0.15	0.30

11 - Install the coupling guard and its extension (if applicable) on the pump, secure the two locking bolts. The gap between motor frame and the guard should not be greater than 2 to 3mm (see fig. 15).

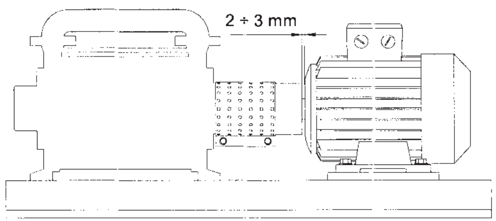


Fig. 15

8 - ELECTRICAL CONNECTIONS

Electrical connections must be made exclusively by qualified personnel in accordance with the instructions from the manufacturer of the motor or other electrical components and must adhere to the local National Electrical Code.

FOLLOW ALL SAFETY PRECAUTIONS AS LISTED IN SECTION 2. BEFORE DOING ANY WORK TO THE INSTALLATION, DISCONNECT ALL POWER SUPPLIES.

It is recommended that electric motors be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be sized in accordance with the full load amperage appearing on the motor nameplate. It is advisable to have an electrical switch near the pump for emergency situations. Prior to connecting the electrical wiring, turn the pump shaft by hand to make sure that it rotates freely. Connect the electrical wiring in accordance with local electrical codes and be sure to ground the motor. Motor connection should be as indicated on the motor tag (frequency and voltage) and as discussed in the motor instruction manual. It is recommended that motors over 75Hp be wired for soft

start, to avoid electrical overloads to the motor and mechanical overloads to the pump. Be sure to replace all safety guards before switching on the electrical power. If possible check the direction of rotation before the motor is coupled to the pump but protect the motor shaft to prevent any accidents. When this is not possible briefly jog the pump to check its direction of rotation (see arrow on pump for correct rotation). If the direction must be changed two of the three electrical wire leads must be alternated with each other (at the terminal box or at the motor starter). Be aware that rotation in the wrong direction and/or pump running dry may cause severe pump damage. Electrical instrumentation such as solenoid valves, level switches, temperature switches, etc. which are supplied with the pump or systems must be connected and handled in accordance with the instructions supplied by their respective manufacturers. Contact TRAVAINI PUMPS USA for specific details.

9 - INSTALLATION INSTRUCTIONS

Information to determine the piping sizes and floor space requirements can be obtained from dimensional drawings and other engineering data. The information required is:

- size and location of suction and discharge flanges
- size and location of service liquid connection and connections for cooling, heating, flushing, draining, etc.
- location and size for mounting bolts for monoblock pump and/or baseplate and/or frame.

In the event additional accessories are required to complete the installation such as separators, piping, valves, etc. refer to sections 9.2 to 9.8. Proper lifting devices should be available for installation and repair operations. Pump assembly should be installed in an accessible location with adequate clear and clean space all around for maintenance, so that an efficient and proper installation can be made. It is important to have proper room around the unit for ventilation of motor and air-cooled radiator, if applicable. Avoid installing the unit in hidden locations, dusty and lacking of ventilation. Select a mounting pad that will minimize vibrations or torsion of the pump baseplate or frame. It is generally preferred to have a concrete base or sturdy steel beams. It is important to provide adequate anchor bolting for the pump frame or baseplate to be firmly attached to the foundations (see fig. 16).

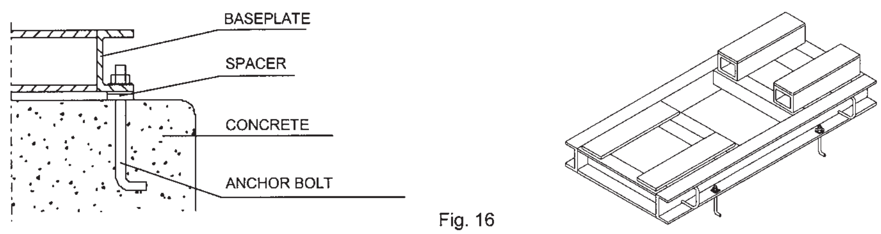


Fig. 16

Concrete pads and other concrete works must be aged, dry and clean before the pump assembly can be positioned in place. Complete all the work relating to the foundations and grouting of the pump assembly, before proceeding with the mechanical and electrical portion of the installation.

9.1 - PIPING CONNECTIONS
Identify first locations and dimensions of all connections required to interconnect the pump with the installation, then proceed with the actual piping: connect the pump suction and discharge flanges, the service liquid line and all other service connections (see fig. 17 to 26).

BE SURE TO PIPE THE CORRECT CONNECTION FROM THE INSTALLATION TO THE RESPECTIVE PUMP CONNECTION!

To prevent foreign matters from entering the pump during installation, do not remove protection cap from flanges or cover from openings until the piping is ready for hook-up. Verify that all foreign objects such as welding bits, bolts, nuts, rags and dirt are removed from piping, separators, etc. before these are connected to the pump. Flanges should be connected parallel with each other, without stress and with bolt holes lined up. The flange gaskets should not interfere with the inside diameter of piping and/or flange. All piping must be independently supported, easily located and must not transmit forces or torque to the pump due to the weight or to thermal expansions. Piping size must never be less than the respective connection on the pump. Suction and discharge flanges are vertical and identified with arrows. To minimize friction losses and back-pressures, the discharge piping should be one size larger than the pump connection size. To avoid back-pressure and possibility of flooding the pump when it stops, it is recommended to limit the rise of the discharge piping to approximately 2 feet above the pump discharge flange. Upon completion, piping and connections should be tested for leakage under vacuum.

9.2 - ACCESSORIES
Listed below are common accessories that may be supplied with the pump or added at a later date. See fig. 17 to 26 for locations and connection sizes on the pumps.

Non return valve, (check valve)
Prevent back-flow of gas and liquid in the suction piping and/or discharge piping when the pump stops. Is installed on the pump suction flange in the case of vacuum service or on the pump discharge flange in the case of compressor service.

Vacuum relief valve
It is used to protect the pump from cavitation or to regulate the suction minimum pressure (or max vacuum).
When the pump capacity exceeds the system load at a given vacuum, the relief valve opens letting in atmospheric air or gas (if connected to the discharge separator) keeping constant the pre-set vacuum.

Automatic draining valve
It is used to drain the pump to the shaft centerline when the pump stops so to prevent that the pump has excessive liquid for the next start-up. Starting the pump full or with too much liquid could severely damage the pump and may cause excessive Amp draw from the motor.

Vacuum gauge
It usually installed under the pump suction flange and will provide an indication of the pump operating vacuum (pressure).

Discharge reservoir separator
It separates the service liquid from the gases at the pump discharge. It can be mounted on the pump discharge flange or on the pump baseplate. It is required when the system is with partial or total recovery of the service liquid.

Heat exchanger
It cools the service liquid for those systems with total liquid recovery: it can be plate and frame, shell and tube or radiator type, depending upon the application.

Filter
Required to stop solids from entering the pump suction. Sizing of the filter is very important as it could create excessive pressure drops, which would affect the pump performance.

9.3 - INSTALLATION SCHEMATICS FOR LIQUID RING VACUUM PUMPS
The working principle of the vacuum pump requires a continuous flow of fresh and clean liquid that enters the pump at the service liquid connection identified by the letter **Z** (see section 9.11). The liquid is discharged together with the handled gas through the pump discharge flange. The quantity of said liquid will vary with pump size and degree of working vacuum (see performance curves and/or table 3). The service liquid absorbs the compression heat generated by the pump compression, which results in a temperature rise of the service liquid (for additional information, see chapter 17). There are three basic installation schematics listed below that may be considered, depending upon the quantity of service liquid that is desired and possible to be recycled.

9.3.1 - Service liquid: Once-through system (no recovery)
All the service liquid is supplied from an external source. The liquid is separated from the incoming gas in the discharge separator and is completely drained. This is a popular installation and is used where there is an abundant supply of fresh liquid and/or there is no contamination of the same. The service liquid should be supplied at the pump connection with a pressure of 5.8psig maximum to avoid flooding the pump with too much liquid. If this is not possible it is recommended to install a reservoir fitted with a float valve, this tank is supplied with the liquid that is then pulled by the pump as required by the operating conditions. The liquid level in the reservoir should be approximately at the pump shaft centerline. Schematic fig. 17 illustrates the once-through system.

9.3.2 - Service liquid: Partial recovery system
This type of installation is used where it is desired to minimize the use of fresh service liquid (for calculations see section 17). The service liquid enters and leaves the pump same as the once through system, however part of the liquid is recycled from the discharge separator and the balance is continuously supplied from an external source. The excessive liquid is drained through the separator overflow connection. The temperature of the mixed liquid supplied to the pump will be higher than the temperature of the make-up liquid. Its final temperature will depend upon the amount of the recycled liquid. It is important to remember that with higher service liquid temperature the pump performance will decrease (see section 17) with the possibility of operating the pump in the cavitation area. When the separator/reservoir is installed along side of the pump, its liquid level should not be above the pump shaft centerline. When flanged separators are mounted on the pump discharge flange, the liquid level is automatically maintained by the location of the connections. Schematic fig. 18 illustrates the system with partial recovery of the service liquid.

9.3.3 - Service liquid: Total recovery system
This system has total recycle of the service liquid without fresh liquid make-up from an outside source. A heat exchanger is required to lower and control the temperature of the recycled service liquid: for sizing and calculations of heat loads

see section 17. A circulating pump will be required for those applications where the vacuum pump operates for extended periods of times in the pressure ranges above 20"Hg vacuum or when there are high pressure drops in the closed loop including the heat exchanger (over approximately 30psi.). The liquid level in the separator/reservoir should not be above the pump shaft centerline. Losses of liquid from the closed loop must be compensated with an equal amount from an outside source. Schematic fig. 19 illustrates the system with total recovery of the service liquid.

9.4 - INSTALLATION SCHEMATICS FOR LIQUID RING COMPRESSORS

The liquid ring vacuum pump can also operate as a compressor up to a maximum differential pressure, depending upon the models, of about 30 psig. The compressor series SA are specifically engineered to perform with differential pressures of up to 150 psig, depending on models. The principle of operation is same as given in previous paragraph (9.3 for vacuum pumps) and there are three possible types of installation: once-through service liquid, partial recovery service liquid and total recovery service liquid. The service liquid entering the compressor connection should have a pressure of minimum 5psig. above the compressor operating inlet pressure. A booster pump will be required if the service liquid is available at lower pressures. Separator/reservoir is considered a pressure vessel and as such it must be engineered and built to the applicable codes (ASME, etc.). Accessories such as a pressure relief valve, check valve (non-return valve), automatic float type drain valve (water trap), etc. are required in a compressor system. Fig. 20, 21 and 22 illustrate the three possible types of installations.

9.5 - INSTALLATION OF "WATER SEALED" SYSTEMS

WATER SEALED systems are factory assembled and piped including discharge separator/reservoir, heat exchanger (air/liquid or air/air), circulating pump, and all required accessories mounted on a common compact baseplate/frame. See section 18 for additional details. Installation of WATER SEALED system is similar to that of a vacuum pump or a compressor with partial recovery or total recovery of service liquid depending upon the application (see section 9.3 or 9.4). It is important to properly engineer the connecting piping to the system suction and discharge, cooling lines, flushing lines, and draining lines. The used heat exchanger is designed with service liquid being cooled approximately 4 to 6°C (39 to 43 °F) over the available cooling media temperature. The cooling liquid flow is approximately the same as the service liquid flow needed by the pump at the operating conditions (see section 9.7 or 9.8). Schematics for once-through, partial and total service liquid recovery are shown in fig. 18 - 19 - 21 - 22.

9.6 - INSTALLATION OF "OIL SEALED (DynaSeal™)" SYSTEMS

OIL SEALED (DynaSeal™) are factory packaged systems including liquid ring vacuum pump using oil for service liquid. For additional details see section 19. Installation is simple and does not require additional details other than those already discussed in the previous chapter. Suction and discharge piping should be connected to the respective pump flanges. When locating the discharge piping it should be noted that although the system is fitted with oil demister, there may still be traces of oil fumes carried by the vented gas. Make sure therefore, that the selected area for vacuum pump discharge is suitable for such purpose. All other connections, (heat exchanger, draining, etc.) must be properly done. See fig. 37 for location of connections.

ATTENTION:
HOT SURFACES, DO NOT TOUCH TO AVOID POSSIBLE BURNS!

During operation, the temperature of pump, frame, separator and piping can reach values over 60 °C. Therefore, take all precautions necessary to comply with the safety regulations.

9.7 - SERVICE LIQUID (H_2O at 60 °F) FLOW (in GPM) FOR VACUUM PUMPS

The listed values are referred to the system with "Once-through" service liquid, handling dry air at 20 °C (68 °F) (for more specific data see the pumps performance curve). To reduce the amount of service liquid flow read the information given in section 17. If the pump is handling saturated or condensable gases at relatively high temperatures, there will be condensation inside the pump. In those cases the service liquid flow listed below can be increased up to 25% to reduce the discharge temperature and minimize the danger of pump cavitation at high vacuum.

Table 3

PUMP MODEL	SUCTION PRESSURE (in Torr) 25-150	>150-450	>450
TRH 32-4	0.9	0.9	0.7
TRH 32-20	1.5	1.3	1.2
TRH 32-45			
TRH 32-60	4.0	3.0	2.6
TRH 40-110			
TRH 40-140			
TRH 40-190	4.4	3.7	3.0
TRH 50-280	10.5	7.5	4.0
TRH 50-340	13.0	9.8	5.3
TRH 50-420	15.8	12.0	7.0
TRH 80-600	11.0	8.7	5.7
TRH 80-750	13.0	10.6	7.0
TRH 100-870	32.5	25.0	16.7
TRH 100-1260			
TRH 100-1600			
TRH 150-2000	53	42	26
TRH 150-2600	58	49	29
TRH 150-3100	16.20	14.10	8.70

PUMP MODEL	SUCTION PRESSURE (in mbar) 150 - 450	> 450
TRS 32-20	1.5	1.0
TRS 32-50		
TRS 40-55	3.4	1.9
TRS 40-80		
TRS 40-100	4.2	2.5
TRS 40-150	5.1	3.2
TRS 50-220	10.6	5.7
TRS 100-550	12.8	7.7
TRS 100-700	14.5	9.2
TRS 100-980	40	24
TRS 125-1250	38	18
TRS 125-1550	44	20
TRS 200-1950	80	50
TRS 200-2500	88	51
TRS 200-3100	114	77

PUMP MODEL	SUCTION PRESSURE (in Torr) 25-150	>150-450	>450
TRM 32-25	1.8	0.9	0.6
TRM 32-50	2.0	1.0	0.7
TRM 32-75	3.0	1.8	1.5
TRM/V 40-110	5.3	3.5	2.2
TRM/V 40-150			2.4
TRM/V 40-200	5.7	4.0	2.6
TRM/V 50-300	7.0	5.3	3.5
TRV 65-300			
TRV 65-450	10.5	7.4	4.0

For the above pumps running as compressors without the specific performance curves, please contact TRAVAINI PUMPS USA.

9.8 - SERVICE LIQUID FLOW (H_2O at 60°F) AND PRESSURE FOR COMPRESSORS SERIES "SA"

Values are applicable when the compressor suction is barometric pressure (1013 mbar) and the gas is air at 20°C (68 °F). The indicated flow and pressure requirements are valid for the compressor total performance curve.

SA0E3U	=	4 GPM at minimum pressure of 20 to 40psi.
SA0G2D	=	4 GPM at minimum pressure of 20 to 40psi.
SA0G2G	=	6 GPM at minimum pressure of 20 to 40psi.

9.9 - TYPICAL INSTALLATION SCHEMATICS FOR VACUUM PUMPS

Fig. 17

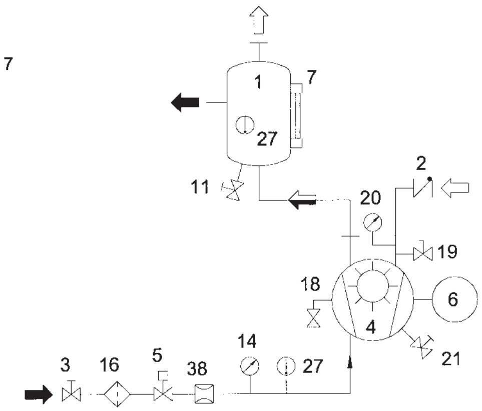


Fig. 18

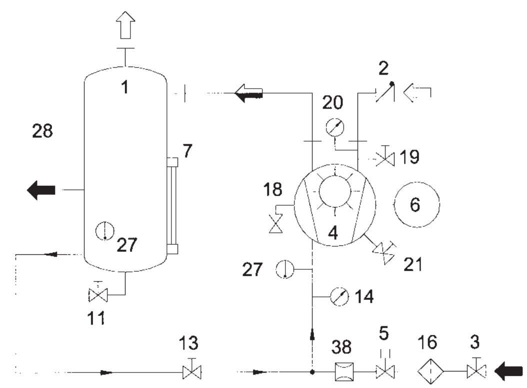
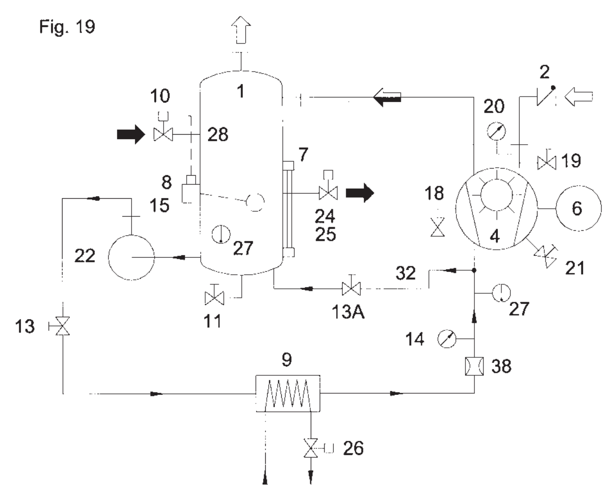


Fig. 19



1 Separator/ reservoir

2 Non-return valve

3 Shut-off valve (check valve)

4 Liquid ring vacuum pump

5 Solenoid valve

6 Electric motor

7 Level gauge glass

8 Float valve

9 Heat exchanger

10 Make-up solenoid valve

11 Drain valve

13 Flow control valve

13A By-pass valve

14 Pressure gauge

15 Level switch

16 Filter (y-strainer)

18 Automatic drain valve (check valve)

9.10 - TYPICAL INSTALLATION SCHEMATICS FOR COMPRESSORS

Fig. 20

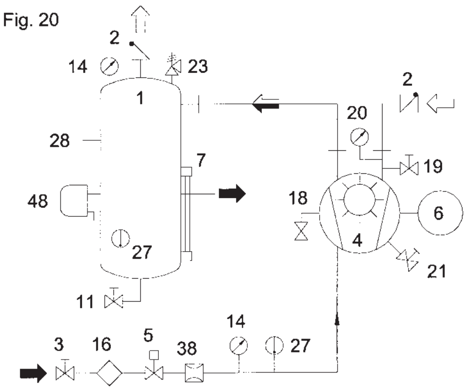


Fig. 21

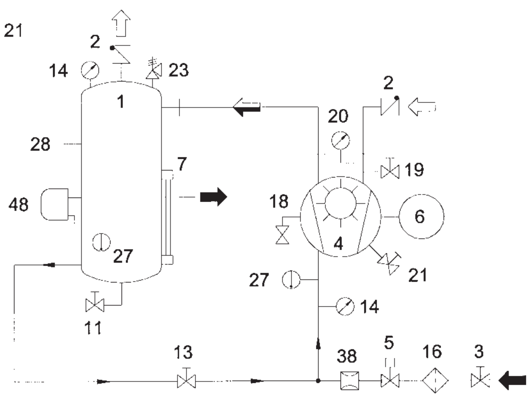
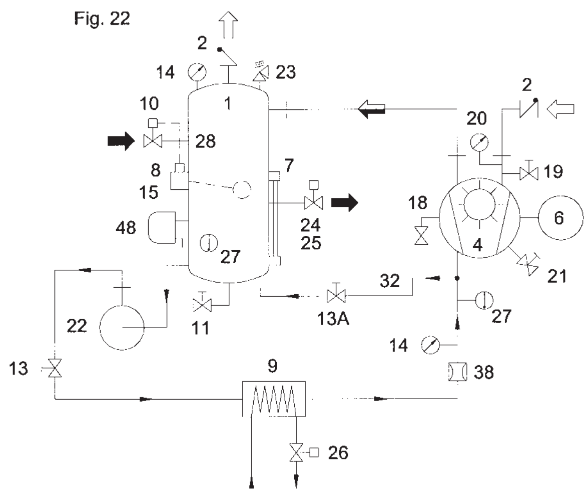


Fig. 22



19 Valve for spare vacuum connection

20 Vacuum gauge

21 Anti-cavitation valve

22 Circulating pump

23 Pressure relief valve

24 Overflow valve

25 Draining solenoid valve

26 Solenoid valve for heat exchanger cooling liquid

27 Temperature gauge

28 Fill connection

32 By-pass piping

38 Orifice flow

48 Automatic drain valve or water trap

Air or Gas

Liquid-Gas mixture

Liquid

9.11 - CONNECTIONS LOCATION

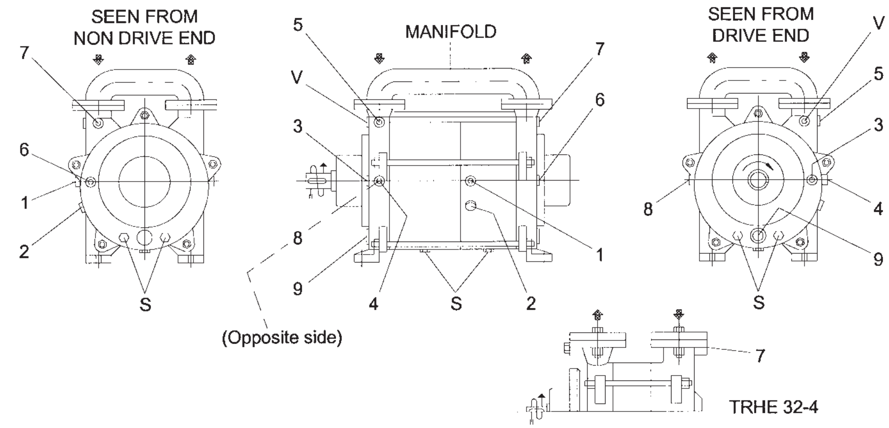


Fig. 23 - Pump series TRH (for details, see table 4)

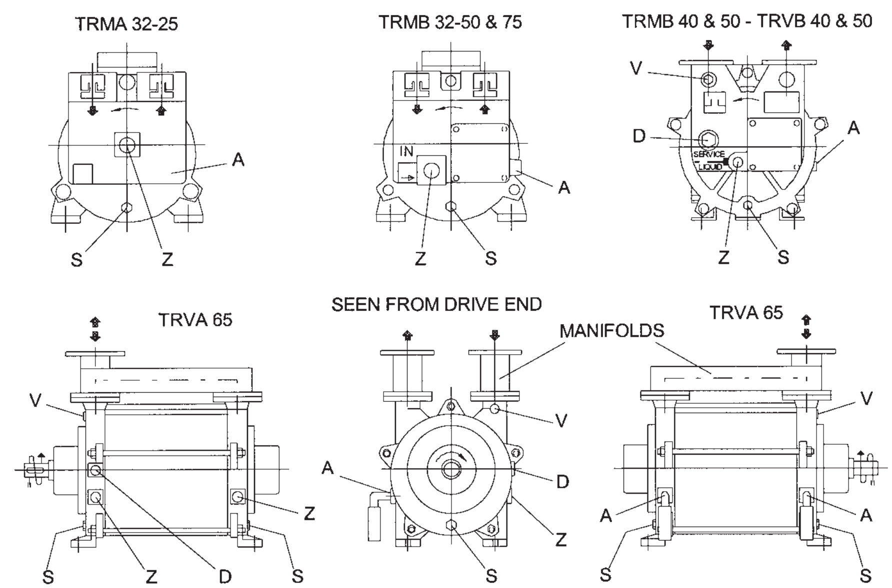


Fig. 24 - Pump series TRM - TRV (for details see table 5)

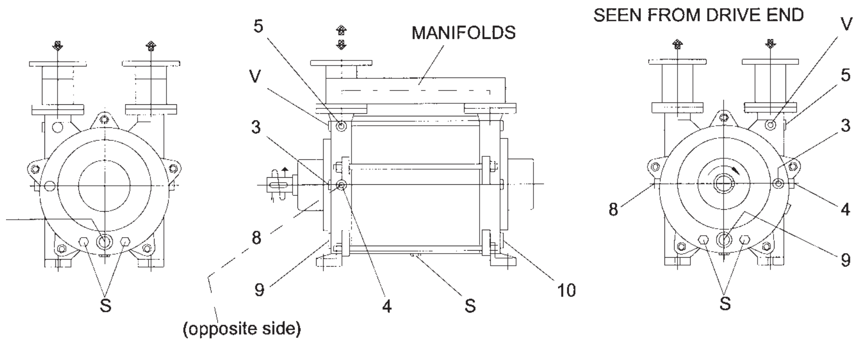


Fig. 25 - Pump series TRS (for details, see table 6)

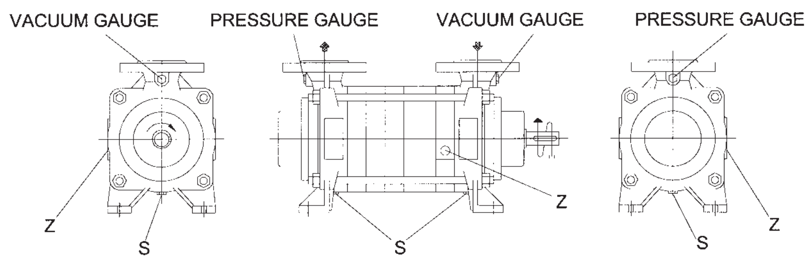


Fig. 26 - Pump series SA (for details, see table 7)

Table 4 – Pump series TRH

PUMP MODEL	A		D		Z		Qty. Manifolds
	Location	Connection Size	Location	Connection Size	Location	Connection Size	
TRHE 32-4	-	-	-	-	7	1/4" GAS	
TRHE 32-20 & 45					8	3/8" GAS	-
TRHC 32-20 & 45	1				4		
TRHE & TRHC 32-60						1/2" GAS	1
TRHE 40-110		1/4" GAS				3/4" GAS	-
TRHC 40-110	2		4			1/2" GAS	
TRHE 40-140 & 190			3	1/2" GAS		3/4" GAS	
TRHC 40-140 & 190			4		9	1/2" GAS	
TRHB 50	7		3			1" GAS	1
TRHC 80	6	3/8" GAS	4			1 1/4" GAS	
TRHE 100		1/2" GAS		1" GAS		1 1/2" GAS	
TRHA 150	7	3/4" GAS	4 - 5			2 1/2" GAS	

Table 5 - Pump series TRM – TRV

PUMP MODEL	Connection Size				Qty. Manifolds
	A	D	S	Z	
TRMA 32-25 & TRMB 32-50		-	1/8" GAS	1/4" GAS	
TRMB 32-75				3/8" GAS	
TRMB & TRVB 40	1/8" GAS	1/2" GAS		1/2" GAS	-
TRMB & TRVB 50		3/4" GAS	1/4" GAS	3/4" GAS	
TRVA 65		1/2" GAS		1/2" GAS	2

Table 6 - Pump series TRS

PUMP MODEL	D		Z		Qty. Manifolds
	Location	Connection Size	Location	Connection Size	
TRSE 32			8	3/8" GAS	
TRSC 32	-	-	4		-
TRSE 40-55 to 150				3/4" GAS	
TRSC 40-55 to 100	4		9	1/2" GAS	
TRSC 40-150		1/2" GAS			1
TRSE 50-220	3			3/4" GAS	
TRSC 50-220				1/2" GAS	
TRSB & TRSC 100	4		9 - 10	1 1/4" GAS	2
TRSE 125		1" GAS		1 1/2" GAS	
TRSA 200	4 - 5			2 1/2" GAS	

Table 7 - Pump series SA

COMPRESSOR MODEL	Connection Size	
	S	Z
SA0E3U		3/8" GAS
SA0G2D	1/4" GAS	1/2" GAS
SA0G2G		

GAS = Straight pipe thread
A = Connection anti-cavitation
D = Auxiliary connection for automatic draining valve, connection valve for spare vacuum pick-up, vacuum relief valve
S = Connection for drain plugs or valves
V = Connection for vacuum gauge 1/4" GAS (series 32 excluded)
Z = Connection for service liquid

All drawings are general and schematics (for additional details see the specific pump catalogue).

9.12 - PUMP ENGINEERING DATA

Table 8

PUMP MODEL	Noise Level	Weight Bare Pump	Weight assembly Monoblock (B5 design)	Weight assembly with baseplate	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
TRHE 32-4	67	30	42	70	1450	1750	0.55	0.75
TRHC 32-20	66	55	68	90	2900	3500	1.1	1.5
TRHE 32-20	66	40	50	75	2900	3500	1.1	1.5
TRHC 32-45	66	62	75	97	2900	3500	1.5	2.0
TRHE 32-45	66	46	56	81	2900	3500	1.5	2.0
TRHC 32-60	66	66	79	103	2900	3500	2.2	3
TRHE 32-60	66	57	68	95	2900	3500	2.2	3
TRHC 40-110	65	147	174	202	1450	1750	4	5
TRHE 40-110	65	108	134	160	1450	1750	4	5
TRHC 40-140	65	174	194	262	1450	1750	4	5
TRHE 40-140	65	147	167	220	1450	1750	4	5
TRHC 40-190	65	191	231	301	1450	1750	5.5	7.5
TRHE 40-190	65	165	205	260	1450	1750	5.5	7.5
TRHB 50-280	70	286	321	429	1450	1750	9	15
TRHB 50-340	70	308	374	466	1450	1750	11	15
TRHB 50-420	71	319	392	484	1450	1750	15	20
TRHC 80-600	76	484	539	792	1450	1750	22	30
TRHC 80-750	76	528	616	829	1450	1750	30	40
TRHE 100-870	79	906	—	1263	960	1150	30	40
TRHE 100-1260	79	1067	—	1434	960	1150	37	50
TRHE 100-1600	79	1140	—	1518	960	1150	45	60
TRHA 150-2000	83	2926	—	3971	730	880	75	100
TRHA 150-2600	84	3256	—	4609	730	880	90	125
TRHA 150-3100	84	3586	—	4939	730	880	110	150
TRSC 32-20	69	42	55	85	2900	3500	1.1	1.5
TRSE 32-20	69	32	45	68	2900	3500	1.1	1.5
TRSC 32-50	69	44	58	89	2900	3500	1.5	2.0
TRSE 32-50	69	38	47	73	2900	3500	1.5	2.0
TRSC 40-55	66	119	147	73	1450	1750	2.2	3
TRSE 40-55	66	75	103	130	1450	1750	2.2	3
TRSC 40-80	66	125	154	180	1450	1750	3	5.0
TRSE 40-80	66	81	110	136	1450	1750	3	5.0
TRSC 40-100	67	132	158	187	1450	1750	3	5.0
TRSE 40-100	67	86	114	141	1450	1750	3	5.0
TRSC 40-150	67	156	194	211	1450	1750	4	5.0
TRSE 40-150	67	97	125	152	1450	1750	4	5.0
TRSC 50-220	67	191	229	268	1450	1750	5.5	7.5
TRSE 50-220	67	162	202	240	1450	1750	5.5	7.5
TRSC 100-550	76	440	495	719	1450	1750	15	20
TRSC 100-700	76	506	561	836	1450	1750	18.5	30
TRSB 100-980	78	550	638	847	1450	1750	30	40
TRSE 125-1250	174	959	—	596	960	1150	37	50
TRSE 125-1550	174	1016	—	634	960	1150	45	60
TRSA 200-1950	183	2475	—	1600	730	880	75	100
TRSA 200-2500	184	2695	—	1700	730	880	75	100
TRSA 200-3100	184	2915	—	1800	730	880	110	160

Table 8 (continued)

PUMP MODEL	Noise Level	Weight assembly Monoblock 50 Hz motor	Weight assembly Monoblock 60 Hz motor	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
TRMA 32-25	69	37	40	2900	3500	0.75	1.1
TRMB 32-50	69	53	57	2900	3500	1.5	2.2
TRMB 32-75	70	81	91	2900	3500	3	4
TRMB 40-110	68	145	156	1450	1750	3	4
TRMB 40-150	69	167	233	1450	1750	4	5.5
TRMB 40-200	72	227	244	1450	1750	5.5	7.5
TRMB 50-300	72	277	—	1450	—	7.5	—

PUMP MODEL	Noise Level	Weight Bare Pump	Weight assembly Monoblock (B5 design)	Weight assembly with baseplate	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
TRVB 40-110	68	—	136	—	1450	1750	3	4
TRVB 40-150	69	—	141	—	1450	1750	4	5.5
TRVB 40-200	72	—	172	—	1450	1750	5.5	7.5
TRVB 50-300	72	—	194	—	1450	1750	7.5	10
TRVA 65-300	70	293	341	354	1450	1750	7.5	10
TRVA 65-450	70	321	387	442	1450	1750	11	15

PUMP MODEL	Noise Level	Weight assembly Monoblock 50 Hz motor	Weight assembly Monoblock 60 Hz motor	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
SA0E3U	67	123	242	2900	3500	11 15	15 20
SA0G2D	69	183	297	2900	3500	11 15	18,5 25
SA0G2G	69	191	139 157	2900	3500	15 22	20 30

NOTES:

- Noise level (measured at 3 feet distance, without motor, with pump installed in the system) for pump series TRH, TRM, TRV when operating at 60 Torr and pump series TRS when operating at 175 Torr. Noise level test to ISO 3746 standards and with pumps at 50 Hz operating speeds.
- Weights are for pumps fitted with Mechanical Seals and in Cast Iron materials (tolerance ± 10%).
- The assemblies, Monoblock and with Baseplate, are suitable for 50 Hz motors, except where otherwise noted. Indicated total weights for the assemblies are without motors.
- The installed motor size will cover the whole performance curve when operating as vacuum pump.

10 - CHECK LIST PRIOR TO START-UP

All questions listed below must have **POSITIVE** answers prior to proceeding to the pump start-up. Please note that the following is a partial list. Special installations may require further precautions therefore; additional safety steps must be taken as the case dictates.

- **This manual has been completely read, including the following chapters, and is understood in its entirety?**
- **The piping system has been flushed of any foreign particles, welding impurities, etc.?**
- **Have all piping and pump obstruction been removed?**
- **All connections and piping are leak proof and there are no external forces or moments applied to the piping or pump flanges?**
- **Pump and motor are properly lubricated, per instructions?**
- **Pump/motor alignment has been checked?**
- **Mechanical seal flushing line has been connected, where required?**
- **All valves in the installation are in the correct position?**
- **All safety guards are in place?**
- **Pump direction of rotation has been checked by jogging the motor?**
- **The pump Stop switch is clear and visible?**
- **Pump as well as installation are ready for start-up?**

11 - STARTING, OPERATING AND STOPPING PROCEDURES

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free the rotor by applying a torque to the pump coupling with a pipe wrench. To free the rotor of a monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end that has a threaded connection and apply the torque by hand. In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.

NOTE: The selected solvent or lubricating fluid must be compatible with the pump, seals and gasketing materials.

CHECK PUMP-MOTOR COUPLING ALIGNMENT!
This must be done prior to the first start-up and before every start-up if pump or motor has been removed from the installation for maintenance or other reasons. See section 7.2.

Prior to starting the pump verify that all auxiliary components are available, ready for use and, where required, they are in the open position (i.e.: double mechanical seals are pressurized with buffer liquid, cooling liquid to heat exchanger is open, etc.) and the pump bearings are lubricated. If the gas and/or service liquid temperatures are in the dangerous levels, it is recommended to insulate the pump, piping and separator to avoid direct contact with their surface, avoid freezing, thermal shock or loosing heat energy.

NOTE: See section 11.4 to 11.6 for OIL SEALED (DynaSeal™) systems start-up, operation and shut-down.

11.1 - START-UP of WATER SEALED Systems

(In the following, reference is made to certain ITEM numbers, which appear on fig. 17 to 22 of section 9 and 18).

Open valve at gas discharge if installed and partially open the valve at the suction side. When operating the pump as a compressor, there must be a check valve ITEM 2, fitted at the discharge side. When pump ITEM 4, is fitted in a partial recovery or total recovery or WATER SEALED systems, as built by TRAVAINI PUMPS USA, it is required to have drain valve ITEM 11, at separator ITEM 1, in the closed position, flow regulating valve ITEM 13, in the open positions. Before start-up fill the pump to the shaft centerline, separator and piping of system with service liquid through pump inlet flange or fill connection ITEM 28. Check all components for leakage. Start all accessories (temperature switches, level switches, pressure switches, etc.) open cooling and flushing lines. Start the pump and open the service liquid valve, ITEM 3 if applicable, soon after, start the circulating pump, ITEM 22 (if applicable) and adjust the service liquid flow (see table 3). Gradually open the valve at gas suction side till the required vacuum level is reached. Check the system for abnormal conditions (see section 12 and 14). If the system is fitted with a circulating pump and/or the service liquid has an excessive pressure the by-pass valve ITEM 13A, (if available) or valve, ITEM 13 can be adjusted to reduce the service liquid flow to the vacuum pump and/or optimize the thermodynamic efficiency of the heat exchanger ITEM 9.

NOTE: WATER SEALED systems engineered with multiple pumps are fitted with isolating valves at suction, discharge, and service liquid lines of each pump. When one or more pumps are not operating it is required to isolate the idle pump(s) by closing these valves. When the pumps are put back into service the said valves (at suction and discharge) must be opened.

11.2 - OPERATION

After starting the vacuum pump check the following:

- the vacuum level is as desired or adjust the flow-regulating valve to the required vacuum
- flow and temperature of service liquid and/or cooling liquid are as expected (within 25% tolerance)
- motor does not draw more amperage than shown on its nameplate
- the pump-motor assembly does not have abnormal vibrations and noises such as cavitation
- the operating temperature at full load does not exceed approximately 85°C
- there are no leaks from mechanical seals, joints and flushing or cooling liquid lines
- liquid level in separator is between the minimum and the maximum.

NEVER OPERATE THE PUMP DRY!

If the gas discharge is not open to the immediate atmosphere but it is piped to other locations, the pump discharge should be checked for back-pressures that could cause higher power consumption and loss of pump capacity.

11.3 - SHUT DOWN of “WATER SEALED” SYSTEMS
First close the service liquid flow and cooling liquid flow (if applicable) then shut down the circulating pump, ITEM 22, (if applicable). Where possible, gradually decrease the vacuum level to 300-675 Torr in about 10 seconds max or, if compressor, decrease the discharge pressure. The discharged service liquid from pump, ITEM 4, helps produce a slow deceleration rather than sudden stop. Turn off the power to motor ITEM 6 and close any accessories and flushing lines. Make sure the non-return valves, ITEM 2 or similar, at suction and discharge lines are leak tight. Should the system be idle for an extended period of time it is recommended to disconnect the electricity to the motor or control panel and drain all liquids from pump, separator and piping. Refer to chapter 6 for storage procedures.

11.4 – START-UP OF “OIL SEALED (DynaSeal™)” SYSTEMS
(In the following, reference is made to certain ITEM numbers which are listed in the figures and legend of section 12.1 and 19). Open the valve at the gas discharge, if applicable, and partially close the valve at the suction side. Close draining valve ITEM 11, and valves for condensate recovery ITEMS 13F and 13L, which are on the frame separator, ITEM 1B; open the valve ITEM 13D which is between the circulating pump, ITEM 22, and the frame separator, ITEM 1B, then partially open flow regulating valve, ITEM 13 between the discharge of circulating pump, ITEM 22 and the heat exchanger, ITEM 9, and the by-pass valve, ITEM 13A. If the system is fitted with a separator cyclone, ITEM 1D, and the adjacent collecting tank, ITEM 1E, it is required to close valves, ITEM 11A and 12 and open valve ITEM 13E. Fill frame separator with service oil through the filling plugs ITEM 28. Proper oil level can be seen on sight glass ITEM 7. Refer to table 12 and 13 for the required oil quantity. Start and/or open applicable accessories (temperature switches, level switches, etc.) and circuitry for cooling and flushing. Start vacuum pump, ITEM 4, and soon after, start the circulating pump, ITEM 22. Adjust the circulating pump capacity with valve ITEM 13. Gradually open the system suction valve till the desired vacuum is achieved. Check the systems for abnormal noises or vibrations (see section 12 and 14). Adjust by-pass valve ITEM 13A, to regulate the oil flow to the vacuum pump or to improve the thermodynamic efficiency of the heat exchanger.

<u>NOTE:</u> OIL SEALED (DynaSeal™) systems engineered with multiple pumps are fitted with isolating valves at suction, discharge, and service liquid lines of each pump. When one or more pumps are not operating, it is required to isolate the idle pump(s) by closing these valves. When the pumps are put back into service the said valves (at suction and discharge) must be opened.

11.5 - OPERATION OF “OIL SEALED (DynaSeal™)” SYSTEMS
After starting the vacuum pump check the following:
- the vacuum level is as desired or adjust the flow-regulating valve to the required vacuum
- the oil temperature is between 140 and 175°F. If required, adjust the thermostat on the radiator or in case of water/oil heat exchanger adjust the cooling water flow
- motor does not draw more amperage than shown on its nameplate
- the pump-motor assembly does not have abnormal vibrations or noises such as cavitation
- the surface temperature at full load, does not exceed approximately 85°F
- that there are no leaks from mechanical seals, joints, flushing or cooling liquid lines
- liquid level in separator and pump is between the minimum and the maximum

- the pressure gauge of the oil demister separator does not read more than 4 psi. When this value is exceeded, it will be required to change the filter element.

If the gas discharge is not open to the immediate atmosphere but it is piped to other locations, the pump discharge should be checked for back-pressures that could cause higher power consumption and loss of pump capacity.

11.6 - SHUT DOWN OF “OIL SEALED (DynaSeal™)” SYSTEMS
Close, if applicable, the cooling water to the water/oil heat exchanger ITEM 9, then turn off the power to the circulating pump ITEM 22. Where possible, gradually decrease the vacuum level to 300-625 Torr in about 10 seconds max. The discharged service liquid from pump ITEM 4 helps producing a slow deceleration rather than sudden stop.
Turn off motor ITEM 6, radiator ITEM 9 and any accessories and flushing circuitry. Make sure the non-return valves ITEM 2, or similar, at suction and discharge lines are leak tight. Should the system be idle for an extended period of time it is recommended to disconnect the electricity to the motor panel, drain all liquids from pump, separator and piping. Refer to chapter 6 for storage procedures.

12 - OPERATING MAINTENANCE

Periodically check the working conditions of the system by means of the instrumentation on the installation (pressure gauges, vacuum gauges, temperature gauges, ampmeters, etc.) and that the pump is consistently handling the application for which it was selected. The operation of the pump should be without abnormal vibrations or noises, if any of these problems is noticed, the pump should be stopped immediately, search for the cause and make the necessary corrections. It is good practice to check the pump/motor alignment, the running conditions of the bearings and of the mechanical seals (see section 13) at least once a year, even if no abnormalities have been noticed. If there is a deterioration of the pump performance, which is not attributable to changes in system demands, the pump must be stopped and proceed with necessary repairs or replacement. If the mechanical seals are fitted with external flushing and/or quenching lines their pressures, temperatures and flows must be checked constantly.

NEVER ALLOW THE PUMP TO OPERATE IN THE CAVITATION AREA!

Cavitation has the characteristic metallic sound, like if gravel was rotating inside the pump, and it causes also high pump vibrations. This happens when the pump is running at absolute pressures close to the vapor pressure of the service liquid at the running conditions. This is a damaging condition for the impellers, port plates and casings. The cavitation causes erosion taking away metal particles and attacking the surface of the pump components. This is particularly damaging if the pump is handling corrosive gases, see chapter 14 for suggestions to correct the problem.

Pump series TRH, TRM and TRV are fitted with an anti-cavitation valve that should be left open (if required) see fig. 23 and 24 for the location. This valve should be connected toward the upper part of the discharge separator so that, depending upon the operating vacuum, the pump can either take air or discharge excessive liquid. For OIL SEALED (DynaSeal™) systems the anti-cavitation valve ITEM 13H is piped from pump ITEM 4 to the frame separator ITEM 1B.

During operation it must be avoided to have sudden and frequent variations from high to low vacuum. (e.g. suddenly opening the suction valve when the pump is operating at pressures lower than 150 Torr). This would flood the pump creating high power absorption that would put heavy stress on the motor and coupling.

Particular attention should be put on the quantity of the service liquid flow. The flow will depend upon the type of installation (see section 9), the pump size, and/or the desired temperature rise. The flow of service water at 15 °C, for standard pumps and normal operating conditions at various vacuum levels, is listed on the specific pump curves and/or on table 3 of section 9.7. Usually the temperature rise of service water, when handling dry air at 68 °F, is approximately 10 °F. When condensable (e.g.: vapours) are present in the gas stream the heat load to be removed by the service water will be higher, therefore the service water temperature rise will be higher. The service liquid flow and its temperature will affect the pump performance. Generally the low service liquid flow will decrease the pump capacity, while a high service liquid flow will increase the absorbed power by flooding the pump (see section 17 for information and calculations). Hard service water will generate lime build-up inside the pump. The severity of the deposit will vary with the water temperature. Lime or mineral deposits on the surface of the internal pump components will cause an increase of absorbed power, wear of the components and eventually will seize the pump. It is recommended to monitor the water hardness and, if too high, treat the water. If there are no alternatives, there should be periodical flushing of the pump with a solution that will remove the specific deposits, or the pump must be periodically disassembled, cleaned of all incrustations and re-assembled. Systems with total service liquid recovery require periodical change of the service liquid contained in the closed loop. The heat exchanger must be kept well cleaned of all mineral deposits for an effective thermodynamic heat exchange. During operation, a closed loop system will lose some of the service liquid, due to evaporation and/or saturation of the discharged gases. It will be required to periodically make-up fresh liquid into the system. This operation is not required for those systems that are fitted with a float type automatic make-up valve ITEM 8. This valve requires water at a pressure of approximately 2 bar. Systems that handle condensable will experience a rise in the level of the service liquid in the separator. The excessive liquid will be overflowed through the overflow valve or connection. If the specific gravity of the condensable is higher than that of the service liquid, the condensable must be discharged through the separator drain valve ITEM 11, preferably with system not running.

12.1 - "OIL SEALED (DynaSeal™)" SYSTEMS

(For ITEM numbers refer to fig. 27 and it's legend).

It is very important to keep the service oil temperature under control when the oil temperature exceeds 90 °C there is the danger of seizing the pump and the gasketing may start leaking.

Every 100 - 200 working hours it is suggested to check the oil level in the oil reservoir, make-up oil if necessary and change the oil every 10,000 working hours (depending upon the use and the application).
Those installations where the handled gases are contaminated with dust or suspended solids that can alter the oil characteristics will require more frequent oil check and changes.

Condensable vapors, if present during evacuation, can be flushed right through the discharge of the separator (if they have low boiling point) or, when the system is idle, can be drained by opening valves, ITEM 16. During operation, the oil demister filter will be impregnated with oil particles; the pressure gauge, ITEM 2,

installed at the housing, ITEM 2, will provide an indication of the filter being plugged; pressure reading over 4 psi. maybe an indication that the filter needs replacement. At higher discharge pressures the discharged air quality will decrease and the vacuum pump absorbed power will increase.

To replace the oil demister filter, simply disconnect the oil scavenger line, remove the cover, ITEM 25, remove the used filter element, apply a gasketing material over the gasket faces of the new filter and place the latter in the housing, put in place the cover and the scavenger line.

