Former Interceram Site
20 Fortune Road West
Town of Wallkill
Orange County, New York

Site Management Plan

NYSDEC Site No. 336045

CHA Project Number: 28574

Prepared for:

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Revisions to Final Site Management Plan:

Revision No.	Submitted Date	Summary of Revision	DEC Approval Date
1	February 16, 2017	Addition of Environmental Easement and P.E. certification	

CERTIFICATION

I, the undersigned, certify that I am currently a New York State registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) *Final DER-10 Technical Guidance for Site Investigation and Remediation*, dated May 2010. This Site Management Plan (SMP) has been submitted for the continual and proper operation, maintenance, and monitoring of all Institutional and Engineering Controls employed at the Site.

For Clough Harbour & Associates LLP:

(Professional Seal)

Michael Hollowood, P.E.
Printed Name of Certifying Engineer

Signature of Certifying Engineer

02/16/17
Date of Certification

068351
Registration Number

New York
Registration State

Clough Harbour & Associates LLP
Company

Vice President
Title

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LIST OF ACRONYMS & ABBREVIATIONS

bgs	Below Ground Surface
BUD	Beneficial Use Determination
CFR	Code of Federal Regulations
CHA	Clough Harbour & Associates LLP
COC	Certificate of Completion
CY	Cubic Yards
DCE	Dichloroethene
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
EPA	Environmental Protection Agency
EWP	Excavation Work Plan
FER	Final Engineering Report
FPS	Feet per Second
IC	Institutional Control
IRM	Interim Remedial Measure
mg/m^3	Milligrams per Cubic Meter
NYCRR	New York Code, Rules & Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OSHA	Occupational Safety & Health Administration
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PPE	Personal Protective Equipment
PPM	Parts Per Million
QEP	Qualified Environmental Professional
RI	Remedial Investigation
ROD	Record of Decision
SCG	Standard, Criteria, and Guidance
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SSDS	Sub-slab Depressurization System
SVI	Soil Vapor Intrusion
TCE	Trichloroethene
TCL	Target Compound List
µm	Micrometers or microns
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site and affected off-site areas, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan (SMP):

Site Identification: #336045 Former Interceram Site, 20 Fortune Rd. West, Wallkill, NY

Institutional Controls:	1. The remedial party or site owner is required to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).; 2. The property may be used for commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws; 3. The use of groundwater is prohibited without necessary water quality treatment as determined by the New York State Department of Health or the Orange County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the NYSDEC. 4. Compliance with the NYSDEC-approved SMP is required. 5. Operation, maintenance, monitoring, inspection and reporting of any mechanical or physical component of the remedy (e.g. sub-slab depressurization systems) shall be performed as defined in this SMP. 6. Access to the Site and affected off-site areas 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 the Environmental Easement. 7. The potential for soil vapor intrusion must be evaluated for any new buildings developed on the Site or affected off-site areas, and actions recommended to address potential exposures related to soil vapor intrusion must be implemented.

Site Identification: #336045 Former Interceram Site, 20 Fortune Rd. West, Wallkill, NY

	8. All future activities on the property that will disturb remaining contamination must be conducted in accordance with this SMP.	
Engineering Controls:	1. Sub-slab Depressurization Systems (SSDS) on the Site in the former Interceram building and on the Rockwood Gardens property in buildings 61, 62 and 65.	
Inspections:		Frequency
1. Site-wide		Annually
Monitoring:		
1. Groundwater monitoring Gauging and sampling of monitoring wells S-2, S-9, MW-3 and SUMP; analysis of groundwater samples for TCL Volatile Organic Compounds by EPA Method 8260.		Semiannually
Maintenance:		
1. SSDS		As needed
Reporting:		
1. Periodic Review Report		Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 GENERAL

This Site Management Plan (SMP) is a required element of the remedial program for the Former Interceram Site, located in the Town of Wallkill, Orange County, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program, Site No. 336045 which is administered by New York State Department of Environmental Conservation (NYSDEC).