TYPICAL BILL OF MATERIALS

ITEM	DESCRIPTION
1	VACUUM GAUGE (STD)
2	PRESSURE GAUGE (STD)
3	TEMPERATURE GAUGE (STD)
4	COMPOUND GAUGE (STD)
5	LEVEL GAUGE (STD)
6	BULLSEYE GAUGE (STD)
7	BACK PRESSURE SWITCH (OPT)
8	LEVEL SWITCH, HIGH AND LOW (OPT)
9	TEMPERATURE SWITCH (STD)
10	HEAT EXCHANGER AIR OR WATER COOLED (STD)
11	FILTER SILENCER (STD)
12	INLET FILTER (OPT)
13	SPIN-ON OIL FILTER (OPT)
14	Y-STRAINER (STD)
15	SEPARATOR ELEMENT (STD)
16	BALL VALVE (STD)
17	BALL VALVE STRAINER ISOLATOR (STD)
18	MANUAL UNLOADING VALVE (STD)
19	AUTOMATIC UNLOADING VALVE (OPT)
20	GLOBE VALVE (STD)
21	CHECK VALVE (STD)
22	VACUUM RELIEF VALVE (OPT)
23	SOLENOID VALVE (NOT USED WITH ITEM 22)(OPT)
24	TEMPERATURE CONTROL VALVE (OPT)
25	SEPARATOR TANK (STD)
26	CIRCULATION PUMP (OPT)
27	TRAVAINI LIQUID RING VACUUM PUMP (STD)
28	CONTROL PANEL NEMA 12 (STD)

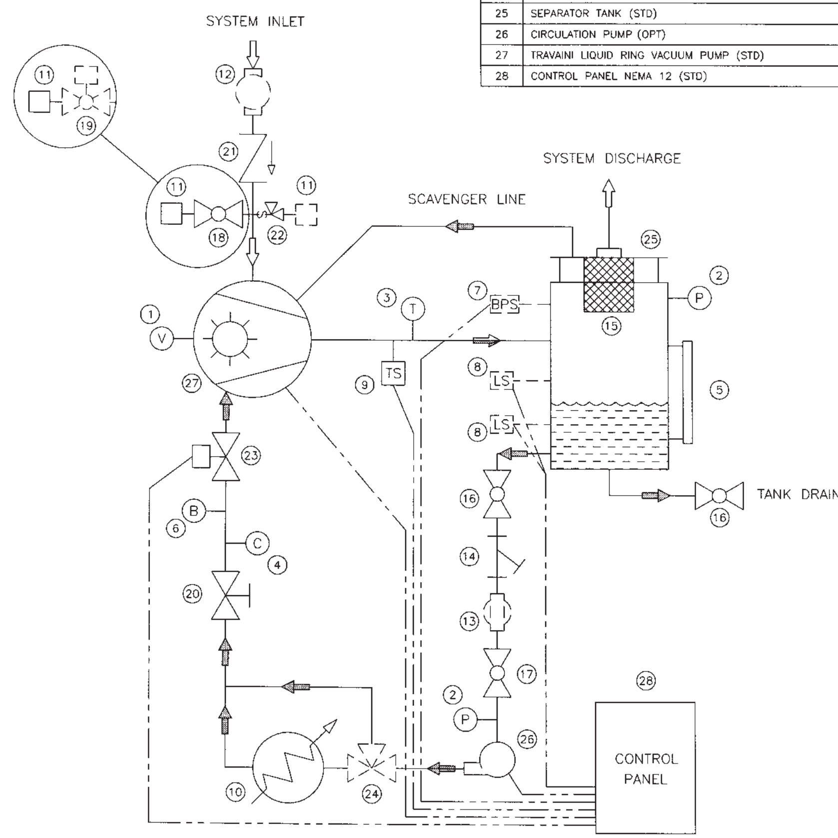


Fig 27 (General Schematic Drawing)

13 - BEARINGS AND MECHANICAL SEALS MAINTENANCE

WARNING: The maintenance must be carried out with the pump turned off and the electrical power, or other driving mechanism, must be disconnected. The power should only be turned back on by the same person doing the maintenance. It is, however, recommended to have at least a team of two workers doing the maintenance and the supervisors should be fully aware of the work in progress.

CAREFULLY FOLLOW THE SAFETY PROCEDURES LISTED IN CHAPTER 2.

13.1 - BEARINGS

At assembly time the pump bearings are lubricated with quality grease (sealed bearings are greased for life). Some of the recommended greases are:

BP - ENERGREASE LS - EP 2	MOBIL - MOBILUX EP 2
EXXON - BEACON EP 2	SHELL - SHELL ALVANIA EP GREASER

Bearings for pumps working in standard conditions should be lubricated every 2000/2500 working hours with a quality grease (see “Disassembly & Assembly” for the replacement of bearings). Bearing temperature should not exceed the 85 °C during normal working conditions and normal environments. Bearings can overheat for reasons such as too much grease, misalignment of flexible coupling, wrong bearings, excessive vibrations, bearing wear. See tab. 9 for bearing numbers and type used for each pump.

13.2 - MECHANICAL SEALS

Mechanical seals can be with many types of materials, design and installations (see fig. 28). TRAVAINI PUMPS USA has evaluated their selection at the time of pump design; it is a function of the fluid and working conditions. The seals are supplied with the proper flow of liquid for their lubrication, through internal pump passages. Upon request, the pump can be provided with seal lubrication coming from an outside source; the set-up must be such that the seals are guaranteed the liquid quantity and pressure as recommended by TRAVAINI PUMPS USA or by the seal manufacturer.

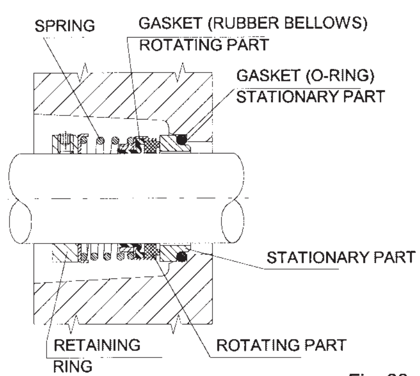


Fig. 28

For mechanical seal shaft size see table 9.
Mechanical seals normally fitted in the vacuum pumps are to DIN 24960 standards. See “Disassembly & Assembly Instructions” for major seal dimensions. Normally mechanical seals do not require maintenance until there is a visible liquid loss (leakage). See “Disassembly & Assembly Instructions” for seal replacement.

Mechanical seals **MUST NOT** run dry! When seals are operated without lubricant and/or flushing liquid their faces and the elastomers may suffer damages beyond repair. It is suggested to check the conditions of the seal faces every approximately 4000 working hours.

Table 9

PUMP MODEL	BEARING			MECHANICAL SEAL	
	Quantity	Type	Grease Quantity each bearing - gr.	Quantity	Diameter mm
TRHE 32-4	1	6302.2RSR		1	16
TRHC and TRSC 32 TRHE 32-20/45/60–TRSE 32	2	6304.2RSR		2	22
TRHE 40-110 – TRSE 40		6305.2RSR			28
TRMA 32-25	1 1	6304.2RSR 6204.2RSR			
TRMB 32-50	1 1	6305.2RSR 6205.2RSR			24
TRMB 32-75	1 1	6306.2RSR 6206.2RSR		1	28
TRMB 40-110	1 1	3208.2RSR 6206.2RSR	—		
TRMB 40-150	1 1	3208.2RSR 6306.2RSR			35
TRVB 40-110/150	2	6208.2RSR			
TRMB 40-200 and 50-300	1 1	3210.2RSR 6308.2RSR			45
TRVB 40-200 and 50-300	1 1	6210.2RSR 6208.2RSR			
TRHC and TRSC 40 TRHE 40-140/190 TRSC and TRSE 50	2	6306.2RSR			35
TRHB 50 - TRVA 50 and 65		6308	20		43
TRHB/C 80 - TRSB/C 100		6310	35	2	55
TRHE 100 - TRSE 125	1 1	6314 NU 314	50		75
TRHA 150 - TRSA 200	2 1	7320B.MB.UA 22320ES.TVPB.C3	180		110

NOTE: The supplied data are for pumps in STANDARD construction. For special construction please contact TRAVAINI PUMPS USA.

14 - TROUBLE SHOOTING: PROBLEMS, CAUSES AND SOLUTIONS

Consult the following table when problems are experienced, if solutions are not found in this chart or should there be any doubts; do not hesitate to contact TRAVAINI PUMPS USA or your local distributor.

Table 10 - LIST OF PROBLEMS

PROBLEM	LIST OF POSSIBLE CAUSES
Pump does not create or the vacuum is too low	1 - 2 - 3 - 4 - 9 - 11 - 18 - 19 – 22 - 23 - 24 - 25
Excessive noise	1 - 4 - 5 - 6 - 7 - 10 – 24
High power consumption	1 - 5 - 6 - 8 - 9 - 15 - 24 – 25
Vibration	5 - 6 - 7 - 8 - 10 - 12 - 13 – 24
Mechanical seal leaking	11 – 14
Pump looses liquid	11 – 19 - 23
Bearing failure	5 - 6 – 7
Pump does not start	1 - 6 – 20 - 21
Shaft partially or totally locked	6 - 10 - 15 - 16 - 21
Cavitation	3 - 4 – 8 - 9 - 17 - 24

	CAUSES	SOLUTIONS
1	Defective motor or wired wrong	Check the voltage, the frequency, motor type, power consumption, rotation, wiring connections, phase consistency
2	Leakage in suction piping	Repair piping; check valves for leakage
3	Service liquid high temperature	Lower the service liquid temperature; check the level of the service liquid; adjust the cooling liquid flow; adjust the radiator thermostat to lower temperature setting
4	Low service liquid flow	Increase the service liquid flow
5	Coupling misalignment	Re-align the coupling and the pump/motor assembly (see cap. 7)
6	Faulty bearing	Replace the bearing(see “Disassembly & Assembly Instructions”)
7	Cavitation	Open the anti-cavitation valve or set the relief valve to a lower vacuum (see table 4 to 6)
8	High service liquid flow	Reduce the service liquid flow; adjust the by-pass valve
9	High back pressure	Check the discharge line for obstructions or high friction losses; reduce the back-pressure to maximum 0.1 bar
10	Wrong pump/motor assembly	Verify that the base surface is level and that all pump feet are resting on the surface, add spacers if required (see section 11)
11	Mechanical seal failure	Change the mechanical seal (see “Disassembly & Assembly Instructions”)
12	Wrong pump mounting	Remount the pump (see section 7)
13	Piping weight resting on pump	Support the piping with hangers or other means (see section 11)
14	Inadequate seal lubrication	Check flushing liquid temperature, flow and pressure
15	Mineral deposits from hard water	Clean the pump
16	Foreign particles in pump	Disassemble the pump to remove the foreign objects (see “Disassembly & Assembly Instructions”)
17	Low suction pressure	Open the vacuum regulating valve and/or the anti-cavitation valve (vacuum relief valve)
18	Wrong pump rotation	Reverse the rotation (see section 8)
19	Bad gaskets	Replace the defective gaskets (see the “Disassembly & Assembly Instructions”)
20	Wrong motor connections	Check the electrical connections (connectors, fuses, breakers) and the power supply line (see section 8)
21	Pump seized	Disassemble and repair the pump (see “Disassembly & Assembly Instructions”)
22	Pump undersized	Select a pump with higher capacity
23	Pump worn-out	Disassemble and repair the pump (see “Disassembly & Assembly Instructions”)
24	Excessive liquid flow through suction line	Reduce the liquid flow through the pump suction; install a centrifugal separator (cyclone) before the pump
25	Instrumentation out of calibration	Check the working characteristics, replace if required

15 - REPAIRING AND REMOVING PUMP FROM THE INSTALLATION

Should there be the need for pump repair a knowledge of the specific “Disassembly and Assembly Instructions” is required.

FOLLOW THE SAFETY PRECAUTION MEASURES OUTLINED IN CHAPTER 2.

Before working on the pump it is important to:
- procure and wear the proper safety equipment (hard hat, safety glasses, gloves, safety shoes, etc.)
- disconnect the electrical power supply and, if required, disconnect the electrical cable from the motor
- close the isolating valves at pump inlet, outlet and service liquid
- let the pump cool down to ambient temperature if it has been handling hot fluids
- adopt safety measures if the pump has been handling hazardous liquids
- drain the pump internals of the pumped liquid through the draining connections, if necessary rinse with neutral liquid.

To remove the pump and the motor from the installation proceed as follows:
- remove bolts from pump suction and discharge flanges
- remove the coupling guard
- remove the spacer of the coupling, if there is one

- if required, remove the motor anchor bolts on the baseplate, for base mounted assembly, or the bolts on the adapter flange in the case of monoblock design
- remove the pump anchor bolts on the baseplate
- remove the pump from the installation. Avoid damaging other system components.

After pump repairs, re-install following the steps from “Assembly and Alignment” procedures and after (see the applicable chapters).

16 - SPARE PARTS

When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimize unnecessary down times in the event of pump failure or routine maintenance.

It is therefore, recommended to stock the following spare parts for each pump size:

(1)	Impeller set
(1)	Complete shaft assembly
(1)	Bearing set
(1)	Mechanical seal set (or packing set)
(1)	Gasket sets
(1)	Radial seal ring set
(1)	Bearing spacer set
(1)	Coupling rubber insert set

For better parts management, the VDMA 24296 standards suggest to stock the number of parts as a function of the number of pumps being used in the plant. On the pump nameplate are printed pump model, year of manufacture and pump serial number. When ordering spare parts always provide this information. Pump type, parts item number (VDMA) and description as per the pump sectional drawing and parts list is useful information that helps to supply correct spare parts for your pump. We recommend the use of original spares: in case this is not respected, TRAVAINI PUMPS USA declines any responsibility for eventual damages and not correct running caused by not original spare parts.

17 - ENGINEERING DATA

17.1 - INFLUENCE OF SERVICE LIQUID TEMPERATURE, SPECIFIC GRAVITY AND VISCOSITY ON PUMP PERFORMANCE

The performance of liquid ring vacuum pumps is based on the use of water at 15 °C as service liquid. With water at different temperatures the pump capacity and the maximum attainable vacuum level will vary as a function of the type of pump, as illustrated by the curve sets of fig. 29 and 30.

<u>EXAMPLE:</u> Pressure = 45 Torr - Water temperature = 24°C - Pump series TRH - Capacity (15°C water) = 310 ACFM From curves of fig. 30 we find the correcting factor of 0.80, therefore the actual capacity for the pump at the given conditions will be: 310 x 0.80 = 248 ACFM. The maximum suction pressure before incurring cavitation will be approximately 35 Torr.

Regarding the performance variation due to changes of specific gravity and viscosity, it can be assumed a proportional variation in power consumption however; the changes in capacity at different pressures must be analyzed case by case. Please refer the conditions to TRAVAINI PUMPS USA when these corrections are needed.

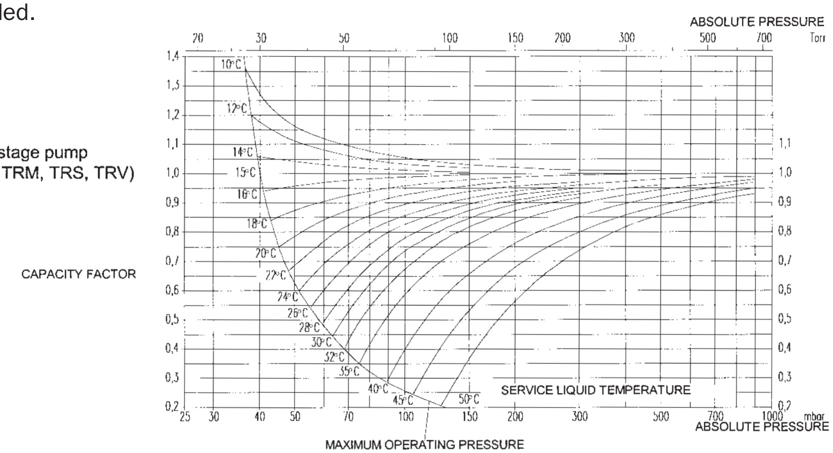


Fig. 29
Single stage pump
(series TRM, TRS, TRV)

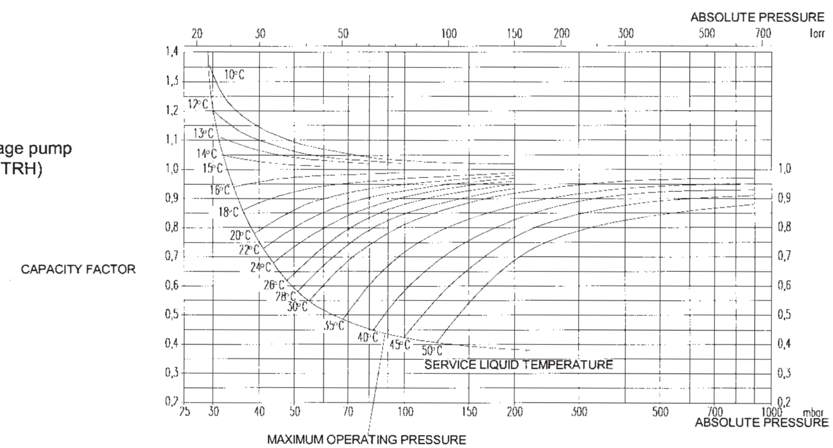


Fig. 30
Two stage pump
(series TRH)

17.2 - SERVICE LIQUID TEMPERATURE CHANGE ACROSS THE PUMP

The service liquid of a liquid ring pump absorbs total heat QT as follows:

$$Q_T\ (BTU) = Q_c + Q_K + Q_R$$

Where:

Q_c	=	0.9 x BHP x 2545	=	Isothermal compression heat
Q_K	=	m_V x r	=	Condensation heat
Q_R	=	m_g x c_p x ΔT_a	=	Cooling heat (Generally negligible, ignored in calculation of Q_T)

m_V	=	mass condensed incoming vapor in PPH
m_g	=	mass incoming gas in PPH
P	=	absorbed power at operating point in kW
c_p	=	gas specific heat in BTU/1B/°F
r	=	heat of vaporization in BTU's
ΔT_a	=	differential temperature in R, between incoming gas TG and service liquid discharge temperature ($T^2 + \Delta T$)
K	=	Kelvin temperature

Once the Q_T is known it is possible to calculate the differential temperature ΔT of the pump service liquid:

$$\Delta T = \frac{Q_T}{Q_A \cdot \rho \cdot c_P}$$

Where:

Q_T	=	total heat load before calculated in BTU/hour
Q_A	=	pump service liquid flow in GPM
ρ	=	service liquid density in kg/m³ (water = 1.0)
c_P	=	service liquid specific heat

NOTE: It can be assumed that the discharge gas and service liquid have same temperature.

17.3 - OPERATION WITH PARTIAL RECOVERY OF SERVICE LIQUID

Where the working conditions will allow it, the service liquid temperature can be increased utilizing a smaller quantity of fresh liquid from an outside source. A similar flow as the make-up is discharged to the drain while the balance of liquid required by the pump is recirculated. In these cases the service liquid working temperature rises and the pump capacity will require correction per curves of fig. 29 and 30. The system installation will be similar to the schematic of fig. 31.
Depending upon the affordable loss of capacity the service liquid temperature T2 may be set and the make-up flow of fresh liquid QF can then be calculated:

$$Q_F(m^3/h) = \frac{Q_A \cdot \Delta T}{T_2 - T_1 + \Delta T}$$

Where:

Q_F	=	Fresh make-up flow from outside source in m³/h
Q_A	=	Total service liquid flow required for the operating conditions in m³/h
ΔT	=	Service liquid temperature rise (see section 17.2)
T_2	=	Service liquid temperature to pump
T_1	=	Temperature of make-up liquid

The fig. 31 indicates a generic schematic of a liquid ring vacuum pump in a partial recovery system. By closing the recirculation line the system would become a "once through" installation where all the service liquid is drained, therefore:

$Q_A = Q_F$ and $T_2 = T_1$

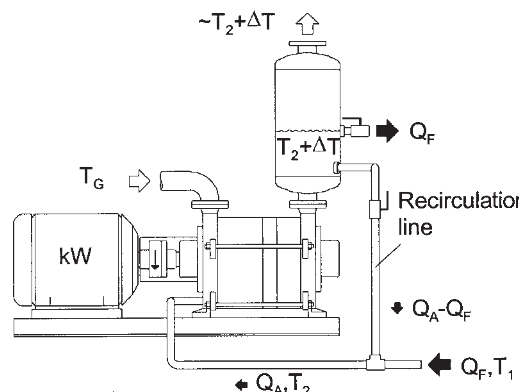
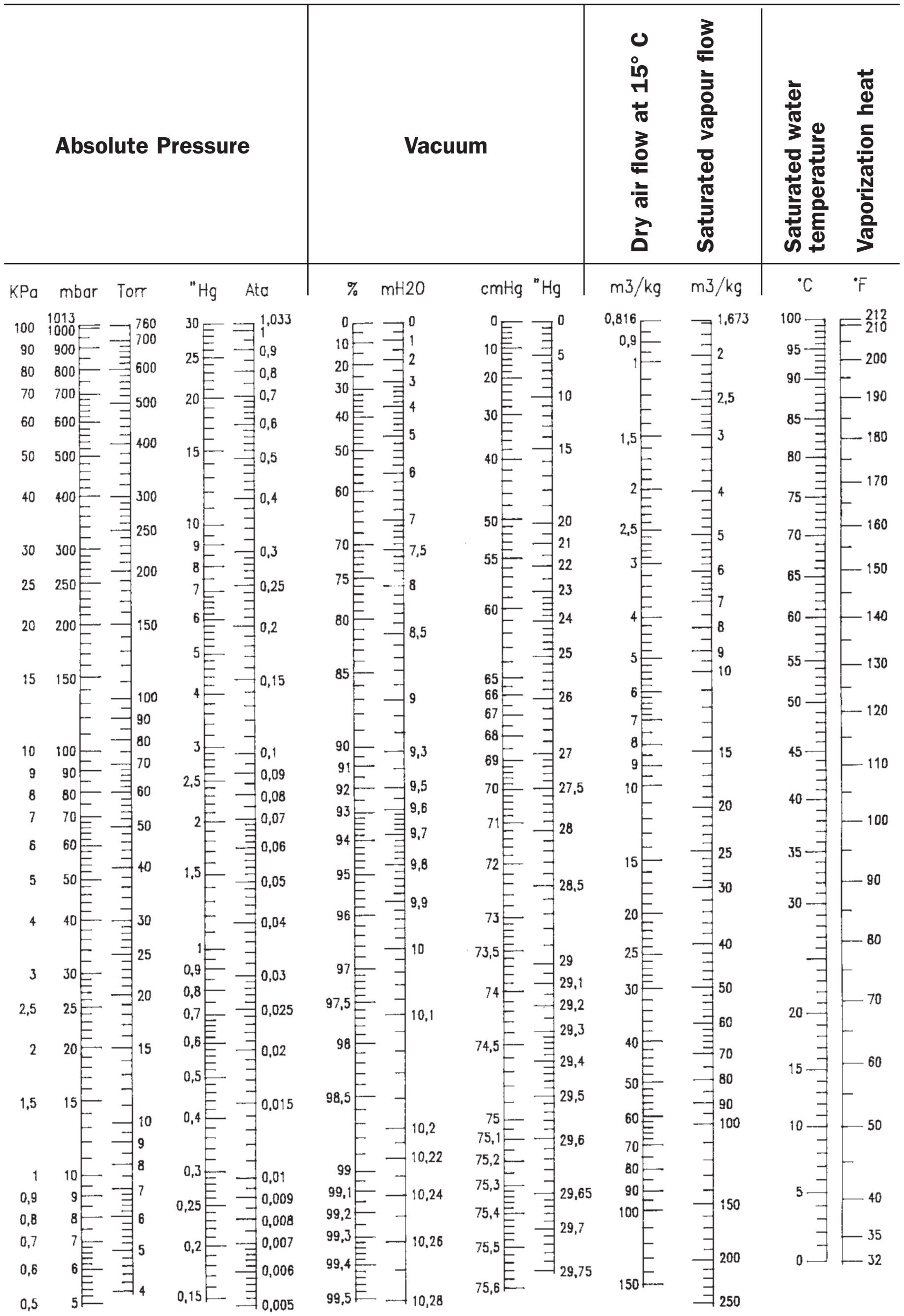


Fig. 31

17.4 - UNIT CONVERSION TABLE



18 - ENGINEERING DATA FOR "WATER SEALED" SYSTEMS

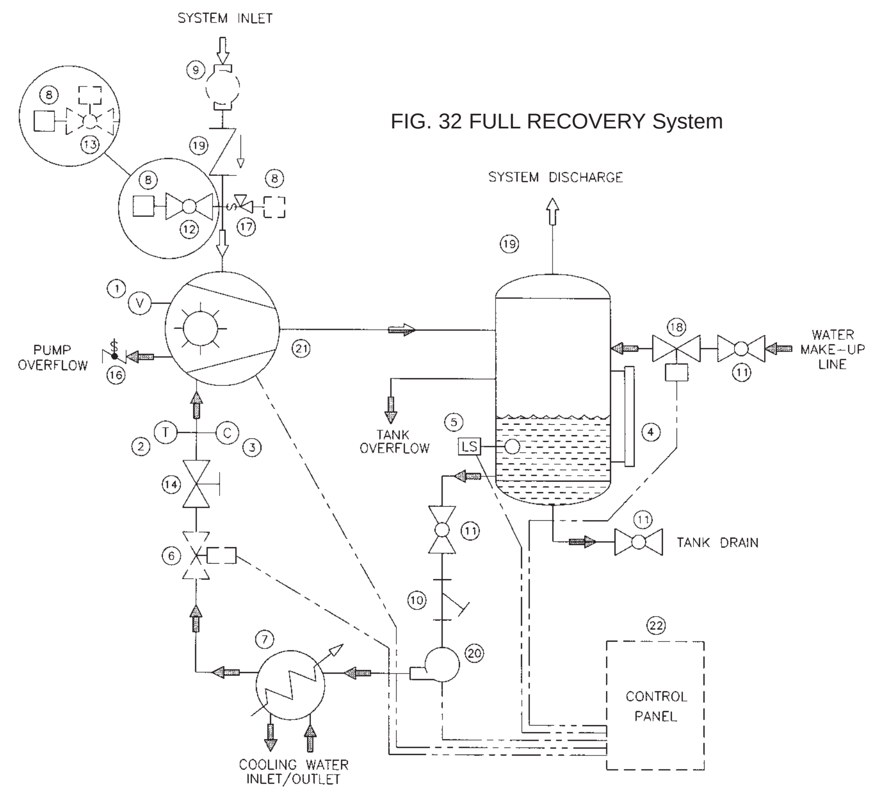


FIG. 32 FULL RECOVERY System

TYPICAL BILL OF MATERIALS	
ITEM	DESCRIPTION
1	VACUUM GAUGE (STD)
2	TEMPERATURE GAUGE (STD)
3	COMPOUND GAUGE (STD)
4	LEVEL GAUGE (STD)
5	LEVEL SWITCH (STD)
6	FLOW SWITCH (OPT)
7	HEAT EXCHANGER WATER COOLED (STD)
8	FILTER SILENCER (STD)
9	INLET FILTER (OPT)
10	Y-STRAINER (STD)
11	BALL VALVE (STD)
12	MANUAL UNLOADING VALVE (STD)
13	AUTOMATIC UNLOADING VALVE (OPT)
14	GLOBE VALVE (STD)
15	CHECK HINGE VALVE (STD)
16	CHECK SWING VALVE (STD)
17	VACUUM RELIEF VALVE (OPT)
18	SOLENOID VALVE (STD)
19	SEPARATOR TANK (STD)
20	CIRCULATION PUMP (STD 50HP AND UP)
21	TRAVAINI LIQUID RING VACUUM PUMP (STD)
22	CONTROL PANEL NEMA 12 (OPT)

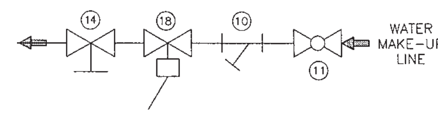


FIG. 32a PARTIAL RECOVERY System

WORKING PRINCIPLE

The WATER SEALED packages main components are: a liquid ring vacuum pump ITEM 21 from series **TRH, TRS, TRM, TRV**, an air/liquid separator reservoir ITEM 19, a heat exchanger ITEM 7, all mounted on a common base. When operating the vacuum pump discharges from the discharge port the gas handled with a portion of the liquid from the pump internal liquid ring. This liquid must be continuously returned to the pump.

The gas/liquid mixture is separated in a cylindrical tank (separator), the gas is vented through the top mounted discharge flange of the separator and the liquid is collected at the bottom of the separator ready to be returned to the vacuum pump.

During the suction and compression cycle of the vacuum pump, all the energy is transformed into heat energy and almost all of it is absorbed by the service liquid. Therefore the liquid must be cooled prior to be returned to the pump, either with a heat exchanger (total recovery system) or with the addition of cool make-up liquid (partial recovery system).

The **FULL RECOVERY** system (see fig. 32 and legend) does not require an appreciable flow of make-up from an external source but only the necessary amount to compensate for the liquid lost due to evaporation, with the discharged gases.

The heat exchanger sizing should be based on using a minimum amount of cooling liquid (usually water) to keep the service liquid at the ideal temperature for the best efficiency of the vacuum pump. Remember the higher the temperature of the service liquid the higher the losses in pump capacity and maximum vacuum see section 17.

This system is particular suitable where the service liquid and the condensed gases cannot be discharged to the environment, either for pollution reasons or because the fluids are too valuable.

The **PARTIAL RECOVERY** system (see fig. 32a and legend) requires a constant flow of cold make-up liquid from an external source. This liquid must be of the same nature as the service liquid being used by the pump. The mixture of the make-up and the service liquid being discharged by the pump, will have a constant temperature when enters the vacuum pump service liquid connection.

The same amount of service liquid taken from the outside source must be overflowed through the separator overflow connection situated at the pump shaft centerline. This system is utilized in many applications for conditions where there is intermittent use, or low vacuum levels, or there is no danger of pollution and the liquid can easily be drained.

Furthermore, this may prove to be the only alternative to the total recovery system for those installations where the cooling liquid is not available or it is too warm. Numerous accessories are available to meet the customers' requests and suitable for the installation, process and maintenance. For materials of construction and some engineering data see table 11 and 12.

Table 11 - STANDARD MATERIALS FOR "WATER SEALED" SYSTEMS

COMPONENT		MATERIAL DESIGN	
Vacuum pump		**GH - F - RA - RZ**	**A3**
Separator reservoir		Carbon steel	AISI 316 SS
Baseplate			
Heat Exchanger	Plates	Carbon Steel	
	Gaskets	Nitrile rubber / Viton	
Piping		Carbon steel	AISI 316 SS
Valves - Thermometer		Brass	
Level gauge		Polycarbonate	"Pirex" Glass

For vacuum pump materials (GH - F - RA - RZ - A3) see section 4.

Table 12 - GENERAL AND NOT BINDING ENGINEERING DETAILS FOR "WATER SEALED" and "OIL SEALED (DynaSeal™)" SYSTEMS

PACKAGE SERIES		Motor Size	Dry weight lbs. WATER SEALED	Dry weight lbs. OIL SEALED (DynaSeal™)
WATER SEALED OIL SEALED	2	5HP 2 poles / 60 Hz	300	450
WATER SEALED OIL SEALED	3	5HP 4 poles / 60 Hz	400	800
WATER SEALED OIL SEALED	4	10HP 4 poles / 60 Hz	1000	1000
WATER SEALED OIL SEALED	5	20HP 4 poles / 60 Hz	1200	1500
WATER SEALED OIL SEALED	6	40HP 4 poles / 60 Hz	1800	2000
WATER SEALED OIL SEALED	7	60HP 6 poles / 60 Hz	2500	3500

EXAMPLE OF "WATER SEALED" SYSTEM General Schematic and Accessories or Options

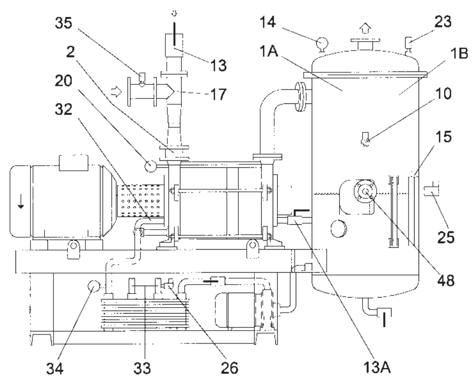


Fig. 34 - Typical accessories and options upon request

LEGEND

1 Separator reservoir
1A Separator reservoir with removable lid
1B Oil demister
2 Check valve
4 Vacuum pump
6 Electric motor
7 Level gauge
8 Float valve
9 Heat exchanger
10 Solenoid valve liquid make-up
11 Drain valve
12 Isolating valve
13 Service liquid flow regulating valve
13A By-pass valve
14 Pressure gauge
15 Level switch
17 Air ejector
20 Vacuum gauge
22 Circulating pump
23 Pressure relief valve
24 Overflow valve
25 Solenoid valve for overflow
26 Solenoid valve for cooling liquid
27 Thermometer
28 Fill connection
30 Frame
32 By-pass piping
33 Connection cooling lines
34 Temperature switch
35 Vacuum relief valve
48 Automatic drain valve (for systems used as Compressor only)

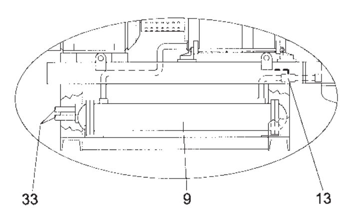


Fig. 35 - Option with Shell & Tube heat exchanger

19 - ENGINEERING DATA FOR "OIL SEALED (DynaSeal™)" SYSTEMS

WORKING PRINCIPLE

OIL SEALED (DynaSeal™) packages main components are: a liquid ring vacuum pump, ITEM 4, from series **TRH, TRS, TRM, TRV,** an air/liquid separator reservoir, ITEM 1A, a heat exchanger ITEM 9 and an oil demister filter, ITEM 1B.

Turbine type mineral oil, or equal, is used for service liquid. The characteristics of the chosen oil are such that at pressures below 75 Torr, the pump capacity is greater than what would be when using water, and higher vacuum levels are attainable. When operating, the vacuum pump discharges the gas handled with a portion of the liquid in tank, ITEM 15, that acts as separator of gas from the oil and let settle any condensable or particles coming through the pump suction flange. The circulator pump, ITEM 26, pumps the oil back to the vacuum pump after it has been through the heat exchanger, ITEM 10, and cooled at about 140-180 ∞F. The gas is vented after being cleaned of all oil with the special oil demister element; a pressure gauge, ITEM 2, on the filter housing, ITEM 5, gives indication of the degree of dirt contained by the filter element. Contrary to rotary vane vacuum pumps, there are no moving parts that come in contact with each other, therefore there is no need for lubrication of the pump internals; these are very robust and reliable pump packages which offer extended operating life even when handling condensable gases. See table 14 for materials of construction and table 12 in chapter 18 for some engineering data.

Table 14 - STANDARD MATERIALS FOR "OIL SEALED (DynaSeal™)" SYSTEMS

COMPONENT		MATERIAL DESIGN
Vacuum pump		**GH - F - RA - RZ**
Baseplate		Carbon steel
Heat exchanger air-oil	Cooler core	Aluminium
	Shroud	Carbon steel
	Fan - Guard	Carbon steel-Plastic coated
Piping		Carbon steel -Carburite rubber
Valves - Thermometer		Brass
Level gauge		Polycarbonate

See section 4 for vacuum pump materials of construction (GH-F-RA-RZ).

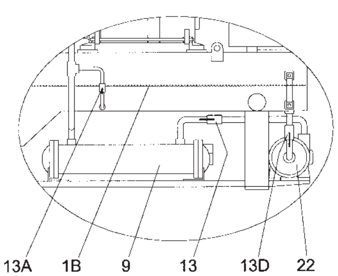


Fig. 38 – Option with Shell & Tube heat exchanger

LEGEND

13H - Anti-cavitation valve
13L - Condensate drain valve
13M - Flow regulating valve
14 - Pressure gauge
20 - Vacuum gauge
22 - Circulating pump
27 - Thermometer
28 - Fill connection
43 - Inspection openings

20 - PRODUCT DATA INFORMATION FORM

PUMP model	Serial Number	System Number	Year of mfg.
....	....	....	....

GAS handled	Capacity	Suction Pressure	Discharge Press.	Temp.
....	...............cfm	..................Torr	....................psi	..........°C/°F

☐ Lethal ☐ Toxic ☐ Noxious ☐ Corrosive ☐ Malodorous ☐ ....

Service LIQUID	Capacity	Temperature
....	.............GPM	..................°C

TOTAL WEIGHT	MAXIMUM DIMENSIONS	NOISE (measured at 1 m)
....................lbs	X =.................in Y =.................in Z =.................in	Pressure =................dB(A) Power =................dB(A)

INSTALLATION	
☐ Inside	☐ Outside
☐ Explosive area	☐ ....

SERVICE	
☐ Continuous	☐ Intermittent
☐	

MOTOR type / Frame	No Poles	No Revolutions	Absorbed power	Installed power
....	....	.......................RPM	.......................Amp	.............kW / ....HP
Frequency	Supply	Enclosure	Insulation class	Absorbed power
............................Hz	.........................Volt	IP.........................	....	.............kW / ....HP

COMMENTS ____

WARRANTY	TRAVAINI PUMPS USA

Subject to the terms and conditions hereof, Travaini Pumps U.S.A., Inc. (hereafter referred to as the “Company”) warrants that the products and parts of its manufacture specified below, when shipped, and its services when performed, will be free from defects in material and workmanship for following warranty time periods:

PRODUCT DESCRIPTION	WARRANTY PERIOD FROM DATE OF SHIPMENT
Liquid Ring Vacuum Pump system or pump products	Two (2) years
Rotary vane system or pump products	24 / 18 months if TPUSA oil used / not used
Centrifugal pump products	18 months, or 12 months from date of installation, whichever occurs first
Mechanical seals	3 months
Repaired pumps / systems	6 months for the repair / work performed

This Warranty shall apply to liquid ring vacuum products only if they are operated with Company approved seal fluids and to rotary vane products only if they are operated with Company approved lubricants. In-warranty repaired or replaced products are warranted only for the remaining unexpired portion of the warranty period applicable to the repaired or replaced product(s).

This Warranty does not extend to equipment such as electric motors, starters, heat exchangers and other accessories furnished to the Company by third party manufacturers and/or suppliers. Said accessories are warranted only to the extent of any warranty extended to the Company by such third party manufacturers and/or suppliers. Replacement of maintenance items, including, in particular, seals, bearings, filters, etc. supplied in connection with standard maintenance service provided by the Company are not covered by this Warranty. Any technical assistance, advice, or comments provided by the Company regarding system components, other than those manufactured by the Company, are not covered under this Warranty; the Company disclaims any liability in connection with same. The Company disclaims any liability in connection with the malfunctioning of any system(s) or component(s) of system(s) which conform to designs, specifications and/or instructions mandated by purchasers.

This Warranty is limited exclusively to products and/or parts of the Company properly installed, serviced and maintained in full compliance with the Operating and Maintenance manual of the Company. This Warranty shall not extend to products and/or parts which have been misused or neglected or not used for the purpose(s) for which they were intended, including, in particular, products operated at/in excessive temperature or dirty environments, products used in conjunction with corrosive, erosive or explosive liquids or gasses, and/or products malfunctioning as a result of build-up of material in the internal parts thereof. Products which are disassembled without the prior written consent of the Company and/or which are repaired, modified, altered or otherwise tampered with in any manner inconsistent with the Operating and Maintenance manual of the Company are not covered under this Warranty. Products and/or parts which are kept in “long term” storage, as such terms are defined in the Operations & Maintenance manual of the Company, and not maintained in accordance with Company long term care procedures specified by the Company are not covered under this Warranty.

Warranty claims must be made within the warranty period specified above for each of the Company’s products and services and include the serial number thereof. The Company’s obligations under this Warranty are limited, in the Company’s sole discretion, to repair, replacement or refund of the purchase price received by the Company for the product, part or service. Notwithstanding the foregoing, the Company shall have the option to provide alternative solutions of a different design. In no event shall the purchaser and/or any subsequent owner or beneficiary of the products, parts and/or services be entitled to recover incidental, special or consequential damages arising out of the breach of this Warranty or any defect, failure or malfunction of the products and/or services supplied by the Company.

A written return authorization must be obtained from the Company prior to the return of any product and/or part under this Warranty. Products and parts are to be returned only to the Company’s facilities or such facilities as the Company may designate in writing. Costs of uninstalling/ reinstalling the product and/or any part under Warranty, as well as all costs associated with the shipment thereof to and from the facilities of the Company shall be at the owner’s sole expense.

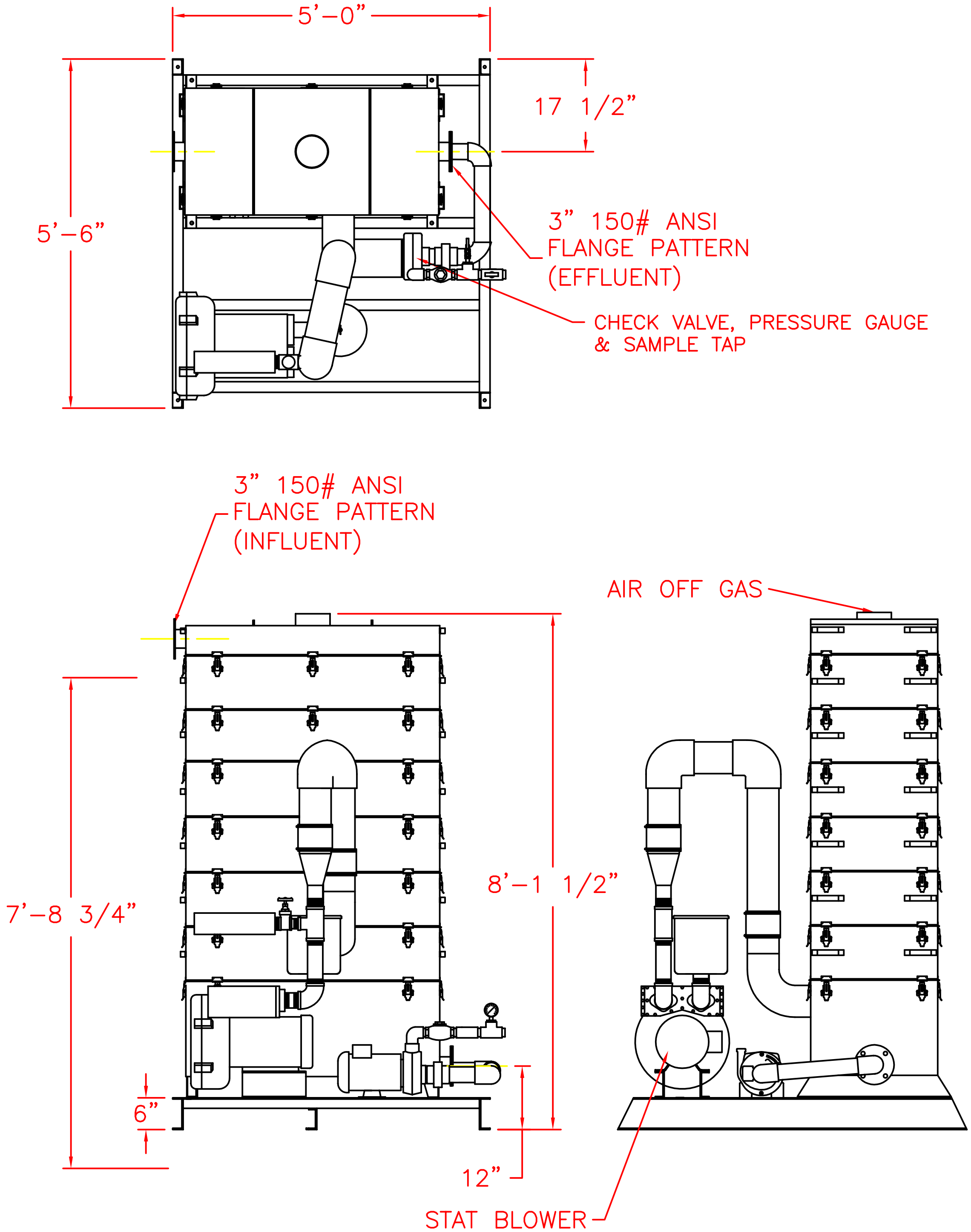
THIS WARRANTY AND THE COMPANY’S OBLIGATIONS HEREUNDER ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. ALL WARRANTIES WHICH EXCEED THE AFOREMENTIONED OBLIGATIONS ARE HEREBY DISCLAIMED BY THE COMPANY AND EXCLUDED FROM THIS WARRANTY, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE. NO EMPLOYEE OF THE COMPANY OR OTHER PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR TO ASSUME ANY OTHER LIABILITY ON THE COMPANY’S BEHALF.

Effective as of January 2007

Appendix D:

Shallow Tray Air Stripper O&M Manual

STAT 80
W/PUMP DOWN



NOTE: Adjust overall height by 10 1/4" for each aeration tray added or deleted.
Influent flange on the same side as effluent with odd number of trays.

Sales Drawing #214510
7/5/02

MINNESOTA | 800.526.4999
(Headquarters)
7500 Boone Ave. N. #101
Brooklyn Park, MN 55428

FLORIDA | 800.241.7833
10419 General Avenue
Jacksonville, FL 32220

TEXAS | 800.893.5937
4889 Hunter Rd. Bldg 1-C
San Marcos, TX 78666

VIRGINIA | 800.204.0324
4003 West Main St.
Salem, Virginia 24153

www.carbonair.com | sales@carbonair.com

Operation & Maintenance Manual

Carbonair Model STAT-80
Low Profile Air Stripper

CONTENTS

1.0 SAFETY PRECAUTIONS

Failure to observe these precautions could result in serious bodily injury and/or property damage.

- Be sure to read and understand this O & M manual before beginning operation. If you have any questions, please call Carbonair Environmental Systems, Inc. at (800) 526-4999.
- Be sure all electrical disconnects are "OFF" and locked out before servicing.
- Always wear gloves, eye protection & protective clothing when working with the equipment.
- Be sure the STAT is properly vented, has adequate air supply and the ducting between blower and STAT is fastened securely.
- The introduction of free-product into the STAT-80 is not recommended because it will adversely affect any nonmetallic materials and reduce system performance.
- Be sure to take proper precautions when lifting STAT trays.

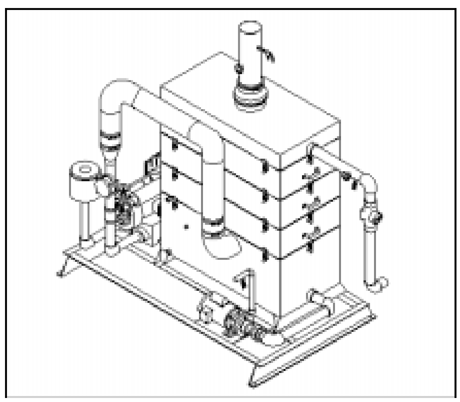


Figure No. 1 - STAT-80 Unit

2.0 EQUIPMENT DESCRIPTION

The STAT-80 is a low profile stainless steel air stripper with a modular design capable of accommodating from 1 to 6 aeration trays. The design allows the trays to be easily removed, cleaned and replaced with minimal downtime. The following table summarizes the specifications for the typical STAT-80 low profile air stripper.

Table No. 1 STAT-80 Specifications

Design Parameter	Specification
Tray Length	48 inches
Tray Width	24 inches
Tray Height	10 inches
Sump Height	24 inches
Demister Height	8 ½ inches
Overall Height (6 tray unit)	94 ¼ inches
Water Flow	5 - 80 gpm
Water Inlet	3 inch
Water Outlet	3 inch
Air Flow	300 & 350cfm
Air Inlet	6 inch
Air Outlet	8 inch

Be sure to refer to Section 12 at the end of this manual for specific operating parameters and dimensions.

The STAT-80 is equipped with the following standard system components:

- ✓ Gravity Drain Sump
    - Sight Glass
    - High Level Switches
- ✓ Aeration Trays
- ✓ Demister
- ✓ Blower
- ✓ Air Bleed Valve
- ✓ Low Pressure Switch

The STAT-80 can also be configured with the following optional components:

- ✓ Air Temperature Kit
- ✓ Air Flow Kit
- ✓ Water Flow Meter Kit
- ✓ Water Temperature Kit
- ✓ Sample Tap Kit
- ✓ Pump-Down Kit
- ✓ Pump-Down Collection Sump
    - Level Control Kit
    - Low, High, High-High Level Switches
- ✓ Blower Muffler Kit

3.0 PROCESS DESCRIPTION

Carbonair's STAT-80 air stripper is a sieve tray aeration unit and does not contain packing media.

In this technology, the water and air are contacted in step-wise fashion through multiple trays. The water enters near the top and flows horizontally across each tray, over a weir, and through a downcomer to the tray below. A pressure blower provides air for the aeration process. The air enters the bottom of the unit and is forced through openings in the trays, bubbling through the water to form "an air/water froth", which provides extreme turbulence and excellent volatilization. The overall effect is a multiple counter-current contact of water and air, with each tray having a cross-flow of water opposing a vertical flow of air.

4.0 INSTALLATION

Be sure to carefully read all of the instructions before beginning the installation of the STAT-80 low profile air stripper.

4.1 Inspection

Upon receipt of the STAT unit, and before the unit is removed from the truck, be sure to inspect the system for damage to the shell, all the fittings, the inlet/outlet ports and other equipment. Structural damage to these items could compromise the integrity of the system. **DO NOT** operate the unit if it has been damaged since this could result in damage to other equipment or personal injury. If the STAT-80 low profile air stripper sustains damage during transit, notify the carrier and call Carbonair immediately at (800) 526-4999.

- ***If not notified immediately, Carbonair cannot warranty any shipping damage.***

4.2 Loading & Unloading

The STAT-80 should be unloaded and placed by an appropriately sized forklift or lifting device operated by an experienced operator. A STAT-80 unit with six trays weighs approximately 1,000 lbs. – excluding external piping.

The STAT-80 must be placed on a level concrete pad designed to handle the full operating load of the unit. The STAT base should be bolted to the concrete pad prior to initiating operation.

Be sure to follow proper safety procedures when loading and unloading the STAT unit.

4.3 Connections

Assemble and mount all of the external piping, valves, and instrumentation after the STAT is in place. Make sure that the piping is adequately supported so that excessive load or torque is not placed on the unit fittings.

4.3.1 Mechanical Connections

1. Locate and anchor the STAT unit in an area which allows access to all sides of the unit. Shim as needed to make sure STAT unit is level.

2. Attach exhaust stack (or off gas downcomer if required). Avoid unnecessary restrictions in off-gas ducting. Ducting should be sized for minimal friction loss according to the STAT design air flow rate. When in doubt, ducting should match the size of the STAT air discharge.

3. Connect the influent water piping to the influent flange. We recommend installing a sampling valve in the influent piping and discharge piping. All interconnection piping should be self-supporting.

4. Connect the drain piping and install pump-down kit if supplied.

For gravity drainage, connect the effluent water discharge piping to the discharge flange. Discharge piping should be the same diameter as the effluent flange on the STAT unit, or larger. (See Table No. 2)

Drain Diameter (INCHES)	Slope Per Foot		
	1/2 INCH	1/4 INCH	1/2 INCH
3	36 gpm	42 gpm	50 gpm
4	180 gpm	216 gpm	250 gpm
5	390 gpm	480 gpm	575 gpm
6	700 gpm	840 gpm	1,00 gpm

Table No. 2 - Minimum Pipe Size for Gravity Drain

IMPORTANT: ***STAT gravity discharge lines require a vacuum relief system. This will prevent any type of vacuum on the float valve on the interior of the STAT . Do not attempt to pump out a STAT sump intended for gravity drain. A simple***

vacuum relief system is a tee inserted in the discharge piping with a vertical pipe open to the atmosphere. The tee should be installed as close as possible to the STAT discharge connection.

5. Locate and anchor the blower anywhere near the STAT air inlet tube, as long as the supplied ducting will reach from the blower discharge to the STAT inlet tube. Secure ends of the ducting with flexible connectors.

4.3.2 Electrical Connections

Make the following electrical connections, observing codes or restrictions (such as explosion-proof wiring) at your installation site:

1. Connect sump high level switch to control panel (if not already wired). The sump high level switch is located near the top of the sump sidewall. The switch can be set to operate either normally open or normally closed. We recommend the normally closed setting

2. Connect blower low pressure switch to controls (if not already wired). The blower low pressure switch is located either on the blower outlet pipe or on the blower stand.
The blower low pressure switch has the following connections:

- ✓ Common
- ✓ Normally Open (closes on blower pressure)
- ✓ Normally Closed (opens on blower pressure)

3. For pump-down systems, a level control kit is provided in the sump sidewall. This control must also be wired (if not wired already) in order to control the discharge pump. The switch options are:

- ✓ Top (Red) .... System Shutdown
- ✓ Middle (White) .... Pump On
- ✓ Bottom (Black) .... Pump Off

The high switch is N.C. and all others are normally open when the sump is empty.

5.0 START-UP

Upon completion of the system installation, checkout and startup of the unit can be initiated.

Before starting the unit, check the following:

1. Verify that the blower low pressure switch is calibrated before start-up. If blower low pressure switch does not operate as described in section 4.3.2, see the manufacturer's data sheet supplied to adjust the set point of the switch.

2. Bump the blower motor and verify proper rotation direction.

3. If a transfer pump is supplied, bump the transfer pump motor and verify proper rotation direction.

After the unit is checked-out, start up can be initiated to test system function prior to continuous operation. Whenever possible, it is advisable to use clean, fresh water for system start-up. This will eliminate possible discharge of contaminants if mechanical adjustments are required.

1. Verify that all the valves are positioned properly.

2. Start the STAT blower. It is important to start the blower first to ensure that contaminated water is treated immediately upon entering the STAT unit.

Note: Because the STAT-80 uses a regenerative type blower, the motor in-rush current draw is unaffected by start-up under a NO LOAD condition.

3. Start the flow of clean water to the unit.

Stripping starts immediately as the downcomer blocking valve forces air into the processing area of each tray, preventing air from passing upward through the water downcomer.

As the flow is initiated, water enters the top of the unit at the demisting section and is directed into the top tray. The water flows over the weir and gravity flows across each successive tray in a serpentine pattern.

If the STAT unit is not equipped with a transfer pump, the water accumulates in the sump section and then gravity drains to the discharge point through the mechanical float valve. The mechanical float valve prevents pressurized air from escaping through the effluent connection.

If the STAT unit is set up for pump-out operation, a mechanical float valve is not used.

4. Immediately start the transfer pump (if supplied) to remove the treated water from the STAT sump.

5. Check the system for leaks at the seams. (Leaks are more likely to occur at corners and on the lower trays.)

6. Check system pressures and equipment temperatures. Verify that the operating parameters are within equipment design specifications.

*Sump pressure should never exceed 45” w.c. under normal conditions.

7. Measure the water and air flows through the unit.

8. Check the pressure drop across the trays and compare with the pressure drop chart in Section 10. Verify that the pressure drop is within system design guidelines.

9. Adjust air flows to minimum design airflow. You may adjust air flow higher to optimize system performance.

Air Flow Adjustment and Measurement

You must have a means of measuring air flow to correctly operate your STAT unit. Carbonair can provide you with an air flow kit (Part No. 159848) to provide a means of measuring the air flow through the system.

This STAT unit is designed to operate at the minimum air flow rate specified in section 12.0 of this manual. The blower air flow rate is not preset at the factory. Varying field conditions and the sensitivity of air bleed valve require that the valve be set to field conditions. Improper adjustment of the valve can lead to excessive water carry over in the exhaust stream as well as a lowered stripping efficiency.

To adjust the STAT operating air flow rate, first turn on the STAT blower and begin to introduce water into the system at the design flow rate. (Note: You must have a means of measuring the water flow rate (flow meter) on the influent line, downstream of any pumps). Once the system is accepting water at the operating flow rate note the measured air flow rate using the air flow kit. If the measured air flow rate is above or below the design air flow rate listed in Section 12.0, you must adjust the air flow using the air bleed valve on the blower exhaust. Turning the valve clockwise will close the valve and increase the air flow through the STAT. Turning the valve counter clockwise will open the valve and decrease the air flow through the STAT.

Note: You must periodically check and adjust the air flow during the operation of the system. Conditions may change (like increase or decrease in water flow rates, addition of downstream air treatment technologies or fouling of the air stripper) that will increase or decrease back pressure in the blower and cause the air flow rate to deviate from the design flow rate.

6.0 OPERATION

When STAT is operating within its parameters, a base line pressure drop should be established. This can be monitored during operation for maintenance purposes. Your STAT system should be supplied with the proper blower for overcoming the total pressure drop through the system. If adding gas phase carbon adsorption to the off-gas of a STAT unit previously operated with atmosphere discharge, contact Carbonair to determine if the current blower/ducting configuration will be adequate. Once the system has been tested with fresh water, proceed with treating contaminated water. (Maximum pressure - 50" w.c.)

7.0 TROUBLE SHOOTING

There are a few situations that may arise while operating the STAT-80 which can adversely effect the performance of the unit and/or result in abnormally high maintenance costs. If these situations cannot be resolved using the following trouble shooting guide, contact Carbonair at (800) 526-4999 for additional help.

Situation #1:

Excessive condensate or foam is noted leaving the exhaust of the STAT.

Probable Causes:

There are two main items that can cause water carry over into the exhaust:

a. Air flow rate that is in excess of the rated air flow of unit.

b. Surfactants in the water such as soaps, detergents and other organic compounds may cause a stable bubble froth to form and accumulate in the unit.

Solutions:

a. Measure the air/water flows and compare with the design water and air flow rate of the system. If air flow is excessive, the flow should be adjusted to design conditions.

b. It may be necessary to add a defoaming agent to influent water of the STAT. This agent will prevent stable bubble formation and allow the STAT to operate properly. Contact Carbonair at (800) 526-4999 for information on defoaming agents.

Situation #2:

The pressure drop across the trays is higher at initial start-up than it should be according to the pressure drop chart in Section 10.

Probable Causes:

If this occurs, the flow of air through the tray holes is restricted. The most common causes for this pressure drop build up are:

a. Sediment/solids in the water stream have clogged the holes in the aeration trays.

At initial start-up, sometimes there can be an excessive amount of solids introduced into the system from the well(s). Eventually, these solids are removed from the well(s) and cleaner ground water is produced.

b. The flow of air through the STAT unit is greater than the system design specifications.

c. The flow of water through the STAT unit is greater than the system design specifications.

Solutions:

a. Measure the air/water flows and check the pressure drop curve to determine the design pressure drop and compare with the actual pressure drop.

b. If the flows are in excess of design specifications, adjust flow accordingly.

c. If process flow adjustments have no effect, clean out the STAT unit and develop the well(s) further before introducing flow to the STAT unit.

Situation #3:

Deteriorating treatment performance.

Probable Causes:

Treatment performance can deteriorate for a number of reasons including:

a. Inadequate air/water ratio resulting in poor volatilization of organic components.

b. Influent contaminant concentrations higher than initial design parameters.

c. Influent contaminant components different than initial design parameters.

d. Aeration trays have become fouled.

Solutions:

a. Verify that the system flows are within the design specifications.

b. Verify that the air/water ratio is within design specifications.

c. Clean the STAT trays.

d. Conduct influent analyses to verify initial design parameters - components and concentrations.

e. Call Carbonair for assistance if operating parameters have changed - system modifications may be necessary.

Situation #4:

The STAT sump high level alarm frequently trips due to high sump level conditions.

Probable Causes:

If the sump high level alarm trips, it means that the water is not being removed as quickly as it is accumulating in the sump. This could occur for the following reasons:

a. The transfer pump has failed.

b. The influent water flow rate exceeds the effluent drainage or pumping capacity.

Solutions:

a. Verify that the transfer pump is operating properly.

b. Measure the influent flow rate and check the effluent drainage design to determine if the influent flow rate exceeds the effluent drainage system capacity.

c. If the flow rate is within design specifications, clean the effluent piping to clear any blockages.

8.0 MAINTENANCE

There are several maintenance tasks which must be performed periodically to ensure continued, trouble free operation. These tasks are discussed in subsequent sections.

8.1 Disassembly/Cleaning

Read all installation instructions before beginning disassembly.

1. Prior to disassembly of unit, turn off influent pump and allow blower to operate for a few minutes. This will allow contaminated water within aeration plates to be treated as the unit drains.

2. When effluent flow has completely stopped, turn off blower and turn main power disconnects to the off position and lock them out.

Be sure that STAT is completely drained by removing plug at the bottom of the sight glass.

3. Disconnect and remove air discharge stack or ducting from top of unit. This procedure may not be necessary if space permits removal of the demister section with stack attached.

4. Disconnect the influent piping. Make sure loose influent piping is adequately supported.

5. Starting with the demister section, unfasten the clips and lift off the demister section.

6. Before and during disassembly, it is important to note the placement of the aeration trays. Taking time to familiarize yourself with the STAT unit will make reassembly faster and easier.

7. Alignment of buttons on trays, sump and demister should be noted. Proper assembly of STAT requires alignment of buttons shown in Figure No. 2.

8. The unit must always be disassembled piece by piece from the top down. It is recommended that removed pieces be set on wooden supports, such as a pallet, to avoid damage to the gasket sealing surfaces and clips.

9. Each section must be raised a few inches prior to moving piece horizontally.

10. Paying special attention to the placement of each aeration tray, remove each tray until only the sump section remains. Again, make note of proper alignment of buttons.

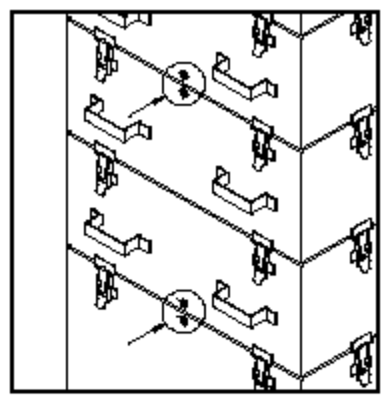


Figure No. 2
Proper Alignment of STAT Buttons

11. Once all aeration trays are removed, check the integrity of the gasket material.

12. Any fouling buildup on the trays may be cleaned using a pressure washer or may be scraped out. Use caution not to damage the flapper valve or gasket material when cleaning. Holes smaller than 3/16” indicate fouling.

13. When cleaning the demister section and aeration trays, be careful not to damage gaskets. The mist eliminator pad may have to be cleaned with water pressure or muriatic acid. If this is unsuccessful, the pad must be replaced. Fouling in the demister can cause excessive back pressure of the system.

14. The sump section should be cleaned in the same manner. Check the float valve gravity flow system in the sump section (if supplied) for plugging and material deterioration. Check each tray downcomer valve for scale and bacteria build-up. Clean if necessary.

15. Prior to reassembly, make sure the areas that mate with the gasket material are clean and free of foreign matter.

8.2 Reassembly

1. To reassemble the unit, follow the disassembly instruction in reverse order. A coating of silicone grease in the corners before reassembly will act as an inert gasket sealant and lubricant. DO NOT use any other material for gasket sealant, as it may affect the operation of the STAT unit. If silicone grease or gasket material is not available, contact Carbonair for supplies. Keep in mind that each piece MUST be put back in the same position and orientation as before disassembly. Improper assembly could cause malfunction or damage to the STAT unit. Refer to Figure No. 2 for button alignment.

2. Connect all inlet and outlet piping, discharge stacks, etc., prior to restarting unit.

3. Whenever possible, use clean, fresh water for system testing after reassembly. Start the blower first. Once blower is operating, start influent pump(s) or water flow.

4. After starting the influent pump(s), check for leaks throughout the system.

Refer to Section 5.0 Startup for full startup procedure.

8.3 Gasket Replacement

<u>Safety Precautions</u>

• Be sure to read and understand this O & M manual before beginning gasket maintenance. If you have any questions, please call Carbonair Environmental Systems, Inc. at (800) 526-4900.

• Always wear gloves, eye protection and protective clothing when working with the equipment.

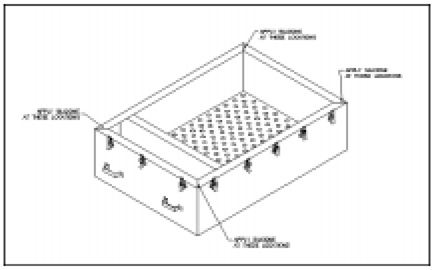
• Be sure all mechanical inlets are blocked off and locked out before disassembly.

• Be sure all electrical disconnects are "OFF" and locked out before servicing.

<u>Replacement Procedure</u>

1. Disassemble STAT (see Section 8.1 of STAT Operations & Maintenance Manual).

2. Remove the old gasket and adhesive. A sharp putty knife can be used to scrape off any fragments not easily removed. Any old adhesive and silicone can be removed using mineral spirits and then hot water and soap. Tray surfaces must be clean before the new gasket is placed on the tray.



3. When the tray is clean, install the new gasket, beginning at one corner and working around to all sides of the tray. You may need to trim some areas to avoid clips or lifting lugs.

Note: On the larger model STATs (180's and up), the gasket may start to pull itself off before the entire gasket is in place. If this happens, try to fasten the corners in place as you go around. A small dab of Super Glue, clothespins, or tape may be used every two feet to hold the gasket in place on the tray. Once the entire gasket is in place, the pins or tape can be removed and the gasket should remain in place on its own.

4. Apply a thin layer of silicone grease to the corners of the gasket and the corners of the tray under the gasket. This helps to create a better seal between the gasket and the tray above.

5. Reassemble STAT (See Section 8.2 of STAT Operations & Maintenance Manual).

6. Begin operation of STAT with clean water and check the system for leaks.

9. SPARE PARTS

When ordering spare parts, refer to the drawings at the end of this manual. Be sure to provide the unit model number and the complete description of the part.

10.0 PRESSURE DROP CHART

The following is the pressure drop chart for the STAT 80 air stripper.

11.0 DRAWINGS

An assembly drawing has been included to simplify the part identification and ordering process.

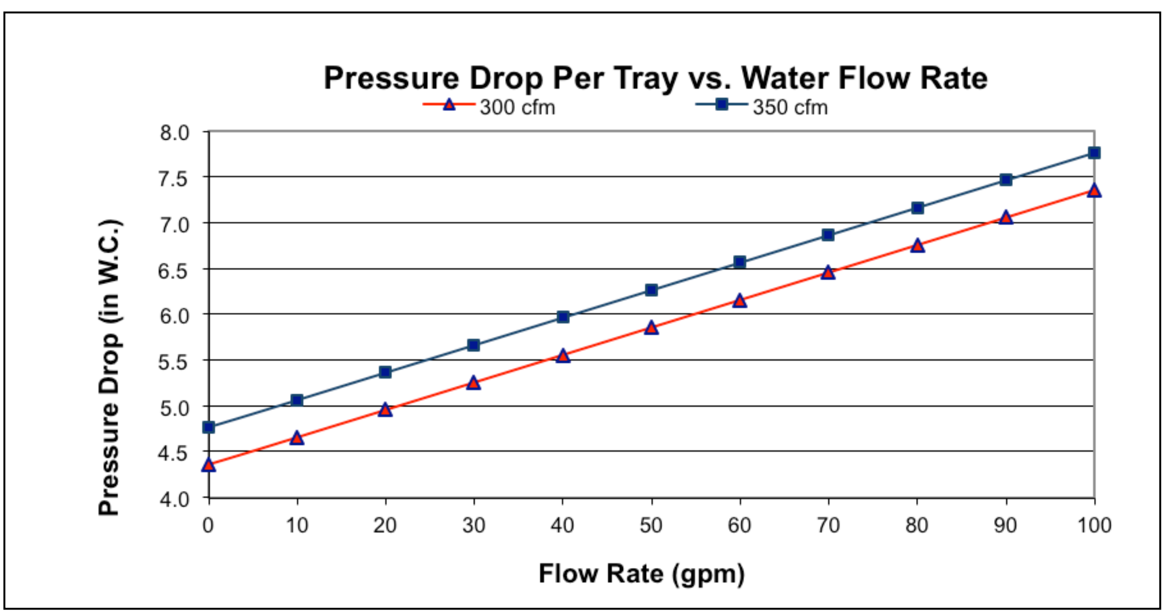


Figure No. 7
STAT-80 Low Profile Air Stripper Assembly Drawing No. 1

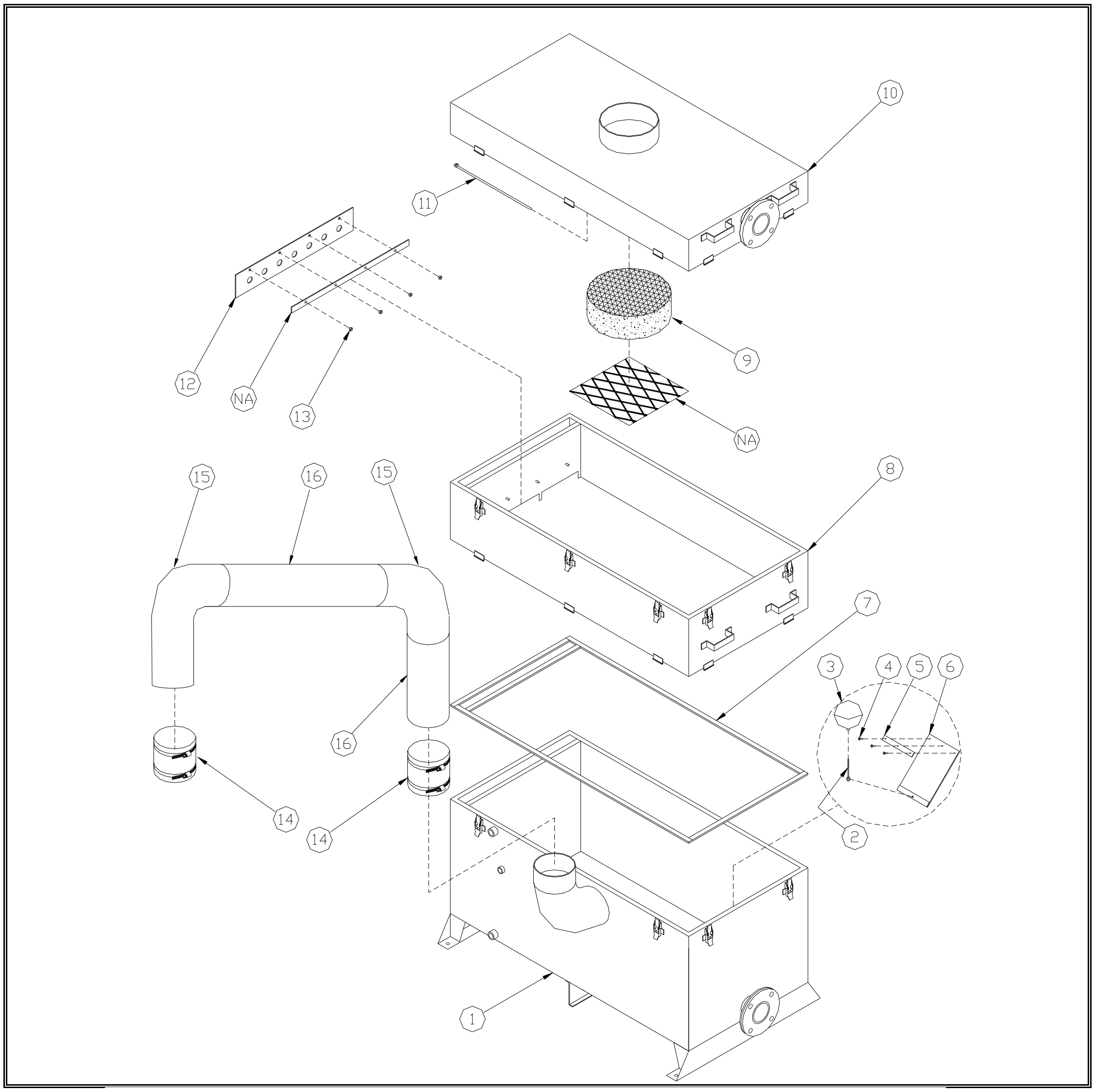


Table No. 4
STAT-80 Low Profile Air Stripper - Parts List & Order Numbers

#	Part Description	Part No.	#	Part Description	Part No.
1	Sump	127435	9	Demisting Material	127581
2	Eye Bolt	230074	10	Demister	127410
3	Float Ball	117923	11	Plastic Tie Cable	NA
4	Stainless Steel Screw	106797	12	Downcomer Valve	127443
5	Flapper Valve Plate	117867	13	Hex Lock Nut	114731
6	Flapper Valve	117842	14	Flex Coupling	128394
7	Foam Gasket Strip	211451	15	PVC Elbow	150825
8	Aeration Tray	127427	16	PVC Duct	150817

12.0 SPECIFIC OPERATING PARAMETERS

Record Operating Parameters at Start-Up.

Water Flow Rate	____	
Water Temperature	____	
Air Flow Rate	____	
Water Discharge	Gravity______________	Pump Out ________________
Air Discharge	Atmosphere__________	Post Treatment____________
Blower Motor	HP__________________	Phase____________________
	Volts________________	Amp Draw__________________

Appendix E:

Waste Disposal Manifests

ENVIRONMENTAL PRODUCTS & SERVICES OF VERMONT, INC.

24-Hour Emergency Phone Number
1-800-843-8265

Please print or type

BILL OF LADING

1. Document No. ALB3727
2. Page 1 of 1

3. Generator's Name and Mailing Address
FULLER PARTNERS, LLC
PO BOX 370
CHATHAM NY 12060

Site Address
136 FULLER ROAD
ALBANY NY 12203

4. Generator's Phone (518) 273-8391

5. Transporter 1 Company Name: ENVIRONMENTAL PROD & SVCS OF VT, INC
6. NYR000115733

A. State Transporter's ID: 41096 (VT)
B. Transporter 1 Phone: 800 843-8265

7. Transporter 2 Company Name
8.

C. State Transporter's ID
D. Transporter 2 Phone

9. Designated Facility Name and Site Address
ENVIRONMENTAL PROD & SVCS OF VT, INC
300 SMITH BLVD.
ALBANY NY 12202
10. NYD986971877

E. State Facility's ID
F. Facility's Phone: 518 465-4000

GENERATOR

HM	11. Shipping Name	12. Containers No.	Type	13. Total Quantity	14. Unit Wt./Vol.
	a. Non-RCRA, Non-DOT, LIQUIDS, N.O.S. (Trace organics contaminated water)	3	DM	1200	G
	b. Non-RCRA, Non-DOT SOLIDS, N.O.S. (Trace organics contaminated debris)	9	DM	5400	P
	c. ~~Non-RCRA, Non-DOT SOLIDS, N.O.S. (RCRA empty container)~~		~~DM~~		~~P~~
	d.				

G. Additional Descriptions for Materials Listed Above

a. App#:A0911071-OT 3 X 55 GAL

b. App#:A0911070-DT, 9 X 55 GAL

c. ~~App#:A0911072-MT, __ X __ GAL~~

d.

15. Special Handling Instructions and Additional Information
1)JOB#A3649 2) 3)

16. **GENERATOR'S CERTIFICATION:** I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this document are not subject to federal manifest requirements.

Printed/Typed Name	Signature	Date Month	Day	Year
Scott Dietzel	Scott Dietzel	9	16	11

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month	Day	Year
J BRADSHAW	[signature]	9	16	11

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator; Certification of receipt of the materials covered by this bill of lading except as noted in item 19.

Printed/Typed Name	Signature	Date Month	Day	Year

BILL OF LADING

ENVIRONMENTAL PRODUCTS & SERVICES OF VERMONT, INC.

24-Hour Emergency Phone Number 1-800-843-8265

Please print or type

BILL OF LADING

1. Document No.	ALB5071
2. Page 1 of	1
3. Generator's Name and Mailing Address	FULLER PARTNERS, LLC PO BOX 370 CHATHAM NY 12060
Site Address	136 FULLER ROAD ALBANY NY 12203
4. Generator's Phone	(518) 273-8391
5. Transporter 1 Company Name	ENVIRONMENTAL PROD & SVCS OF VT, INC
6.	NYR000115733
A. State Transporter's ID	410 RCVT
B. Transporter 1 Phone	800 843-8265
7. Transporter 2 Company Name	
8.	
C. State Transporter's ID	
D. Transporter 2 Phone	
9. Designated Facility Name and Site Address	ENVIRONMENTAL PROD & SVCS OF VT, INC 300 SMITH BLVD. ALBANY NY 12202
10.	NYD986971877
E. State Facility's ID	
F. Facility's Phone	518 465-4000

GENERATOR

HM	11. Shipping Name	12. Containers No.	Type	13. Total Quantity	14. Unit Wt./Vol.
	a. Non-RCRA, Non-DOT SOLIDS, N.O.S. (Trace organics contaminated debris)	4	DM	200	G
	b.				
	c.				
	d.				

G. Additional Descriptions for Materials Listed Above

a. App#:A0911070-DT, 4 X 55 GAL

c.

b.

d.

15. Special Handling Instructions and Additional Information

1)Job#A4377

16. GENERATOR'S CERTIFICATION: I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this document are not subject to federal manifest requirements.

Printed/Typed Name	Signature	Date Month	Day	Year
C. Scott Dietzel	C. Scott Dietzel	8	1	12

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month	Day	Year
Armand J. Marotta	[signature]	8	1	12

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator; Certification of receipt of the materials covered by this bill of lading except as noted in item 19.

Printed/Typed Name	Signature	Date Month	Day	Year

BILL OF LADING

Appendix F:

Example Field Data Sheet

Trailer Daily LOG
136 Fuller Road BCP

Date:			
HVE / TFE			
Water Flow (Gallons to Date)			
Wtr Flow (GPM - 24 Hr. Avg.)			
Ring Pump Vacuum (in-Hg)			
Separator Dscg Pump (PSI)			
Bag Filter Unit (in Psi)			
Bag Filters Replaced			
AS Eff Pump Pressure			
Clean Oil/Water Sep Tank			
Clean Level Sensor Probes			
TFE Measured Current (amps)			
Clean Air Stripper			
SVE			
Vacuum (In-wtr)			
Dichharge Monitroring			
Stack (PPM)			
Stack Flow FPM (6-in - 0.2cf)			
HVE (PPM)			
HVE Flow FPM (4-in - 0.08 cf)			
SVE (PPM)			
SVE Flow FPM (2-in - 0,023 cf)			
Sampling			
HVE Influent Water Time			
HVE Effluent Water Time			
Stack (Whole Air) Time			

Daily Notes:

Appendix G:

System Operating Field Data (Tables 1 and 2)

TABLE - 1
SYSTEM FIELD MEASUREMENTS

Date	Total Gallons (6 AM)	Avg Gallons 24 Hour Avg	HVE Vacuum In of Hg	HVE Flow CFM +	HVE VOCs PID	SVE In of Wtr	SVE Flow CFM +	SVE VOCs PID	Stack Total CFM +	Stack Total VOCs PID	Notes:
11/15/11	0		8.5								System Startup
12/14/2011	32532	1.5	8.8	516	116	46	202	3	740	51	Initial Monthly Data
12/31/2011	54898	1.01	8.4	536	136	46	198	0.2	660	88	Initial Monthly Data
1/12/2012	67640	0.72	8	504	95	46	168	1	540	74	Monthly Lab Sampling
2/27/2012	97818	0.74	7.4	440	192	46	191	0.2	640	143	Monthly Lab Sampling
3/30/2012	117858	0.43	10.5	440	163	46	205	0.8	600	118	Monthly Lab Sampling
4/26/2012	129451	0.32	10	496	188	46	207	0.5	580	120	Monthly Lab Sampling
5/30/2012	143559	0.8	11	480	225	46	285	2	520	165	Monthly Lab Sampling
7/10/2012	162989	0.34	10	500	220	46	290	0.1	640	82	Monthly Lab Sampling
8/16/2012	175730	0.25	8.7	656	58	46	329	0.2	760	45	Monthly Lab Sampling

\+ FLOWS LISTED ARE AS MEASURED WITH A HOT WIRE ANEMOMETER AND DO NOT ALWAYS TOTAL AT STACK DUE TO DIFFERENCES IN AIR MOISTURE CONTENT, PIPE DIAMETER AND TURBIDITY

The system was not sampled in June of 2012 because it was down for maintenance when sampling would have occurred.

TABLE 2
System Mass Removal Calculations and Air and Sewer Discharge Limit Verification

Calculations based on monthly lab sample analysis data

DATE	1/12/12	2/27/12	3/30/12	4/26/12	5/30/12	7/10/12	8/16/12	Action Levels
Mass removed in Vapor (pounds/day)	0.0042	0.00597	0.0025	0.0039	0.0059	0.0006	0.0002	NA
Mass removed in Liquid (pounds/day)	1.06589	1.20471	0.36015	1.54121	1.59079	1.67004	1.57892	NA
TOTAL (pounds/day)	1.1	1.2107	0.3626	1.5451	1.5967	1.6707	1.5791	NA

Air Effluent Total VOCs (pounds/hour)	0.0444	0.05020	0.0150	0.0642	0.0663	0.0696	0.0658	0.5 Pounds / Hour

Appendix I

Quality Assurance Project Plan

Quality Assurance Program Plan
136 Fuller Road Site
Brownfield Cleanup Program
NYSDEC Site No. C401055

City of Albany and Town of Guilderland
Albany County, New York

June 2010

THE Chazen COMPANIES®
Engineers
Environmental Professionals
Land Surveyors
Landscape Architects
Planners

Prepared for:

Fuller Partners, LLC
PO Box 370
133 Route 395
East Chatham, NY 12060

New York State Department of Environmental Conservation – Region 4
1130 N. Westcott Road
Schenectady, New York

Prepared by:

Capital District Office:
The Chazen Companies
547 River Street
Troy, New York 12180

TABLE OF CONTENTS

Attachments

1.0 PROGRAM DESCRIPTION

This Quality Assurance Program Plan (QAPP) describes protocols and procedures necessary to ensure that specific tasks and actions undertaken by The Chazen Companies (TCC) are planned and executed in a manner consistent with the Quality Assurance (QA) objectives. This QAPP also details responsibilities for compliance with these requirements.

The QAPP provides guidance and specifications for:

- Organizational structure within The Chazen Companies
- A method for determining Data Quality Objectives
- All routine calibration and sampling procedures conducted by The Chazen Companies
- Chain of Custody requirements and Analytical Procedures
- Data Reduction, Validation, and Reporting
- Internal Quality Control and Internal Auditing
- Specific Routines to Assess Data Quality
- Preventative Maintenance
- Performance Reporting

This document will support all work performed by TCC in the areas of soil and groundwater Remedial Investigations and Alternatives Analyses, environmental site audits, Remedial Design (RD) and long-term environmental monitoring.

The format for this QAPP is based on "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final", 1988 (EPA/540/G-89/004), "Data Quality Objectives for Remedial Response Activities (Development Process)", 1987 (EPA/540/G-87/003), and on NYSDEC Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10, Draft November 2009) .

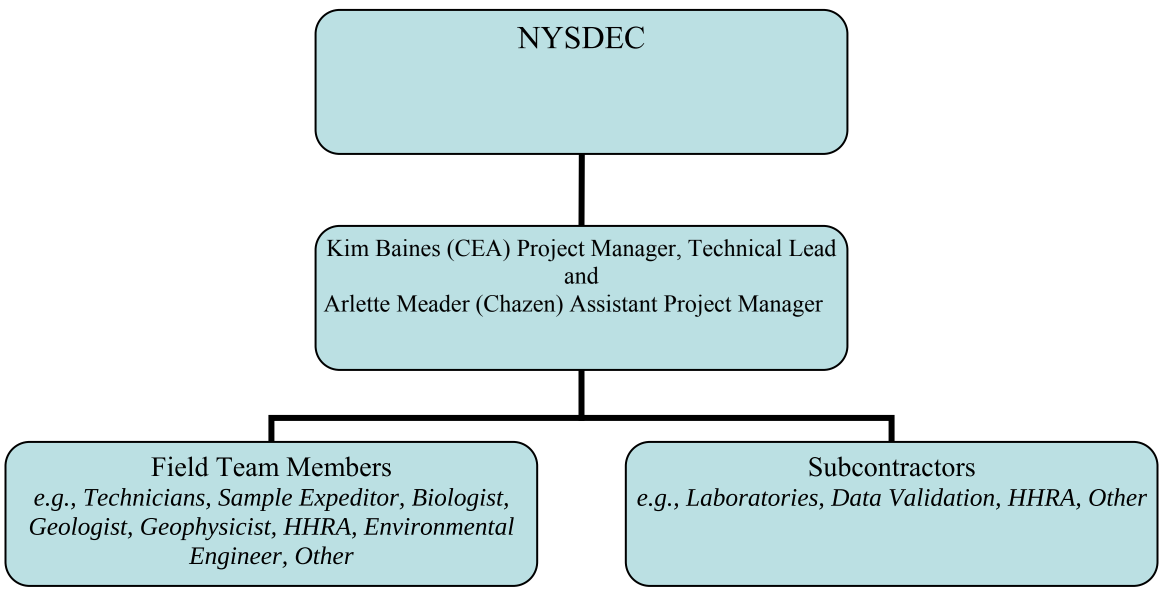
The QAPP is divided into 14 sections as described in the document "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final", 1988 (EPA/540/G-89/004).

2.0 PROGRAM ORGANIZATION

2.1 Company Organization

The Chazen Companies assigns a specialized team of experts to each project. These individuals act together to meet the needs of the project. Each project is assigned a Project Principal and Project Manager who oversee the components of the project. The project organization chart is shown below.

Organization Plan



2.2 Specific Responsibilities

Principals: Principals of The Chazen Companies are responsible for establishing a contract for the services to be performed, for committing the corporate resources necessary to conduct the program work activities, and for supplying corporate-level input for problem resolution.

Project Manager: The Project Manager will be responsible for establishing protocols to be used during the investigation and remedial activities, and establishing sampling methods. He will provide oversight and technical guidance during field activities and report preparation, maintain quality and consistency, and monitor the overall work progression. The Project Manager is responsible for the management and quality of the project. The Project Manager is named in the Site Investigation Work Plan and may be the Director of Environmental Services or his/her designee (e.g. Assistant Project Manager). The Project Manager is responsible for ensuring that all project objectives are met, including schedule and budget tracking, QA adherence, and ultimate product delivery. The duties and responsibilities of the Project Manager include:

- General supervision of project execution to ensure that the project objectives are met on schedule and on budget.
- Assisting in project activities.
- Financial management.
- Identifying project staff, equipment, and other resource requirements.
- Conducting project progress meetings with the client and the technical reviewers.
- Final review of project deliverables prior to issue.
- Implementation of subcontracting, as required.

Field Operations Leader: The Field Operations Leader named in the Work Plan is usually a member of the Senior Environmental staff at The Chazen Companies and is responsible for the coordination and execution of the field activities, data reduction, and interpretation. Assigned responsibilities include:

- Organization of personnel, equipment, and materials to meet the objectives of the field tasks.
- Direction of field activities in accordance with the Work Plan and project QAPP.
- Coordination of subcontractor activities including verification and adequacy of subcontractor QA/QC programs.
- Assisting in project activities.
- On-going Quality Control (QC) during performance of work.
- Field and laboratory data reduction and interpretation.
- Execution of corrective actions for identified QA/QC problems.
- Supervision of field team.
- Supervision of deliverable preparation.

Technical Reviewer/Quality Assurance Manager: The Technical Reviewer(s) named in the Work Plan is (are) generally peer reviewers, the Director of The Chazen Companies or the managing Principal. Technical reviewers review field data and methodology and act as Quality Assurance Managers. The Technical Reviewer(s) will be responsible for the overview of tasks and procedures, which affect the quality of work performed during the investigation. The Technical Reviewer/Quality Assurance Manager is responsible for:

- Verification of the Quality Assurance Program through evaluation and overview of program tasks.
- Identification of problems affecting quality and recommending corrective actions.
- Reporting to the Project Manager on the status and adequacy of the overall QA program.
- Consultation on data analysis and interpretation.
- Technical review of the project.

Field Team Member: Field Team Members involved in the field investigation, geophysical survey, location and elevation survey, or other field activities are responsible for the on-site execution of planned field activities. Field team members named in the Work Plan are assigned responsibilities which may include:

- Completion of all field activities in accordance with the Work Plan.
- Field supervision of subcontractor activities.
- Monitoring of, and adherence to, health and safety requirements in accordance with the HASP during field activities.

2.3 Personnel Qualifications and Training

The Project Manager and the Quality Assurance Manager review the assignment of technical staff and the project management plan with regard to the appropriate qualifications in the technical areas relevant to the Project and any associated QC techniques. Training, if required, is specified and implemented prior to project start-up.

Site-specific training is provided to all members of the field team and includes:

- General briefings covering the QA program and Project plans;
- Detailed briefings on specific methods required by the Work Plan and QAPP;
- Specific briefings on individual QA and QC procedures and activities.

All employees of TCC involved with hazardous waste investigations are required to attend an OSHA-approved 40-hour health and safety course prior to working on hazardous waste sites. In addition, these employees are required to annually attend an 8-hour refresher health and safety course and to participate in a medical surveillance program.

2.4 Analytical Laboratory and Other Support Services

The subcontractors for analytical services will be determined prior to the initiation of the field investigations. Data validation, if required, will be performed by The Chazen Companies or by a qualified firm.

The responsibility for implementing the laboratory QA Program resides with the laboratory subcontractor's Laboratory Analytical Task Manager. The Laboratory Analytical Task Manager is responsible for the following:

- Following the Project QC Plan.
- Supporting the TCC Project Manager and Quality Assurance Manager.
- Maintaining sufficient instruments, space resources, and personnel to perform the analyses as necessary.
- Handling/receiving samples in a manner consistent with New York State and Federal guidance as outlined in the Work Plan/QAPP.
- Implementing corrective action to account for analytical problems or QC deficiencies.
- Maintaining appropriate instrument controls/calibration.
- Reviewing all sampling and analyses, instrument blanks, sample blanks, and other QA/QC information to ensure that it meets the desired quality standards.

- Providing QA/QC checks at the proper frequency and maintaining an awareness of the laboratory condition to detect conditions which might jeopardize controls of the various analytical systems (e.g. improper calibration, improper sample storage conditions, and equipment maintenance intervals).
- Providing in-house QC audit documentation for sample storage, labeling, preservation, transportation, and disposal in accordance with Analytical Services Protocol (ASP).

3.0 QUALITY ASSURANCE OBJECTIVES

Quality Assurance (QA) is a management system that ensures that all information, data, and decisions generated during a site investigation or feasibility study is technically sound and properly documented. Quality Control (QC) is the functional mechanism through which the quality assurance objectives are achieved. The overall objective of the QA/QC program is to establish procedures such that data obtained from the field and laboratory analyses are of adequate quality to satisfy the project objectives.

3.1 Data Quality Objectives

Data quality objectives (DQOs) are stated qualitatively and quantitatively, where applicable, in the Work Plan for a site investigation or feasibility study. DQOs specify the required quality of data necessary to support decisions related to the program including: site screening, characterization, assessment of health risk, the remedial actions that may take place on a site.

The basis of DQOs is that the quality of data is dependent upon its intended use. DQOs are established based upon site-specific conditions and project objectives and are applicable to all data collection activities.

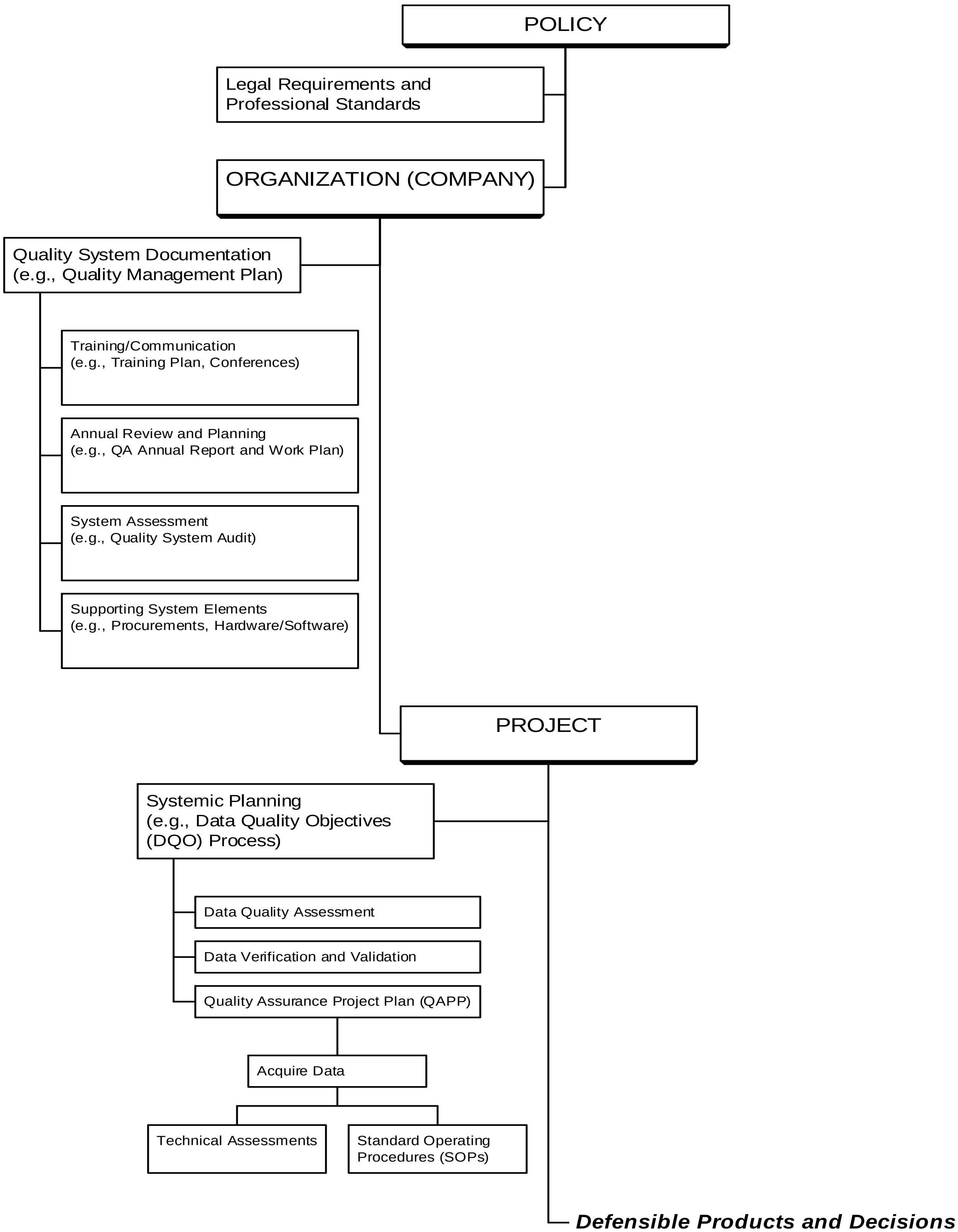
Data quality objectives are developed through an iterative process by which all the DQO elements are continually reviewed and re-evaluated to meet the overall project objectives. This process can be summarized as follows:

<u>Stage 1</u>: Defines the types of decisions which will be made during site remediation by identifying data users, evaluating available data, developing a conceptual model, and specifying goals for the project. Stage 1 results in a specific identification as to why new data are needed.

<u>Stage 2</u>: Identifies the data necessary to meet the objectives established in Stage 1. It also stipulates criteria for determining data adequacy. During Stage 2, sampling approaches and analytical options are evaluated to determine timely or cost-effective approaches.

<u>Stage 3</u>: The final design of the data collection program is established in Stage 3. The design of the data collection program results in the specification of the methods by which acceptable data will be obtained to make decisions.

QUALITY SYSTEM COMPONENTS AND TOOLS



3.2 Data Quality Characteristics

Data quality characteristics will be addressed as they pertain to a proposed investigation. Based on the DQOs selected, data will be assessed and evaluated for:

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability
- Reporting Limits

The manners in which these characteristics will be assessed and evaluated are described in the following sections.

3.2.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. The duplicate results for each precision check event will be compared to determine the range of the measurements as an indication of the precision associated with the measurement. In addition, the laboratory will analyze matrix spike/matrix spike duplicate samples to monitor the precision of the analytical methods.

Precision will be determined by calculating the relative percent differences (RPD) between the duplicate samples. The RPD for each sample will be calculated using the following equation:

$$\%RPD = \frac{D_1 - D_2}{\left(D_1 + D_2\right)/2} \times 100\%$$

where,
RPD Relative Percent Difference
D_1 First Sample Value
D_2 Second Sample Value (duplicate)

The RPD data will be used to evaluate the long term precision of the analytical/measurement methods. The laboratory will also calculate RPD values on the results of the matrix spike/matrix spike duplicate samples. These RPD values will be compared to RPD values provided in the current NYSDEC ASP protocols.

Procedures to be employed to maximize the precision of the data to be collected include:

- written methods and procedures documented in the project QAPP;
- multiple techniques will not be used to generate or collect the same data;
- all sampling and analytical personnel will be trained and required to follow the Work Plan and QAPP procedures;

- the Field Operations Leader will provide oversight during this investigation to monitor the adherence of project staff to these plans.

3.2.2 Accuracy

Accuracy measures the bias in a measurement system and is a determination of the closeness of the measurement to the true value. Sources of error include the physical sampling process, decontamination procedures, sample preservation and handling, homogeneity of the sample matrix, and sample preparation and analysis techniques used by the laboratory. Accuracy will be measured using blank and spike samples. The levels detected in the blanks and the difference between the reported and known concentrations for spikes will be used to assess the accuracy of the results.

The results of sample spiking will be used to calculate the Percent Recovery (%R), which will be used as the quality control Parameter for accuracy evaluation. Percent Recovery is calculated by the following equation:

$$\%R = \frac{ObservedValue}{TheoreticalValue} \times 100\%$$

Surrogate standard determinations will be performed on all samples and blanks. All samples and blanks will be fortified with surrogate spiking compounds before purging or extraction as specified in current USEPA SW-846 protocols.

Procedures employed to maximize the accuracy of the data to be collected include:
- written methods and procedures documented in the project FSP;
- all sampling and analytical personnel will be trained and required to follow the procedures specified in these plans, use of standard methods and known procedures to generate accurate data;
- adherence to strict decontamination procedures of sampling equipment;
- frequent calibration against known standards of field and laboratory equipment.