CeramTec North America Corporation (CeramTec) entered into an Order on Consent on March 3, 1997 with the NYSDEC to remediate the Site. Figures showing the site location and boundaries of the Site are provided as Figures 1 and 2.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement, issued by the NYSDEC, and recorded with the Orange County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site and affected portions of off-site properties. A copy of the Environmental Easement is included in Appendix A of this document.

This SMP was prepared to manage remaining contamination at the Site and affected portions of off-site properties until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the NYSDEC in accordance with the Environmental Easement. This SMP may only be revised with the approval of the 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 Order on Consent (Index #W3-0781-96-06; Site #336045) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided in Appendix B of this SMP.

This SMP was prepared by CHA Consulting, Inc., on behalf of CeramTec, the Remedial Party, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site. Responsibilities of the Site Owner(s) and Remedial Party under this SMP are outlined in Appendix C of this document.

1.2 REVISIONS

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. 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. Any approved revisions to this SMP must be denoted on the cover page of the Plan.

1.3 NOTIFICATIONS

Notifications will be submitted by the property owner or Remedial Party to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.

- 7-day advance notice of any field activity associated with the remedial program.

- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.

- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, 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 ECs 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 submitted to the NYSDEC within 45 days describing and documenting 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/Remedial Party has been provided with a copy of the Order on Consent, 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 to the NYSDEC.

Table 1-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information.

Table 1-1: Notifications

Name	Contact Information
Randy Whitcher, NYSDEC Project Manager	Phone: (518) 402-9662 E-mail: randy.whitcher@dec.ny.gov

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 SITE LOCATION & DESCRIPTION

The Site is located in the Town of Wallkill, Orange County, New York and is identified as Section 41, Block 1 and Lot 26.5 on the Orange County Tax Map. The Site is an approximately 3-acre parcel, situated within a mixed commercial and residential area. The Site is bounded by an undeveloped wooded area and then residential properties to the north, Fortune Road West and then a commercial property to the south, a residential apartment complex (Horizon Hills) to the east, and a resident apartment complex (Rockwood Gardens) to the west (see Figure 2). The owner of the Site parcel at the time of issuance of this SMP is: Ingo Priebke LLC, 11 Somerset Lane, Warwick, New York, 10990.

In addition to the Site, portions of the Rockwood Gardens Apartment Complex property immediately west of the Site are also subject to the requirements of this SMP, based on migration of contamination from the Site. Areas subject to the requirements of the SMP are indicated on Figure 3. These areas are located on three of the tax parcels that comprise the Rockwood Gardens property: Section 24, Block 1, Lots 34.31, 34.32 and 34.34 on the Orange County Tax Map. The owner of record of these parcels at the time of issuance of this SMP is: Rockwood Gardens Associates, 287 Hunting Ridge Road, Stamford, Connecticut, 06903.

2.2 PHYSICAL SETTING

2.2.1 Land use

The Site consists of a single-story commercial building and adjacent parking lot located on the north side of Fortune Road West. Currently, Medical World, a medical parts supplier, occupies the eastern portion of the building and Auto Parts International, an auto parts supplier, occupies the western portion of the building.

Historically the northern portion of the Site was occupied by an apple orchard in the early 1950s and remaining portions of the Site were covered by woodlands until 1967. Starting in 1967, the southern portion of the site was graded and a 10,404 square foot building was constructed with a parking lot located on the east side of the building. In 1979, a 10,026 square foot addition was constructed increasing the total square footage to 20,430.

Between 1976 and 1991, Ceramx Corporation operated in the manufacturing facility. Operations included electroplating, polishing, anodizing, and the coloring of semiconductors and related devices. Several chemical and freshwater rinses were incorporated along with alkaline soap, sodium cyanide, hydrochloride, nitric acid, and sulfuric acid dip. Several acids, bases, caustics, solvents (trichloroethene and methyl alcohol), sodium cyanides, and potassium gold cyanides were used and stored on-site.

Chemical wastes were stored outside on the western side of the building at ground level until 1986, when the chemical storage area was enclosed with a concrete floor, concrete walls, and a roof to limit the potential for the release of contaminants to the environment.

A wet blast/abrasive reworking process was used to clean parts with high pressure water and abrasives. Rinse water from this cleaning process was directed through a series of holding tanks for settling, diluted with tap water, and piped outside the building underground to the on-site storm drain system. Reportedly, 15,000 to 20,000 gallons of wet blast/abrasive rinse water was discharged daily to the on-site storm water system.

2.2.2 Geology

Surficial and bedrock geologic maps compiled by the United States Geological Survey (Lower Hudson Sheet) indicate that the surficial soils in the area of the Site consist of till which is underlain by bedrock of the Austin Glen Formation, consisting of greywacke and shale.

Based on soil borings completed as part of past subsurface investigations on the Site and the adjoining Rockwood Gardens property to the west, overburden consists of fine to medium sand, fine to medium gravel and minor amounts of silt to depths ranging from 6 to 12 feet below grade, underlain by a dense till.

2.2.3 Hydrogeology

Based on historical water level measurements and groundwater elevation data from monitoring well locations on the Site and the adjoining Rockwood Gardens property to the west, the depth to groundwater generally ranges from 2 to 5 feet below grade, and groundwater flow is generally toward the west-northwest.

2.3 INVESTIGATION AND REMEDIAL HISTORY

Subsurface investigations conducted by others at the former Interceram property during 1992 and 1993 identified the presence of industrial solvent-related volatile organic compounds (VOCs), including trichloroethene (TCE), tetrachloroethene (PCE) and 1,2-dichloroethene (1,2-DCE), in soil and groundwater on the western portion of the property, extending in a westerly direction from the former exterior chemical storage area to the property line. In May 1993, the Site was included on the New York State Registry of Inactive Hazardous Waste Disposal Sites as a Class 2a site, and a preliminary site assessment was conducted pursuant to an Order on Consent executed by Ceramx and the NYSDEC.

A subsurface assessment conducted in September 1993 on the adjacent Rockwood Gardens Apartments property in the area immediately east of Building #62 (referred to as Building #16 at the time of the assessment) identified the presence of TCE in subsurface soils and also in groundwater at concentrations above the New York State Ambient Water Quality Standard.

In January 1994, Ceramx entered into an Order on Consent with the NYSDEC to conduct a Remedial Investigation and Feasibility Study at the Site and in March 1994, the Site was reclassified as a Class 2 site on the Inactive Hazardous Waste Disposal Site Registry.

In late 1995, a Remedial Investigation was completed at the former Interceram site. The investigation included sampling and analysis of surface soil, subsurface soil, soil vapor, indoor air, and groundwater. Results of the investigation indicated the presence of multiple VOCs in groundwater at concentrations exceeding the New York State Ambient Water Quality Standards. In addition, low concentrations of VOCs were also identified in indoor air samples collected from Building #62 on the Rockwood Gardens property. Based on the results of the Remedial Investigation, a Feasibility Study was completed in 1996 to identify and evaluate the potential remedial alternatives to address the chemical constituents present in the soil and groundwater at the subject site. According to the Record of Decision issued by the NYSDEC in February 1997, the selected remedial action for contaminated soils (Operable Unit 1 or OU-1) included on-site soil treatment using low temperature thermal desorption (LTTD), implementation of a long term groundwater monitoring program, an indoor air sampling program, and a deed restriction ensuring that the premises will be serviced exclusively by public drinking water. The long-term groundwater monitoring requirement included the stipulation that if the rate of natural attenuation was determined to be unsatisfactory, remediation of contaminated groundwater (Operable Unit 2 or OU-2) will be implemented.