Calculations performed with analytical data are also checked for accuracy and precision by the Project Manager, Field Operations Leader or their designees, and reviewed by the Quality Assurance Manager.

3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent an analytical result from the matrix being sampled. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program.

Procedures employed to maximize the representativeness of the data to be collected include:
- written methods and procedures documented in the project FSP;
- avoiding use of multiple techniques to generate or collect the same data;

- all sampling and analytical personnel to be trained and required to follow the procedures specified in the project plans;
- Field Operations Leader to provide oversight during the investigation to monitor the adherence of project team members to these plans.

In addition, the sampling locations and number of samples to be collected (as specified in a Work Plan) will be selected to provide data representative of the media and potential contaminants of concern at locations where releases would be expected to be detected if present.

3.2.4 Completeness

Completeness is defined as the percentage of data collected judged to be valid and useful to the objectives of the project. Completeness is the amount of valid data obtained from a measurement system expressed as a percentage of the number of valid measurements that should have been (i.e., were planned to be) collected according to the Work Plan. The completeness objective will be 100% valid data for samples collected or analyzed. If this objective cannot be met due to unforeseeable problems, the problems will be addressed in the data usability report. Any data deficiencies will be evaluated in terms of their impact on project goals, and corrective action will be taken, if needed.

Procedures employed to maximize the usefulness and completeness of project data include:

- real-time field screening to focus on potential contaminant source regions;
- soils and groundwater samples for laboratory analysis for confirmation purposes;
- sample handling and shipping procedures which protect samples from breakage;
- communication with the laboratory to ensure their awareness of sample holding times;
- the availability of backup instruments or equipment for field measurements;
- collection of minimum-recommended sample volumes, which frequently include sufficient volume for re-analysis if a problem occurs in the laboratory;
- monitoring of field activities by the Field Operations Leader so as to allow for potential re-sampling or other measures to ensure that the required samples are collected.

3.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Methods will be employed during this investigation to ensure that the data generated can be compared to other relevant data sets of similar quality. The analytical results of QA/QC samples and internal laboratory QA/QC samples will be reported along with the results of field sample analyses. Standard sample analysis and reporting methods will follow NYSDEC ASP protocols.

3.2.6 Reporting Limits

Formulae for determining the reporting limits specific to each parameter analyzed are provided by the laboratory.

3.3 Quality Assurance Reports

The Quality Assurance Manager will prepare status reports to summarize QA/QC issues related to the collected data. The objective of the status report is to verify that the work being performed on the project adheres to all of the project plans, and that the collected data meet the previously described goals for precision, accuracy, and completeness.

3.4 Data Quality Requirements

Site specific data requirements are presented in the Work Plan, FSP, or associated documents for a particular project or investigation. There are five general analytical levels of data quality. These levels are described as follows:

Level I: Field screening utilizing portable instruments. These data may include pH, temperature, and specific conductance measurements of water samples, and ambient air and soil screening measurements with photoionization, flame-ionization, O_2, lower explosive limit (LEL), or other meters.

Level II: Field analyses utilizing more sophisticated portable analytical instruments. These instruments may be set up in a mobile laboratory on site. There is a wide range in the quality of data that can be generated. Data quality depends on the use of suitable calibration standards, reference materials, sample preparation equipment, as well as the training of the operator. Results from Level II data are available in real-time or within several hours of sample collection.

Level III: These data include analytical laboratory data utilizing USEPA-approved procedures other than ELAP protocols. All analyses are performed in an off-site analytical laboratory following SW-846 protocols. Level III is characterized by rigorous QA/QC protocols and documentation.

Level IV: Analytical laboratory analysis using ELAP methods and supported by a rigorous QA program and documentation. These data are typically used for definitive site characterization, risk assessment, engineering alternative selection and design, and litigation activities. Level IV methods may include pre-approved non-standard methods for specific constituents or detection limits. All analyses are performed in an off-site analytical laboratory.

Level V: These data include physical property and engineering material analysis by approved standard or non-standard methods including analysis of non-standard sample matrices (e.g. wastes, biota). All analyses are performed in an off-site laboratory. The following table presents a summary of analytical levels appropriate to data uses.

Summary of Analytical Levels Appropriate to Data Uses

Data Uses	*Analytical Level*	*Type of Analysis*	*Limitations*	*Data Quality*
Site Characterization. Monitoring during implementation.	Level I	Total organic and inorganic vapor detection using portable instruments, Field test kits	Instruments respond to naturally occurring compounds	If instruments are calibrated and data are interpreted correctly, can provide indication of contamination
Site Characterization. Evaluation of alternatives. Engineering design. Monitoring during implementation.	Level II	Variety of organics by GC; Inorganics by AA; XRF Tentative ID; Analyte-specific; Detection limits vary from low ppm to low ppb	Tentative ID Techniques and instruments mostly limited to volatiles, metals	Dependent on QA/QC steps employed. Data typically reported in concentration ranges.
Risk assessment. PRP determination. Site characterization. Evaluation of alternatives. Engineering design. Monitoring during implementation.	Level III	Organics and inorganics using EPA Procedures other than CPL can be analyte specific RCRA Characteristics tests	Tentative ID in some cases Can provide data of same quality as Levels IV, NS	Less rigorous QA/QC
Risk assessment. PRP determination. Evaluation of alternatives. Engineering design.	Level IV	HSL organics and inorganics by GC/MS; AA; ICP Low ppb detection limits	Tentative identification of non-HSL parameters. Some time may be required for validation of packages	Goal is data of known quality. Rigorous QA/QC.
Risk assessment. PRP determination.	Level V	Non-conventional parameters. Method specific detection limits. Modification of existing methods. Appendix 8 parameters	May require Method Development or Modification. Mechanism to obtain services requires special lead time.	Method specific

Reference: EPA Document No. 540 G-87 003, 1987, "Data Quality Objectives for Remedial Response Activities"

4.0 ENVIRONMENTAL SAMPLING / TESTING PROCEDURES

An essential aspect of any field investigation is assurance that sample collection is conducted in a manner that will provide high-quality, representative data. This section of the QAPP provides a description of sampling techniques, procedures, and equipment used during field sampling programs.

4.1 Site Specific Sampling and Testing Rationale

The Work Plan provides the sampling rationale for every investigation, including the rationale for the following tasks:

- sampling of environmental media,
- determination of constituents to be measured in each environmental media,
- sampling locations,
- sample depths and types,
- number and frequency of samples to be collected.

The specific details of a field investigation such as sampling locations, target depths, analytical methods, and a reference map are detailed in the project Work Plan.

4.2 Documentation

During the implementation of any investigation, field activities will be documented in field log books. The field log book is a controlled document, which records all major on-site activities during the investigation. The log book is a bound notebook with pages that cannot be removed without cutting or tearing pages. Each page of the log book will be numbered consecutively and signed at the bottom of the page with the signature or initials of the person who completed the page. All entries will be made in ink and errors crossed-out with a single line and initialed and dated.

Field data for all tasks completed during this field program, as well as general observations, pertinent conversations, and unexpected occurrences will be documented in field log books. At a minimum, the following information will be recorded:

- Names of personnel on-site (including all subcontractors);
- Date and time of arrival and departure;
- Daily objectives;
- Site name, location, and project number;
- Field observations;
- Weather conditions;
- Site sketch with description of sampling points;
- Health and Safety monitoring data;
- Field calibration, decontamination procedures, and performance frequency;
- Well bailing or pumping procedure and equipment;
- Well specifics including static water level, depth, and volume of water removed;

- Type and quantity of monitoring well construction materials used;
- Surveying data;
- Sample identification numbers;
- Sample point names and descriptions;
- Sample collection procedures and equipment;
- Sample preservation used;
- References to maps or sketches of the sampling site;
- Results of any field measurements, such as pH, water temperature, specific conductivity, and field screening results;
- Notes on conversations with site personnel, observers, or subcontractors;
- Problems encountered and the manner of their resolution;
- General observations that may support the data; and
- Summary of daily activities completed.

4.3 Pre-Sample Planning

The quality of sample collection is maintained by specifying the technique used for both the medium/matrix to be sampled and the analytes of interest. For example, groundwater samples intended for SVOC analyses are collected in amber glass containers; groundwater samples for VOC analyses are collected in Teflon-capped glass vials with no headspace to minimize diffusive and evaporative losses; and groundwater samples for inorganic analyses are collected in polyethylene bottles. Sample containers provided by the analytical subcontractor are prepared in a manner consistent with USEPA protocol.

Acquisition of environmental samples also requires specialized techniques to preserve sample integrity and to ensure that a representative portion of the source is collected. Media-specific sample collection techniques and sample preservation are specified in the following sections.

4.3.1 Sample Labels and Records

Sample labels will be prepared using a pre-determined labeling system. Each sample may require several containers depending on the intended analysis to be performed. At the time the sample is collected, a sample data record sheet and field logbook entries will be completed. The sample documentation may include:

- A plan of the site with the sample location and sample numbers indicated
- A description of the sample site
- Physical descriptors of the sample site, if appropriate (e.g., stream width, groundwater depth, etc.)
- Photographs of the sample site showing the sampling equipment and/or unusual conditions (orientation of photograph must be shown on sketch map, and photo number recorded in field notebook)
- Chain of Custody documentation (see Section 5)

Identification of samples collected during the field investigation will be accomplished using alphanumeric Sample Identification codes indicating sample type, sample identification, depth of sample (if applicable), and designation of duplicate samples. An explanation of the Sample Identification codes system for soil, groundwater, and sediment samples is shown below:

Sample Identification Code System

Digits	*Identification*	*Description*	*Code/Example*	
1, 2	Site Code	Two letter code to identify the site	FR	Fuller Road
3, 4	Sample Type	Two letter code to identify sample media	SB	Test Boring Soil Sample
			SS	Surface Soil
			BW	Screened-auger Groundwater Sample
			MW	Monitoring Well Groundwater Sample
			SW	Surface Water
			SD	Sediment Sample
			TB	Trip Blank
			EB	Sampler Blank
			SV	Sub-Slab Vapor Sample
			TP	Test Pit Soil
			PW	Test Pit Water
			WT	Waste Sample
			DL	Drum Liquid
			DS	Drum Solids or Sludge
			IA	Indoor Air Sample
			OA	Outdoor Air Sample
			GP	Geoprobe® Soil Sample
			CD	Septic System/Sump Sludge Sample
			CL	Septic System/Sump Catch Basin Liquid Sample
			CB	Catch Basin/Storm Drain Sediment Sample
5, 6, 7	Sample Locator	Three numbers to identify sample site name or location	MW102	Monitoring Well Groundwater Sample from Well 102

Digits	*Identification*	*Description*	*Code/Example*	
8, 9, 10	Depth of Sample Below Reference Surface		SB-XX0	SB samples collected from 0 to 2 feet below ground surface (bgs)
			SB-XX1	SB sample depth is assumed to be the top of a 2-foot, split-spoon sample
			X25	MW sample depth is assumed to be the bottom of the well screen measured in feet bgs
			128	All samples obtained from the ground surface or from drums or containers will be designated XXX
11, 12			XX	Duplicates will periodically be sent to the lab with the XX designation to preserve duplicate anonymity, according to Section 9.2.
			XF	Sample collected for field analysis or future reference
			XD	Duplicate sample
			MS	Matrix spike
			MD	Matrix spike duplicate
			XS	Laboratory split sample

4.3.2 Sample Container Requirements and Sample Preservation

Sample integrity will be maintained by using special containers and preservation methods keyed to both the medium/matrix to be sampled and the analytes. Sample containers and preservation methods specified in NYSDEC protocols are summarized in the table below. Any changes to these protocols required by a specific project will be detailed in a site-specific Work Plan.

4.3.3 Preparation of Sample Containers

Sample containers will be provided by the laboratory and are prepared according to USEPA protocols. The bottles will be equivalent to I-Chem series 300. QC records for the bottles used will be maintained by the laboratory. The preparatory procedures used by the vendor providing the laboratory with sample containers are detailed below.

4.3.3.1 Volatile Organic Analyte (VOA) Containers

(40-mL glass vials and 2-oz or 4-oz glass jars)

1. Wash vials, septa, and closures in hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse three times with ASTM Type II water.
4. Oven dry vials, septa, and closures.

5. Remove vials, septa, and closures from oven.
6. Place septa in closures, Teflon side down, and place on vials. The attendant must wear gloves and the vials cannot be removed from the preparation room until sealed.

4.3.3.2 Semi-Volatile Organic Analyte (SVOA) Containers

(1-liter amber glass bottles and 4-ounce glass jars)

1. Wash containers, closures, and Teflon® liners in hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse with 1:1 nitric acid.
4. Rinse three times with American Society for Testing and Materials (ASTM) Type II water.
5. Rinse with pesticide-grade methylene chloride.
6. Oven dry.
7. Remove containers, closures, and Teflon® liners from oven.
8. Place Teflon liners in closures and place closures on containers. The attendant must wear gloves and the containers cannot be removed from the preparation room until sealed.

4.3.3.3 Metals Containers

(1-liter, 500, 250, 120 and 60-milliliter (mL) clear and 1-liter amber polyethylene bottles)

1. Wash bottles, closures, and Teflon® liners with hot tap water and laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse with 1:1 nitric acid.
4. Rinse three times with ASTM Type II water.
5. Air dry in contaminant-free environment.
6. Place liners in closures and place closures on bottles. The attendant must wear gloves and the bottles cannot be removed from the preparation room until sealed.

4.3.3.4 Sample Preservation

Samples are preserved according to the protocol established for the selected analytical method. Unless the proper sample container preparation and sample preservation measures are taken in the field, sample composition can be altered by contamination, degradation, biological transformation, chemical interactions, and other factors during the time between sample collection and analysis.

Steps to maintain the in-situ characteristics required for analysis may include storage of samples at 4°C, pH adjustment, and chemical fixation. Specific sample and container preservation requirements are detailed in Table 3 above. Where pH adjustment is performed, the pH will be checked in the field with pH paper to ensure the required pH level is achieved. If pre-preserved sample containers are provided by the laboratory, extra preservation material should be available in the field in case it is needed to achieve the target pH.

Table 3 - Summary of Required Containers, Preservation Requirements and Holding Times

Parameter	*Matrix*	*Required Container*	*Minimum Volume* *Required for Analysis*	*Preservation Technique*	*Holding Time (2)*
Volatile Organics (3)	Water	Glass vials with Teflon faced septa and screw cap. (Two 40 ml vials per sample)	50 ml	Cool (4°C) Preserved with acid (HCl to pH<2)	7 days
	Soil	2-2oz or 1-4oz wide-mouth glass jar with Teflon-lined cover.	10 grams	Cool (4°C)	7 days
Semi-Volatiles, Pesticides, PCBs (3), or Total Petroleum Hydrocarbons	Water	1-L Amber glass jar with Teflon lined screw cap.	1,000 ml (1 Liter)	Cool (4°C)	Extraction within 5 days of sampling. Analysis within 40 days of extraction
	Soil	8-oz wide mouth glass jar with Teflon-lined cover	50 grams	Cool (4°C)	Extraction within 5 days of sampling. Analysis within 40 days of extraction
Metals (Total and Dissolved) (1) (4)	Water	Polyethylene bottle (one 1 L bottle)	100 ml	(Dissolved metals only - field filtered using 0.45 micron filter) Cool (4°C) Preserved with acid (HNO_3 to pH<2)	180 days
	Soil	8-oz wide mouth glass jar with Teflon-lined cover	10 grams	Cool (4°C)	180 days
Total Petroleum Hydrocarbons Fingerprint Analysis	Water	Glass jar with Teflon lined screw cap (one 1 L bottle)	1,000 ml (1 Liter)	Cool (4°C)	28 days
	Soil	8-oz wide mouth glass jar with Teflon-lined cover	50 grams	Cool (4°C)	28 days
Total Cyanide	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C) Preserved with base (NaOH to pH>12)	180 days
	Soil	8-oz wide mouth glass jar with Teflon-lined cover	10 grams	Cool (4°C)	12 days
Mercury (Total and Dissolved)	Water	Polyethylene bottle (one 1 L bottle)	100 ml	(Dissolved metals only - field filtered using 0.45 micron filter) Cool (4°C) Preserved with acid (HNO_3 to pH<2)	26 days
	Soil	8-oz wide mouth glass jar with Teflon-lined cover	10 grams	Cool (4°C)	26 days
Biochemical Oxygen Demand	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C)	24 hours
Bicarbonate	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C)	14 days
Carbonate	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C)	14 days
Chemical Oxygen Demand	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C) Preserved with acid (H_2SO_4 to pH<2)	26 days
Chloride	Water	Polyethylene bottle (one 1 L bottle)	100 ml	None Required	26 days
Sulfate	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C)	28 days
Total Dissolved Solids (TDS)	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C)	7 days
Total Suspended Solids (TSS)	Water	Polyethylene bottle (one 1 L bottle)	100 ml	Cool (4°C)	5 days

Reference: EPA Document No. 540 P-87 001, 1987, "A Compendium of Superfund Field Operations Methods"
NOTES: (1) Metals analysis will be conducted on unfiltered samples. If filtered samples are analyzed, unfiltered samples must also be collected and analyzed. If turbidity presents a problem, the samples will be handled according to NYSDEC "Guidelines for Handling Excessively Turbid Samples" following approval by the Division of Hazardous Waste Remediation (DHWR). (2) Holding times are calculated from VTSR (Verified Time at Sample Receipt). Samples must be received by the lab within 48 hours of collection. (3) TCL = Target Compound List. (4) TAL = Target Analyte List.

4.4 Decontamination Procedures

Standardized procedures for decontamination have been established to reduce the likelihood of cross-contamination between samples and sampling locations. Equipment to be decontaminated includes: backhoes, drilling equipment, and sampling equipment.

All decontamination procedures will comply with the personal protection requirements detailed in the site Health & Safety Plan (HASP). Personal protection levels will depend on the nature of the contamination and the specific decontamination method. Specific decontamination methods for exploratory and sampling equipment are described in the following sections.

4.4.1 Heavy Equipment

Heavy equipment such as drill rigs and backhoes may need to be steam cleaned with a portable high pressure steam cleaner upon arrival at the site and prior to demobilization. During the course of investigation activities, it is only necessary to decontaminate equipment that comes in contact with soils and/or groundwater (i.e., drill rods, bits, backhoe bucket, etc.).

Prior to initiation of drilling activities at the site, a temporary steam cleaning area will be established, if necessary, for the decontamination of the drill rig and associated tools and augers. When selecting the steam cleaning location, the following items will be considered:

- Free from traffic;
- Away from any proposed test boring or monitoring well locations;
- Readily accessible to the investigation area; and
- Free of known surficial contamination.

The decontamination area will consist of a controlled area or structure to contain all wash water and eliminate the possibility of drilling equipment coming in contact with the underlying surficial soils and/or pavement during steam cleaning. Site-specific decontamination area construction requirements may be detailed in the Work Plan.

All equipment will be placed on clean pallets or racks prior to and after steam cleaning. Potable water will be used for the steam cleaning activities. The equipment to be steam cleaned includes: drill rods, augers, bits, tools, and split-spoon samplers. Decontamination wastewater and soils will be initially drummed into 55 gallon steel containers or other appropriate holding vessels pending laboratory analyses.

4.4.2 Drilling Equipment

Drilling equipment that is exposed to soil and/or groundwater will be steam cleaned between sampling locations. The purpose of this decontamination is to ensure that potential contaminants are not transferred between sampling locations.

4.4.3 Sampling Equipment

Contaminated tools and sampling equipment will be placed in a plastic pail, tub, or other container with a Liquinox® (or equivalent) soap and water solution. The tools will be brushed off, rinsed, and transferred to a second soap and water solution bath. Tools will be rinsed with potable water and finally rinsed with de-ionized water. Tools such as wrenches, split-spoons, etc., may be decontaminated between exploration locations with a high-pressure steam cleaner instead of washing. Sampling equipment such as reusable bailers or submersible pumps will be wrapped in aluminum foil after cleaning to prevent contamination before their next use. Control and disposal of decontamination fluids are discussed in Section 4.4.4

4.4.4 Control and Disposal of Decontamination Materials

In general, The Chazen Companies is responsible for collecting, controlling, and staging material generated during field investigations. Disposal arrangements will be made for the client, if required, for particular work assignments. Specific procedures for handling contaminated environmental materials and contaminated personal protective equipment will be presented in the Work Plan and/or the HASP.

Contaminated soil and water will be handled according to NYSDEC Technical Guidance for Site Investigation and Remediation (DER-10) (dated November 2009) unless otherwise specified in the Work Plan. These documents describe alternatives for disposal of these materials and requirements for handling.

4.4.4.1 Soil Disposal

Drill cuttings and soils generated during investigation activities are presumed to be contaminated. Alternatives for on-site disposal of investigation derived soils include:

- Backfill inside the borehole that generated the soil, with the top 12 inches consisting of clean cohesive, compacted soil, or to depth that allows restoration of paved surface, whichever is applicable. Soil can not be used to backfill boreholes if it contains free product, non-aqueous phase liquid or is grossly contaminated; if a well will be installed in the borehole, if the borehole penetrated an aquitard, aquiclude, or other confining layer or extends into bedrock; or if backfilling the borehole with soil cutting will create a significant path for vertical movement of contaminants.
- Containerize and temporarily store on-site prior to off-site disposal;
- Transport from off-site areas to site (without need to manifest or contract with licensed hauler).

Hazardous soils can be sent off site for disposal to a properly permitted treatment, storage, or disposal facility, and non-hazardous soils can be sent to a solid waste management facility. Representative samples of materials will be analyzed for proper classification, treatment, and disposal. Materials will be transported by a licensed hauler and accompanied by the proper manifests.

Disposal alternatives are subject to precautions listed in DER-10 Section 3.3(e). Specific handling and disposal requirements for drill cuttings will be identified by the Field Operations Leader based on field screening and analytical results of drill cutting samples, if applicable.

4.4.4.2 Groundwater Disposal

The control of contaminated groundwater is important to prevent impacts to surficial soils. Alternatives for the disposal of groundwater generated during sampling at hazardous or petroleum impacted sites are generally recognized and are provided below:

- Transportation off-site to an authorized disposal/treatment facility;
- Discharge to a sanitary sewer for treatment at a publicly-owned treatment works (POTW);or
- Transport by truck to a POTW.

In order to determine the proper disposal option for groundwater generated during monitoring well development and purging, the water will be containerized pending the receipt of laboratory analysis.

4.4.5 Sample Handling/Shipping Areas

Sample containers will be wiped clean at the sample site, taken to the decontamination area to be further cleaned, as necessary, and transferred to a clean carrier. The sample identities will be checked off against the COC record. The samples will then be stored at approximately 4° C in a secure area prior to shipment.

Sample handling areas will be cleaned/wiped down daily. For final cleanup, all equipment will be disassembled and decontaminated. Equipment that cannot be satisfactorily decontaminated will be disposed of.

4.4.6 Monitoring Equipment

When monitoring equipment is used under conditions where contamination is possible, the equipment will be protected from contaminant sources by draping, masking, or otherwise covering as much of the instrument as possible with plastic without hindering the operation of the unit.

Any contaminated equipment will be taken from the source area and the protective coverings removed and disposed of in appropriate containers. Any direct or obvious contamination will be brushed or wiped with a disposable paper wipe. The units will then be dried, checked, and calibrated for subsequent operations.

4.5 Air Monitoring

The air monitoring program is designed to provide the necessary information to ensure the safety of on-site personnel and to evaluate potential increases to air contaminant levels and dispersion patterns during site activities. Air monitoring will be conducted during field activities as detailed in the site-specific HASP and/or Work Plan.

4.5.1 Site Safety Air Monitoring

The required level of personal protection equipment specified in the site-specific HASP will be verified by the results of air quality screening performed on-site during field activities. The screening will be performed using a photoionization detector (PID) which detects and measures concentration levels of total VOCs relative to a reference standard on a real-time basis. The PID lamp sensitivity will be specified in the site-specific HASP based on any information regarding identification of potential contaminants. Most sites will require a PID with a lamp of 10.2 or 11.7 electron volts (eV).

The HASP outlines the air monitoring procedures to be followed during the field investigation. Air monitoring equipment used on site may include a PID, chemical indicator tubes (e.g., Draeger® tubes), percent oxygen/lower explosive limit meter, respirable dust monitor, or a radiation detector.

In addition to work place air monitoring, the Community Air Monitoring Plan (CAMP) will be implemented to document air monitoring for perimeter areas. The CAMP is provided in Appendix E of the Work Plan.

4.6 Field Screening

4.6.1 Soil Jar Headspace Testing

Headspace vapor monitoring will be performed as a screening tool for determining the relative concentrations of VOCs in soil samples. A photoionization-detector (PID) and/or flame ionization detector (FID) will be used. The PID/FID will be calibrated daily in accordance with manufacturer's specifications. Headspace readings will be collected using the static headspace analysis method detailed below:

- Approximately 2 oz. of soil will be collected from each open split-spoon or Geoprobe Macrocore sampler and placed in a dedicated laboratory-cleaned glass jar. Alternatively, soil may be placed in a resealable plastic bag which will be immediately sealed. The mouth of the jar will then be immediately covered with aluminum foil prior to sealing the jar lid to minimize the loss of VOCs. Headspace samples will be collected for each split spoon sample.
- The jar will be shaken to break up the compacted soil or material, and will be placed in a specified location (e.g., field vehicle), out of direct sunlight, for a period of no less than 15 minutes to equilibrate prior to field monitoring.
- Where ambient temperatures are below $0^{o}C$, headspace development should be within a heated vehicle or building. Ambient temperature during headspace analysis will be recorded and reported.
- The jar lid will be removed from the jar. Headspace will be monitored within the jar by piercing the aluminum foil with the PID probe. Care will be taken to prevent unnecessary mixing of jar headspace and outside air. Monitoring with the PID will continue until a stable reading is shown or the readings have peaked and subsequent readings are decreasing. The highest concentration observed will be recorded along with the sample interval in the field notebook and on the Soil Boring Log.

4.6.2 NAPL in Soil Field Screening

Field screening of soil in the source area will also be field screened using a hydrocarbon and NAPL screening test kit such as the dual dye Oil-In-Soil™. The kit instructions will be followed and are included in the attachment. Field screening soil for DNAPL will follow the kit instructions which are summarized as follows.

- Place soil in the bottle to the line "Fill soil to HERE." Do not compact the soil.
- Add potable water to the bottle to the line "Fill water to HERE." Ensure that water is warm enough (68 ºF or warmer) to dissolve the dye cube.
- Replace cap on the bottle and shake jar until cube is **completely** dissolved.
- Assess the color of bottle contents. Red liquid or spots on the side of the bottle will appear within 30 to 60 seconds in DNAPL or petroleum are present in the sample. The water will be green, to provide color contrast with the red. If color is not immediately apparent in the jar, check the polystyrene ball, sides of the bottle and the layer beneath the water layer. If the ball has ANY color (even a faint pink halo or hue) this indicates the presence of more than 500 ppm total petroleum hydrocarbons (TPH) in that sample. If there is no color on the ball, TPH is less than 500 ppm.
- Record field screening readings findings using the Endelman Score© symbols

Explanation of the Edelman Score© Symbols

Score	Explanation
++	Very strong reaction. For chlorinated compounds the soil is stained red as well as the plastic walls of the test kit. For petroleum materials the soil is stained red as well as having a red colored meniscus on the surface of the water in the kit (i.e., some NAPL was extracted).
+	Positive reaction (greater than approximately 10% red coloration of soil for chlorinated compounds or any red coloration for petroleum)
+/-	A few soil grains are stained red for chlorinates and/or the Styrofoam float ball in the test kit is stained red or pink. For petroleum, the Styrofoam float is stained red or pink.
-	No reaction.

- Dispose of the kit with other IDW.

4.6.2 Portable Gas Chromatograph

Field screening of soil may also be conducting using a portable gas chromatograph (GC). This screening method allows for field identification of VOCs and facilitates selecting samples for laboratory analysis. The SRI Model 8610 and other, similar portable gas chromatographs (GCs) are used for field and laboratory screening of air, soil gas, water, and soil headspace samples for volatile organic compounds. The SRI Model 8610 utilizes both a photoionization detector (PID) and a dry electrolytic conductivity detector (DELCD) to monitor for a wide range of chlorinated and non-chlorinated compounds and aromatic hydrocarbons. Resolution of 1 part per billion (or 1 ug/l) is possible using GC analytical techniques. When utilizing a portable GC, both standard operating procedures and variances from the standard are to be documented in the operators' written log.

Similar to other field screening methods, a subsample is collected from the soil sample. A 40-mL glass vial is half-filled with soil and the cap is secured before the vial is placed in a heated water bath at a constant 80 ºC temperature. Then a gas-tight syringe is used to extract a 1 cubic centimeter (cc) sample (0.1 cc if high contaminant concentrations are present) and to introduce the sample onto the capillary column of the GC. As the sample travels through the length of the column, some of its chemical constituents are readily adsorbed to the column and are retarded while others are not as readily adsorbed to the column and elute more rapidly. This achieves separation at the detector end of the column. Variations in column length as well as temperature and pressure within the GC can increase or decrease chemical separation within the column. It is necessary to strike a balance between separation of retention times and total analytical run time in order to achieve a high level of productivity in the field while still realizing meaningful results. This is primarily achieved by altering the temperature program on the GC.

As compounds elute, they first reach the PID. Because it is non-destructive, it is often run in series with other detectors for multiple levels of detection from a single injection. The SRI Model 8610 contains a 10.8 eV PID. Aromatic hydrocarbons and most compounds with a carbon double bond are readily detected by the PID, while chlorinated solvents generally have ionization potentials greater than 10.8 and are not detected by the PID.

The DELCD is useful for low-level detection of chlorinated and brominated solvents. The DELCD is mounted after the PID in series on the GC column.

The detection levels are reported as voltage response vs. time to a serial port on the GC. A portable PC connected via serial cable to the GC is utilized to operate the GC and record the detection data. Detected compounds appear as positive voltage "peaks" on the chromatographs. Qualitative identification of compounds with a GC is based on a comparison of retention times to those of known standards. Quantification of compounds is based on a comparison of peak areas (areas under the peak) to those of known standard concentrations.

While portable, the GC is best utilized in a stable, temperature controlled environment. The instrument is not designed to be exposed to precipitation. High humidity ambient air may also cause deleterious effects. These problems can be avoided by operating the GC inside of a vehicle (cargo van) where the climate can be controlled.

4.7 Borings and Environmental Wells

4.7.1 Drilling Methods

Soil borings will be drilled to facilitate collection of subsurface soil samples for geologic classification, chemical analyses, and physical testing. Drill rigs are utilized to advance the borings. The rigs are typically mounted on trucks, all-terrain vehicles, or skids. There are a variety of drilling methods that may be utilized including direct push, hollow-stem auger (HSA), drive and wash, and mud rotary. Each of these methods enables the collection of soil or groundwater samples. Drilling methods also facilitate the installation of monitoring wells to provide hydrogeologic data.

A geologist will observe drilling operations summarizing boring information in a field notebook, taking photographs when appropriate, and collecting samples in accordance with the Field Sampling Plan. A boring log will be prepared that includes: characterization of subsurface materials and geologic conditions, air monitoring readings, field screening readings, pertinent drilling information, and relevant observations (i.e., staining, odor, sheen, etc.). An example of a typical boring and monitor well log is presented below.

Typical Boring Log

THE Chazen COMPANIES

PROJECT:		**Test Boring No.:**	**MW-6**
LOCATION:			
CLIENT:			
PROJECT NO.:		**Total Depth:**	ft.
Contractor:	**Start Date:**	**Northing:**	**Borehole Dia.:** in.
Drill Rig:	**Finish Date:**	**Easting:**	**Depth to Water:** ft.
Driller:	**El. Datum:**	**Longitude:**	**Depth to Rock:** ft.
Inspector:	**G.S. Elevation:**	**Latitude:**	**Depth of Well:** ft.

Depth *(Feet)*			**Elevation** *(Feet)*	**Casing Data**	**Sample No.**	**Sample Data**	**Recovery** *(Inches)*	**PID** *(ppm)*	**Group Symbol**	**Stratum and Field Descriptions:**	**Well Diagram**	**Field Notes, Well Notes, Comments:**
					S1	9	5	0		0-3" Asphalt		
1			*-1*			8				3-6" Gravel road base		
						5				6"-11" Fill - Black, ash, wood, dry, no odor		
2			*-2*			5						
					S2	8	5	0		2'-2'5" Fill - Black ash, wood, gravel, tip of spoon wet, no odor		
3			*-3*			2 4						
						8						
4			*-4*			7						
					S3	6	3	0		4'-4'3" Black, silty CLAY, saturated, no odor		
5			*-5*			3						
						1						
6			*-6*			1						Bentonite:
					S4	3	12	0		6'-6'3" Same as above		Sand:
7			*-7*			8				6'3"-7' Reddish brown, silty CLAY, gravel, saturated, no odor		
						4						
8			*-8*			3						
					S5	4	12	0		8'-9' Dark brown and reddish brown, plastic CLAY, saturated,		
9			*-9*			1				no odor		
						1						
10			*-10*			2						
					S6	2	12	0		10'-11' Dark brown, silty CLAY, moist to wet, no odor		
11			*-11*			3						
						2						
12			*-12*			4						
										Boring terminated at 12 feet below ground surface		
14			*-14*									

ADDITIONAL NOTES:

Drilling methods used during an investigation will be determined in advance and will be detailed in the Work Plan with the provision that the drilling procedure may be modified in response to conditions encountered during drilling. A more detailed discussion of the various drilling methods, sampling procedures, and well installation procedures is provided below.

4.7.1.1 Hollow-Stem Augers

The Hollow Stem Auger (HSA) method utilizes coupled lengths of continuous-flight, hollow steel augers to advance through overburden materials. With this method, drill cuttings rise upward on the flights as the string of augers is rotated.

Typically, $4^1/_4$-inch or $6^1/_4$-inch inner diameter (ID) augers are used for hazardous waste investigations. These produce nominal 8-inch and 10-inch boreholes, respectively.

A center plug equipped with cutting teeth is attached to drilling rods and placed inside the augers to facilitate cutting and to prevent subsurface materials from entering the augers.

When the augers are advanced to the appropriate depth, the center plug is removed to allow for the collection of soil or in situ samples.

The advantage of the HSA method is that limited fluid use is required. In addition, 2-inch ID monitoring wells can be easily installed inside the augers. The limitations of HSA drilling include the inability to advance through very dense materials like rock, cobbles, rubble, etc., or drilling through loose saturated sands and silts which tend to flow around the plug and seize the tooling. Drilling depths are usually limited to the first dense rock layer encountered or by the torque of the machine.

4.7.1.2 Direct Push

Soil probing or "direct push" machines such as the Geoprobe® push tools and sensors into the ground without the use of rotation to remove soil and to make a path for the tool. A Geoprobe® relies on a relatively small amount of static (vehicle) weight combined with a hydraulic hammer as the energy for advancement of a tool string. Probing tools do not remove cuttings from the probe hole but depend on compression of soil or rearrangement of soil particles to permit advancement of the tool string. The attachment includes Geoprobe® standard operating procedures for dual tube and Macro-Core® sampling. These tooling options may be used for sites where boreholes collapse and/or where discrete sampling is needed.

Probing tools are advanced as far as possible using only the static weight of the carrier vehicle. Greater depth is achieved using the combined effect of the vehicle weight and hydraulic hammer. Hammering is often required when probing near the ground surface to penetrate hard-packed surface soil and other hard surfaces. The probe is then allowed to penetrate using only static force until refusal is again encountered, at which time the hammer is reapplied. The hammer is applied as required when probing through sands, gravels, high friction clays, tills, fill materials, and surface frost.

A Geoprobe® can be used to drive tools to obtain continuous soil cores or discrete soil samples; obtain groundwater samples or soil gas samples; install permanent sampling implants and air sparging points; set small diameter permanent monitoring wells; or drive a conductivity sensor probe to map subsurface lithology. Soil probing equipment is typically used for site investigations to depths of 30 to 60 feet.

The advantage of using a Geoprobe® versus conventional drilling techniques, are:

- Minimal cuttings are generated. This reduces handling, containing, storing, sampling, analyzing, and disposing of potentially hazardous and contaminated cuttings. This also reduces disposal costs and potential exposure of site workers, facility employees, residents, and surroundings to hazardous contaminants.

- Only a small diameter hole is created. Grouting is less expensive because a small volume of grouting material is required.

- Less obtrusive equipment required. Small, light, probing equipment is used for sample collection which allows the operator to reach many locations not accessible to larger and heavier drilling equipment.

- Minimal physical disturbance of the sample materials occurs.

- Typical penetration rates are from 5 to 25 feet per minute, although probing time is highly dependent upon soil conditions.

- Sampling time is shorter; therefore, more sample locations can be sampled per day, depending upon soil conditions.

- The unit can sample all subsurface media including soil, groundwater, and soil gas; log soil conductivity and contaminants; grout probe holes; and inject remediation materials.

4.7.2 Subsurface Soil Sampling

4.7.2.1 Split-Spoon Sampling

Split-spoon samplers are used to collect soil samples from the bottom of a borehole. The sampler consists of a thick-walled, steel tube that is split lengthwise. It has a cutting shoe attached at the lower end and a check valve at the upper end.

When needed, the split-spoon sampler is attached to drill rods with a threaded adapter. The split-spoon sampler is driven into the ground in accordance with the standard penetration test (ASTM D1586). The standard penetration test (SPT) consists of driving a $1^3/_8$-inch ID, 2-foot split-spoon 24 inches into the soil using a 140-pound hammer falling 30 inches. The number of blows required to drive the split-spoon each 6 inches is recorded to obtain the SPT-N value, which is defined as the total blows for the penetration from 6 to 18 inches. Often, larger split-spoons are used in order to provide sufficient soil volume when collecting samples for chemical analyses. The size of the split-spoon and the sampling interval are detailed in the FSP.

After the sampler has been retrieved, a field geologist will perform field screening, soil characterization, and sample collection according to the following procedures:

1. The split-spoon will be screened for VOCs immediately upon opening with a total VOC analyzer such as a PID. The instrument will be passed over the sample while slightly disturbing the soil with a sampling trowel or spoon.
2. The soil from the split spoon will be characterized in the field using Modified Burmeister Soil Classification System or the Unified Soil Classification. Physical characteristics such as color, grain size, soil type, texture, consistency, and moisture will be recorded in a field notebook or boring log form.
3. Representative soils will be placed into the appropriate jars for physical and chemical testing. The type and frequency of tests that will be performed are discussed in the FSP. Samples that may be submitted for laboratory analysis will be placed immediately into laboratory-supplied jars with a pre-cleaned stainless steel trowel or spoon. The samples will be labeled with the date and time of sampling, sample identification and site location, then packed for shipment to the laboratory in a cooler with ice. An 8-ounce jar and/or 40-ml vial will also be filled (if specified in the Work Plan) for soil jar headspace tests as detailed in Section 4.6.1.
4. The split-spoon and sampling utensils will be decontaminated between each sample according to the procedures outlined in Section 4.4.3.

4.7.2.2 Geoprobe® Sampling

Macro-Core Soil Samples

The MacroCore® Soil Sampler is a solid barrel, direct push device for collecting continuous core samples of unconsolidated materials at depth. The standard MacroCore® Sampler has an assembled length of approximately 52 inches (1,321 mm) with an outside diameter (OD) of 2.2 inches (56 mm). Collected samples measure up to 1,300 ml in volume in the form of a 1.5-inch by 45-inch (38-mm by 1,143-mm) core contained inside a removable liner. The MacroCore® Sampler may be used in an open-tube or closed-point configuration. It has a removable/replaceable, thin-walled liner tube inserted inside for the purpose of containing and storing soil samples. The standard MacroCore® liner is 1.75-inches OD by 46-inches long (44-mm by 1,169-mm). Liner materials include stainless steel, Teflon®, PVC, and PETG.

To obtain a soil sample, an assembled MacroCore® Soil Sampler is driven one sampling interval into the subsurface and then retrieved using a Geoprobe® soil probing machine. The collected soil core is removed from the sampler inside a liner.

The MacroCore® Soil Sampler is most commonly used as an open-tube sampler. 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 soil core. In stable soils, an open-tube sampler is advanced back down the same hole to collect the next core.

In unstable soils, which tend to collapse into the core hole, the MacroCore® Sampler can be equipped with a piston rod point assembly. The point fits firmly into the cutting shoe and is held in place by a piston rod and stop-pin. The MacroCore® Piston 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.

Loose soils may fall from the bottom of the sampler as it is retrieved from depth. Better recovery is 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.

Large Bore Soil Sampler

The Large Bore (LB) Soil Sampler is a solid-barrel, piston-sealed, direct push device for collecting discrete interval samples of unconsolidated materials at depth. The assembled Large Bore Sampler is approximately 30-inches long with an OD of 1.5-inches. Collected samples measure up to 283-ml in volume in the form of a 1.0-inch by 22-inch core contained inside a removable liner. It has a 1.15-inch OD by 24-inch long removable/replaceable, thin-walled tube liner inserted inside for the purpose of containing and storing soil samples. Liner materials include brass, stainless steel, Teflon®, and clear plastic (cellulose acetate butyrate).

The Large Bore Sampler is used primarily as a discrete interval sampler; that is, for the recovery of a sample at a prescribed depth. In certain circumstances, it is also used for continuous coring.

To obtain a sample, the assembled Large Bore Sampler is connected to the leading end of a Geoprobe® rod and driven into the subsurface using a Geoprobe® Soil Probing Machine. Additional probe rods are connected in succession to advance the sampler to depth. The sampler remains sealed (closed) by a piston tip as it is being driven. The piston is held in place by a reverse-threaded stop-pin at the trailing end of the sampler. When the sampler tip has reached the top of the desired sampling interval, a series of extension rods, sufficient to reach depth, are coupled together and lowered down the inside diameter of the probe rods. The extension rods are then rotated clockwise using a handle. The male threads on the leading end of the extension rods engage the female threads on the top end of the stop-pin, and the pin is removed. After the extension rods and stop-pin have been removed, the tools string is advanced an additional 24 inches. The piston is displaced inside the sampler body by the soil as the sample is cut. To recover the sample, the sampler is retrieved from the hole and the liner containing the soil sample is removed.

4.7.3 Monitoring Well Installation

This section outlines the general procedures and typical materials utilized for monitoring well installation. The number, location, and construction details of monitoring wells will depend on the project objectives and will be discussed in the Work Plan.
Well construction materials consist of well screen, riser pipe, sand pack, bentonite seal, cement grout, and protective casing. Specific monitoring well details may be outlined in the Work Plan. Typical well construction specifications are described below.

Well Screen and Riser Pipe

The most common materials used in the construction of monitoring wells are polyvinyl chloride (PVC) and stainless steel. Generally, PVC is used because it is less expensive and non-corrosive. However, PVC may deteriorate as a result of certain compounds. In such cases, stainless steel may be preferred. Riser pipe and well screen is typically 1-inch or 2-inch ID and has flush joint threads.

When PVC is used, wells constructed in unconsolidated materials less than 100 feet deep are constructed with Schedule 40 PVC.

Well screens are used in the construction of monitoring wells to limit sediment from entering the well. Generally, screens are machine slotted at slot sizes of 0.01 inches (10-slot) for fine materials or 0.02 inches (20-slot) for coarse materials such as coarse sand and gravel. The screen slot size should be selected to retain 90 percent of the filter pack material or native aquifer material.

Sand Pack

The sand pack consists of uniformly graded sand. A grade of sand is selected such that it will not pass through the well screen and will exclude the fines from the formation. At least a 2-inch layer of sand will be placed at the bottom of the hole prior to the well installation. Sand will be placed around the well screen to a level of 2 feet above the top of the screen. In situations that require a well to straddle a shallow water table, it may be necessary to place less sand above the top of the screen to allow enough space for an adequate bentonite seal.

If there is difficulty with well installation, a well screen that is pre-packed with a layer of sand may be used.

Bentonite Seal

The bentonite seal may consist of pure Wyoming sodium bentonite chips, pellets, or slurry. A bentonite seal expands by absorbing water, and due to its low permeability, serves to isolate the screened interval from the rest of the borehole. The bentonite seal should be at least 2 feet thick and be placed directly above the sand pack. It may be necessary to install less bentonite for shallow water table wells. Bentonite seals that are placed above the water table should be hydrated with potable water. For deeper installations it is often more practical to tremie a bentonite slurry. In such cases, the bentonite slurry may be placed up to the ground surface in place of cement or cement-bentonite grout.

Cement-Bentonite Grout

Grout is placed from the top of the bentonite seal to the ground surface via the tremie method. Generally, grout consists of a cement-bentonite mixture. Cement is Portland Type 1, in conformance to ASTM specifications C150. The bentonite is powdered Wyoming sodium bentonite. Cement-bentonite grout typically consists of 94 pounds of cement mixed with 3 to 5 pounds of powdered bentonite and 7 gallons of water or a media approximating this mixture. The purpose of the grout seal is to replace material removed from the borehole during drilling and prevent collapse and subsidence around the well. Pure bentonite slurry may also be used in place of the cement-bentonite grout.

Protective Casings
Protective casings are placed around wells to prevent damage, provide security, and to provide a seal to prevent surface runoff from entering the well. They usually consist of a 4- or 6-inch diameter steel casing with a 2-3 foot stick up above the ground or a manhole road box installed flush to the ground surface (flush-mounted casing). The casings should be watertight and equipped with a locking cover. All protective casings should be labeled with the well identification. A concrete surface seal should be constructed around the protective casing at the ground surface to provide a seal and to divert surface runoff away from the well. All details of well installation will be recorded by the geologist.

4.7.4 Well Development

Monitoring wells will be developed in order to restore the natural permeability of the formation adjacent to the borehole and to permit water to flow through the screen easily. Well development removes fine sediment from the formation so, during sampling, water will not be turbid or contain suspended materials that can interfere with chemical analysis.

Shallow wells are generally developed with a bailer, a foot-valve pump, or a submersible pump. Pumping is usually a more efficient method for deeper wells. The selection of the well development methods and equipment will be determined on site by the field personnel based on drilling, well construction, and site-specific geologic information.

Well development will occur after a minimum of 24 hours following construction or after recovery is complete, whichever is later. All equipment that is introduced into the well will be decontaminated according to the procedures discussed in Section 4.4. The general procedures for well development are summarized below:

1. Measure the water level in the well with a water level indicator. The depth to the bottom of the well is measured with a weighted measuring tape.
2. A bailer or other pumping device is lowered to the bottom of the well. The well is surged by the bailer or the pump to agitate and loosen fines in the well screen and sand pack.
3. Groundwater is bailed or pumped from the well. If a pump is used, the pump intake will be periodically placed at different depths throughout the well and within the screen interval during development.
4. Readings of pH, temperature, specific conductance, and turbidity will be collected after each well volume removed or at other intervals depending upon well output and other factors pertinent to sampling.
5. Well development will continue until the field measurements stabilize. Ideally, the well should be developed to 50 Nephelometric Turbidity Units (NTU), if possible. The goal of 50 NTUs may not be practical in formations which contain a lot of silt and clay in which case the well will be developed until the turbidity readings appear to have stabilized.
6. The development tools will be removed from the well and the water level and well bottom will be measured following development.
7. The well will be covered and locked.

8. Purged water will be containerized pending subsequent sampling and handled according to the procedures outlined in Section 4.4.4.
9. All pertinent field data will be recorded on a Field Data Sheet (see Section 4.10).

4.8 Groundwater Sampling

Groundwater samples are collected from monitoring wells for laboratory analysis. The specific number and location of samples, rationale, and parameters to be tested are discussed in the Work Plan. The equipment and general procedures normally utilized for groundwater sampling are presented below.

4.8.1 Groundwater Sampling Equipment

Monitoring wells will be purged using one of the following pieces of equipment:

- Lubricant-free stainless steel submersible pump with polyethylene or Teflon discharge tubing.
- Peristaltic pump equipped with dedicated polyethylene tubing with or without a foot valve.
- Dedicated Teflon bailer connected to new solid-braid nylon rope.
- Inertial lift pump with dedicated polyethylene valve and tubing.

Project-specific purging methods are outlined in the Work Plan. The selection of a purging method is determined based on the following information:

1) Well depth
2) Static water level
3) Hydraulic conductivity
4) Well diameter
5) Well location

4.8.2 Procedures for Collecting Groundwater Samples

4.8.2.1 Pre-Sampling Activities

Before sampling, the following pre-sampling activities will occur:

- The well will be inspected for integrity and proper identification.
- A sheet of polyethylene will be laid out for placement of monitoring and sampling equipment.
- If site conditions are unknown, conditions warrant, or project requirements call for VOC monitoring, VOCs will be measured at the rim of the opened well with a PID and recorded in the field logbook.
- After removing the well cap, the water level will be allowed to equilibrate for a minimum of 5 minutes. The static water level in the well will be measured with a water level indicator to the nearest 0.01 feet referenced to a permanent mark on the PVC riser. The probe of the meter will be decontaminated according to the procedures detailed in Section 4.4.
- The volume of water in the well will calculated by the following equation:

$$V = (\pi) r^2 l (7.48)$$

where,
V = volume, in gallons
π = 3.14
r = inside radius of well, in feet
l = height of water in well, in feet
7.48 = conversion factor for cubic feet to gallons

- If present, the depth of any non-aqueous phase liquids (NAPLs) will be measured using an interface probe and recorded. If LNAPLs or DNAPLs are detected, the well will not be sampled. A sample of the LNAPLs or DNAPLs present may be obtained using a bailer, if appropriate.