Site soils were treated using the LTTD system between January and June 1997. According to the Site Remediation Report dated October 1997, approximately 11,000 cubic yards of soil and rock were excavated from the western portion of the former Interceram property, between the west side of the former Interceram building and the eastern end of the Rockwood Gardens property. Several hundred yards of rock was crushed and decontaminated and returned to the excavation. The remaining soil materials were treated by the LTTD system. In addition, approximately 125 tons of soil were transported off site for disposal. Subsequent to collection and analysis of post-excavation soil samples, the excavations were backfilled with the treated soils.

From 2001 through 2012, groundwater monitoring was conducted annually, including collection of groundwater samples from the monitoring location identified as SUMP on the western portion of the former Interceram property (within the former soil remediation area) and monitoring wells located in the vicinity of Building 62 on the Rockwood Gardens property adjacent to the former Interceram property (see Figure 3). Based on historical groundwater elevation data, the direction of groundwater flow in the area of the Site is generally toward the west-northwest, from the former Interceram property toward the adjacent Rockwood Gardens property. A groundwater contour map, based on groundwater elevation data from August 2014, is included as Figure 4. Historical groundwater analytical data since 2001 showed fluctuating concentrations of TCE ranging from 290 to 1,400 µg/L at the monitoring location identified as SUMP (located east and upgradient of Building 62) and concentrations ranging from 4,200 to 17,000 µg/L at the location of monitoring well S-2 (located west and downgradient of Building 62). Historical data showed fluctuating concentrations of cis-1,2-DCE ranging from 290 to 1,400 µg/L at the location of the SUMP, and concentrations ranging from 510 to 1,100 µg/L at S-2. The results from the January 13, 2012 groundwater sampling event (the most recent sampling event prior to implementation of the Interim Remedial Measure for OU-2) showed the presence of TCE and cis-1,2-DCE each at concentrations of 1,000 µg/L at the location of the SUMP. Concentrations of these two compounds at the location of S-2 were 8,000 µg/L and 870 µg/L, respectively. These results indicated that there had been no significant reduction in the concentration of these compounds in groundwater since 2001. Concentrations of both TCE and cis-1,2-DCE remained above the established New York State Ambient Water Quality Standards.

In 2008 and 2009, CHA conducted vapor intrusion (VI) investigations at the former Interceram facility and at the Rockwood Gardens apartment complex in Buildings 61, 62, 64, 65 and 66. In 2010, based on the results of the VI investigations, sub-slab depressurization systems (SSDS) were installed in Buildings 61, 62 and 65 to address indoor air concerns within these buildings. No further action was required for Buildings 64 and 66. The SSDS in Buildings 61, 62 and 65 have

been monitored periodically since installation and continue to operate. The systems have been inspected annually for proper operation by the environmental contractor that installed them. The most recent inspection was completed in November 2014. System inspection reports have been submitted to the NYSDEC.

In an effort to evaluate downgradient contaminant extent within the shallow aquifer, in advance of anticipated groundwater remedial activities, an additional 1-inch diameter PVC monitoring well (S-9) was installed in December 2012 in the area to the north of Building #61, approximately 100 feet west-northwest of monitoring well S-2. The analytical results of the groundwater sample collected from this new well showed the presence of TCE at a concentration of 260 µg/L (above the New York State Ambient Water Quality Standard), indicating that groundwater in the area between S-2 and S-9 was impacted and should be addressed as part of the anticipated remedial activities.

Based on historical analytical data, discussions during a November 2012 meeting between CHA, CeramTec and the NYSDEC, and the December 2012 groundwater analytical results from monitoring well S-9, it was determined that remedial efforts would be focused on the areas immediately to the east and west of Building 62 (vicinity of the SUMP and monitoring well S-2) and the area to the north of Building 61, between monitoring wells S-2 and S-9.