4.8.2.2 Sampling Procedures

<u>Low Flow Sampling:</u>

- Install Pump: Slowly lower the pump, safety cable and tubing into the well to the depth specified for that well. The pump intake should be in the middle or slightly above the middle of the screened interval. Too close to the bottom increases the possibility that solids that have collected in the well over time will be collected in the sample. Too close to the top increases the possibility that water stored in the casing will be included in the sample. Record the depth to which the pump is lowered.

- Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

- Purge Well: Start pumping the well at 100 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every 5 minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should be reduced, if needed, to the minimum capabilities of the pump to ensure stabilization of the water level. Care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

- Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (temperature, specific conductance, and pH) approximately every 5 minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows:

  ±0.1 for pH

  ±3% for temperature

  ±3% for specific conductance (conductivity)

The pump must not be removed from the well between purging and sampling.

- Sample collection should be directly from the dedicated or disposable tubing, not from the flow-through cell discharge hose.

- Remove pump and tubing: After collecting the samples, the tubing must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.

- Close and lock the well.

Sample Collection
All laboratory samples will be placed in containers according to the procedures outlined in Section 4.3.3 of this document. Drums containing purge water will be handled in accordance with Section 4.4.4.

4.9 Water Level Measurements

Groundwater level measurements are taken to calculate groundwater elevations so that groundwater contour maps can be constructed. Groundwater contour maps are used to assess flow directions and hydraulic gradients.

Water levels are measured with a water level indicator to the nearest hundredth (0.01) foot. Measurements collected from monitoring wells are taken from the top of well casing. The measurement point is notched or marked indelibly on the casing.

Water levels are measured according to the following procedures:

- Check the well for proper identification.
- Inspect the integrity of the protective casing and surface seal.
- If previous data warrant, or unknown conditions exist, then monitor the ambient air in the breathing zone and at the well head while unlocking and removing the well cover.
- Using a pre-cleaned water level indicator, measure the water level to the nearest hundredth (0.01) foot from the reference mark at the top of the well riser pipe.
- Record the water level measurements in a field notebook and/or on a field data sheet along with the date and time of measurement.
- Decontaminate the water level probe between locations by rinsing it with methanol and deionized water.
- Replace the well cover and lock.

4.10 Ground Penetrating Radar

Ground penetrating radar (GPR) uses high frequency radio waves to investigate shallow geologic features (e.g. depth to the water table or depth to bedrock) and for the detection of buried objects. GPR can provide subsurface information ranging in depth from several tens of feet to inches and is useful for locating subsurface objects, utilities, and geologic interfaces.

Ground penetrating radar operates by transmitting pulses of microwave-range (0.1- to 100-cm wavelength) electromagnetic energy into the ground through an antenna (a.k.a. transducer). Some of the energy is scattered where materials with different dielectric permitivity interface. The rest of the energy passes through the interface and on to the next interface where it may be reflected or pass through to deeper interfaces. The reflected signals are received by a control unit which registers the reflections against two-way travel time in nanoseconds. The control unit typically contains an output display on which the signals are plotted in profile (radargram).

The GPR antenna is pulled slowly along the ground surface radiating energy downward into the subsurface. Reflected energy is gathered at a receiving antenna and variations in the return signal are continuously recorded. These variations are caused by wave reflections from surfaces of materials having different electrical properties. These surfaces may be geologic features (e.g., soil interfaces, changes in moisture content, voids or fractures in bedrock) or indications of human activity (e.g., buried drums, utilities, tanks).

The depth of penetration is highly site-specific and is dependent on the soil types and properties. In general, dry, sandy soils provide better data, while moist, clayey or conductive soils provide poorer results.

4.10.1 Equipment/Instrumentation

The GPR system consists of a control unit, antenna, and a graphic recording device. The antenna transmits electromagnetic pulses of short duration into the ground. Pulses are reflected back to the antenna from the various interfaces within the subsurface. The receiver sends the signal to the control unit for processing and display.

Several manufacturers produce commercially-available GPR systems. For this reason, a detailed description of instrument operation is not practical. The operator should refer to the instrument setup and operations manual to prepare the instrument for a survey. The instrumentation should be selected based on the desired target and actual field conditions. The selection of a transducer frequency will need to balance the desired depth of penetration with resolution.

4.10.2 Field Procedures

The general field procedures for conducting GPR surveys are outlined below:

- Where possible, the instrument is calibrated by burying a metal object at known depth. The instrument is then adjusted so that the readings are consistent with the true depth.

- A grid of parallel lines is established across the investigation area. The size of the grid is dependent upon the project objectives and is detailed in the FSP.

- Data are collected by slowly pulling the antenna along the survey lines. The beginning and end points of each traverse should be surveyed from a known location, which can be recovered at a future date.

4.10.3 Data Analysis

Most modern GPR systems utilize portable digital processors operating on battery (DC) power. Digital processing allows the operator to utilize filtering, stacking, and gain controls as well as manipulate them in the field. Data is typically stored in an unfiltered (raw) form that can be reviewed and processed after the survey is complete.

GPR data are evaluated qualitatively in the field as the survey progresses. Data is displayed on the GPR system and observed in profile as it is collected. Estimates of depth are automatically made by utilizing a velocity conversion factor. The velocity conversion factor is a user-entered estimate of the radar wave propagation rate through the subsurface. It is used to determine distance (depth) from the GPR antenna.

4.10.4 Data Evaluation

The propagation velocity of the EM pulse depends upon the relative dielectric permittivity of the material (e_r) through which the pulse travels. The relative dielectric permittivity is a measure of the degree to which a medium can resist the flow of the EM pulse: the higher the relative permittivity, the lower the resistance to flow, and vice versa. For most earth materials and rocks, the relative dielectric permittivity does not exceed 10 and is always greater than unity, the value for a vacuum. The table below gives typical permittivity values for commonly encountered materials.

Approximate Electromagnetic Properties of Various Materials

Material	*Relative Dielectric Permittivity*	*Pulse Velocity (ns/ft)*
Air	1	1
Freshwater	81	9
Seawater	81	9
Sand (dry)	4 – 6	2.1 – 2.4
Sand (saturated)	30	5.5
Silt (saturated)	10	3.1
Clay (saturated)	8 – 12	2.8 – 3.3
Average “dirt”	16	4
Dry sandy coastal land	10	3.1
Marshy forested flat land	12	3.5
Rich agricultural land	15	3.9
Pastoral land, hilly, forested	13	3.6
Freshwater ice	4	2
Permafrost	4 – 8	2.0 – 2.9
Granite (dry)	5	2.2
Limestone	7 – 9	2.6
Concrete	6.4	2.5
Asphalt	3 – 5	1.7 – 2.5

The dielectric permittivity is related to the propagation velocity by the formula:

$$e_r = \left(\frac{c}{V_m}\right)^2$$

where, "c" is the propagation velocity in free space ($3x10^8$ meters per second or approximately 1 foot per nanosecond) and Vm is the propagation velocity through a material. It follows that

$$(e_r)^{1/2} = \frac{c}{V_m} \qquad \text{or} \qquad \frac{1}{V_m} = \frac{(e_r)^2}{c}$$

Since c is approximately equal to 1 ft/ns, then

$$1/V_m \approx (e_r)^{1/2} \qquad \text{(Formula 1)}$$

Where units are in ns/ft (one-way travel time).

Formula 1 gives a method for estimating the propagation velocity for a medium (and therefore the depth to a reflecting horizon) if the soil conditions are known. If they are unknown or their properties cannot be estimated accurately enough, a reflector of known depth can often be used to calibrate the GPR recordings to site conditions.

Approximate Depth Ranges for Various Antenna Frequencies

Frequency (MHz)	**Minimum Target Size (m)**	**Approximate depth range (m)**
100	0.1-1	2-15
250	0.05-0.5	1-10
500	0.04	1-5
800	0.02	0.4-2

4.11 Soil Vapor Sampling

If needed, soil vapor sampling will be conducted in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion, Final October 2006.

Soil vapor samples are collected outside, and not beneath the foundation or slab of a building, to determine whether there is soil vapor contamination, to characterize the nature and extent of soil contamination, and to identify possible sources of contamination. The results are often used to evaluate the potential for current and future human exposures and to determine the effectiveness of measures implemented to remediate contaminated subsurface vapors.

4.11.1 Investigation Considerations

Existing environmental data and site background information are used to select the sample locations. When evaluating sites that are proposed for development, where soils are suspected or known to be contaminated, the soil vapor samples should be collected from:

- Known or suspected VOC source material
- In a grid pattern across the area
- From multiple depths from suspected subsurface sources, former source, or a depth comparable to the expected depth of foundation footings.

Soil vapor intrusion investigations often involve more than one round of sampling.

4.11.2 Sample Probe Installation

Samples at depths less than 5 feet below the ground surface (bgs) are prone to negative bias from infiltration of outdoor air and should only be collected when deeper samples are not feasible.

Soil vapor probe installation can be permanent, semi-permanent, or temporary. Permanent probes are preferred for data consistency. Soil probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be used when constructing and installing soil probes:

- Direct-push technology is the preferred method of installing sample probes. When necessary, an auger could be used.
- Porous backfill material (e.g. coarse sand or glass beads) should be used to create a sampling zone of 1 to 2 feet in thickness.
- Implants/probes should be fitted with VOC-inert tubing (e.g. polyethylene, stainless steel, or Teflon®) of the appropriate size (typically $^{1}/_{8}$-inch to $^{1}/_{4}$-inch diameter) that is of laboratory or food grade quality.
- The probes should be sealed above the sampling zone with bentonite slurry for a minimum depth of 3 feet to prevent surface air infiltration. The hole should be filled with clean material.
- For multiple probe depths, the borehole should be grouted with bentonite between probes to create discrete sampling zones.
- For permanent installations, a protective casing should be set around the top of the probe tubing and grouted in place to the top of the bentonite to minimize infiltration of outdoor air, as well as to prevent accidental damage to the probe.

4.11.3 Soil Vapor Sample Collection

Soil vapor samples should be collected in the same manner at all locations to minimize discrepancy and should include the following:

- Samples should be collected a minimum of 24 hours after the installation of permanent probes, and shortly after the installation of temporary probes.

- One to three implant volumes (volume of sample probe and tube) must be purged prior to sample collection.
- Flow rates for purging and collecting must NOT exceed 0.2 liters/minute to minimize outdoor air infiltration.
- Use conventional sampling methods, in an appropriate container that meets the requirements of the sampling and analytical methods and has been certified to be clean by the laboratory.
- Sample size is dependent on the volume needed for laboratory minimum reporting limits.
- Tracer gas (i.e. helium, butane, or sulfur hexafluoride) must be used to verify that outdoor air infiltration is not occurring. Once verified, continued use of the tracer gas may not be necessary. Two approaches can be selected when using a tracer gas:
    - Include the tracer gas in the list of laboratory analytes.
    - Use a portable field monitoring device to analyze the sample for the tracer gas.

4.11.4 Documentation/Considerations

The following should be considered during a soil vapor sampling event and may influence the interpretation of the results:

- If sampling near a building, uses of VOC-containing products during normal operations of the facility should be identified.
- Outdoor sketches, including site, streets, nearby facilities, and outdoor ambient air sample locations (if appropriate) should be drawn.
- Weather conditions should be noted for 24-48 hours prior to sampling events.
- Pertinent observations (odors, field screening readings) should be recorded.

A sample log sheet should be maintained to include:

- Sample ID
- Sample date and time
- Sampler ID
- Sampling Methods/devices
- Purge volume
- Volume of vapor sample
- For canisters, the vacuum reading before and after sample collection
- Apparent moisture content of sampling zone
- Chain of Custody procedures used to track sample

4.11.5 QA/QC Precautions and Laboratory Analytical Methods

On the day of sample collection activities, the person collecting the samples should avoid the following: fueling vehicles, use of permanent markers, wearing freshly dry-cleaned clothing, wearing perfumes, and any other activity where the use of VOCs could contaminate the samples. Proposed analytical procedures are identified in the Work Plan. TO-15 for VOCs, and NYSDOH Method 311-9 for tetrachloroethene are the preferred laboratory analytical methods.

5.0 DOCUMENTATION / CHAIN OF CUSTODY PROCEDURES

5.1 Chain of Custody

Chain-of-Custody (COC) procedures are followed to insure that sample integrity is maintained throughout the sampling and analysis process and that all samples collected are accounted for at all times. The COC process begins when the sample is collected and carries on throughout the analytical laboratory operations. The field team member responsible for the collection of the samples acts as the initial sample custodian.

A sample is considered "in custody" of an individual if it is either in direct view of, or directly controlled by, that individual. Chain-of-Custody transfer is accomplished when the samples or sealed sample containers are directly transferred from one individual to the next. At the time of transfer, the first individual witnesses the signature of the receiver on the COC record. The objective of the COC program is to ensure that:

- Samples are protected from loss or damage.
- The correct samples are analyzed.
- All samples are uniquely identified.
- Samples are traceable to their records.
- Documentation of sample handling procedures including: sample location, sample number, number of sample containers, and the COC process.
- A signed COC record is included for each sample shipment, documenting contents of the shipment. The COC record indicates the following information:
    - Site name
    - Sample Identification Numbers
    - Date and time of collection
    - Sample type (e.g., groundwater, soil, etc.)
    - Number and type of containers per sampling location
    - Parameters requested for analysis for each container
    - Signature of person(s) involved in the chain-of-possession
    - Description of sample bottles and their condition
    - Problems associated with sample collection (i.e., breakage, no preservatives), if any.

The COC records are printed on triplicate forms. One copy is retained by The Chazen Companies when the samples are taken into custody by either a shipping agency or the lab. A second copy is kept by the analytical lab. The third copy is returned to Chazen with completed lab results.

5.1.1 Sample Tracking

In order to track the samples sent to the laboratory, a permanent log of each shipment is maintained in a log book. A copy of all COC records is also maintained in a project file. All pertinent COC information is recorded in the log book, as well as follow-up correspondence with the laboratory, via telephone or mail, indicating receipt of the samples, breakage, turnaround time, or any problems with the shipment. As analytical data are received, the database is updated to reflect the new information. Turnaround times are compared to protocols to ensure quality control. Missing data or invalid samples are addressed by the Field Operations Leader or the Project Manager.

5.1.2 Laboratory Operations

Specific laboratory Standard Operating Procedures used during the investigation are provided by the selected analytical laboratory. These procedures include sample tracking, methods for collection and handling of laboratory blanks, laboratory duplicates, matrix spikes, laboratory control samples, and surrogates. Maximum/minimum holding times and data reporting procedures are also defined by the laboratory.

5.2 Analytical Sample Shipping

Sample containers are packed in coolers. Bottles are packed tightly in materials such as Styrofoam, vermiculite, and/or “bubble pack” to minimize motion. Ice is placed in zip-lock bags and can be added to the cooler to cool the samples to around 4° C. All paperwork is sealed in a separate zip-lock bag and placed in the cooler which is then taped shut. The samples are shipped to the laboratory together with the COC documents.

The standard procedure followed for shipping environmental samples to the analytical laboratory is:

1) Samples are shipped by courier or equivalent overnight delivery service.
2) Samples are shipped to the laboratory within 24 to 48 hours of acquisition.
3) Prior to leaving for the field, the Analytical Lab is notified of the number, type, collection date, and shipment dates for samples. If the number, type, or date of shipment changes due to site constraints or program changes, the Lab is informed of the change. Notification to the Lab also occurs when sample shipments will arrive on Saturdays. This communication is critical to allow the laboratory enough time to prepare for the samples’ arrival.
4) If prompt shipping and laboratory receipt of the samples is not possible, members of the Field Team are responsible for proper storage of the samples until adequate transportation arrangements can be made.

6.0 CALIBRATION PROCEDURES

This section details the calibration and operating procedures for the field and laboratory analytical instruments that will be used during this investigation.

6.1 Field Instruments

Field instrumentation is calibrated according to the manufacturer's instructions to ensure that accurate field data are collected. Each piece of equipment is calibrated daily prior to use or as specified by the manufacturer. More frequent calibration may be performed when accuracy of the equipment becomes suspect or under extreme field conditions. Calibration information is recorded in the same field notebook in which the field instrument readings will be recorded. The recorded calibration includes:

- Name of instrument
- Instrument serial number
- Date of calibration
- Observations and results of calibration
- Calibration gas used, if applicable
- Buffer solutions used, if applicable
- Specific calibration procedures and operating instructions are detailed below.

6.1.1 pH Meters

pH is the measure of the acidity or alkalinity of a solution. It is defined as the negative logarithm of the hydrogen ion activity. Hydrogen ion activity is related to the hydrogen ion concentrations, which in relatively weak solutions are nearly equal. For practical purposes, pH is the measure of the hydrogen ion concentration.

The operation of a pH meter relies on the same principal as many other ion-specific electrodes. Measurement relies on establishment of a potential difference in the response to hydrogen ion concentration across a membrane in the electrode. The membrane is conductive to ionic concentrations, which in combination with a reference electrode (which can be combined into a single "combination" electrode), can generate a potential difference proportional to the hydrogen ion concentration.

Variation in temperature will effect the association of hydrogen and hydroxide ions, which without proper compensation will affect the pH. pH meters have several controls to compensate for the variations between electrodes and the different responses to changes in temperature.

It is very important to obtain a pH measurement as soon as possible after sample collection, since temperature changes, precipitation/dissolution reactions, and sorption of carbon dioxide from the air all affect the pH of a solution.

Because of the great variety of pH meters available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures for their instrument. The following general procedure is used for measuring pH in the field with a pH meter:

- The pH meter is calibrated at each sample site.
- The instrument and batteries are checked prior to the initiation of the field effort. pH electrodes are kept moist at all times.
- Buffer solutions used for calibration are checked since buffer solutions will degrade upon exposure to the atmosphere.
- Generally, 4.00 and 7.00 pH buffers are selected for calibration.
- All electrolyte solutions within the electrode(s) are filled to their proper levels and no air bubbles are present within the electrode(s).
- The electrodes are immersed in a pH-7 buffer solution.
- The temperature compensator is adjusted to the proper temperature (on models with automatic temperature adjustments, immerse the temperature probe into the buffer solution). Alternatively, the buffer solution may be immersed in the sample and allowed to reach temperature equilibrium before equipment calibration. It is best to maintain buffer solution at or near expected sample temperature before calibration.
- The pH meter is adjusted to read 7.0.
- The electrodes are removed from the buffer and rinsed well with deionized water. The electrodes are immersed in pH-4 (or pH-10 buffer solution) and the slope control is adjusted to read the appropriate pH. To check the calibration, three successive readings are taken, one minute apart, to see that readings are within ±0.1 pH unit.
- The electrodes are immersed in the unknown sample, slowly stirring the probe until the pH stabilizes. Stabilization may take several seconds to minutes. If the pH continues to drift, the sample temperature may not be stable, a chemical reaction (e.g., degassing) may be taking place in the sample, or the meter or electrode may be malfunctioning. This must be clearly noted in the logbook.
- The pH and temperature of the sample are read and recorded. pH is recorded to the nearest 0.1 pH unit.
- The electrodes are rinsed with deionized water.

6.1.2 Specific Conductance Meters

Conductivity is a numerical expression of the ability of a water sample to carry an electric current. This value depends on the total concentration of ionized substances dissolved in the water and the temperature at which the measurement is made. It is important to obtain a specific conductance measurement soon after sample collection since temperature changes, precipitation reactions, and sorption of carbon dioxide from the air affect the specific conductance.

Specific conductance can be used to identify the direction and extent of the migration of contaminants in groundwater and surface water. It can also be used as a measure of subsurface biodegradation or to indicate alternate sources of groundwater contamination.

A conductance cell and a Wheatstone Bridge (for the measurement of potential difference) may be used for measurement of electrical resistance. The ratio of current applied to voltage across the cell may also be used as a measure of conductance. Depending on ionic strength of the aqueous solution to be tested, a potential difference is developed across the cell which can be converted directly or indirectly (depending on instrument type) to a measurement of specific conductance.

Because many conductivity meters are available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures. The following general procedure is used for obtaining specific conductance measurements:

- The conductivity meter is calibrated at the start of each sampling day or more frequently if deemed necessary.
- Batteries are checked before going into the field.
- The instrument is calibrated using a potassium chloride standard solution by completely immersing the electrode into the solution. The temperature of the calibration solution is checked and the temperature dial is adjusted on the meter (if not self-compensating). Calibration measurements and time are recorded in the field logbook.
- The umho value of the solution is checked in terms of the temperature. The Cell Constants dial is adjusted until the display reads the appropriate value.
- The electrode is rinsed with one or more portions of the sample to be tested.
- The electrode is immersed in the sample and the temperature and the conductivity are measured.
- The results are noted in the field logbook.
- If the specific conductance measurements become erratic, or inspection shows that any platinum black has flaked off the electrode, replatinization of the electrode is necessary. See the manufacturer's instructions for details.

6.1.3 Photoionization Detector

For monitoring total ambient air quality during field activities and for conducting static headspace testing, TCC uses a MiniRae 2000 PID. This instrument measures total VOC concentrations. The operating and calibrating procedures for this instrument follow.

A MiniRAE 2000 PID can be used to detect a variety of trace gases, particularly VOCs. The MiniRAE 2000 uses the principle of photoionization to detect and measure the VOC concentrations in the atmosphere or from a sample.

The MiniRAE 2000 operates using an electrodeless discharge ultraviolet (UV) lamp as the high-energy photon source. As organic vapors pass by the lamp, they are photo-ionized and the ejected electrons are detected as a current. The PID sensor with a standard 10.6 eV lamp detects a broad range of organic vapors. In principle, any compound with ionization energy lower than that of the lamp can be measured.

The following procedure is used for operating and calibrating the MiniRAE 2000:

- Press and hold the MODE key for one second and release to turn on the MiniRAE 2000. The audio buzzer will beep once and the air pump will turn on. The display will show "ON"
- To turn off the MiniRAE 2000, press and hold the MODE key for 5 seconds. The monitor will beep once per second during the power-down and the message "OFF" will flash and the screen will go blank.
- After the monitor is turned on, it runs through the start up menu and then a "READY…" message is displayed. At this point the user can either 1) step through the operation menu or 2) take a measurement.
- In the first menu of the programming mode, the user can calibrate the MiniRAE 2000. The calibration is a two-point process using "fresh air" and the calibration gas (Isobutylene)
- Calibration Process
  - Press and hold down both the [N/-] and MODE keys for three seconds to enter the programming mode; the first menu item is "Calibrate/select Gas"
  - The Fresh Air calibration determines the zero point of the sensor calibration curve. If a fresh air source from a cylinder or tedlar bag is not available, any clean ambient air without detectable contaminant or a charcoal filter can be used.
  - The first menu shows "Fresh Air Cal?"; make sure the instrument is connected to the fresh air source; press the [Y/+] key, the display will show "zero in progress", flowed by "wait.." and a countdown timer; after a pause, the display will show the message "zeroed…reading= x.x. ppm…"; press any key or wait about 20 seconds, the monitor will return back to the submenu.
  - For the second point of the sensor calibration, a cylinder of span gas (Isobutylene) fitted with a 500 cc/min. flow limiting regulator is attached to the instrument.
  - Press the [Y/+] key at the "Span Cal?" to stat the calibration. The display shows the gas name and the span value of the corresponding gas; the display will show "Apply gas now" at which point the valve will be turned to open the gas supply.
  - The display with ask you to wait 30 seconds. When the count down timer reaches 0, the display will show the calibrated value. Turn off the flow to gas and disconnect the span gas. Press any key
- To record measurements
  - Press the [Y/+] key to start a measurement in survey mode
  - Instantaneous readings in ppm are updated every second
  - To stop measurements press the MODE key and the display shows STOP. Press [N/-] to continue measurement

The meter is calibrated once per day or more frequently, if necessary. The MiniRAE 2000 is used to monitor the breathing zone for health and safety precautions or to screen samples by placing the probe near suspected sources of contaminants.

6.1.4 Airborne Particulate Matter Meters

For monitoring airborne particulate matter (i.e., dust) during field activities, TCC uses a MIE, Inc. Personal Data-logging Real-time Aerosol Monitor (*personal*DataRAM). This instrument provides direct and continuous data measurements and is a high sensitivity nephelometric monitor optimized for the measurement of the respirable fraction of airborne dust emitted from ground intrusive work or work that has the potential to produce dust. The following procedures are used for calibrating and operating the *personal*DataRAM:

- Calibration/Zeroing Process
  - Conduct zeroing in a particle-free environment such as a *personal*DataRAM Z-Pouch, a clean room, a duct or area directly downstream of a HEPA filter, or the MINIRAM Z-Bag. The following instructions are for the Z-Pouch.
  - Wipe the outside surfaces of the instrument to remove as much dust as possible, then in a reasonably clean area, open the zipper of the Z-Pouch and place the unit inside.
  - Open the small nipple of the Z-Pouch and insert the fitting of the hand-pump/in-line filter unit into the nipple. Start pumping the hand-pump until the Z-Pouch begins to bulge slightly.
  - While continuing to pump, press ENTER and keep pumping slowly while ZEROING is displayed for 1.1 minutes followed by CALIBRATION: OK. If screen shows BACKGROUND HIGH or MALFUNCTION, consult instruction manual.
  - To set up a run and scroll logging/operating parameters, press NEXT when screen shows READY: NEXT.
  - After completing zeroing process, remove the *personal*DataRAM from the Z-Pouch, close the zipper and flatten the Z-Pouch while plugging its nipple to prevent dust contamination in the Z-Pouch.

- Operating Process
  - To enable the logging function, press ENTER when screen shows LOGGING DISABLED.
  - LOG INTRVL 600s indicates that logging is enabled (in this example for 10-minute log period). Press ENTER.
  - At ALARM: OFF press ENTER to toggle through alarm modes.
  - Press NEXT to move through the calibration factor screen and battery charge screen.
  - Press NEXT at CONNECT TO PC, then again to return to ready mode (this will enable data to be downloaded).
  - Press ENTER at LOG INTRVL with TAG # displayed. Concentration screen will be displayed after three seconds. Pressing NEXT will successively scroll to show various run values.
  - Press EXIT to terminate the current run, then ENTER to return to Ready mode.

6.1.5 Gas Chromatograph

GC calibration is generally conducted prior to mobilization to the site as it can take several hours to complete. This effort involves creating a calibration curve constructed by injecting the same volume of several standards with varying concentration levels of the target compounds.

<u>Serial Dilution of Certified Calibration Standards</u>

Certified standards of target compounds can be purchased from various laboratory supply companies. Purchased standards are typically 1,000 ug/L or 2,000 ug/L in concentration. Using them directly at this concentration may lead to fouling of the GC column. Only diluted standards are used for calibration. The following procedure can be used to serially dilute the certified standard to lower concentrations:

1. Using a clean syringe, add 1 ml of 1,000ug/L standard to 9ml purge and trap grade methanol to create a 100ug/L standard.
    a. If mixing two or more single compound standards together, use 1 ml of each and add sufficient methanol to make a total of 10ml of solution.
2. Repeat the process with the newly created 100ug/L standard to create a 10ug/L standard.
    a. Note that compounds are not added individually at this point.
3. Repeat the process a third time to create 1ug/L standard.

Creating a Calibration Curve

Certified standards are provided with a chromatograph from the manufacturer. If the standard contains more than one compound, the order of elution can be gleaned from the chromatograph. For custom mixtures of standards created for the field, a check of readily available references will provide the elution order. The following procedure is used to create a calibration curve for the SRI GC utilizing Peak Simple software from SRI.

1. Using a syringe, introduce 1uL of a prepared standard onto the column while simultaneously starting the data recorder on the PC.
2. Allow the GC to run through the pre-programmed temperature and pressure programs until the final compound has completely eluted.
3. Record the calculated area under each peak into the calibration table for each compound in Peak Simple. Peak Simple will automatically create an average of analytical runs if the same standard is analyzed more than once.
4. In Peak Simple, select the best fit algorithm for matching a line to the area vs. concentration results.

    Once the area and concentration data have been entered into the tables and lines have been fitted to the resultant chart, Peak Simple will calculate a concentration for each compound that peaks within the windows of time that the known standards are anticipated to elute during subsequent analytical runs.

6.2 Laboratory Equipment Calibration

The Laboratory's Project Manager will be responsible for the operation and calibration of laboratory analytical instruments in accordance with the schedules and procedures specified by the NYSDEC ASP (Analytical Services Protocol, Revised September 1993).

The laboratory calibration procedures are addressed in the QA documents for the laboratory subcontractor.

7.0 ANALYTICAL PROCEDURES

Laboratory analyses will be scheduled based on previous site investigation information, review of data objectives, and NYSDEC criteria. Specific parameters are outlined in the Field Sampling Plan.

7.1 Analytical Laboratory

All sample analyses will be performed by a laboratory certified by the New York State Department of Health (NYSDOH). In order to provide legally defensible data, selected analytical procedures to be used will be in accordance with the most recent NYSDEC ASP. Laboratory analytical parameters will be based on previous site information, as well as data quality objectives and applicable NYSDEC criteria. The sampling program and related analytical methods are documented in the FSP. All samples will be received by the laboratory within 48 hours of collection.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Independent third party data validation will be utilized. Data will be validated using the NYSDEC ASP Revision 12/91 and the USEPA Region II Functional Guidelines. The details supporting an independent validator's selection, describing how the individual is independent from the project, will be set forth in the Work Plan or other supplementary documentation.

8.1 Data Reduction

Data reduction is the conversion of raw data into a useful form from which conclusions can be made and presented. Raw data may consist of field data, which are real-time measurements, and technical data, which includes field and laboratory analytical data. Raw field data (e.g. PID readings) will be compared to laboratory analytical results which will be compared to site-specific criteria.

8.2 Data Validation

Data validation is the process of reviewing data and accepting it or rejecting it on the basis of sound criteria.

Records of all data will be maintained, even those judged to be "outlying" or spurious values.

The principle criteria that will be used to validate the integrity of the data during collection and reporting should be modeled from the following EPA guidance documents:

- "National Functional Guidelines for Organics Review", (USEPA, June, 1991)
- "Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses", (USEPA, October, 1989)
- "NYSDEC ASP Revision 12/91"

8.2.1 Field Data Validation

Field data will be validated at the time of collection by following standard procedures and QC checks and after the data is reduced to review data sets for anomalous values. The objectives of field data validation are as follows:

- Adherence to approved site-specific plans.
- Standard operating procedures are followed.
- Sufficient sample volume is obtained, sample integrity is maintained, all required analyses are conducted, and all applicable field QC samples are provided with each sample set.
- Complete chain-of-custody documentation is maintained throughout the duration of the field effort.
- Maximize data consistency between field personnel by random checks of sampling and field conditions by supervisory personnel.

8.2.2 Laboratory Data Validation

Laboratory data verification will be performed by qualified individuals appointed by the analytical laboratory. Data verification will involve routine audits of the data collection and flow procedures and monitoring GC sample results. Results from the analysis of project and blind audit QC samples will be calculated and evaluated as reported. Immediate corrective action will be taken if these results indicate data quality problems.

An individual independent from the project will be responsible for validating the laboratory data, in some cases. Details supporting the validator's selection, describing how the individual is technically qualified to do the validation and independent from the project, will be presented in the Work Plan. Independent validation will be according to criteria such as:

- Holding times
- Instrument tuning and performance
- Calibration
- Blanks
- Surrogate recoveries
- Matrix spike and matrix spike duplicate recoveries

8.3 Reporting

When required for a project, Category B Deliverables will be supplied for laboratory analysis. Validated field and laboratory data will be presented in a final report in the form of tables and/or figures. Figures may include planimetric maps, cross sections, and contour maps. All supporting data, such as raw field and laboratory analytical data, will be presented as an appendix to the final report. Electronic files may be provided in lieu of hardcopies.

9.0 INTERNAL QUALITY CONTROL PROCEDURES

Quality control (QC) checks will be performed to ensure the collection of representative and valid data. QC checks provide the mechanisms by which the quality assurance objectives are monitored.

9.1 Field Quality Control

Field quality control measures will be conducted in accordance with the NYSDEC RCRA Quality Assurance Project Plan Guidance dated March 29, 1991. The field QC checks that will be used are listed and described as follows.

9.1.1 Documentation

All activities must be properly documented including: sampling procedures, decontamination activities, chain-of-custody procedures, equipment calibration, and justification for all actions taken contrary to the approved QAPP, Work Plan, and FSP.

9.1.2 Blank and Duplicate Samples

Three types of blanks can used during sampling: trip blanks, field blanks and equipment blanks. These are discussed below.

<u>Trip Blanks</u>: Trip blanks are for assessing the potential for contaminating aqueous samples with VOCs during sample shipment. The trip blank consists of a VOC sample container shipped to the site with the other VOC sample containers either filled with reagent water at the lab or filled on-site with reagent water. Trip blanks will be used so as to maintain a 1:20 ratio of blanks to samples or with each shipment, whichever is greater. Non-aqueous samples do not require trip blanks.

<u>Field Duplicates (Replicates)</u>: When required, field duplicates of soil, sediment, and groundwater samples will be submitted for analysis of all site-specific parameters at a rate one every 20 samples collected for analyses. These duplicates are intended to assess the homogeneity of the sampled media and the precision of the sampling protocol. True duplicates of soil, sediment, and solid waste samples; however, are not possible because chemicals are typically not uniformly distributed.

<u>Equipment Blanks</u>: Equipment blanks for the bailer, sampling pump, and/or tubing assembly are collected during monitoring well sampling at a rate of one per day on one piece of equipment per equipment type. VOCs, SVOCs, or inorganics present within the bailer, pump apparatus, or discharge tubing are assessed by collecting a sample of reagent water passed through the sampling apparatus after washing with the decontamination solution followed by at least one rinse with reagent water.

Equipment blanks, sometimes called rinsate blanks, are collected during each field event at a rate of one per day on one piece of equipment per equipment type. VOC, SVOC, or inorganics present within or on the sampling apparatus where intimate contact with the sample occurs (i.e., split-spoon, trowel) are assessed by rinsing the sampling apparatus with ASTM Type II water following decontamination. Rinsate blanks are collected directly into the appropriate water container.

Matrix Spike/Matrix Spike Duplicates (MS/MSD): For some projects, the NYSDEC ASP requires the laboratory to analyze MS/MSDs for organic analyses at a frequency of five percent. To meet this requirement, the Field Operations Leader will select samples for MS/MSD analyses and will provide additional sample volume to the laboratory.

9.1.3 Completeness

Completeness of scheduled sample collection is controlled in the field by comparing a pre-sampling inventory with samples actually collected each day. Daily checking of field data sheets and comparison of transport and COC logs provides further control of documentation and completeness.

9.1.4 Field Analytical Quality Control

QC checks are performed on field measurement systems that emulate laboratory measurement systems (e.g., portable field GC).

9.2 Laboratory Analytical Quality Control

Data from QC samples (e.g., blanks, spiked samples) will be used as a measure of performance and as an indicator of potential sources of cross-contamination. In some cases, quality control data and records will be submitted to the data validator. Laboratory analytical quality control will be in accordance with the requirements outlined in the NYSDEC RCRA Quality Assurance Project Plan.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 Systems Audit

System audits are performed to ensure that the QA/QC procedures are being followed. These audits include a careful evaluation of both field and laboratory control procedures.

Organization and Personnel: The project organization is reviewed for compliance with the proposed organization and for clarity of assigned responsibility. Personnel assigned to the project will be placed so that responsibility, skill, and training of the personnel are properly matched.

Facilities and Equipment: The audit will address whether field equipment and analytical instruments are meeting requirements specified by the project objectives stated in the Work Plan. Equipment and facilities provided for personnel health and safety may also be evaluated. Calibration and documentation procedures for instruments will also be verified.

Analytical Methodology: A review of analytical methodology with regard to the data requirements for the project will be performed. An on-site observation of analyst technique, data reduction, and record keeping may be performed if determined necessary. Periodic review of precision and accuracy of data will be performed.

Sampling and Sample Handling Procedure: An audit of scheduled samples versus samples collected versus samples received for analysis may be performed. Field documentation may be reviewed. If deemed necessary, a site visit will be made to document that designated control procedures are practiced during sampling activities.

Data Handling: During a system audit, the Quality Assurance Manager will review data handling procedures with the TLs. Accuracy, consistency, documentation, and appropriate selection of methodologies will be discussed:

10.1.1 Field Systems Audit

Field systems audits are performed by QA personnel to compare field practices with standard procedures. These audits focus on such things as:

- Compliance with Work Plan
- Proper working order of field equipment
- Documentation procedures
- Field team efficiency
- Level of QA conducted by field members
- Proper sample packaging and shipping

10.1.2 Laboratory Systems Audit

Laboratory systems audits are conducted to ensure that measurement systems are properly maintained and used. Laboratory records and procedures may be reviewed for completeness, accuracy, precision, and adherence to prescribed methods.

10.1.3 Field Performance Audits

Field performance audits are conducted by QA personnel on an ongoing basis during a project as field data are generated, reduced, and analyzed. Field performance audits include review of numerical manipulations and review of blank and replicate samples.

10.1.4 Laboratory Performance Audits

Laboratory performance audits may be conducted and may include:

- Verification of written procedures, and analyst's understanding
- Verification and documentation of procedures and documents
- Periodic unannounced inspections, if warranted
- Review of a portion of all analytical data and calculations

11.0 PREVENTATIVE MAINTENANCE

11.1 Analytical Instrumentation

Preventative maintenance of analytical instrumentation is outlined in the QA documents of the subcontract analytical laboratory.

11.2 Field Instrumentation and Equipment

Preventative maintenance of field instrumentation and equipment includes the following measures:

- The field operations leader shall ensure that all scheduled maintenance occurs as obligated.
- Critical spare parts will be kept in stock.
- Equipment will be cleaned on a daily basis after use.
- Field crews will report on the condition and performance of the equipment after each sampling event.

12.0 DATA MEASUREMENT ASSESSMENT PROCEDURES

The purpose of a data quality assessment is to document that data generated under the program are accurate and consistent with project objectives. The quality of data is assessed based on the precision, accuracy, representativeness, comparability, and completeness of the data that are generated. Data quality assessments are conducted in three phases.

Phase I: Prior to data collection, sampling, and analysis procedures are evaluated in regard to their ability to generate the appropriate, technically acceptable information required to achieve project objectives.

Phase II: During data collection, results will be assessed so that selected procedures are efficient and effective and that the data generated provide sufficient information to achieve project objectives. In general, evaluation of data are based on performance audits, results of duplicate and spiked sample analyses, and review of completeness objectives.

Documentation may include:
- Number and identity of duplicate samples collected
- Number and identity of duplicate, spike, and field blank samples analyzed
- Identification of statistical techniques, if used
- Use of historical data
- Identification of analytical method
- Data validation results

Procedures for assessing precision and accuracy for analytical data are outlined in Section 3.2. Precision is generally expressed as the relative percent difference (RPD) among duplicate analyses. Accuracy is generally expressed as percent recovery. Precision and accuracy of instrumental analysis is further addressed in the NYSDEC ASP and the Laboratory QAPP. It is the laboratory's responsibility to attempt to identify the source of substandard recoveries and take corrective action or document the cause as required by the NYSDEC ASP.

Phase III: Following completion of data collection activities, an assessment of the adequacy of the database generated in regard to completing project objectives is undertaken by the Project Manager and/or the Technical Reviewer. Recommendations for improved QC are developed, if appropriate. If data gaps are identified, additional raw data collection may be recommended to fully support the project findings and recommendations.

13.0 CORRECTIVE ACTIONS

Corrective actions are QA/QC problem-solving measures taken to rectify a laboratory or field measurement system that is out of control. Corrective action is required when potential or existing conditions are identified which may adversely affect the data quality. The need for corrective action may be identified by system or performance audits or by standard QC procedures. The corrective action system will include the following procedures:

The Project Manager is immediately notified of any potential problem with the data quality, and will then evaluate the need for changes in affected procedures and conduct appropriate corrective actions. Potential data quality problems may include:

- Loss of a sample or damaged sample containers.
- Analytical results that are substantially different from those expected.
- Laboratory QC samples that do not attain target performance objectives.
- Events that may require changes in specifications and sampling procedures.

Corrective action related to questionable analytical results or damaged sample containers may include re-sampling and re-analysis, if appropriate. Modification of procedures may be necessary to remedy problems related to unexpected conditions encountered in the field.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Project Manager submits periodic QA reports for appraisal by management, appropriate to their level of responsibility. Reports to management include:

- Periodic assessment of measurement data accuracy, precision, and completeness.
- Results of performance and system audits.
- Significant QA/QC problems and recommended solutions.
- Resolutions of previously stated problems.

14.1 Field Quality Assurance Reports

Periodic status reports describing the progress of the project are submitted periodically to management. These reports include: copies of field notes or daily field progress reports, compiled field data sets, and corrective action documentation. The Project Manager is notified immediately of situations requiring corrective action measures.

14.2 Laboratory Quality Assurance Reports

A project QA report that summarizes QA activities and QC data is issued to the QA Manager and Project Manager. Any laboratory QA situations requiring immediate corrective action is reported to the Project Manager.

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Quality Assurance Project Plan Attachments

OIL IN SOIL ™

Manufacturers of Petroleum & DNAPL Screening Kits

OIL-IN-SOIL™

Oil Screening Test Kit

Instruction Manual

OIL IN SOIL, LLC
6 Queen Anne Road
Levittown, PA 19057 USA
Tel: (215) 687-0355
www.oil-in-soil.com

"Congratulations on purchasing the easiest and fastest test kit available today for screening hydrocarbons and DNAPL!"

INTRODUCTION:
The OIL-IN-SOIL™ screening kit is composed of a styrene bottle; a label indicating recommended soil and water levels; a small Styrofoam ball, and a cube containing finely dispersed dyes which is glued to the inside of the jar lid.

In the **Sudan IV** version of the screening test kit the cube is impregnated with two dyes:

- A deminimis amount of **SUDAN IV**, a Red Azo Dye soluble in most DNAPL and petroleum which stains the oils and petroleum products, and a
- Fluorescent Green/Yellow water soluble dye to color the water and provide a visual backdrop for the red dye.

The dual dye method is employed to improve detection by the user. The other soil test kits all contain the single dye indicated by the product name.

USING THE KIT:
OIL-IN-SOIL kits are designed with ease of use in mind. Simply follow the instructions on the label:

Step 1 Fill the bottle with soil to the line "*Fill soil to HERE*"
  Note: Do not compact the soil.
Step 2 Fill the bottle to the line "*Fill water to HERE*" →
  Note: ensure water is warm enough to dissolve the cube.
Step 3 Replace cap on bottle and shake jar until cube is **completely** dissolved.

If DNAPL or petroleum is present in the sample a red meniscus (or red spots on the side of the jar) will appear within 30-60 seconds. If color is not immediately apparent in the jar – check the polystyrene ball. The presence of ANY color on the ball (even a faint pink halo or hue) indicates the presence ore more than 500ppm TPH in that sample material. Conversely, a “clean” ball indicates that there is less than 500ppm TPH.

Note: Most DNAPLs dissolve styrene. Therefore, red spots may appear on the sides of the jar.

Note: Whenever possible, use potable water for the screening tests. However, salt water can be used if necessary.

Cold water can inhibit the rapid release of viscous hydrocarbons from soil and cause False Negative results. Therefore, at temperatures below 68º F (20º C), we recommend users carry a thermos of hot water for field testing purposes.

RECOMMENDED PROTECTIVE EQUIPMENT:

Please follow safety instructions outlined in the MSDS. Always use gloves and safety glasses when using the OIL-IN-SOIL™ kits.

DISPOSAL OF USED KITS:
As per the MSDS and local regulations.

MANUFACTURER'S GUARANTEE:

We will replace any broken or defective kits purchased.

If you are not satisfied with our product, return any defective kits to OIL-IN-SOIL for a refund. We reserve the right not to provide refunds if the kits have been tampered with in any way, or if not used in accordance the OIL-IN-SOIL MSDS and Instruction Manual.

OIL IN SOIL, LLC
Levittown, Pennsylvania
USA

info@oil-in-soil.com

Material Safety Data Sheet
To comply with OSHA's Hazard Communication Standard, 29 CFR 1910.120

OIL-IN-SOIL Test Kit
CAS 3 85-83-6 (SUDAN IV; OIL REB"B")

SECTION I – Manufacturer and International Distributors

Manufacturer:
OIL IN SOIL, LLC
6 Queen Anne Road
Levittown, PA USA 19057
1 (215) 687-0355
info@oil-in-soil.com

All Products are produced in and shipped from Pennsylvania USA
Date of MSDS Preparation 6/7/96

SECTION II --Composition Information on Ingredients

Dyes are dispersed in a sugar cube that has an approximate weight of 2.4 g. The red dye, is a standard dye used throughout the oil industry to color the oil red, is a possible mutagen but its weight is less than 0.1 percent. The fluorescent green dye comprises less than 1 percent of the weight of the dye cube and is not hazardous.

SECTION III -- Physical Characteristics

Property
Melting point - 186 ^{o}C
Specific gravity - 1.58

Solubility in water -sugar cube - very soluble
(water soluble dye - very soluble)
(red oil dye - insoluble in water soluble in oil or other hydrocarbons)

Flammability limit - Unknown
Extinguishing media - Water or foam
Special Fire Fighting Procedures - None

SECTION IV -- Reactivity Data

Stability - All Components are STABLE.
Incompatibility - None
Hazardous decomposition production - Stable compounds
Hazardous Polymerization - Will not occur
Conditions to Avoid - Fire

SECTION V -- Health Hazard Information

First Aid
If swallowed wash out mouth. If dye comes in contact with skin thoroughly wash area with soap and water.
Eye Contact
Flush eyes with large amounts of water for 15 minutes. Seek medical attention.
Skin Contact
Wash hands thoroughly with soap and water.

SECTION VI -- Spill, Leak and disposal Procedure

Spills and Leaks: Dig up the soil that kit material has spilled on. If spilled on hard surface soak up spill and wash
with detergent and water.
Disposal: Dispose of soil with oily soil. Dispose of cleanup absorbent with other absorbent material.

SECTION VII -- Special Precautions

Respiratory Protection:
None required if dye cube not crushed to powder. If crushed use dust mask.