Following evaluation of factors including contaminants of concern, contaminant concentrations and distribution, depth to water, soil type, groundwater gradient, site structures and other site characteristics, the primary remedial technology selected to address the groundwater contamination was in-situ chemical oxidation (ISCO) using a product called PersulfOx™, supplied by Regenesis, supplemented with enhanced anaerobic biodegradation using a product called 3-D Microemulsion or 3DME (also supplied by Regenesis). Remedial activities were conducted as an Interim Remedial Measure (IRM), in accordance with the NYSDEC-approved Interim Remedial Measure Work Plan dated April 23, 2013.

The remedial technologies referenced above were implemented via subsurface injection using direct-push (Geoprobe) methods during the summer and fall of 2014. In the areas of the SUMP and S-2 (east and west of Building #62, respectively), both technologies were implemented. In the area of S-9, only Enhanced Anaerobic Biodegradation technology was implemented, based on the lower concentrations of target contaminants in this area. In the areas of the SUMP and S-2, two PersulfOx™ injection events were completed, the second occurring approximately six weeks

following the first. A third injection event, for application of the 3-D MicroEmulsion in all three areas, occurred approximately two months following the second PersulfOx™ injection event.

Remedial injection activities and post-remediation groundwater monitoring results were presented in CHA's Final Engineering Report, dated April 7, 2015.

2.4 REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for the Site as listed in the Record of Decision dated March 2015 are as follows:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

2.5 REMAINING CONTAMINATION

2.5.1 Groundwater

Historical groundwater sampling results indicated elevated levels of trichloroethene (TCE), cis-1,2-dichloroethene, freon 113 and 1,1,1-trichloroethane (collectively the contaminants of concern). Post remediation results indicate that a significantly lower level of these contaminants remain in groundwater near the boundary between the former Interceram property and the Rockwood Gardens property. Groundwater contamination does not appear to extend to the south or southwest beyond the parking lot and road west of Building 62 on the Rockwood Gardens property, as groundwater monitoring wells in these directions did not show detections of contaminants.

Post IRM samples collected on January 13, 2015, show the maximum concentrations of TCE, cis-1,2-dichloroethene, Freon 113 and 1,1,1-trichloroethane in groundwater were 370 µg/L, 450 µg/L, 2,300 µg/L and 12 µg/L, respectively.

Table 2-1 summarizes the results of all samples of groundwater that exceed the SCGs after completion of the remedial action (January 13, 2015 sampling date). Data from the most recent pre-remedial action sampling events are also included for reference (1/12/13 for S-2, MW-3 and SUMP, and 12/18/12, for S-9). Data from January 13, 2015 are presented graphically on Figure 5.

Table 2-1: Contaminants of Concern Remaining in Groundwater

Compound	Analytical Results (µg/L)								TOGS 1.1.1 Class GA Ambient Water Quality Standard (µg/L)
	S-2		S-9		MW-3		SUMP		
	1/13/12	1/13/15	12/18/12	1/13/15	1/13/12	1/13/15	1/13/12	1/13/15	
Trichloroethene	8,000	370	260	150	240	210	1,000	80 U	5
cis-1,2-dichloroethene	870	450	11	390	37	49	1,000	80 U	5
1,1,1-trichloroethane	44	8 U	10 U	10 U	15	12	2	80 U	5
Freon 113	1 U	8 U	1 U	10 U	12	13	4,900	2,300	5

µg/L – micrograms per liter (or parts per billion)
U – Compound not detected above the laboratory reporting limit indicated

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 GENERAL

Since remaining contaminated groundwater exists beneath the Site, Institutional Controls and Engineering Controls (IC/ECs) are required to protect human health and the environment. An Environmental Easement, issued by the NYSDEC, and recorded with the Orange County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site and affected portions of off-site properties. A copy of the Environmental Easement is included in Appendix A. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the Site. The IC/EC Plan is one component of the SMP and is subject to revision by NYSDEC.

This plan provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation 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 IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 INSTITUTIONAL CONTROLS

The NYSDEC has defined an institutional control as "any non-physical means of enforcing a restriction on the use of real property that limits human and environmental exposure, restricts the use of groundwater, provides notice to potential owners, operators, or members of the public, or prevents actions that would interfere with the effectiveness of a remedial program or with the effectiveness and/or integrity of operation, maintenance, or monitoring activities at or pertaining to a remedial Site."

A series of ICs is required by the ROD to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the Site to commercial and industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easement (Appendix A) and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries (or areas subject to this SMP) are shown on Figure 2. These ICs are as follows:

- The remedial party or site owner is required to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).
- The property may be used and developed for commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws.
- The use of groundwater is prohibited without necessary water quality treatment as determined by the New York State Department of Health or the Orange County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the NYSDEC.
- Compliance with the NYSDEC-approved Site Management Plan is required.
- Operation, maintenance, monitoring, inspection and reporting of any mechanical or physical component of the remedy (e.g. sub-slab depressurization systems) shall be performed as defined in this SMP.
- Access to the Site and affected off-site areas 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 the Environmental Easement.
- The potential for soil vapor intrusion must be evaluated for any new buildings developed on the Site or affected off-site areas, and actions recommended to address potential exposures related to soil vapor intrusion must be implemented. The evaluation of the potential for soil vapor intrusion must be conducted in accordance with the most recent NYSDOH "Guidance for Evaluating Vapor Intrusion in the State of New York". Any measure(s) to be implemented for mitigation of potential vapor intrusion must be evaluated, selected, designed, installed and maintained based on the SVI evaluation, the NYSDOH guidance and construction details of the proposed structure.

The approach to evaluating soil vapor intrusion is dependent upon site-specific conditions. A thorough understanding of the site is necessary, including its former uses, the site geology, the depth to water and the potential for preferred pathways in the subsurface (e.g., utility corridors, sewer lines, etc.).

To determine the potential for soil vapor intrusion in a proposed structure, soil vapor samples should be collected to determine whether a source of contamination exists, or is migrating within the footprint of the proposed structure. Note that soil vapor results alone may not be relied upon to rule out the potential for future vapor intrusion. This is due to the fact that during construction, preferred pathways may be created, pathways for vapor migration may be altered, soil moisture may be altered and soil compaction changed.

More details on sampling approach and evaluation of results can be found in the "Final Guidance for Evaluating Soil Vapor Intrusion, October 2006" prepared by the New York State Department of Health.

- All future activities on the property that will disturb remaining contamination must be conducted in accordance with this SMP.

3.3 ENGINEERING CONTROLS

The NYSDEC has defined an engineering control as "any physical barrier or method employed to actively or passively contain, stabilize, or monitor contamination, restrict the movement of contamination to ensure the long-term effectiveness of a remedial program, or eliminate potential exposure pathways to contamination. Engineering controls include, but are not limited to, pavement, caps, covers, subsurface barriers, vapor barriers, slurry walls, building ventilation systems, fences, access controls, provision of alternative water supplies via connection to an existing public water supply, adding treatment technologies to such water supplies, and installing filtration devices on private water supplies." Engineering controls in place at the Site consist of a sub-slab depressurization system within the former Interceram manufacturing building and sub-slab depressurization systems within three of the apartment buildings (61, 62 and 65) on the adjacent Rockwood Gardens property.

3.3.1 Sub-Slab Depressurization Systems

Sub-slab depressurization systems (SSDS) for potential vapor intrusion mitigation are currently installed and operating on the Site within the former Interceram building and on the adjacent Rockwood Gardens property, in buildings 61, 62 and 65. Since their installation in 2010, the systems have been monitored and inspected on an annual basis. These systems shall remain in place

and active, and the current monitoring/inspection schedule shall continue, until such time as the NYSDEC authorizes deactivation of the systems.