Ventilation:
Use in open air.
Protective Gloves:
Always use protective vinyl or polyethylene gloves.
Eye Protection:
Always wear safety glasses

SECTION VIII --Special Precautions
Storage Information:
Keep away from temperatures greater than 140^{o}F (Adhesive for dye cube may melt). Dye cube may crack with sudden
shock at temperatures less than 32 ^{o}F**. Avoid inhaling any dust from dye cube!**

DOT Class - Non flammable

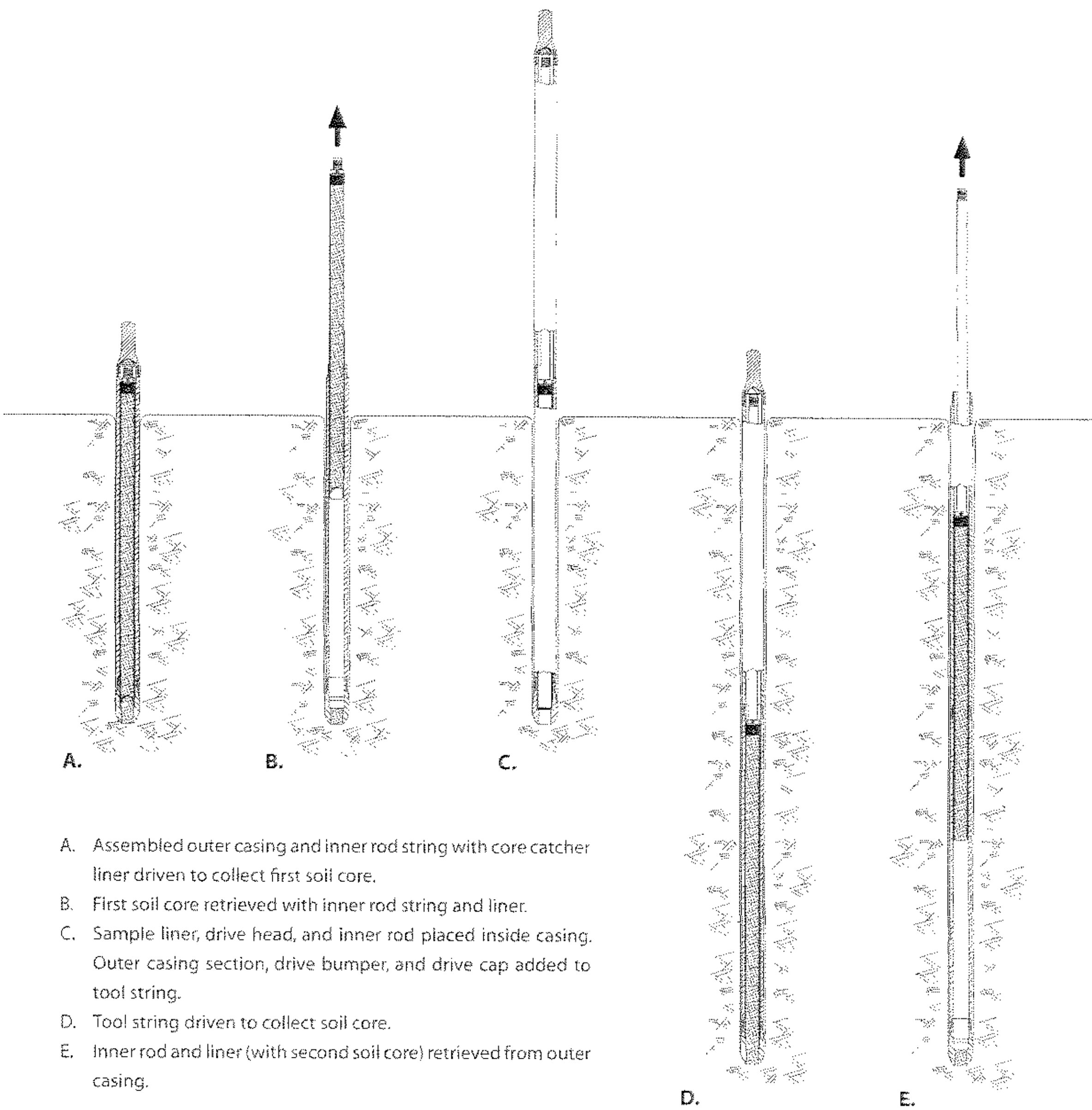
Geoprobe® DT22 Dual Tube Soil Sampling System

Continuous Core Soil Sampler

Standard Operating Procedure

Technical Bulletin No. MK3140

PREPARED: November, 2006



A. Assembled outer casing and inner rod string with core catcher liner driven to collect first soil core.
B. First soil core retrieved with inner rod string and liner.
C. Sample liner, drive head, and inner rod placed inside casing. Outer casing section, drive bumper, and drive cap added to tool string.
D. Tool string driven to collect soil core.
E. Inner rod and liner (with second soil core) retrieved from outer casing.

OPERATION OF THE DUAL TUBE 22 SOIL SAMPLING SYSTEM

Geoprobe Systems®

Geoprobe® and Geoprobe Systems® are
Registered Trademarks of Kejr, Inc., Salina, Kansas

1.0 OBJECTIVE

The objective of this procedure is to collect a representative soil sample at depth through an enclosed casing 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, soil conductivity and contaminant logging, grouting, and materials injection.
** Geoprobe® is a registered trademark of Kejr Engineering, Inc., Salina, Kansas*

Dual Tube 22 Soil Sampling System: A direct push system for collecting continuous core samples of unconsolidated materials from within a sealed casing of Geoprobe® 2.25-inch (57 mm) OD probe rods. Samples are collected and retrieved within a liner that is threaded onto the leading end of a string of Geoprobe® 1.25-inch (32 mm) OD probe rods and inserted to the bottom of the outer casing. Collected samples measure up to approximately 800 ml in volume in the form of a 1.125-inch x 48-inch (29 mm x 1219 mm) core.

Liner: A 1.375-inch (35 mm) OD thin-walled, PETG tube that is inserted into the outer casing on the leading end of the inner rod string for the purpose of containing and retrieving core samples. Liners are available in two configurations; a simple open tube or a tube with a core catcher permanently attached to the leading end. Nominal liner lengths include 24 inches, 36 inches, 1 meter, and 48 inches.
***Nominal liner length identifies the length of tools with which the liner is used (see Page 8). The actual end-to-end lengths of the various DT22 liners will differ from the specified nominal lengths.*

Core Catcher: A dome-shaped device positioned at the leading end of a liner to prevent loss of collected soil during retrieval of the liner and soil core. Flexible fingers at the top of the core catcher are pushed outward by soil entering the liner during advancement of the tool string. As the filled liner is subsequently retrieved, the fingers of the core catcher move back inward, effectively closing off the end of the liner and limiting soil loss. The core catcher designed for the DT22 system is made of PETG material and is permanently fused to the liner.

2.2 Discussion

Dual tube sampling gets its name from the fact that two sets of probe rods are used to retrieve continuous soil core samples from the subsurface. One set of rods is driven into the ground as an outer casing (Fig. 2.1). These rods receive the driving force from the hammer and provide a sealed casing through which soil samples may be recovered. The second, smaller set of rods are placed inside the outer casing with a sample liner attached to the leading end of the rod string (Fig. 2.1). These smaller rods hold the liner in place as the outer casing is driven to fill the liner with soil. The inner rods are then retracted to retrieve the full liner.

Standard Geoprobe® 2.25-inch OD probe rods provide the outer casing for the DT22 Dual Tube Soil Sampling System. A cutting shoe is threaded into the leading end of the rod string. When driven into the subsurface, the cutting shoe shears a 1.125-inch OD soil core which is collected inside the casing in a clear plastic liner.

The second set of rods in the DT22 system are standard Geoprobe® 1.25-inch OD probe rods. A sample liner is attached to the end of these smaller rods and then inserted into the casing. The 1.25-inch rods hold the liner tight against the cutting shoe as the outer casing is driven to collect the soil core. Once filled with soil, the liner is removed from the bottom of the outer casing by lifting out the 1.25-inch rods.

The outer, 2.25-inch probe rods provide a cased hole through which to sample. The main advantage of sampling through a cased hole is that there is no side slough to contend with. In addition, the outer casing effectively seals the probe hole when sampling through perched water tables. These factors mean that sample cross-contamination is eliminated. The DT22 sampling system is therefore ideal for continuous coring in both saturated and unsaturated zones.

Solid Drive Tip

A Solid Drive Tip (22956) can be placed on the leading end of the 1.25-inch probe rod string in place of a sample liner (Fig. 2.2). When installed in the outer casing, the drive tip firmly seats within the cutting shoe and effectively seals the tool string as it is driven into the subsurface. This enables the operator to advance the outer casing to the bottom of a pre-cored hole or through undisturbed soil to reach the top of the sampling interval.

Grouting

The DT22 system allows bottom-up grouting through the primary tool string. This means that a cement or bentonite grout mix can be pumped through the outer casing as it is withdrawn from the ground. This is in contrast to most other soil samplers which require driving a second set of tools back down the probe hole in order to deliver the grout mix.

Monitoring Well Installation

An expendable cutting shoe enables the operator to install a Geoprobe® Prepacked Screen Monitoring Well through the outer casing of the DT22 Dual Tube System. After the collection of continuous soil cores to the desired depth, prepacked screens can be inserted to the bottom of the outer casing on the leading end of a PVC riser string. The well is finished, complete with grout barrier, bentonite well seal, and a high-solids bentonite slurry/neat cement grout, during retrieval of the outer casing.

Groundwater Profiler

The DT Groundwater Profiler Kit (GW2100) brings groundwater sampling to the dual tube system. With these tools, operators can perform soil sampling, groundwater sampling, and slug testing at multiple depth intervals in one probe push.

The DT profiler utilizes a 3/4-inch Schedule 40 PVC screen with a slotted length of 12 inches. Standard Geoprobe® extension rods are used to install and retrieve the screen through the cutting shoe on the leading end of the outer casing. This ability to install and retrieve the screen with the outer casing in place allows for alternating of soil and groundwater sampling and slug testing in a single probe push.

For specific information on using the DT profiler, refer to *Dual Tube (DT21) Groundwater Profiler Kit - Installation and Operation Instructions* (Geoprobe® Instructional Bulletin No. 19275).

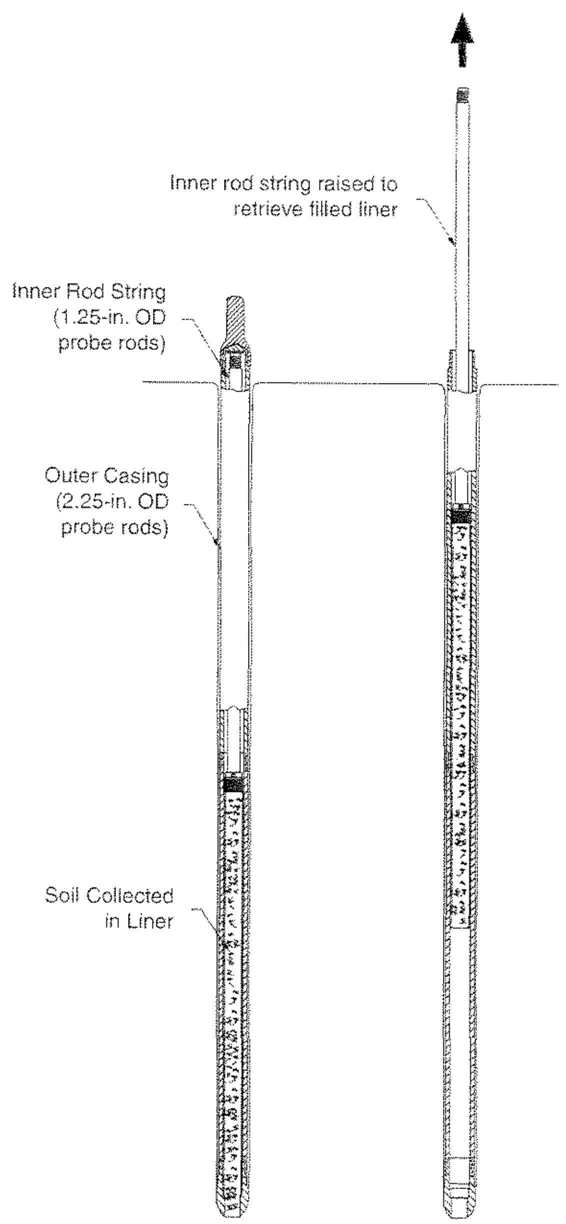


FIGURE 2.1
Outer Casing Driven With Liner

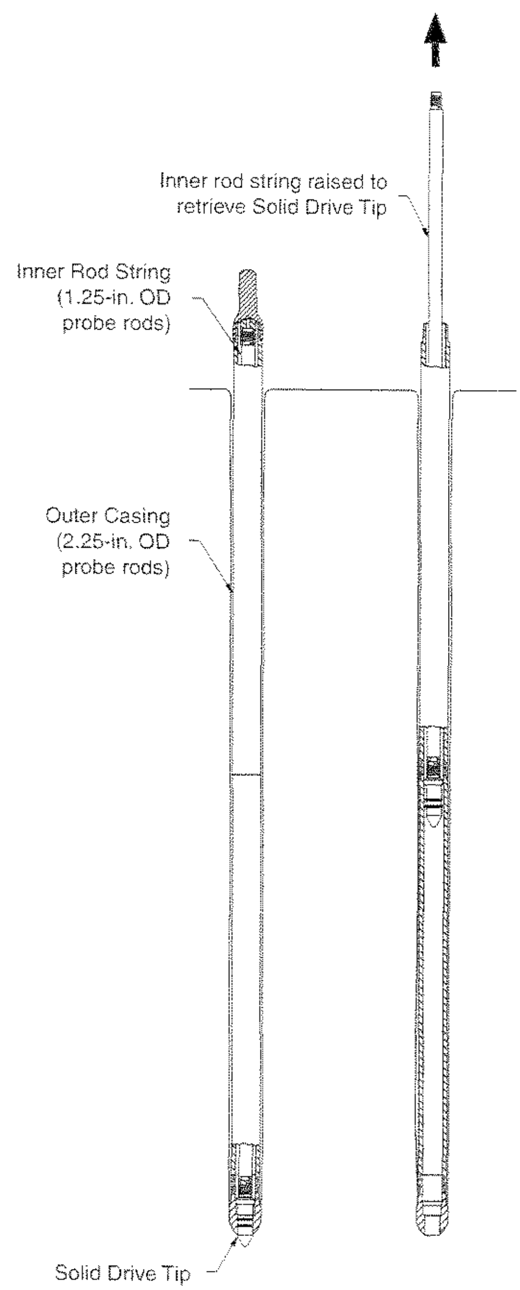


FIGURE 2.2
Outer Casing Driven With Solid Drive Tip

3.0 REQUIRED EQUIPMENT

The following equipment is used to recover samples with the Geoprobe® Dual Tube 22 Soil Sampling and probing systems. Refer to Figure 3.1 for parts identification.

DUAL TUBE 22 SAMPLER PARTS	QUANTITY	PART NUMBER
DT21 Drive Bumper, Pkg. of 5	-1-	DT4010K
DT22 Threadless Drive Cap, for 1.25-inch rods	-1-	22955
DT22 Cutting Shoe, Standard	-1-	25341
DT22 Expendable Cutting Shoe Holder	-1-	29402
DT22 Expendable Cutting Shoe, 2.375 in. OD	variable	DT4045
O-rings for Expendable Cutting Shoe, Pkg. of 50	variable	DT4045R
DT21 Liner Drive Head Assembly, for 1.25-inch rods	-1-	DT4052
Rebuild Kit for DT21 Liner Drive Head	-1-	DT4051K
DT21 Solid Drive Tip, for 1.25-inch rods	-1-	22956
O-rings for Solid Drive Tip, Pkg. of 25	variable	DT4070R
DT21 Vinyl End Caps, Pkg. of 100 (50 pair)	variable	DT4026K
DT21 Liner, PETG, 48-inch, Box of 50*	variable	DT4048K
DT21 Liner With Core Catcher, PETG, 48-inch, Box of 50*	variable	DT4148K
DT21 Liner Grooving Tool	-1-	18170
Universal Liner Holder	-1-	22734

GEOPROBE TOOLS AND EQUIPMENT	QUANTITY	PART NUMBER
Light Weight Center Rod, 1.25 inch OD x 48 inches	variable	21900
Probe Rod, 1.25 inch OD x 24 inches	variable	AT1224
O-rings for 2.125-inch Probe Rods	variable	AT2100R
GH60 Threadless Drive Cap for 2.25 inch rods*	-1-	31530
GH40 Threadless Drive Cap for 2.25 inch rods	-1-	31405
GH40 Threaded Drive Cap for 2.25 inch rods	-1-	25362
Pull Cap, for 2.25-inch rods	-1-	25298
Probe Rod, 2.25 inches OD x 48 inches*	variable	25300
Rod Grip Pull System, for GH40 Hammer	-1-	29461
Rod Grip Pull Handle, for GH60 Hammer and 2.25-inch rods**	-1-	29385

ADDITIONAL TOOLS	QUANTITY
Hex Key, 3/32 in.	-1-
Utility Knife (with straight blade)	-1-
Pipe Wrench	-2-

* The considerable percussive force of the GH60 Hydraulic Hammer may result in reduced tool life for components such as the DT21 Drive Bumper and rod string as compared to operation with the GH40 Hydraulic Hammer.

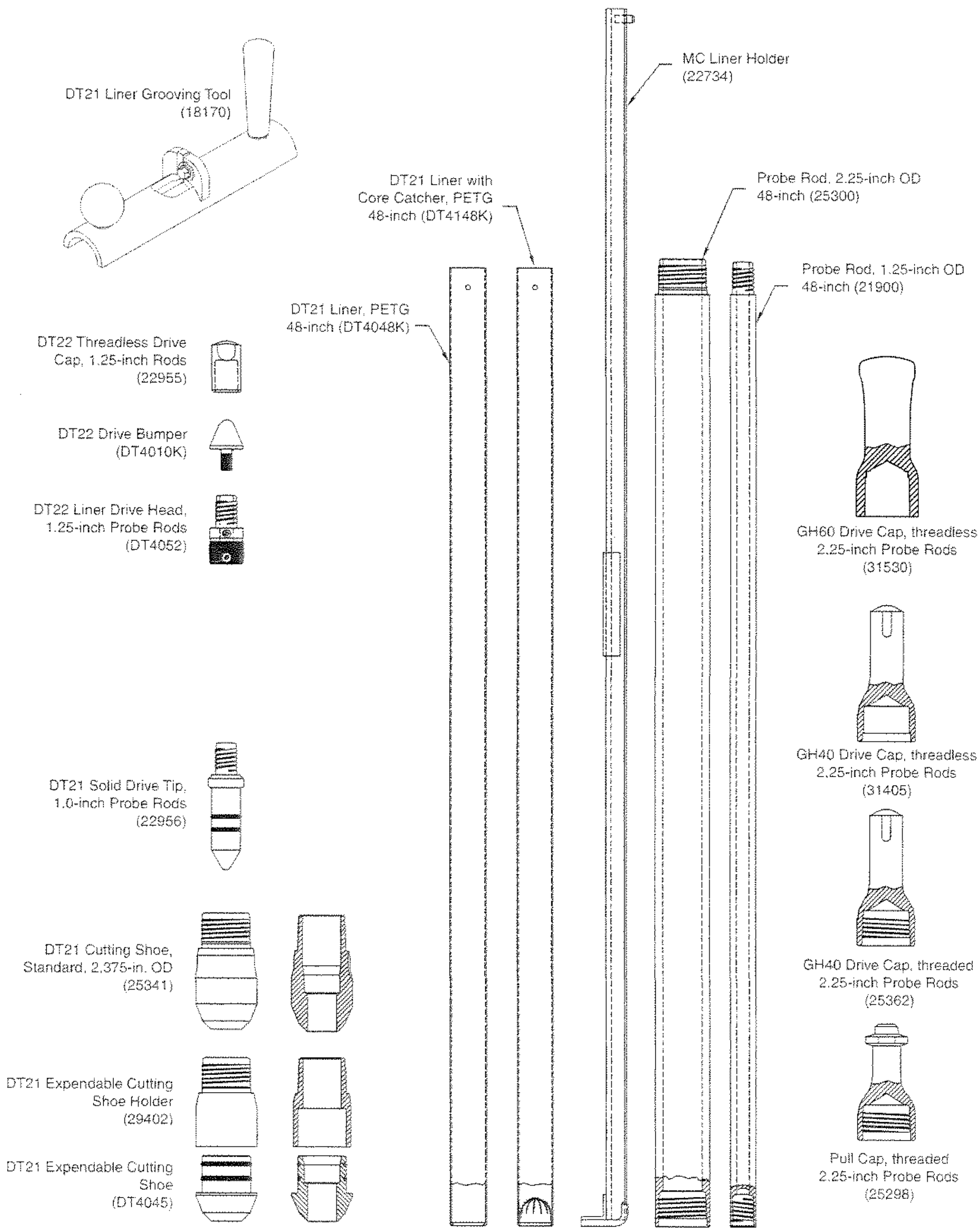


FIGURE 3.1
Dual Tube 22 Soil Sampling System Parts

3.1 Tool Options

Three major components of the DT22 Soil Sampling System are probe 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 DT22 Dual Tube System.

Probe Rods

Standard Geoprobe® 1.25-inch (32 mm) OD and 2.25-inch (57 mm) OD probe rods are required to operate the DT22 Soil Sampling System. The probe rods are available in 48 inches (1,219 mm) lengths. Both rod sets (1.25-inch and 2.25-inch) must be of the same length.

Sample Liners

Sample liners are made of a heavy-duty clear plastic for convenient inspection of the soil sample. A nominal length of 48 inches is available with an OD of 1.375 inches (35 mm).

Sample liners with integral core catchers are available in a nominal length of 48 inches. Utilize the core catcher liners when sampling flowing sands, noncohesive soils, extremely dry soils, or any other materials that fall from the liner during retrieval. DT22 core catcher liners are used with the same equipment as open sample liners. No special tooling or adapters are required.

Cutting Shoes

The standard DT22 Cutting Shoe is available for use with the DT22 Dual Tube System (Fig. 3.2). The DT22 sampling system may also employ an expendable cutting shoe. In this arrangement, a DT22 Expendable Cutting Shoe Holder (29402) is threaded into the leading end of the outer casing. A DT21 Expendable Cutting Shoe (DT4045) is then inserted into the holder. Upon completion of soil sampling, the outer casing is withdrawn slightly. The expendable cutting shoe detaches from the holder, leaving an open casing through which a prepacked screen monitoring well may be installed. Dimensions for the expendable cutting shoe are the same as the standard cutting shoe (ID = 1.125 in. (29 mm) and OD = 2.375 in. (60 mm)).

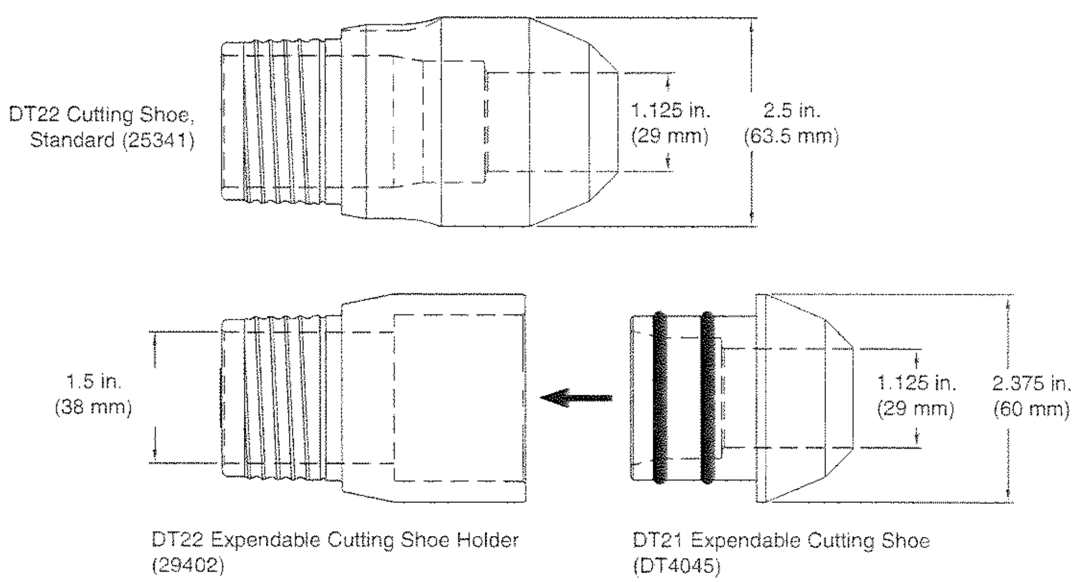


FIGURE 3.2
Cutting Shoe Options for the DT22 Dual Tube Soil Sampling System

4.0 OPERATION

4.1 Decontamination

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

4.2 Operational Overview

The DT22 Soil Sampling System is designed to collect continuous soil cores. Sampling may begin either from ground surface or a predetermined depth below ground. Once sampling begins, consecutive soil cores must be removed as the outer casing is advanced to greater depths.

When sampling is to begin at the ground surface, the first soil core should be collected using a core catcher liner to maximize sample recovery (Fig. 4.1-A). This is especially true when the first core is composed of dry, loose soil. Upon removal of the first liner and soil core (Fig. 4.1-B), a new liner is inserted to the bottom of the outer casing on the end of an inner rod. A section of outer casing is added to the tool string (Fig. 4.1-C) and the entire tool string is driven to fill the liner with soil (Fig. 4.1-D). The filled liner is removed from the outer casing to retrieve the second soil core (Fig. 4.1-E). A new liner is then inserted to the bottom of the outer casing and the process is repeated over the entire sampling interval.

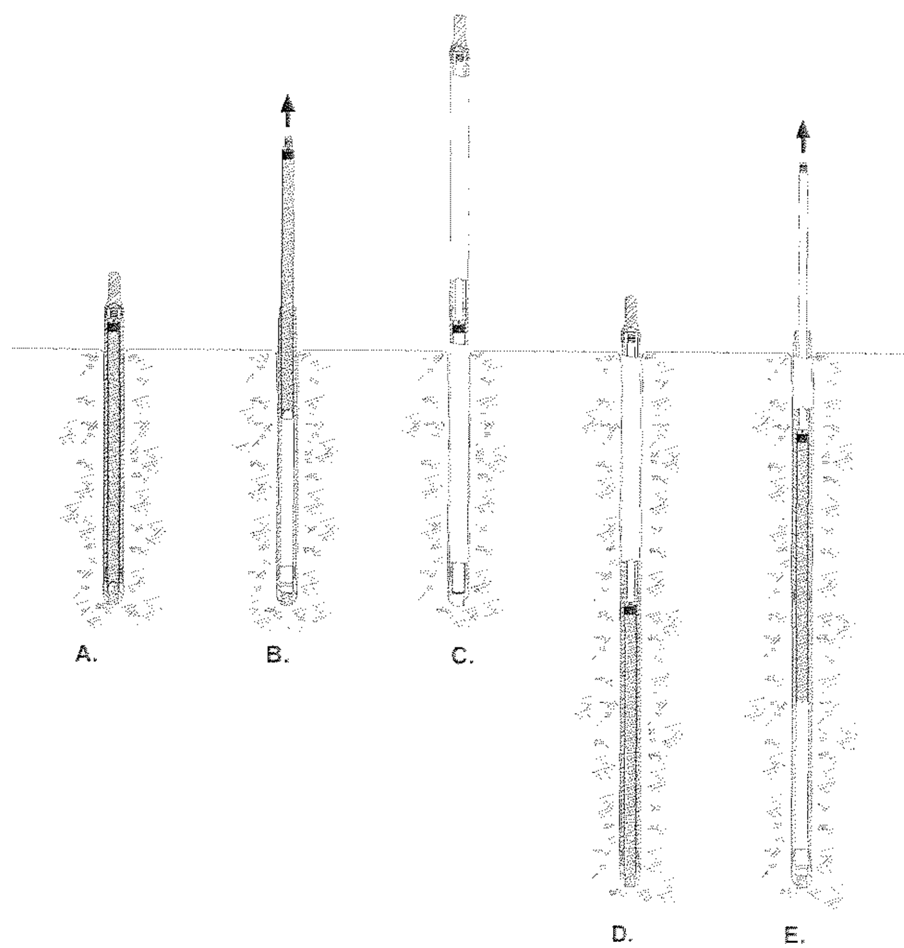


FIGURE 4.1
Continuous Core Sampling From Ground Surface with Dual Tube 22 System

When the sampling interval begins at some depth below ground surface, a DT22 Solid Drive Tip is installed in the outer casing and the entire assembly is driven from ground surface directly through undisturbed soil (Fig. 4.2-A). This enables the operator to reach the top of the sampling interval without stopping to remove unwanted soil cores. Once the interval is reached, the solid drive tip is removed (Fig 4.2-B) and sampling continues as described in the preceding paragraphs (Fig. 4.2-C, Fig. 4.2-D, and Fig. 4.2-E).

Specific instructions for the assembly and operation of the DT22 Dual Tube Soil Sampling System are given in the following sections.

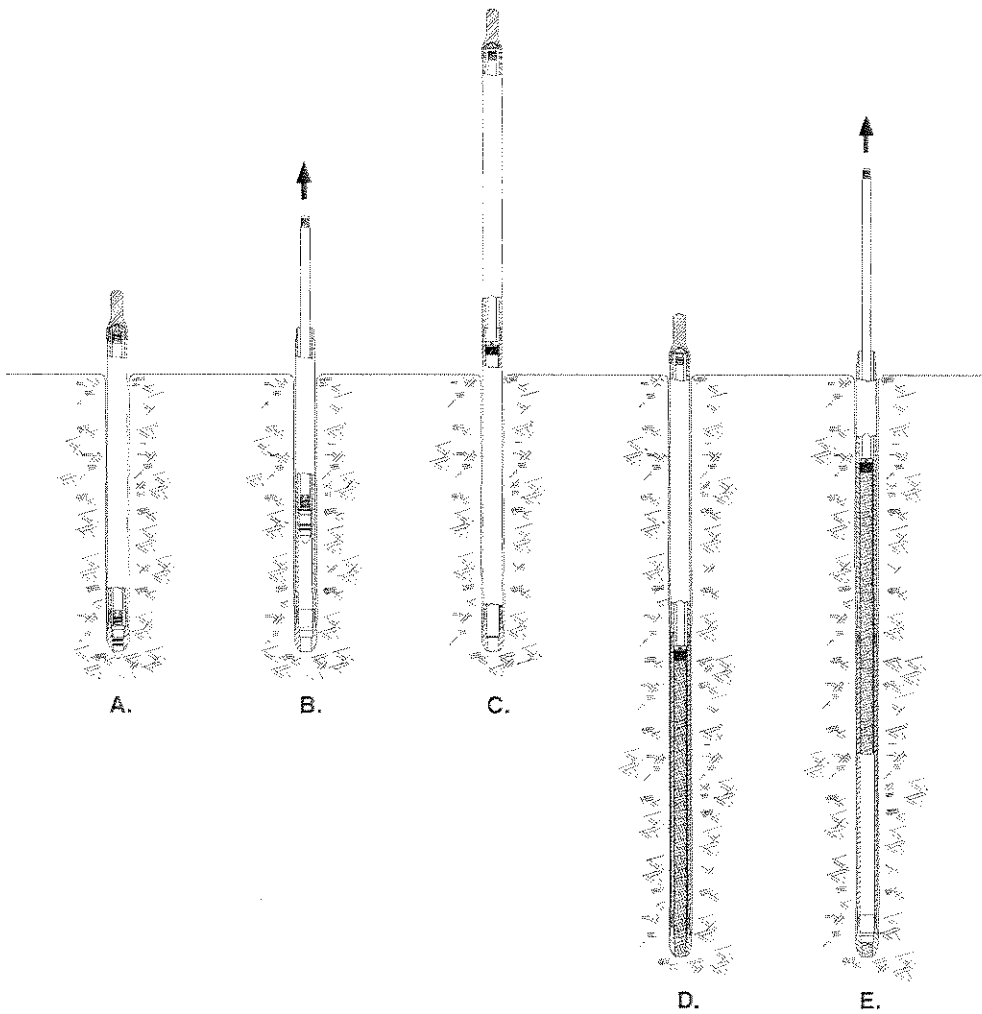


FIGURE 4.2
Outer Casing Driven Through Undisturbed Soil to Begin Sampling with DT22 System

4.3 Assembling and Driving the Outer Casing Using a DT21 Solid Drive Tip

If soil sampling is to begin at some depth below ground surface, the outer casing of the DT22 Dual Tube System can be driven to the top of the sampling interval with a DT22 Solid Drive Tip installed in the leading end. The solid drive tip seals the outer casing as it is driven to depth. Once the desired sampling interval is reached, the solid drive tip is removed to allow collection of the first soil core. This section describes assembling and driving the outer casing using the DT22 Solid Drive Tip.

1. When using a DT22 Standard Cutting Shoe (25341) install an O-ring (AT2100R) at the base of the threads as shown in Figure 4.3. If using an expendable cutting shoe, install an AT2100R O-ring on the DT22 Expendable Cutting Shoe Holder (29402) and two DT4045R O-Rings on the DT21 Expendable Cutting Shoe (DT4045) (Fig. 4.3).

2. Thread the DT22 Cutting Shoe or DT22 Expendable Point Holder into the leading end of a 2.25-inch OD Probe Rod (25300). Completely tighten the cutting shoe or cutting shoe holder using a pipe wrench.

3. Install an O-ring (DT4070R) in both grooves of the DT22 Solid Drive Point (22956) (Fig.4.4).

4. Thread the solid drive point into the female end of a 1.0-inch OD probe rod of the same length as the 2.125-inch probe rod (outer casing).

5. Lubricate the O-rings on the solid drive point with a small amount of deionized water. Insert the point and probe rod into the outer casing until the point partially extends from the bottom of the cutting shoe.

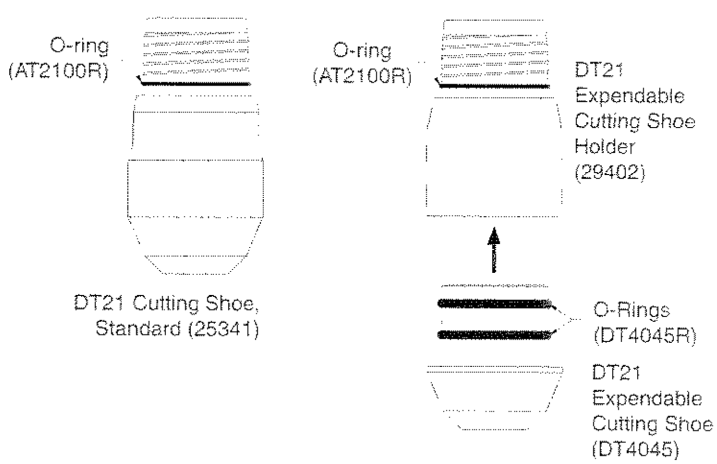


FIGURE 4.3
DT22 Cutting Shoes Utilize O-ring Seals

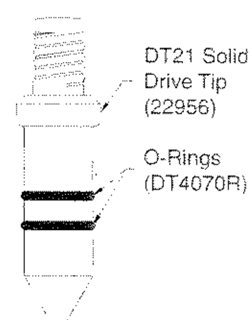


FIGURE 4.4
Solid Drive Point Utilizes Two O-Rings

6. Place a DT22 Threadless Drive Cap (22955) on top of the inner rod (Fig. 4.5). This drive cap is threadless for quick installation/ removal, yet still provides protection for the probe rod threads.

7. Thread a GH40 Drive Cap (25362) or GH60 Threadless Drive Cap (25296) onto the 2.25-inch probe rod (outer casing) as shown in Figure 4.5.

   For GH40 Users: Current 25362 Drive Caps are manufactured using a process that leaves an angled surface inside the cap (Fig. 4.6). This provides room for the Threadless Drive Cap (22955).

   For GH60 Users: A GH60 Threadless Drive Cap (25296) is recommended for the 2.25-inch probe rods when driving the DT22 system. The GH60 Threaded Drive Cap (25362) secures the inner rod string during percussion so that the outer casing and inner rod string are advanced as one assembly. The standard threadless drive cap may allow the outer casing to advance slightly ahead of the inner rod string, resulting in poor sample recovery and alignment problems when adding rods to the tool string.

   NOTE: Do not allow the threaded drive cap to unthread more than approximately 1/8 inch while driving the tool string. Failure to keep the drive cap tight during percussion will fuse the drive cap to the outer casing and permanently damage the threads of both the drive cap and top probe rod.

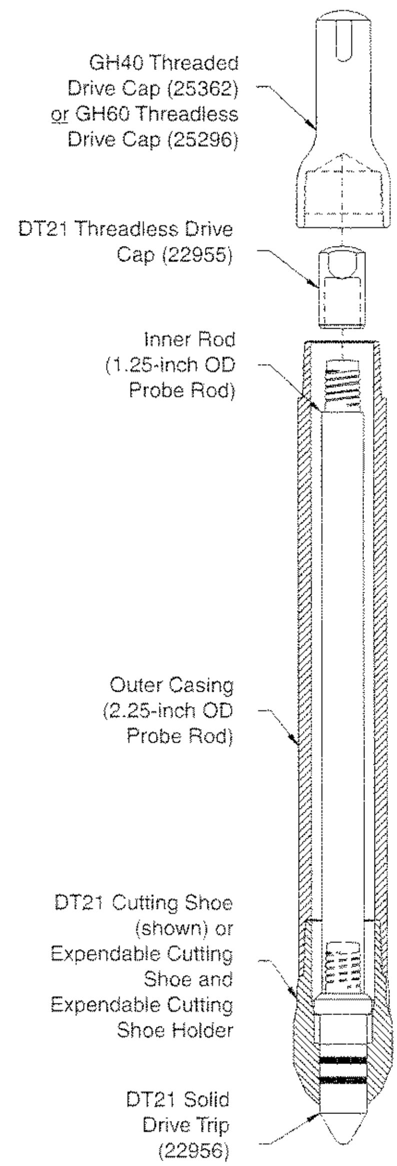


FIGURE 4.5
Outer Casing with Solid Drive Tip

8. Place the assembled outer casing section under the direct push machine for driving. Position the casing directly under the hammer with the cutting shoe centered between the toes of the probe foot.

9. Lower the hydraulic hammer onto the drive cap and advance the outer casing into the subsurface.

10. Raise the hydraulic hammer and remove the drive cap from the outer casing and the threadless drive cap from the inner rod string.

11. Place an O-ring (AT2100R) on the outer casing section that extends from the ground (Fig. 4.7).

12. Thread a 1.0-inch probe rod onto the inner rod string. Place a 2.25-inch probe rod over the inner rods and thread it onto the outer casing (Fig. 4.8). Completely tighten the outer casing using a pipe wrench.

13. Place the threadless drive cap on top of the inner rod. Thread the 2.25-inch drive cap over the threadless drive cap and onto the outer casing.

14. Lower the hydraulic hammer onto the drive cap and advance the outer casing into the subsurface.

   Repeat Steps 10-13 until the leading end of the outer casing is at the top of the proposed sampling interval. Continue with Step 15 to remove the DT22 Solid Drive Point for sampling.

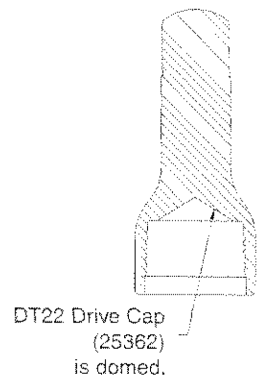


FIGURE 4.6
DT22 Drive Cap

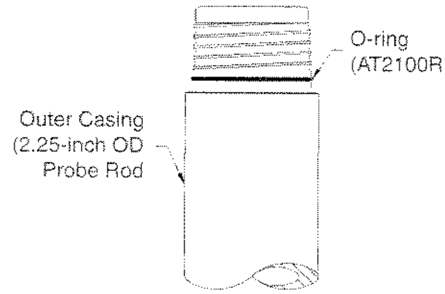


FIGURE 4.7
Outer Casing Joints are Sealed with O-Rings

15. Raise the hydraulic hammer and retract the probe derrick to provide access to the top of the tool string.

16. Unthread the 2.25-inch drive cap and remove the threadless drive cap from the inner rods.

17. Thread a 1.25-inch OD probe rod onto the inner rod string. Lift and remove the inner rods from the outer casing. The DT21 Solid Drive Point is removed from the leading end of the casing with the inner rods.

The outer casing is now ready for sampling.

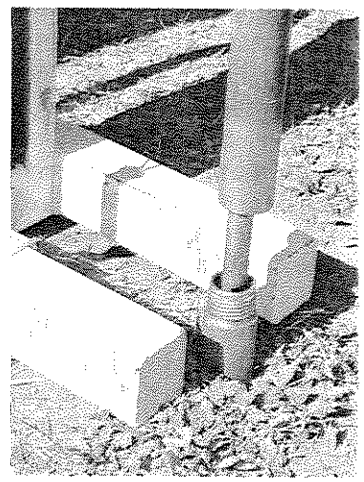


Figure 4.8. Place a 2.25-inch probe rod over the 1.25-inch rod and thread it onto the outer casing string.

4.4 Liner Drive Head Assembly

The main function of the DT22 Liner Drive Head Assembly (DT4052) is to connect a liner to the leading end of the inner rod string. This enables the inner rods to hold the liner tight against the cutting shoe to fill the liner with soil as the outercasing is driven. The inner rods are then used to retrieve the liner and soil core from within the outer casing.

The liner drive head assembly includes an internal check ball to improve sample recovery (Fig. 4.9) A considerable vacuum is created below the filled liner as it is lifted from the bottom of the outer casing. Because the inner rod string and liner drive head are hollow, atmospheric air can travel through the rods creating a positive pressure differential above the soil core during retrieval. The check ball seals the liner drive head to eliminate air flow into the liner which could otherwise push the soil sample out of the liner. The check ball also allows air to escape up through the liner drive head and inner rod string when lowering a new liner down the outer casing and as soil enters the liner during sampling.

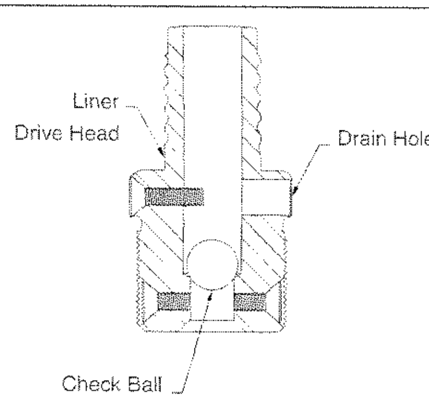


FIGURE 4.12
Cross-Section of Liner Drive Head

Saturated conditions can also challenge sample recovery. Water enters the outer casing either from the saturated formation or is deliberately poured from the ground surface to keep flowing sands out of the casing. As with air in unsaturated formations, the check ball lets water pass through the liner drive head as a new

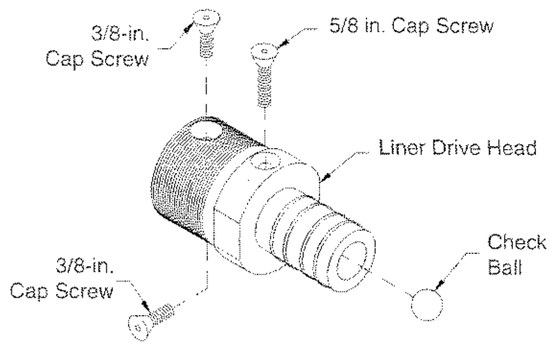


FIGURE 4.10
Liner Drive Head Assembly Components

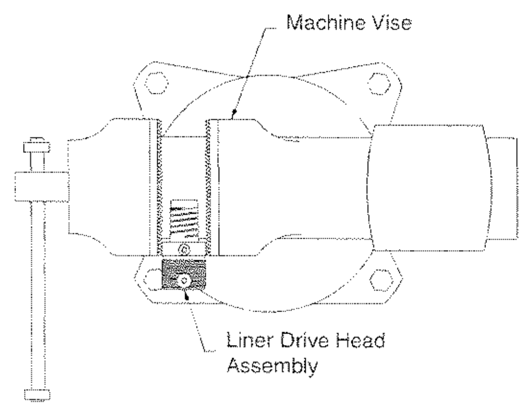


FIGURE 4.11
Place Liner Drive Head in Vise

liner is lowered to the bottom of the casing and during sampling as the liner is filled with soil. The check ball then seals the drive head during retrieval so that water draining from the inner rods does not wash the sample out the bottom of the liner. A drain hole located on the side of the liner drive head (Fig. 4.9) allows water to exit the inner rods and travel harmlessly along the outside of the liner.

The liner drive head assembly is made up of five parts as shown in Figure 4.10. The two 3/8-inch flat head socket cap screws are used to attach liners to the liner drive head. The longer 5/8-inch flat head socket cap screw holds the stainless steel check ball within the liner drive head. To disassemble the liner drive head for cleaning, simply unthread the 5/8-inch cap screw and remove the check ball.

Instructions for attaching a liner to the DT22 Liner Drive Head Assembly (DT4052) are given below.

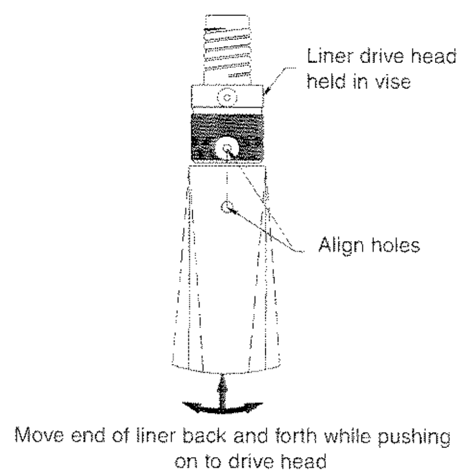


FIGURE 4.12
Push Liner Onto Liner Drive Head

1. Visually inspect the liner drive head assembly to ensure that the check ball moves freely within the drive head and the drain hole is unobstructed.

2. Place the liner drive head assembly in a machine vise so that either one of the 3/8-inch caps screws is on top as shown in Figure 4.11.

   NOTE: Only one 3/8-inch cap screw is used to attach a liner to the liner drive head assembly. Two 3/8-inch cap screws are included on the drive head to provide a backup in case one incurs thread damage. Either cap screw may be used to attach the liner.

3. Remove the 3/8-inch cap screw using a 3/32-inch hex key.

4. Place the open end of a DT21 Liner against the bottom of the liner drive head. Align the hole in the liner with the hole in the liner drive head as shown in Figure 4.12. Wiggle the free end of the liner back-and-forth while pushing the liner onto the drive head (Fig. 4.12).

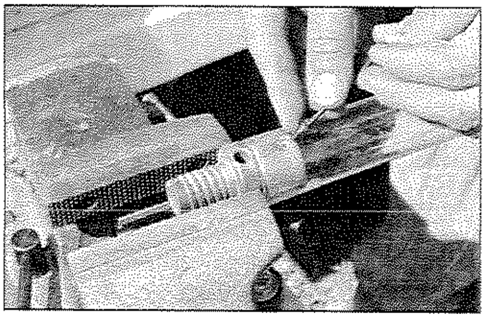


Figure 4.13. Thread cap screw into liner drive head to secure liner.

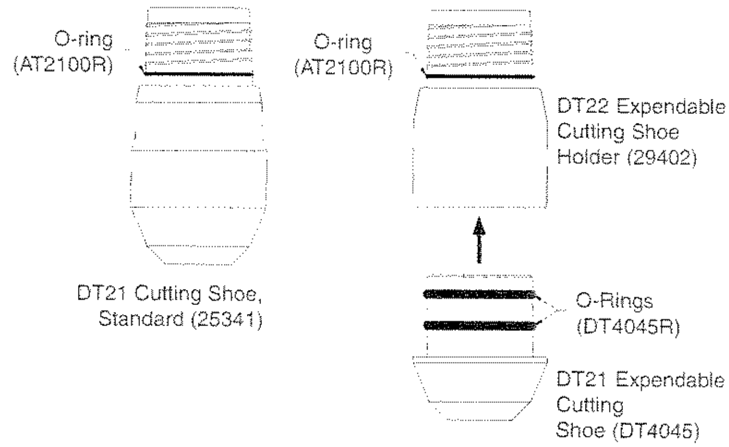


FIGURE 4.15
DT21 Cutting Shoes Utilize O-ring Seals

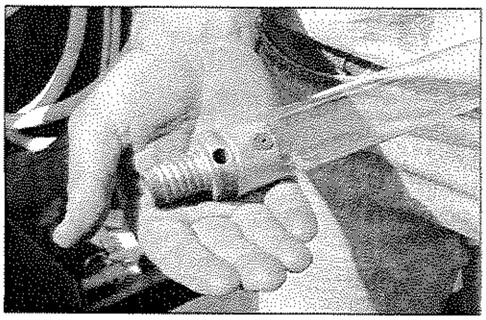


Figure 4.14. Liner attached to liner drive head and ready for sampling.

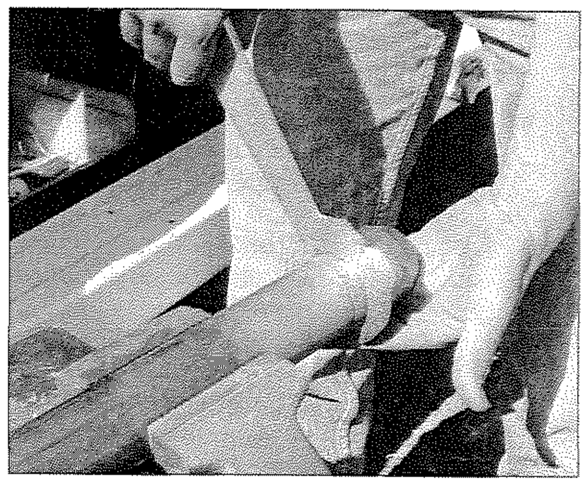


Figure 4.16. Place probe rod (outer casing) in vise and tighten cutting shoe with MC Combination Wrench.

5. Thread the 3/8-inch cap screw through the liner and back into the liner drive head (Fig. 4.13). Tighten the cap screw with the 3/32-inch hex key.

   The DT21 Liner is now attached to the DT22 Liner Drive Head Assembly (Fig. 4.14).

4.5 Soil Core Collection

This section describes collection of continuous soil core samples from within the sealed outer casing of the DT22 Dual Tube Soil Sampling System. The procedure is written for a sampling series that begins at the ground surface. If sampling is to begin after driving the outer casing through undisturbed soil using a DT21 Solid Drive Tip, skip ahead to Step 13 of this section.

1. Install an O-ring (AT2100R) at the base of the threads on the Standard Cutting Shoe (25341) as shown in Figure 4.15. If using an expendable cutting shoe, install an AT2100R O-ring on the expendable cutting shoe holder and two DT4045R O-Rings on the expendable cutting shoe (Fig. 4.15).

2. Thread the DT22 Cutting Shoe or DT22 Expendable Point Holder into the leading end of a 2.25-inch OD Probe Rod (25300). Completely tighten the cutting shoe or cutting shoe holder using a machine vise and pipe wrench as shown in Figure 4.16.

3. Attach a DT22 Liner Drive Head Assembly (DT4052) to a new liner as described in Section 4.4. A core catcher liner is recommended for when the first soil core begins at ground surface as this configuration will provide maximum sample recovery.

4. Insert the liner and drive head into the 2.25-inch OD probe rod such that the core catcher contacts the cutting shoe as shown in Figure 4.17.

5. Place a DT21 Drive Bumper (DT4010) on top of the liner drive head (Figure 4.17).

6. Thread a GH40 Drive Cap (25362) or GH60 Threaded Drive Cap (25296) onto the 2.25-inch probe rod (outer casing) as shown in Figure 4.17.

   NOTE: Do not allow the threaded drive cap to unthread more than approximately 1/8 inch while driving the tool string. Failure to keep the drive cap tight during percussion will fuse the drive cap to the outer casing and permanently damage the threads of both the drive cap and top probe rod.

7. Place the assembled outer casing section under the direct push machine for driving. Position the casing directly under the hydraulic hammer with the cutting shoe centered between the toes of the probe foot.

8. Lower the hydraulic hammer onto the drive cap and advance the outer casing into the subsurface using continuous percussion.

9. Raise the hydraulic hammer and move the probe assembly back to provide access to the top of the tool string.

10. Remove the drive cap and drive bumper.

11. Thread a 1.25-inch Light Weight Center Rod onto the liner drive head. Rotate the probe rod and liner assembly two or three revolutions to shear the soil core at the bottom of the liner. Lift the probe rod and filled liner from the outer casing to retrieve the first soil core.

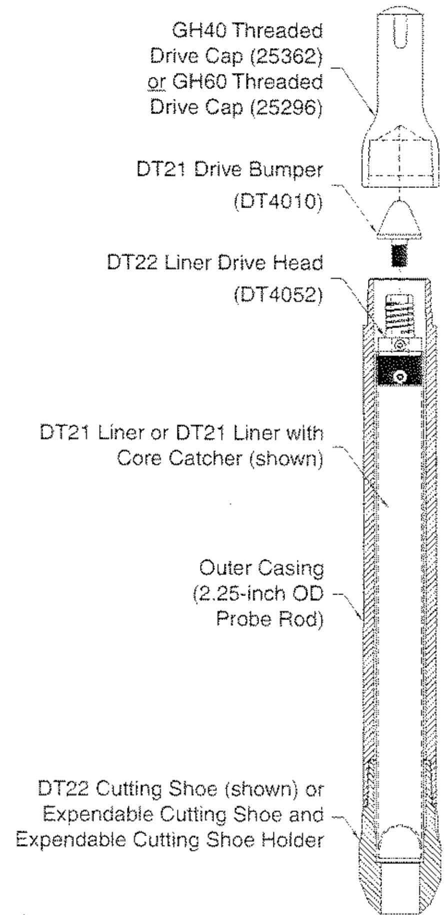


FIGURE 4.17
Outer Casing with DT22 Liner

12. Remove the filled liner from the liner drive head as described in Section 4.6. Prepare the soil core for subsampling or storage as specified by the project plan.

13. Place an O-ring (AT2100R) in the groove just below the male threads on the top section of the outer casing (Fig. 4.18).

14. Thread a 1.25-inch probe rod onto an assembled DT22 Liner Drive Head (DT4052) and DT21 Liner (Fig. 4.19).

15. Insert the liner and probe rod into the outer casing (Fig. 4.20). The inner rod will extend past the top of the outer casing if only one section of casing was previously driven into the ground. If the casing was driven to a greater depth, continue adding 1.0-inch probe rods until the last rod extends from the casing.

16. Place a 2.25-inch probe rod over the inner rods and thread it onto the outer casing (Fig. 4.21). Completely tighten the outer casing using a pipe wrench.

17. Place a DT21 Drive Bumper (DT4010) on top of the inner rod as shown in Figure 4.22.

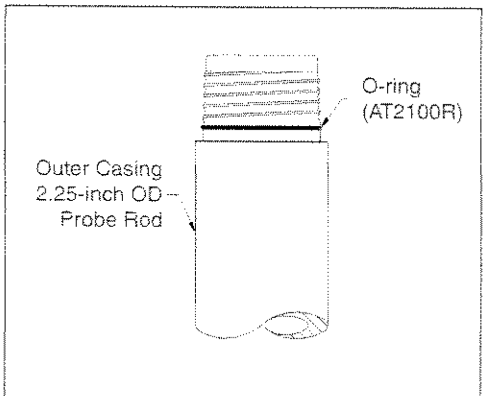


FIGURE 4.18
Outer Casing Joints are Sealed with O-Rings

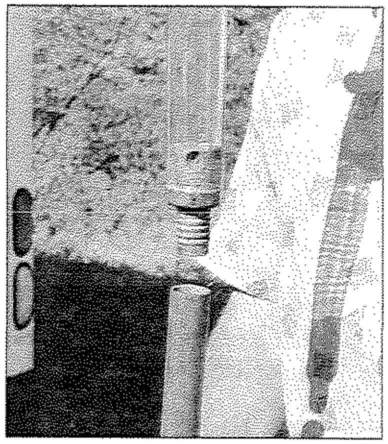


Figure 4.19. Thread liner and liner drive head into 1.25-inch Light Weight Center Rod.

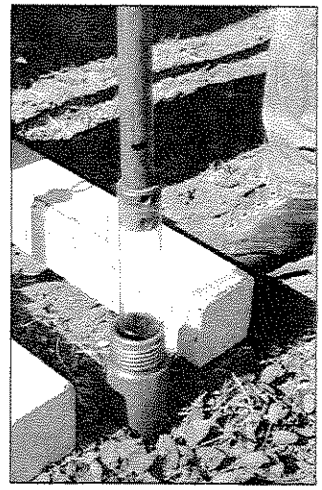


Figure 4.20. Lower liner to bottom of outer casing on leading end of inner rods.

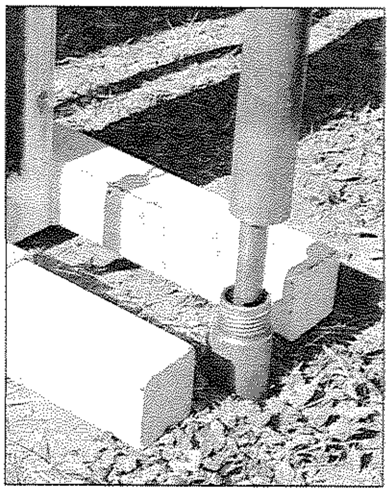


Figure 4.21. Place a 2.125-inch probe rod over the 1.0-inch probe rod and thread it onto the outer casing string.

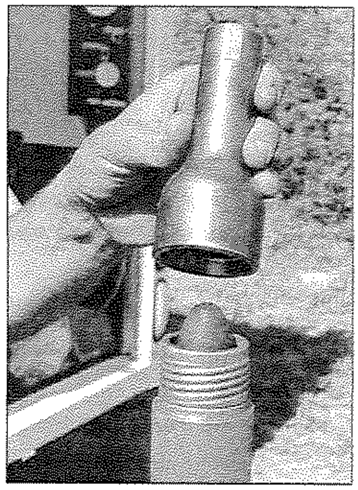


Figure 4.22. Place a drive bumper on top of the inner rods and thread a drive cap onto the outer casing.

Figure 4.23. Thread a 1.0-inch probe rod onto inner rod string to retrieve filled liner.

18. Thread a Drive Cap (25362 or 25296) onto the 2.25-inch probe rod (Fig.4.22). Completely tighten the drive cap with a pipe wrench. **(Refer to notes in Step 6 regarding Drive Caps.)**

19. Lower the hydraulic hammer onto the drive cap and advance the outer casing one liner length into the subsurface to collect the first soil core. Apply hammer percussion to the tool string as this helps move soil through the cutting shoe and into the liner for increased sample recovery.

20. Raise the hydraulic hammer and retract the probe derrick to provide access to the top of the tool string.

21. Unthread the drive cap and remove the drive bumper.

22. Thread a 1.25-inch Light Weight Center Rod onto the inner rod (Fig. 4.23). Rotate the inner rods two or three revolutions to shear the soil core at the bottom of the liner. Raise the inner rods to retrieve the filled liner.

23. Remove the filled liner from the liner drive head as described in Section 4.6.

(Repeat Steps 13-23 to collect consecutive soil core samples.)

4.6 Removing the DT22 Liner Drive Head from a Filled DT21 Liner

The liner drive head assembly remains attached to the filled liner after retrieval from the outer casing (Fig. 4.24). In order to decontaminate the drive head for further sampling, it must first be removed from the filled liner. This process is easily accomplished using a machine vise and sharp utility knife.

Place the liner drive head in the machine vise such that the 3/8-inch cap screw threaded through the liner is positioned on top. Remove the cap screw with a 3/32-inch hex key.

Using a utility knife, score a line from the top of the liner to the bottom of the drive head (Fig. 4.25). Move the free end of the liner side-to-side until the top of the liner splits and releases from the drive head (Fig. 4.26). The soil core may now be prepared for storage or analysis according to project guidelines.

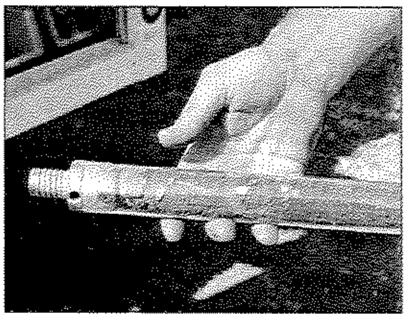


Figure 4.24. Liner drive head remains attached to filled liner after retrieval from outer casing.

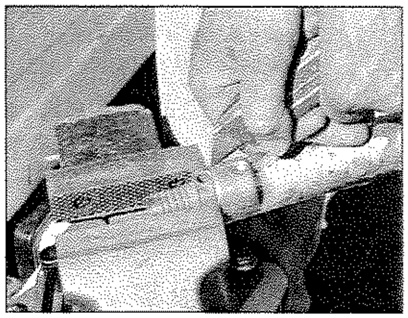


Figure 4.25. Score a line from top of liner to base of liner drive head using a utility knife.

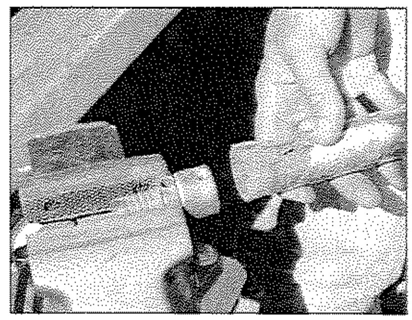


Figure 4.26. Move free end of liner back-and-forth to split liner and free it from the liner drive head.

4.7 Removing a Section of Liner with a DT21 Liner Grooving Tool and Utility Knife

A special tool is needed to help efficiently and safely cut through the thick DT21 liners in order to access the soil sample. The DT21 Liner Grooving Tool (18170, Fig. 4.27) greatly improves the liner cutting process by creating a deep longitudinal groove in the sample liner (Fig. 4.28). The sample liner is then easily cut along the groove with a normal utility knife.

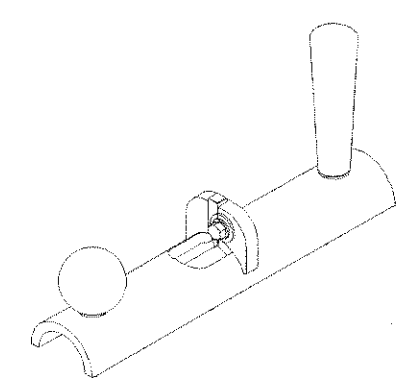


FIGURE 4.27
DT21 Liner Grooving Tool

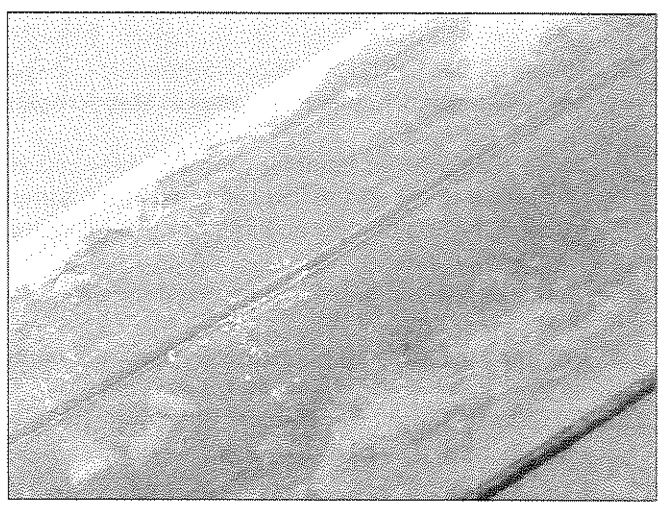


Figure 4.28. Groove in liner created by DT21 Grooving Tool.

Grooving the Liner

Because DT21 liners are flexible and will bend under load, a means of holding the liner is absolutely necessary in order to successfully operate the grooving tool. A Universal Liner Holder (22734) works well for this application.

1. Secure the liner holder in a machine vise or place it on a sturdy table or platform.

2. Lay the filled liner in the holder with the top (drive head) end of the liner toward the "hook" stop and the downhole end toward the "pin" stop (Fig. 4.29).

3. The grooving tool is pulled along the top of the liner to cut a single longitudinal groove. Right-handed operators will generally pull the tool beginning at the left end of the liner while left-handed operators will generally pull the tool beginning at the right end.

   Place the grooving tool on top of the liner with the cutting insert positioned approximately 0.25 inches (6 mm) in from the appropriate end as determined by the operator's dominant hand (Fig. 4.30).

4. Pull the grooving tool across the entire length of the liner by applying steady force to the front (spherical) handle. **For the grooving tool to function correctly, it is very important to put the majority of the pulling force on the front handle.** Only use the back (tapered) handle to guide the tool. When used correctly, the grooving tool will remove material in a continuous string as shown in Figure 4.31.

5. Repeat Steps 3 and 4 to cut a second groove that will allow removal of a section of liner for easier access to the soil sample.

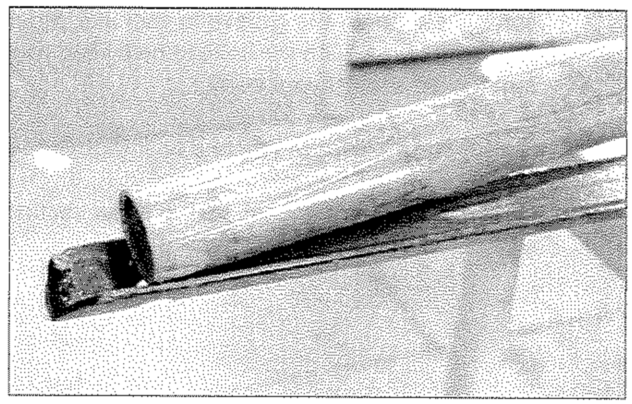


Figure 4.29. Lay the liner in the holder tray.

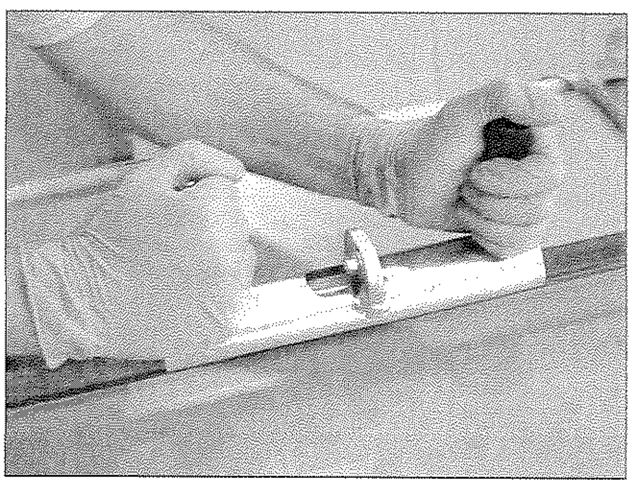


Figure 4.30. Place the grooving tool on top of the liner with the cutting insert positioned approximately 0.25 inches (6 mm) in from the end.

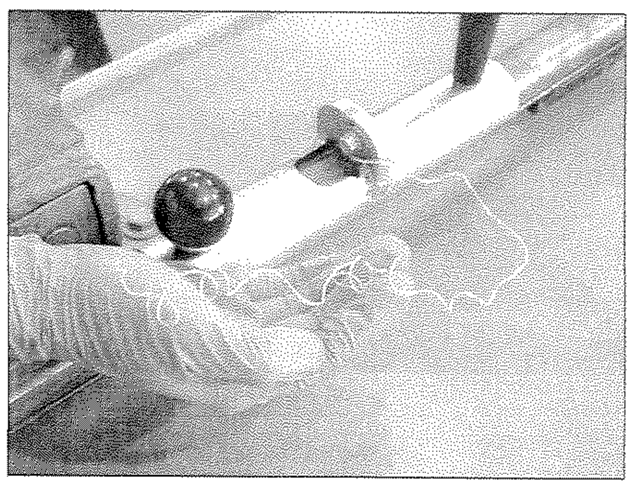


Figure 4.31. A thin ribbon of material will be cut as the tool is drawn down the length of the liner.

Cutting the Liner Open

Once the liner is grooved with the DT21 Grooving Tool, the groove is cut using a utility knife. **Make sure no one is standing near you before starting this procedure!**

1. Holding the utility knife perpendicular to the liner, place the blade in the groove to be cut (Fig. 4.32).

2. Push the blade into the groove by pushing straight down on the knife. Push down until the blade is completely through the liner wall.

3. With the knife blade still in the liner, rotate the knife approximately 90° until the blade is almost tangent to the liner (Fig. 4.33).

4. Grasp the knife such that it is held with the palm of the hand facing up as shown in Figure 4.33.

5. Place your other hand on the liner for support (Fig. 4.33). Make sure the knife blade faces away from this hand to avoid injury should the knife slip out of the liner while cutting.

6. Stand close to the liner holder to keep the hand with the utility knife close to your body for maximum control. Carefully pull the knife completely down the groove in the liner. Move your entire body with the knife to help keep your arm tucked against your body.

7. Repeat Steps 1-6 for the second liner groove.

8. Once both grooves are cut, pull the liner section away to access the soil sample (Fig. 4.34).

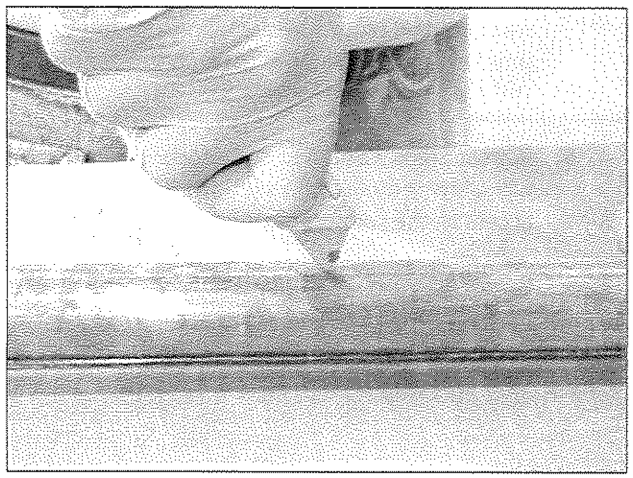


Figure 4.32. Insert the knife blade straight down into the

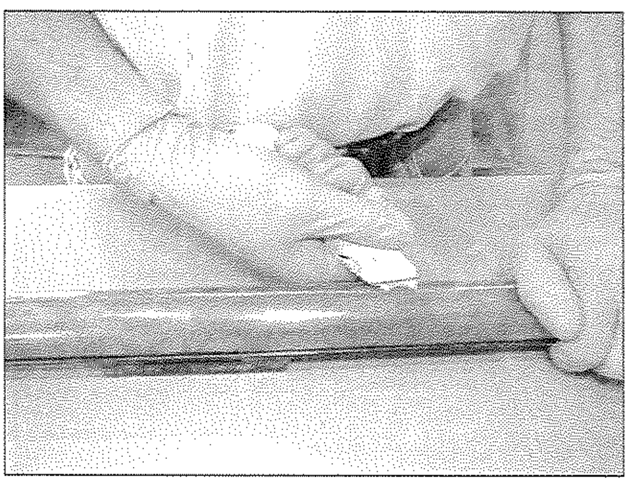


Figure 4.33. Rotate the knife until it is almost tangent to the liner. Gripping the knife palm up and keeping your arm close to your body for control, pull the knife along the groove.

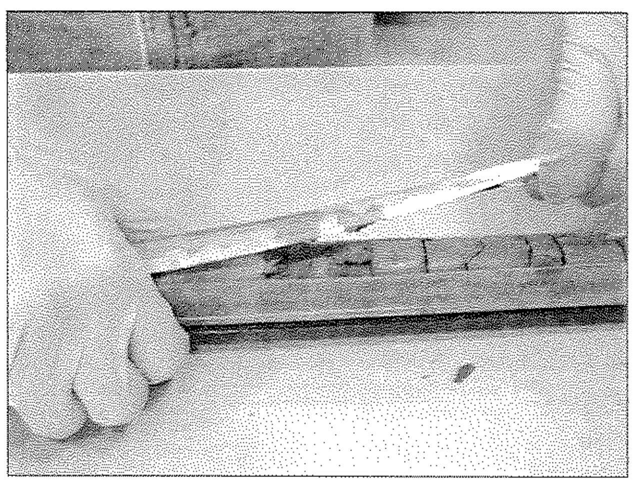


Figure 4.34. After cutting along the two grooves, peel away the liner section to access the soil sample.

4.8 Dual Tube Soil Sampling Tips

Saturated sands are the most difficult formations to sample with the DT22 system. Saturated conditions place positive pressure on the soil outside of the outer casing. When sampling in noncohesive formations (e.g. sands) below the water table, it may be necessary to add water to the outer casing to prevent formation heave. Adding water to the probe rods puts a positive head on the system and may keep formation material from flowing into the rods as the liner and soil sample are retracted. If a small amount of formation material is still drawn into the outer casing as the soil core is retrieved, the material may be displaced by slightly raising the outer casing while lowering the next new liner to depth. Water must be maintained within the outer casing during this process to overcome the hydraulic head imparted by the formation fluid.

DT21 core catcher liners will provide the best sample recovery in saturated noncohesive formations.

DT21 core catcher liners will help considerably with sample recovery in noncohesive soils and other materials that do not fill the liner diameter. Core catcher liners are not recommended for cohesive or expansive soils as the core catchers may actually inhibit soil movement into the liner.

Some clay materials will expand during sampling. Under these conditions, using a shorter sample interval (24-inch liners) may improve sample recovery by minimizing the wall friction as the material is sampled.

4.9 Outer Casing Retrieval

The outer casing of the DT22 Dual Tube System may be retrieved in one of three ways:

1. Casing pulled then probe hole sealed from ground surface with granular bentonite.

   The outer casing may be pulled from the ground with the probe machine and a Pull Cap (25298) or a Rod Grip Pull System (for GH40 Hammers [29461] or for GH60 Hammers [29385]) if the probe hole is to be sealed with granular bentonite from the ground surface (Fig. 4.35). This method is used for shallow probe holes in stable formations only. Such conditions allow the entire probe hole to be sealed with granular bentonite.

2. Casing pulled with probe hole sealed from bottom-up during retrieval.

   Bottom-up grouting should be performed during casing retrieval in unstable formations where side slough is probable. Such conditions create void spaces in the probe hole if granular bentonite is installed from the ground surface.

   A GS500 or GS1000 Grout Machine is used to deliver a sealing material (high-solids bentonite slurry or neat cement grout) to the bottom of the outer casing through flexible tubing. The grout mix is pumped through the tubing to seal the void remaining as the outer casing is retrieved (Fig. 4.36). This is an advantage of the DT22 Dual Tube System as other soil samplers require a second set of tools to deliver grout to the bottom of the probe hole. Contact Geoprobe Systems® for more

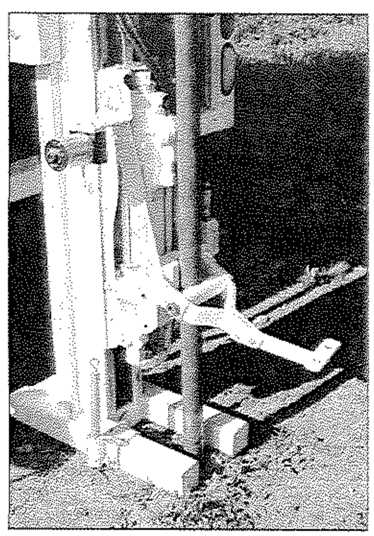


Figure 4.35 Outer casing may be retrieved with a pull cap or rod grip pull system if the probe hole is sealed with granular bentonite.

Figure 4.36. A grout machine and flexible tubing allow bottom-up grouting as the outer casing is retrieved.

information on bottom-up grouting with the GS500 and GS1000 Grout Machines.

3. Casing pulled with Geoprobe Prepacked Screen Well installed during retrieval.

The final option is to install a 1.4-inch OD Geoprobe® Prepacked Screen Monitoring Well in the probe hole during retrieval of the outer casing. A DT22 Expendable Cutting Shoe Holder (29402) and a DT21 Expendable Cutting Shoe (DT4045) allow the operator to collect continuous soil cores as the outer casing is driven to depth. When sampling is complete, the outer rods are raised and the expendable cutting shoe is removed from the leading rod. This leaves an open casing through which a set of prepacked screens is lowered on the leading end of a PVC riser string (Fig. 4.37). The well is finished, complete with grout barrier, bentonite well seal, and a high-solids bentonite slurry/neat cement grout, during retrieval of the outer casing.

Refer to *Geoprobe® 0.5-in. x 1.4-in. OD and 0.75-in. x 1.4-in. OD Prepacked Screen Monitoring Wells Standard Operating Procedure* (Geoprobe® Technical Bulletin No. 962000) for specific information on well installation.

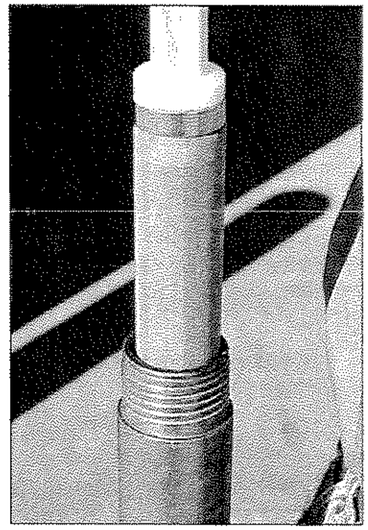


Figure 4.37. Geoprobe® prepacked screens may be installed through the outer casing when an expendable cutting shoe is used.

5.0 REFERENCES

Geoprobe Systems®, *Dual Tube (DT21) Soil Sampling System - Standard Operating Procedure.* Technical Bulletin No.982100, 2003.

Geoprobe Systems®, *Dual Tube (DT21) Groundwater Profiler Kit - Installation and Operation Instructions.* Instructional Bulletin No. 19275, 2001.

Geoprobe Systems®, *Geoprobe® 0.5-in. x 1.4-in. OD and 0.75-in. x 1.4-in. OD Prepacked Screen Monitoring Wells - Standard Operating Procedure.* Technical Bulletin No. 962000, 2002.

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

Equipment and tool specifications, including weights, dimensions, materials, and operating specifications included in this brochure are subject to change without notice. Where specifications are critical to your application, please consult Geoprobe® Systems.

Geoprobe Systems®

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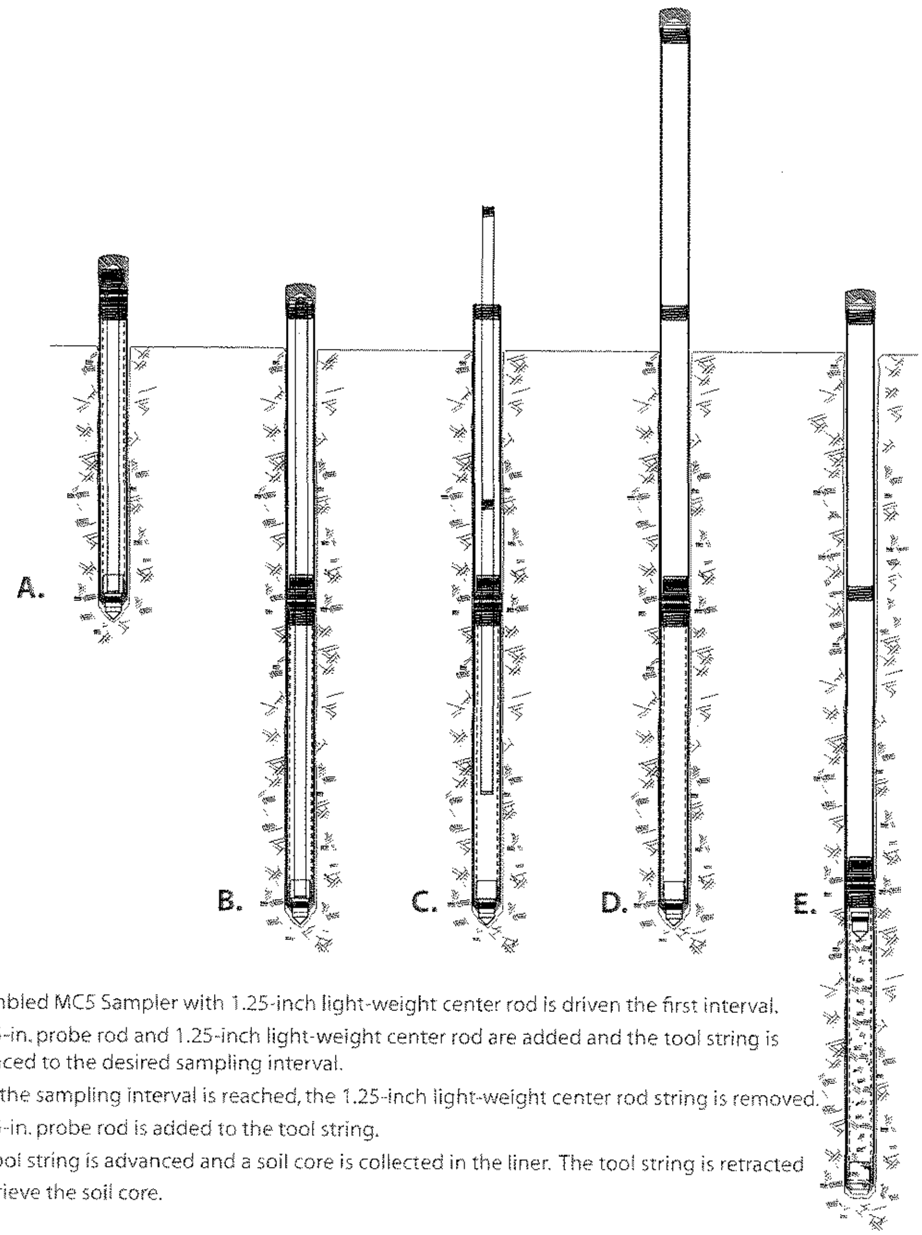
Geoprobe® Macro-Core® MC5
1.25-inch Light-Weight Center Rod Soil Sampling System

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®

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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.

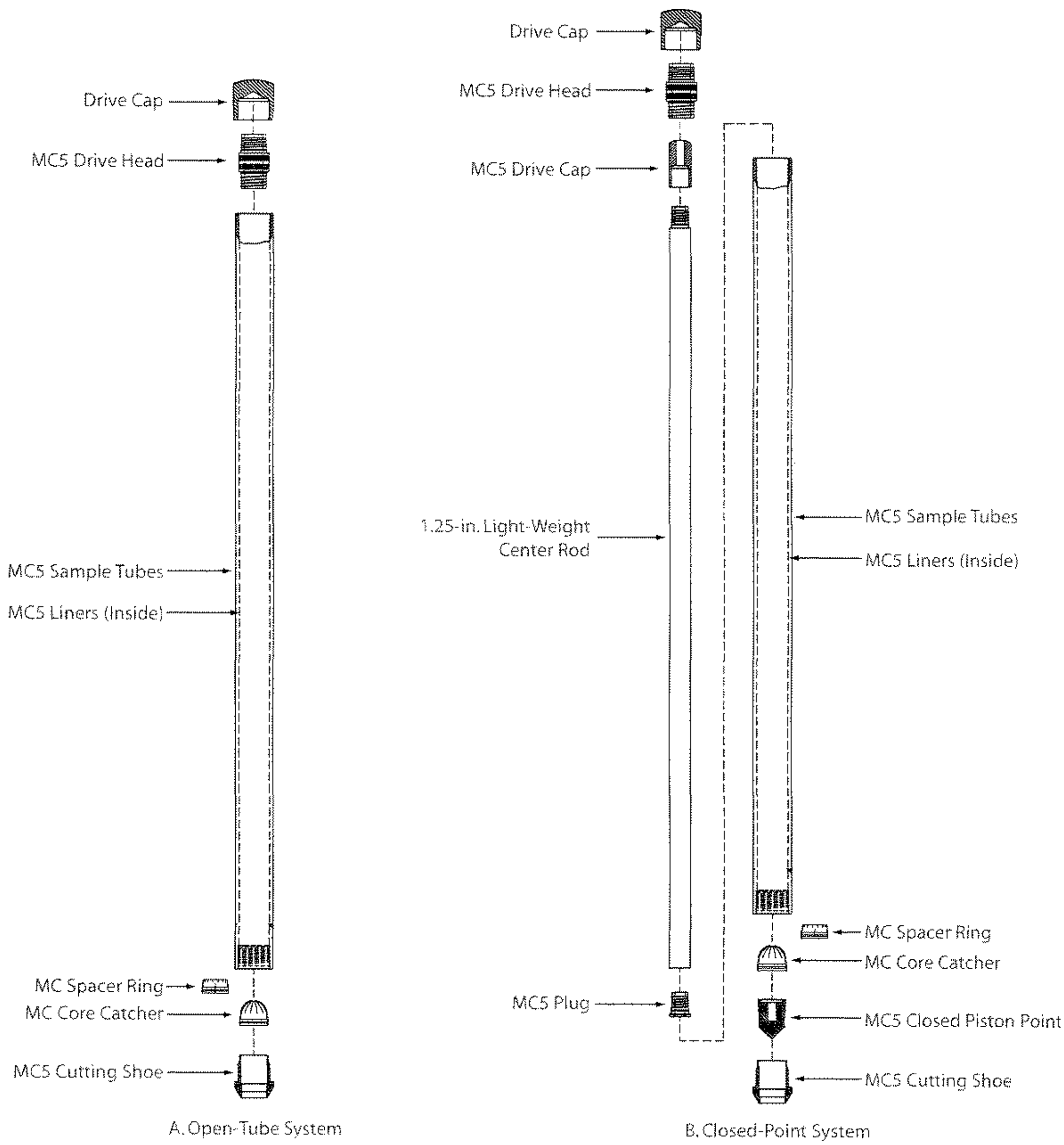


Figure 2.1
Macro-Core® MC5 Soil Sampler Configurations

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

	Part Numbers for Specific Probe Rod OD	
Probe Rods and Probe Rod Accessories	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	

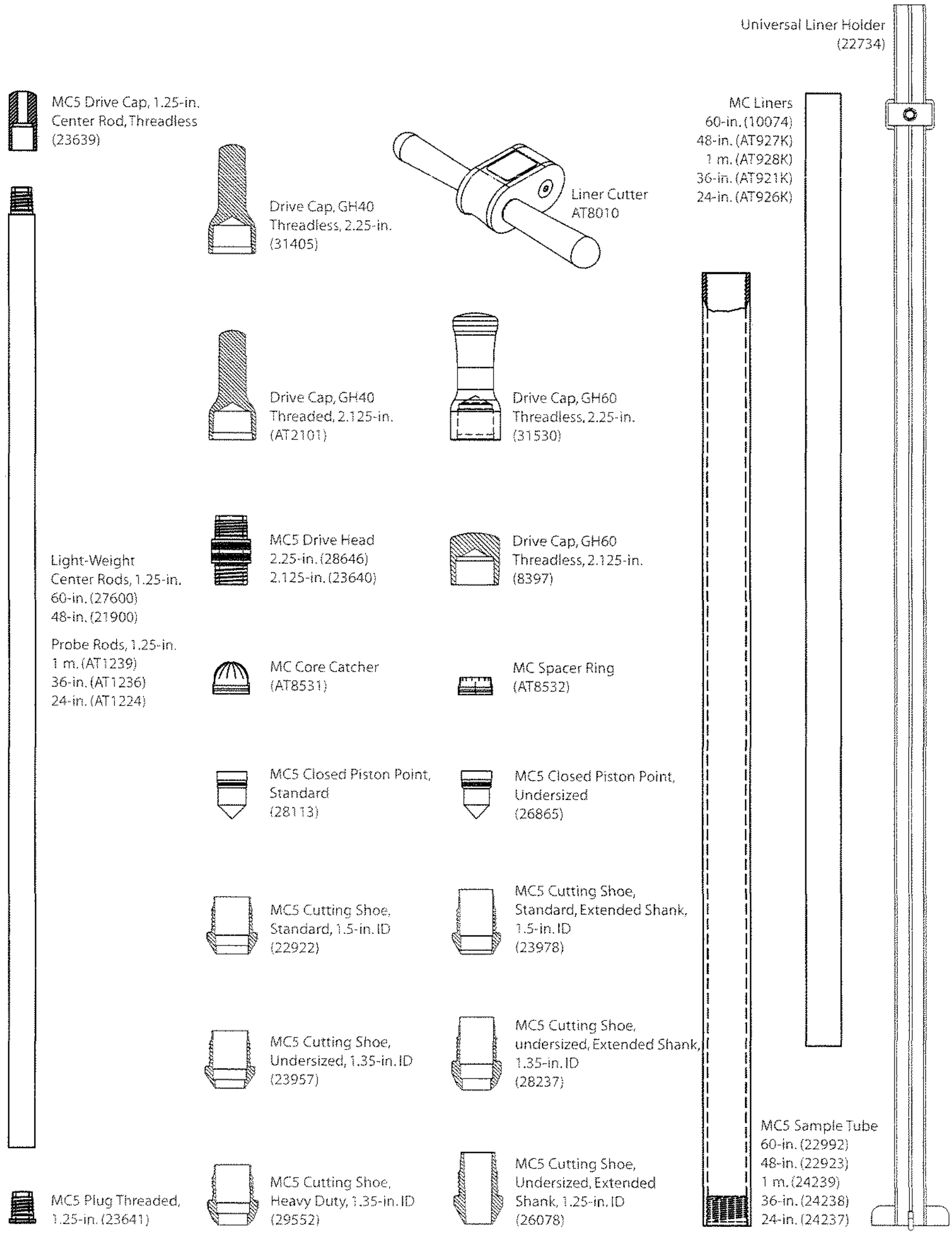


Figure 3.1
Macro-Core® MC5 Soil Sampler Parts

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.

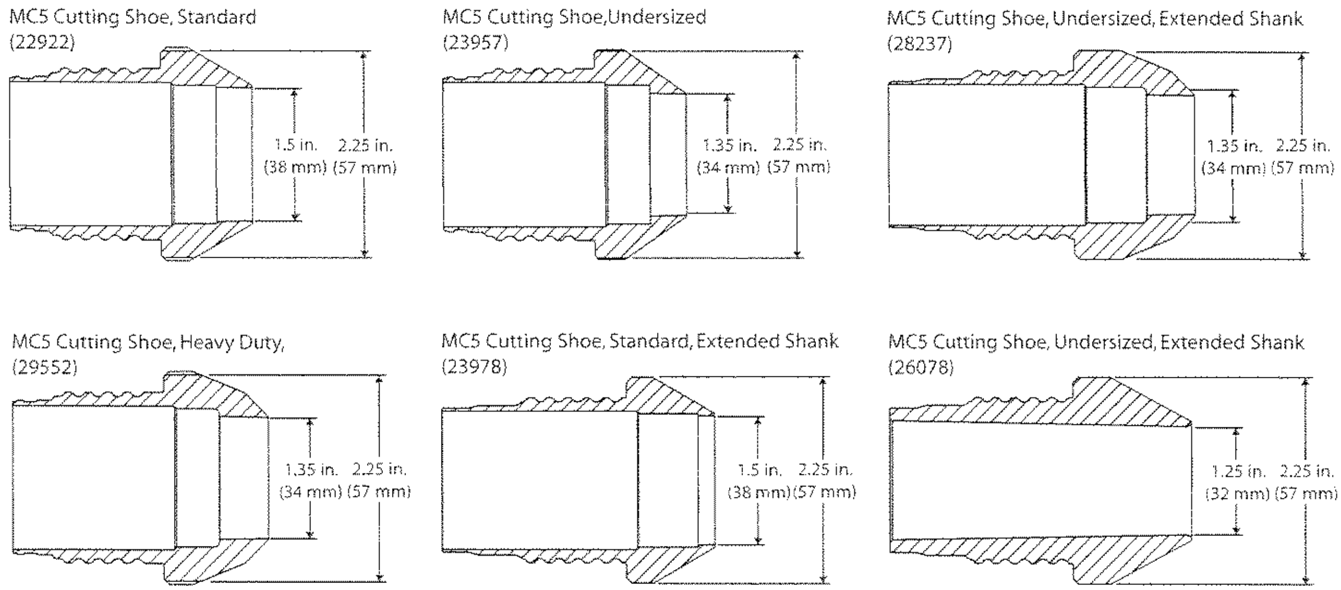


Figure 3.2
Cutting Shoe Options for Macro-Core® MC5 Soil Sampler

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.

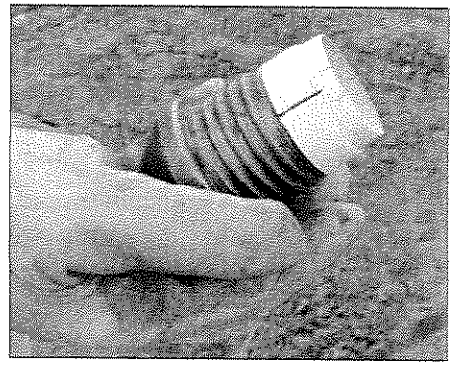


Figure 4.1. The spacer ring fits securely onto the MC5 Cutting Shoe.

1b. Using the MC Spacer Ring

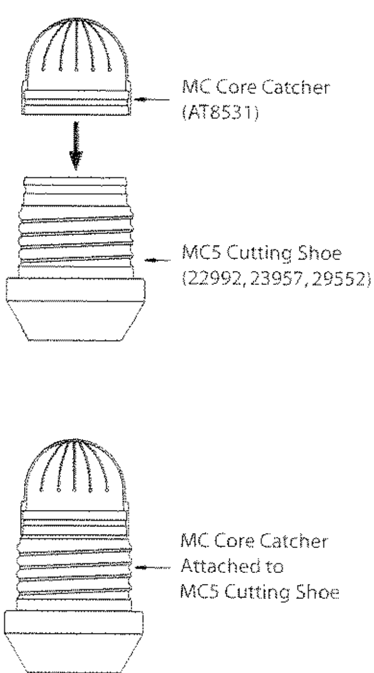


Figure 4.2
Core Catcher Attachment

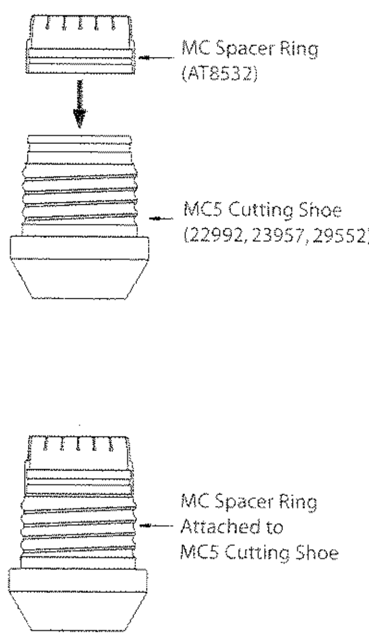


Figure 4.3
Spacer Ring Attachment

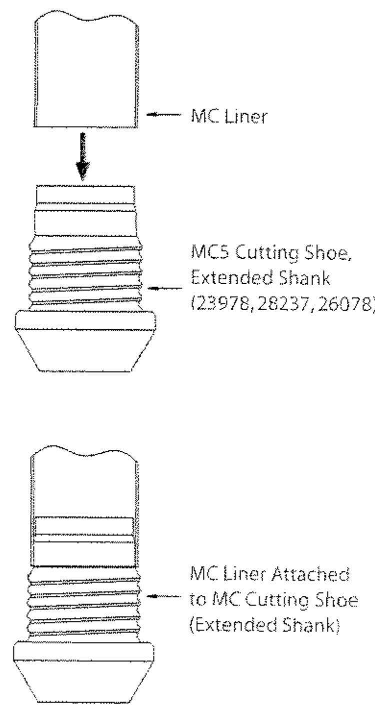


Figure 4.4
Liner Attachment on Extended Shank

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

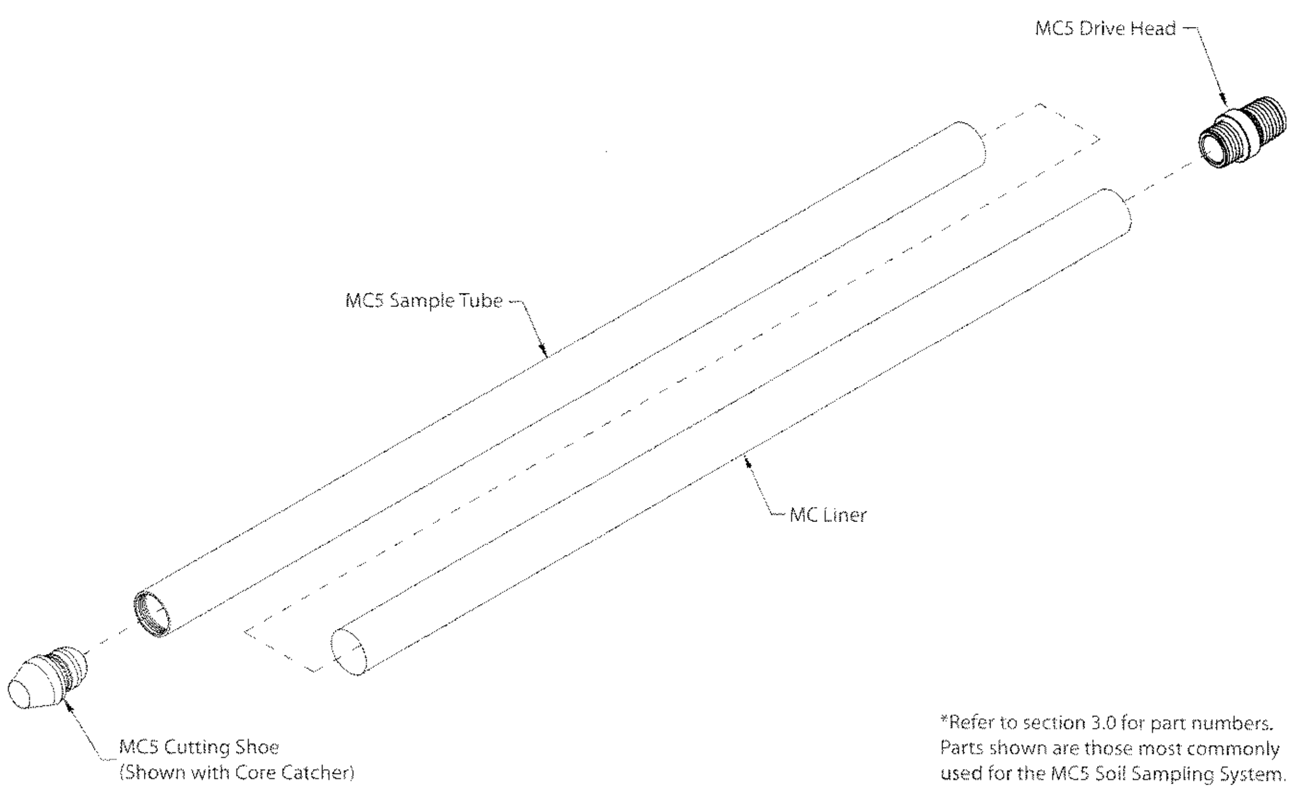
The cutting shoes with extended shanks (23978, 28237, 26078) do not use core catchers or spacer rings. MC5 Liners should securely slide onto the end of these cutting shoes (Fig. 4.4). The extended shank cutting shoes should only be used when sampling cohesive soils. When sampling loose soils, especially 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



*Refer to section 3.0 for part numbers. Parts shown are those most commonly used for the MC5 Soil Sampling System.