Procedures for operating, maintaining and monitoring the active SSDS are documented in the Operation, Maintenance and Monitoring Plan in Appendix D of this SMP.

3.3.2 Criteria for Termination of SSDS

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.

Operation of the active SSD systems will not be discontinued unless prior written approval is granted by the NYSDEC. In the event that monitoring data indicates that the SSD systems are no longer required, a proposal to discontinue operation of the SSD systems will be submitted by the Site owner and/or the remedial party to the NYSDEC and NYSDOH. The proposal will include provisions for sub-slab soil vapor and indoor air sampling, to be conducted during the heating season, following an agreed upon period of system shut-down. Sampling will be conducted in accordance with the most recent NYSDOH "Guidance for Evaluating Vapor Intrusion in the State of New York" and sampling results will be compared to the Soil Vapor/Indoor Air Matrices contained in the aforementioned NYSDOH guidance document.

As noted above, the potential for soil vapor intrusion must be evaluated for any *new* buildings developed on the Site or affected off-site areas prior to construction, and actions recommended to address potential exposures related to soil vapor intrusion must be implemented. The evaluation of the potential for soil vapor intrusion must be conducted in accordance with the most recent NYSDOH "Guidance for Evaluating Vapor Intrusion in the State of New York".

4.0 MONITORING AND SAMPLING PLAN

4.1 GENERAL

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of groundwater;
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

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

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 6.0 of this SMP.

4.2 SITE-WIDE INSPECTION

Site-wide inspections will be performed on a regular schedule, at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed, which 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 being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

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

- Whether ECs 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; and
- If site records are complete and up to date; and

Reporting requirements are outlined in Section 6.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event

to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 POST-REMEDIATION GROUNDWATER MONITORING AND SAMPLING

Groundwater samples shall be collected from a total of four (4) existing monitoring wells on the Site and the adjoining Rockwood Gardens property on a routine basis. Monitoring of the wells will be performed bi-annually, beginning in the fall of 2015. The sampling frequency and requirements may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC. Trends in contaminant levels in groundwater will be evaluated to determine if the remedy continues to be effective in achieving remedial goals.

Sampling locations, required analytical parameters and schedule are provided below in Table 4–1. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 4-1: Post Remediation Sampling Requirements and Schedule

Well ID	Design Criteria	Monitoring Activity	Analytical Parameter(s)	Frequency
SUMP	Monitor downgradient water quality	Sample/Gauge	TCL VOCs/ EPA 8260	Bi-annually
S-2	Monitor downgradient water quality	Sample/Gauge	TCL VOCs/ EPA 8260	Bi-annually
S-9	Monitor downgradient water quality	Sample/Gauge	TCL VOCs/ EPA 8260	Bi-annually
MW-3	Monitor downgradient water quality	Sample/Gauge	TCL VOCs/ EPA 8260	Bi-annually

All monitoring well sampling activities will be recorded on a groundwater-sampling log. Other observations (e.g., well integrity, accessibility, etc.) will also be noted on the well sampling log.

Groundwater monitoring wells will be gauged, purged, and sampled following the sampling and handling protocols described in the associated Standard Operating Procedures (SOPs). To avoid cross-contamination between monitoring wells, all non-disposal equipment will also be decontaminated prior to moving the equipment to each well at the Site as described in the corresponding SOP. SOPs are presented in Appendix E. The following table indicates the sampling activity and its corresponding SOP. A brief description of sampling activities is described below:

Table 4-2: Well Sampling SOPs

Activity	SOP #
Well Gauging	**313**
Well Purging/Sampling	**315, 317**
Decontamination	**501**

The water level in all Site monitoring wells will be measured to the nearest 0.01-foot using an electronic water level meter and recorded on a water level log prior to the collection of any samples. After calculating the amount of groundwater in the well casing, approximately three (3) times the volume of stored water in the well casing will be purged prior to obtaining a representative groundwater sample. Care will be taken during the purging process to minimize any disturbance to the water column in the well. In the event that the well is pumped or bailed dry during the purging process, the well will be allowed to recharge and a representative sample will then be collected. A submersible pump (or equivalent) with dedicated polyethylene tubing will be utilized to purge and sample the wells. The wells will be purged at a maximum rate of two (2) gallons per minute and sampled at a maximum flow rate of one-half (0.5) gallon per minute.