Figure 4.5
MC5 Open-Tube Sampler Assembly

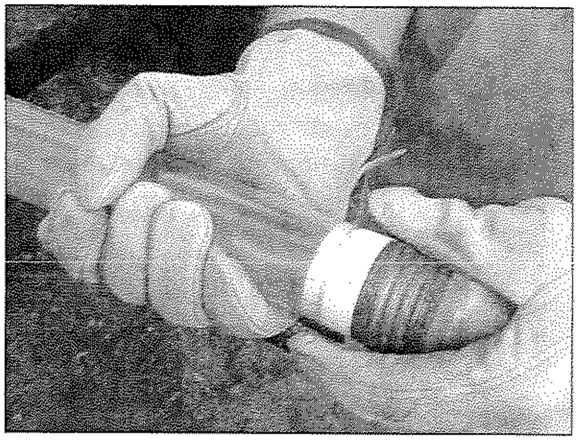


Figure 4.6. Place either end of the liner onto the spacer ring or core catcher. The liner should fit securely.

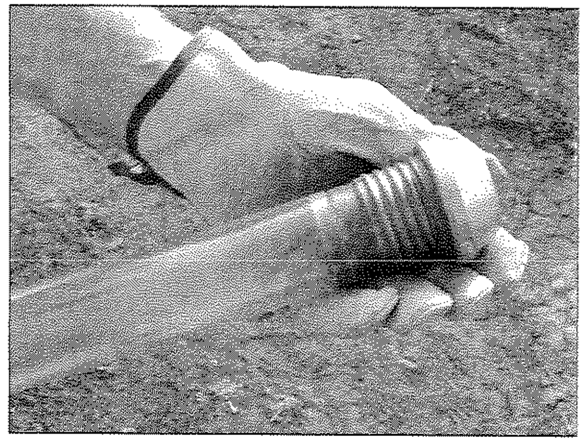


Figure 4.7. Place either end of the liner onto the extended shank cutting shoe. (This is used in place of a spacer ring or core catcher)

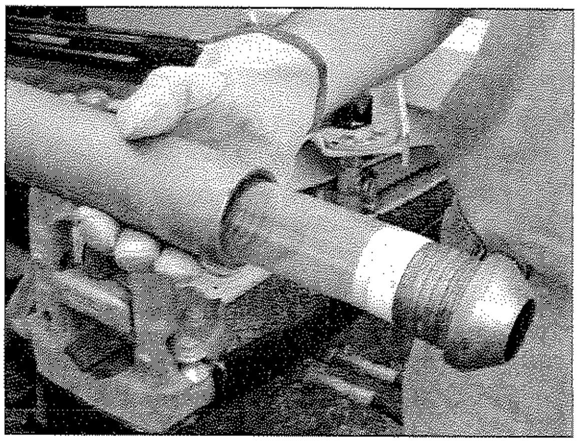


Figure 4.8. Slide whole assembly into either end of the sample tube.

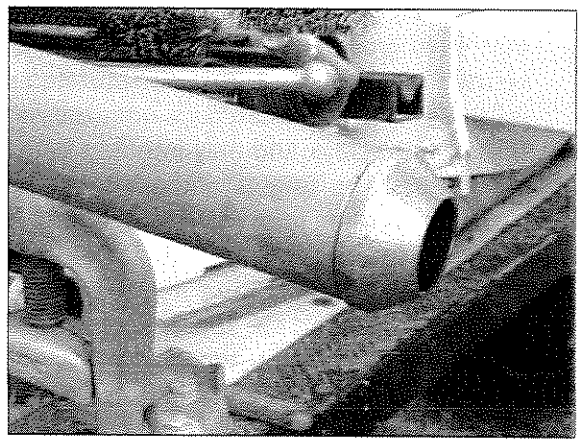


Figure 4.9. Thread the cutting shoe onto the sample tube.

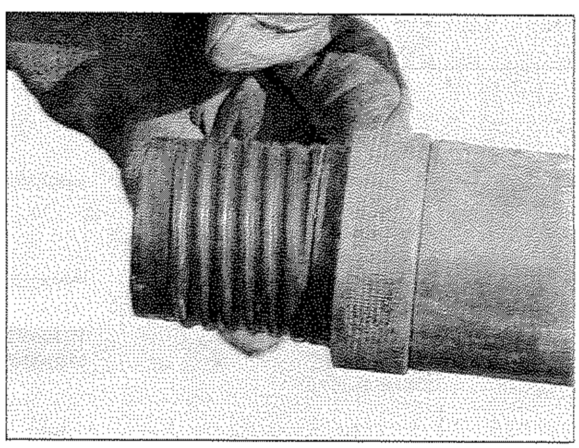


Figure 4.10. Thread the MC5 Drive Head onto the opposite end of the sample tube. Tighten by hand.

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.

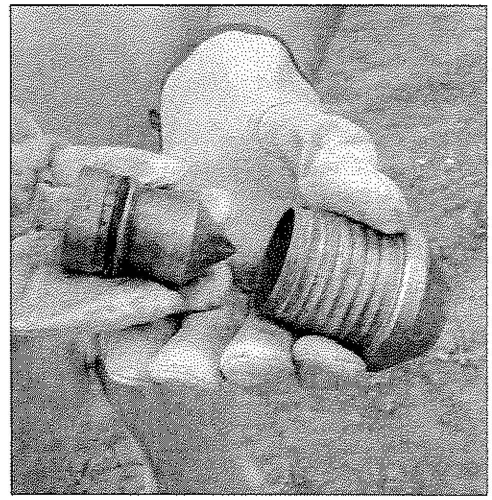


Figure 4.11. The MC5 Closed Piston Point slides into the cutting shoe.

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.

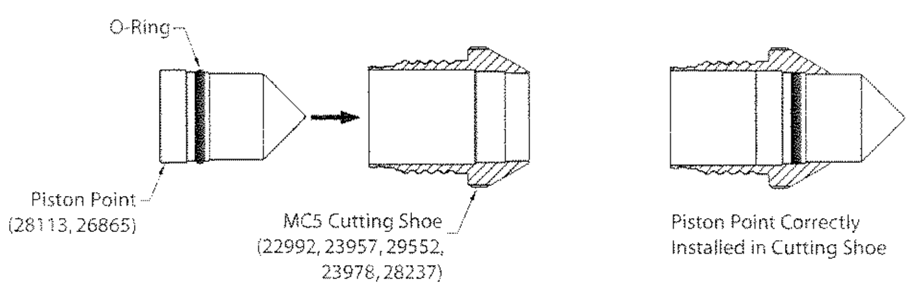


Figure 4.12
Installation of MC5 Closed Piston Point Assembly in MC5 Cutting Shoe

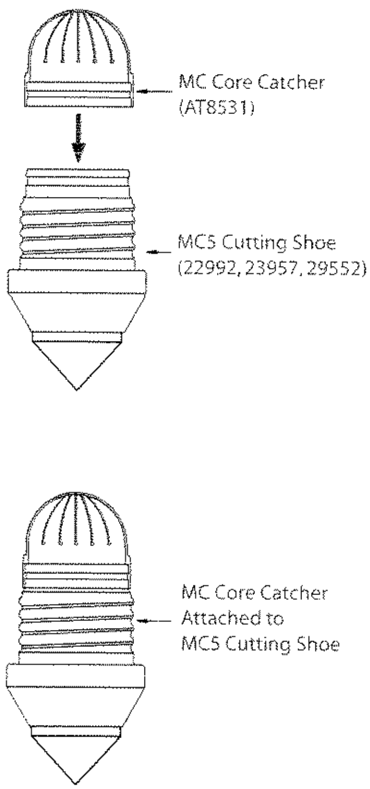


Figure 4.13
Core Catcher Attachment
With Point Assembly

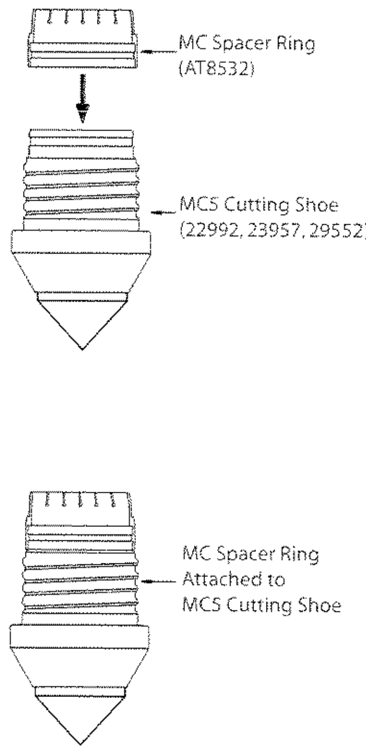


Figure 4.14
Spacer Ring Attachment
With Point Assembly

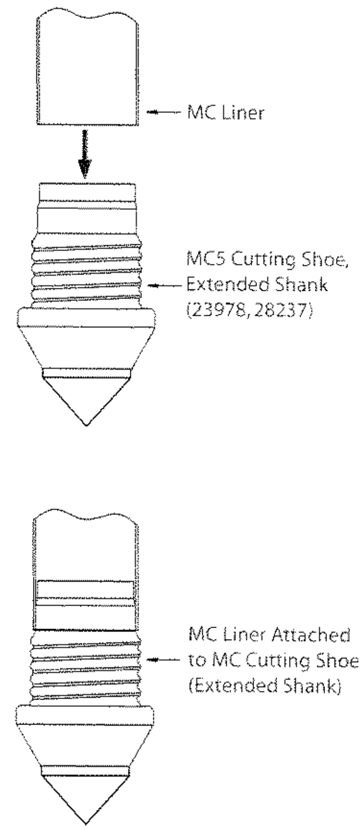


Figure 4.15
Liner Attachment on Extended
Shank With Point Assembly

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).

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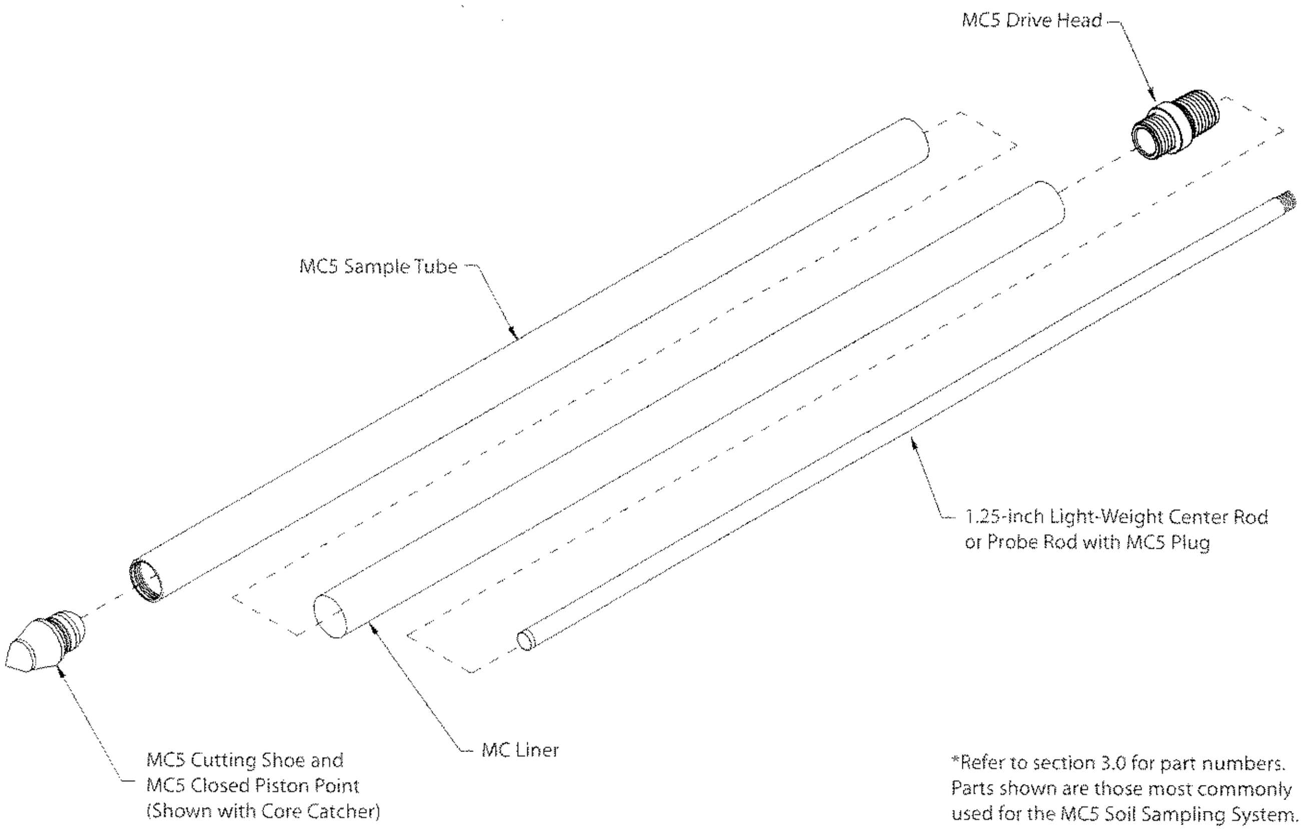


*Refer to section 3.0 for part numbers. Parts shown are those most commonly used for the MC5 Soil Sampling System.

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

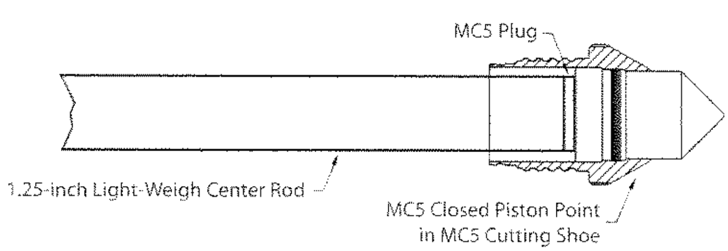


Figure 4.17
MC5 Closed-Point Center Rod Assembly

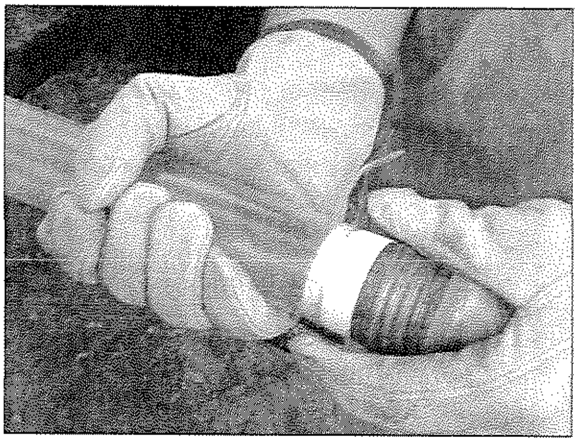


Figure 4.18. Place either end of the liner onto the spacer ring or core catcher. The liner should fit securely.

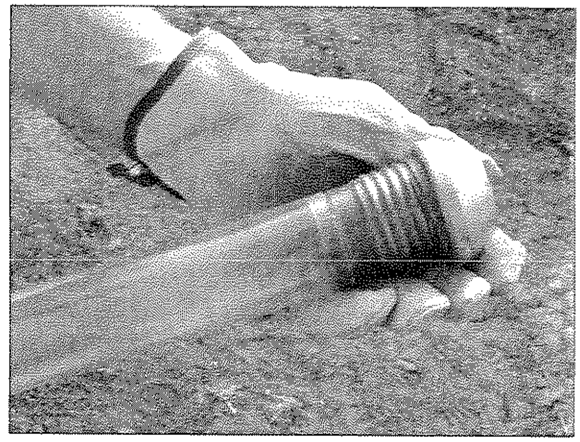


Figure 4.19. Place either end of the liner onto the extended shank cutting shoe. (This is used in place of a spacer ring or core catcher)

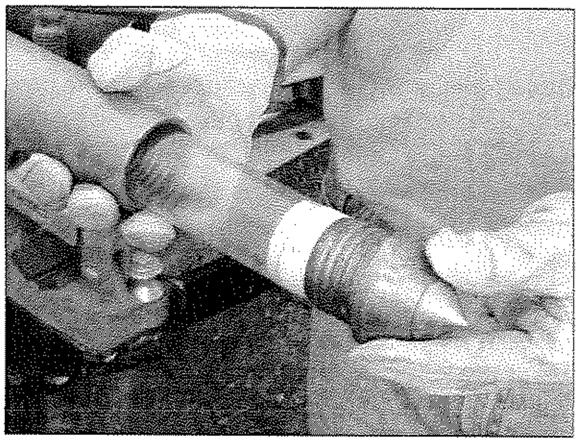


Figure 4.20. Slide whole assembly into either end of the sample tube.

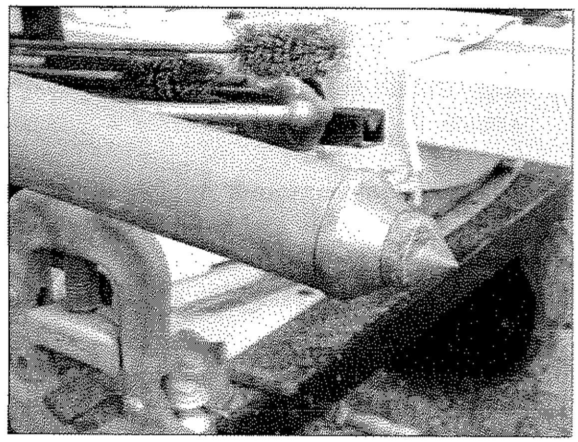


Figure 4.21. Thread the cutting shoe and point onto the sample tube.

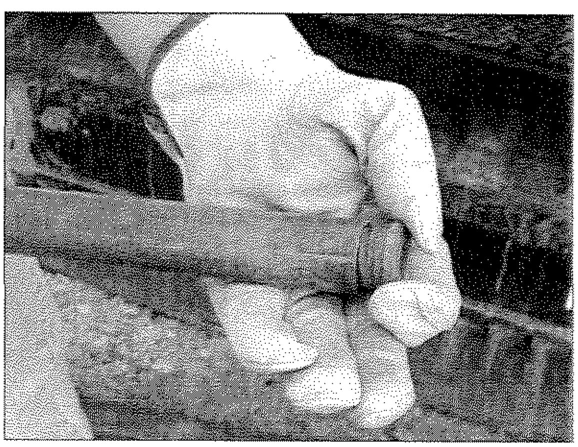


Figure 4.22. The MC5 Plug is threaded onto the end of the 1.25-inch light-weight center rod.

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.

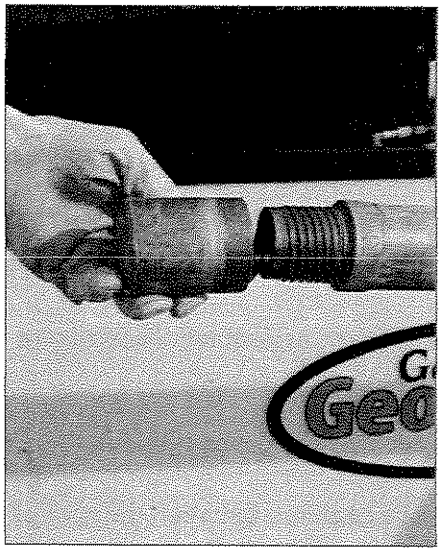


Figure 4.24. Place drive cap onto sampler drive head.

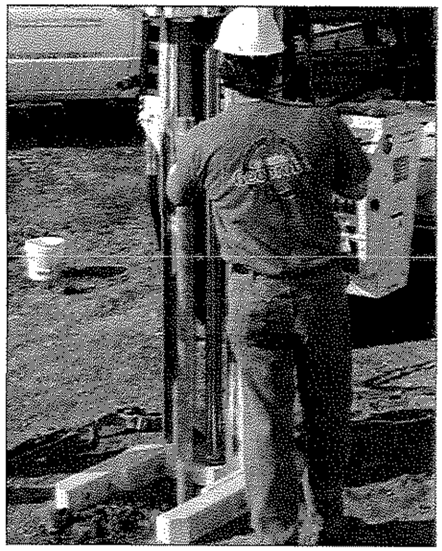


Figure 4.25. The sampler should be parallel to the probe derrick for driving.

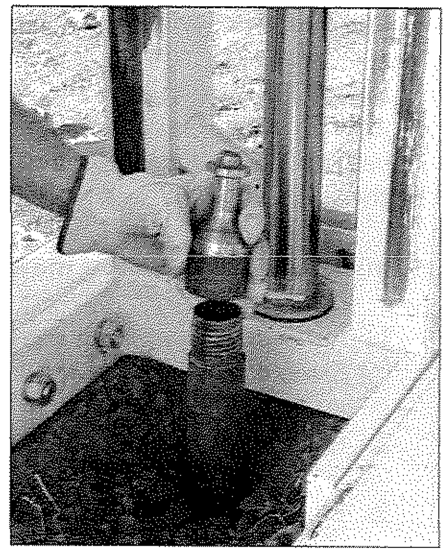
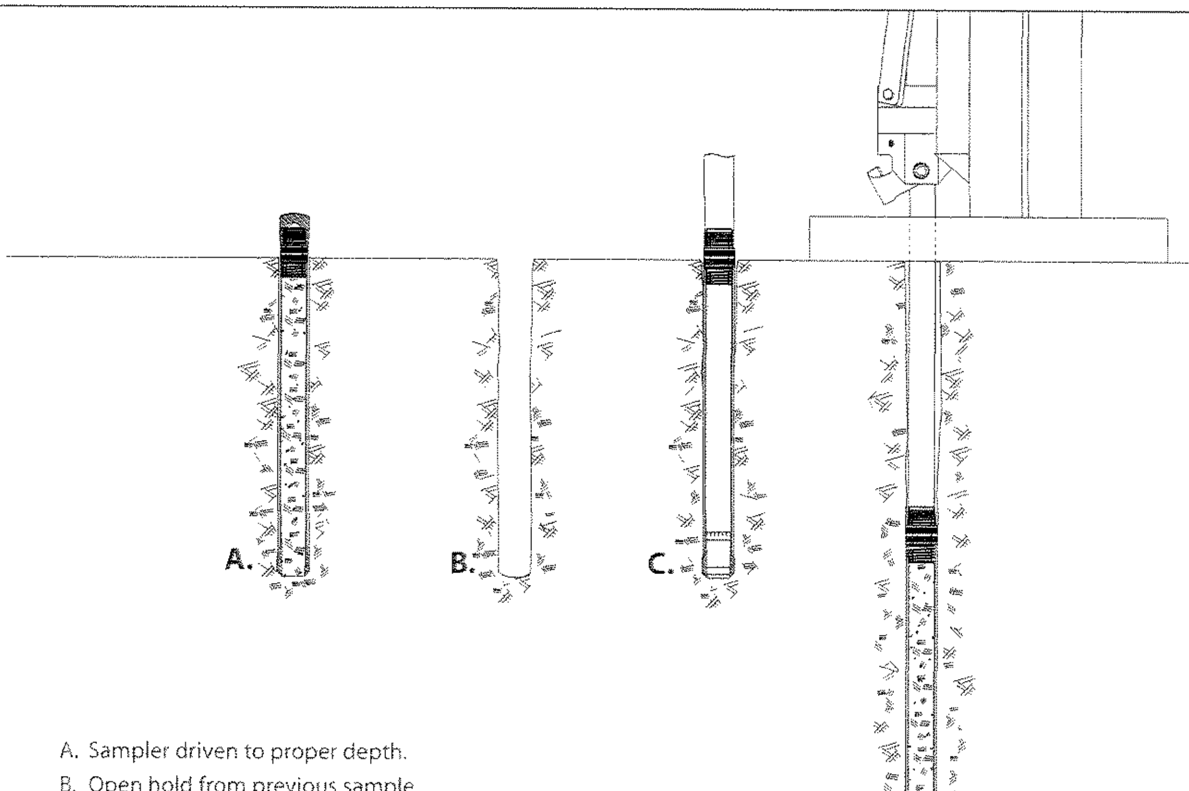


Figure 4.26. The pull cap is one way to remove the sampler from the ground.



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).

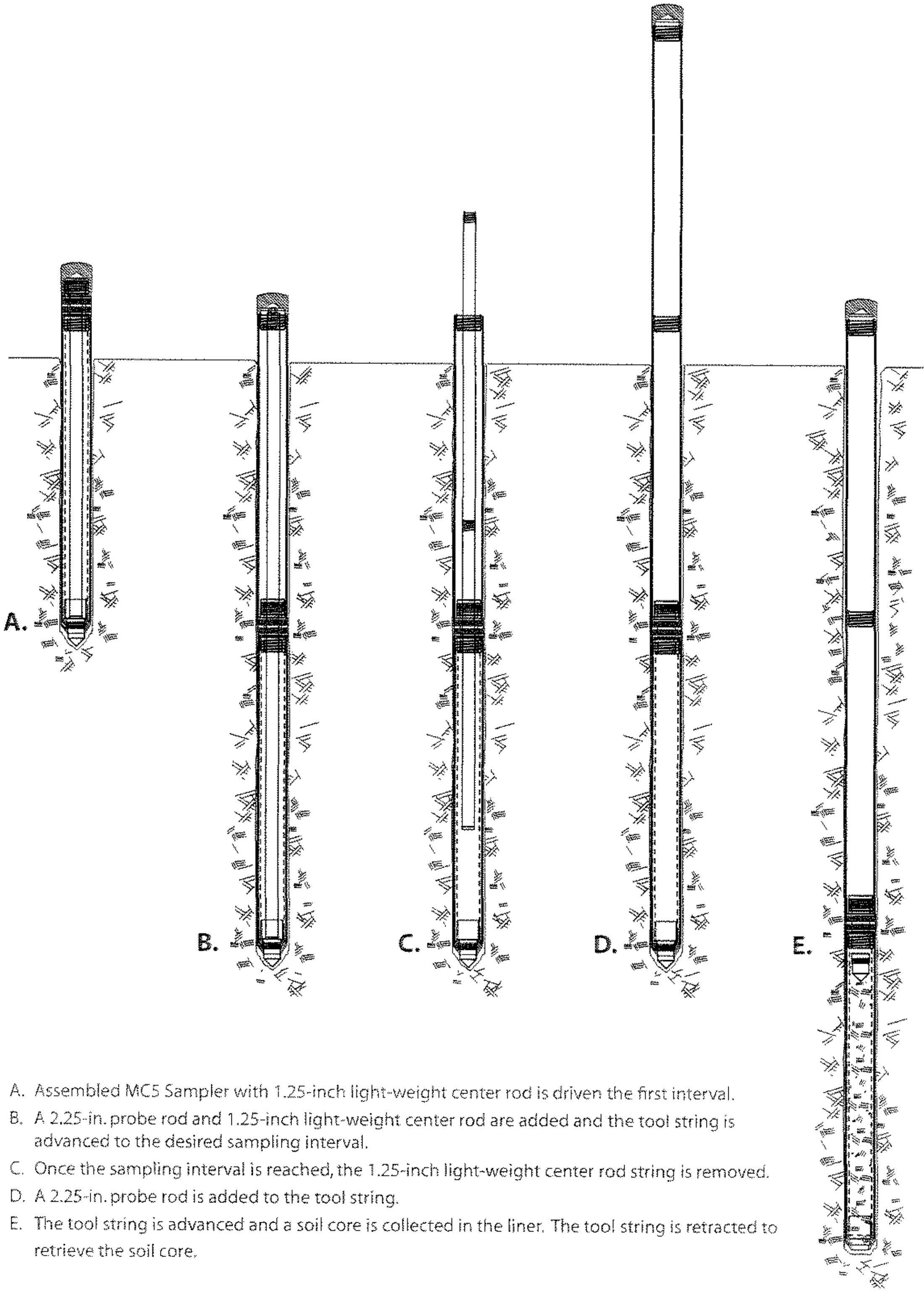
8. Advance the tool string to collect the soil core in the liner (Fig. 4.28E).

   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).

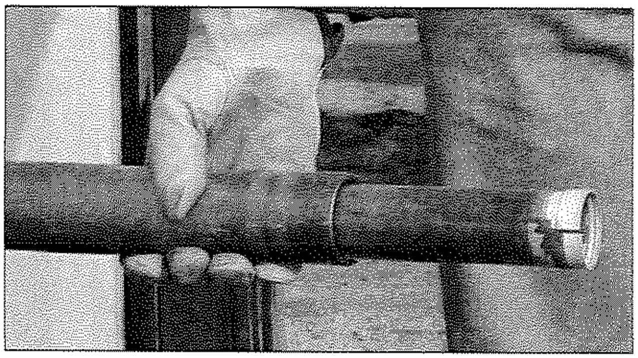


Figure 4.29. Remove the MC5 Cutting Shoe and liner from the MC5 Sampler Tube.

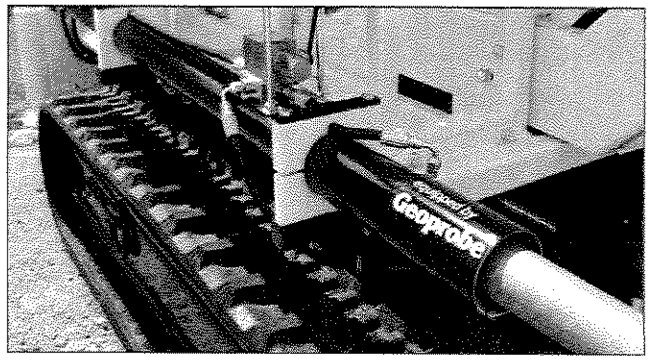


Figure 4.30. The Hydraulic Liner Extruder helps remove the liner.

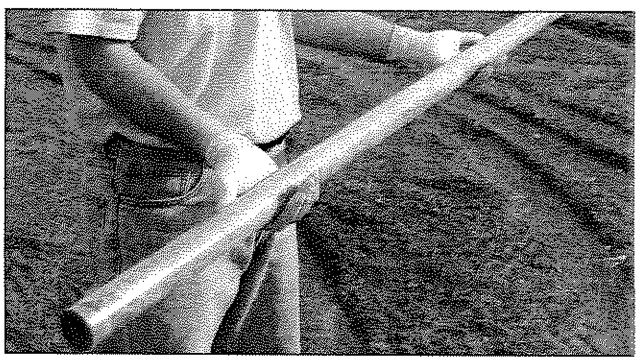


Figure 4.31. MC5 Liner filled with soil core.

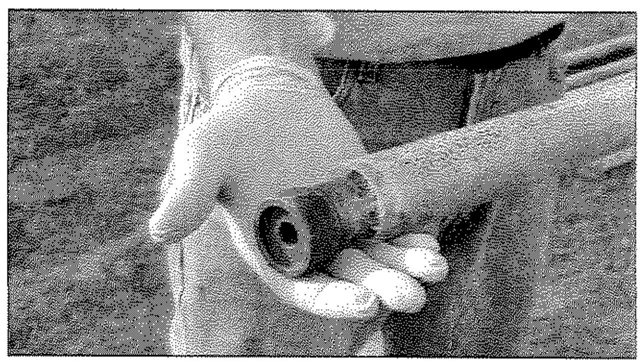


Figure 4.32. MC5 Closed Piston Point is retrieved from the top of the liner.

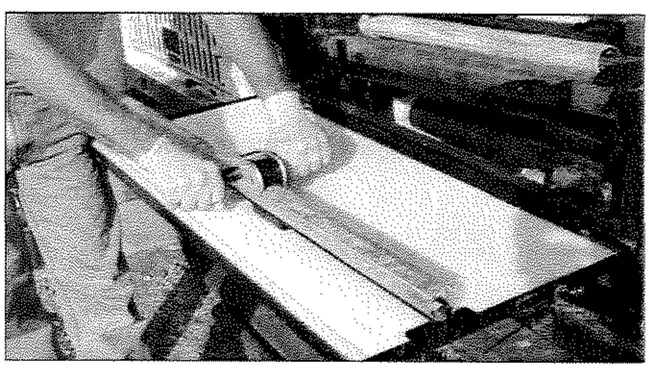


Figure 4.33. MC Liner Cutter makes two longitudinal cuts in PVC Liners.

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.

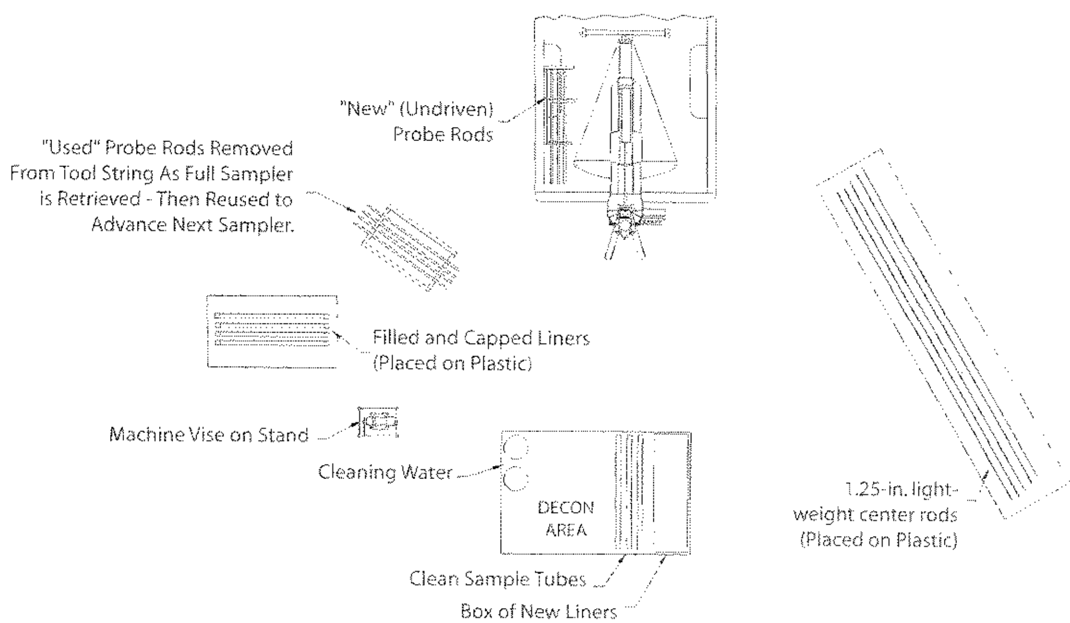


Figure 4.36
Equipment Layout Example to Maximize Sampling Productivity

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

Equipment and tool specifications, including weights, dimensions, materials, and operating specifications included in this brochure are subject to change without notice. Where specifications are critical to your application, please consult Geoprobe Systems®.

Geoprobe Systems®

A DIVISION OF KEJR, INC.

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www.geoprobe.com

Appendix J

NYSDEC Approvals after March 2013 SMP Submittal

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B, 12th Floor
625 Broadway, Albany, New York 12233-7016
Phone: (518) 402-9768 • **Fax:** (518) 402-9773
Website: www.dec.ny.gov

Joe Martens
Commissioner

April 15, 2013

Arlette St. Romain Meader
Senior Environmental Scientist/Project Manager
The Chazen Companies
547 River Street, Troy, NY 12180

Re: 136 Fuller Road Site
Brownfield Cleanup Program
NYSDEC BCP Site No. C401055
Albany County, New York
Site Management Plan
Approval Letter

Dear Ms. St. Romain Meader:

The New York State Department of Environmental Conservation and the New York State Department of Health have reviewed the *Site Management Plan,* stamped and dated March 2013 by the Chazen Companies for the 136 Fuller Road BCP Site in Albany, New York. Based on this review, the Site Management Plan is approved.

Should you have any questions, please contact me at (518) 402-9768.

Sincerely,

P.E.

John Durnin, P.E.
Environmental Engineer 2
Remedial Bureau B, Section B
Division of Environmental Remediation

ecc: B. Cozzy, BD, RBB
J. Brown, SC, RBB, Section B
J. Quinn, RHWE
M. Schuck, NYSDOH
K. Baines
E. Hoe
K. Sommer

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor, Albany, NY 12233-7016
P: (518) 402-9768 I F: (518) 402-9773
www.dec.ny.gov

August 2, 2016

Arlette St. Romain
Senior Environmental Scientist
Assistant Project Manager
The Chazen Companies
547 River Street, Troy, NY 12180

Re: 136 Fuller Road Site
Brownfield Cleanup Program
NYSDEC BCP Site No. C401055
Albany County, New York
SMP Addendum No. 1
Approval

Dear Ms. St. Romain:

The New York State Department of Environmental Conservation has reviewed the *Request to Modify Groundwater Monitoring and Periodic Review Reporting Requirements* dated July 21, 2016 by Earth Environmental and The Chazen Companies for the 136 Fuller Road BCP Site, in Albany, NY. This request is to modify the March 2013 approved Site Management Plan (SMP) to reduce the frequency of monitoring for some wells, discontinue monitoring in other wells and increase the Periodic Review Reporting (PRR) period from annually to every three years.

The following modifications to the SMP are approved:
MW-3: discontinue the quarterly groundwater monitoring and perform annually,
MW-8: discontinue groundwater monitoring all together,
MW-17: discontinue groundwater monitoring all together,
MW-29: discontinue the quarterly groundwater monitoring and perform annually,
MW-35: discontinue groundwater monitoring all together.

In addition, the approved **PRR period is now every three years**.

This letter will be included as Addendum No. 1 to the approved SMP. Should you have any questions, please contact me at (518) 402-9768.

Sincerely,

P.E.

John Durnin, P.E.
Environmental Engineer 2
Remedial Bureau B, Section B
Division of Environmental Remediation

ecc: J. Brown, DER, RBB, M. Schuck, NYSDOH
K. Baines, Earth Environmental, E. Hoe, Fuller Partners LLP L. Peritz, wTe Corp., Scott Mellen, wTe Corp.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor, Albany, NY 12233-7016
P: (518) 402-9768 I F: (518) 402-9773
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April 11, 2018

Edward Hoe
Fuller Partners, LLC
1133 State Route 295
East Chatam, NY 12207

Arlette St. Romain
The Chazen Companies
547 River Street
Troy, NY 12180

Kim Baines
Earth Environmental, LLC
10 Stone Clover Drive
Saratoga Springs, NY 12866

Re: Corrective Measures Work Plan
136 Fuller Road BCP Site #C401055, Albany County, New York

Dear Mr. Hoe, Mr. Baines, and Ms. Romain:

The New York State Department of Environmental Conservation (Department) has reviewed the April 10, 2018 Corrective Measures Work Plan (CMWP) prepared by the Chazen Companies (Chazen) on behalf of Fuller Partners, LLC. Based on the Department's review of the CMWP, the document is hereby approved.

Based on email communication from Chazen, it is understood that drilling activities have been scheduled to complete this work on April 24th and 25th. Please inform the Department if this schedule changes prior to the start of work.

If you have any questions, please call me at (518) 402-8644.

Sincerely,

Kyle Forster

ec: G. Burke
J. Brown
J. Durnin
Joseph Lanaro, Chazen
Leigh Peritz, wTe Corp.
Scott Mellen, wTe Corp.

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P: 518.273.0055 or 888.539.9073
www.chazencompanies.com

August 30, 2018

Mr. Kyle Forster
New York State Department of Environmental Conservation
Section B, Remedial Bureau B
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, NY 12233-7016

Re: Proposed Site Management Plan Addendum No. 2
136 Fuller Road BCP Site #C401055, Albany County, New York
Chazen Job 90618.00

Dear Mr. Forster:

On behalf of Fuller Partners LLP (Fuller Partners), this letter presents a proposed Addendum to the Site Management Plan (SMP) for the above-referenced BCP site. This addendum documents the addition of another groundwater monitoring well and the expansion of the existing High Vacuum Extraction/Soil Vapor Extraction (HVE/SVE) system. Details of the associated work are described in a Corrective Measures Report.

PROPOSED SMP AMENDMENTS

Based on the results of the Corrective Measures Report, we propose the following amendment. To consolidate this proposed SMP Addendum with the August 2, 2016 Addendum No. 1, we have also included an SMP Executive Summary table for inclusion with the SMP.

- One additional groundwater monitoring well (MW-37) was installed between MW-32 and MW-34 (see attached Figure 1). To document CVOC concentrations in the plume, MW-25 has been included in the last two quarterly events for 2018 to supplement data within the plume and is proposed to be added to the quarterly sampling program.
- The HVE/SVE system was modified to add R-11 and disconnect R-3. Recovery well R-1, formerly operating as an SVE well, was also disconnected and capped during this process. Figure 2 shows the updated HVE/SVE configuration.

If you have any questions, please contact Kim Baines at (518) 588-2104 or Arlette St. Romain at (518) 266-7328.

Sincerely,

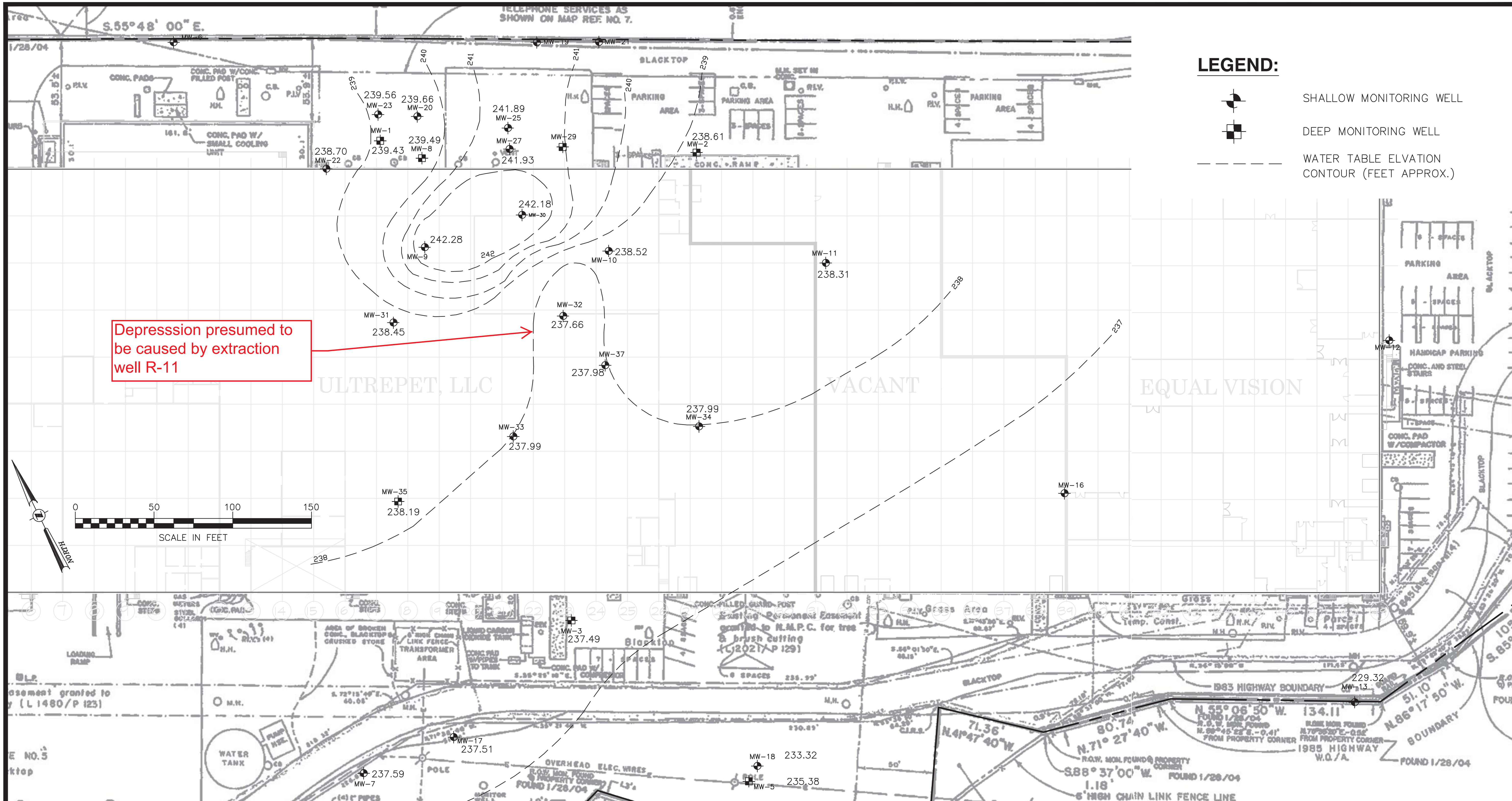
Kim L. Baines, LEP	Arlette St. Romain
Project Manager, Earth Environmental	Assistant Project Manager, Chazen

Reviewed and approved by

Joseph M. Lanaro, PE
Senior Principal, Vice President, Engineering

cc via email:	Mr. Kyle Forster, NYSDEC	Mr. Leigh Peritz PE, wTe Corporation
	Ms. Maureen Schuck, NYSDOH	Mr. Scott Mellen, President & CEO, wTe Corporation

<u>Attachments:</u>
Figure 1 2018 Groundwater Monitoring Well Network
Figure 2 April 2018 Modifications to HVE/SVE System
SMP Executive Summary Table (August 2018)



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GROUNDWATER CONTOUR MAP
JUNE 13-14, 2018

designed	checked
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date 06/13/18	scale 1"=60'
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sheet no. FIG.1	

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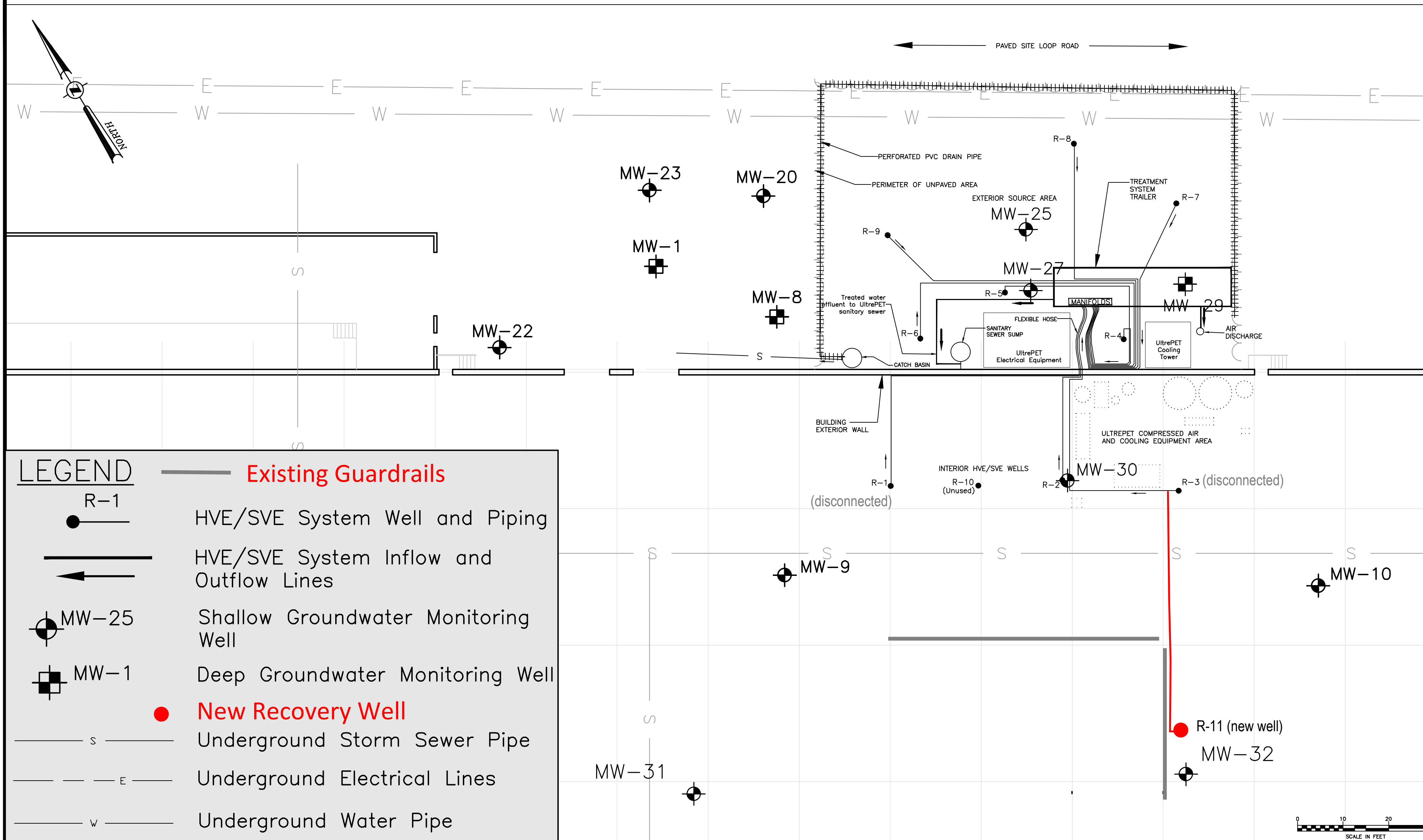

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APRIL 2018 MODIFICATION□ TO □□E□□□E □□□TEM

136 FULLER ROAD
CITY OF ALBANY, ALBANY COUNTY, NY

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FIG.2	