The wells will be sampled in order from least contaminated to most contaminated. During the purging process, field water quality parameters, including pH, temperature, turbidity, specific conductance, dissolved oxygen (DO), and the oxidation-reduction potential (ORP) of the groundwater shall be measured. A final round of water quality measurements will be taken immediately after collection of the groundwater sample. The water level, purge data, field water quality data, and sampling information shall be documented on a well sampling log. All samples will be packed in ice immediately following sampling and transported to a qualified laboratory with a completed chain of custody.

The groundwater samples will be submitted to a laboratory certified under the New York State Department of Health's (NYSDOH's) Environmental Laboratory Approval Program (ELAP) for analysis following appropriate chain-of-custody protocols. Each groundwater sample will be analyzed for the following parameters:

- Target Compound List Volatile Organic Compounds (VOCs)

For QA/QC purposes, as part of the groundwater sampling event, one blind duplicate will be collected during each round of sampling. Additionally one trip blank will be analyzed. No third party data validation will be performed as part of the environmental monitoring.

Table 4-3, below, summarizes the wells' identification numbers, as well as the locations, diameters, depths and screened intervals of the wells.

Table 4-3: Monitoring Well Construction Details

Monitoring Well ID	Well Location	Well Diameter (inches)	Well Depth (feet below grade)
SUMP	Former Interceram Site West of Former Interceram building	8	29
S-2	Rockwood Gardens property West of Building 62	2	16.5
S-9	Rockwood Gardens property North of Building 61	1	15
MW-3	Rockwood Gardens property Near southeast corner of Building 62	2	25

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, 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 any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 6.0 – Reporting Requirements. A summary of the sampling event will be included in the annual Periodic Review Report. The summary will include:

- The date of the event;
- A list of activities performed.
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- The laboratory data table showing comparisons to NYSDEC groundwater standards;
- A submission of data in NYSDEC EQuIS format to the data management unit, if required by the DEC project manager; and
- A determination as to whether groundwater conditions have changed since the last monitoring event.

4.4 POTENTIAL ADDITIONAL APPLICATION(S) OF ISCO AMENDMENTS

The Record of Decision required that provisions be included within the SMP to address a potential rise or plateauing of contaminant concentrations following the application of the ISCO amendments during the IRM. The proposed groundwater monitoring plan will provide the post-remediation monitoring results to evaluate the effectiveness of the ISCO application. However, it is important to note that a major objective of the NYSDEC-approved Remedial Action Plan was "*to reduce levels of target contaminants in groundwater to an order of magnitude lower than the most recent analytical results, or less, in the vicinity of Building #62 within 1 to 3 years of implementation.*" That objective was achieved. If future monitoring results show a significant increasing trend in contaminant concentrations to previous levels, then future actions may be required. The extent of the future actions will be determined in consultation with NYSDEC and will consider actual contaminant concentrations, potential for exposure and any change in site conditions.

5.0 REPORTING REQUIREMENTS

5.1 SITE MANAGEMENT REPORTS

All site management inspection, maintenance and monitoring events will be documented on appropriate forms. All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC and will be summarized in the annual Periodic Review Report, discussed in Section 6.2.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- 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);
- 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 in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;

- Description of maintenance activities performed;
- 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).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- 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).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

5.2 PERIODIC REVIEW REPORT

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion or equivalent document is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the NYSDEC or at another frequency as may be required by the NYSDEC. In the event that the site is subdivided into separate parcels with different ownership, a single PRR will be prepared that addresses the Site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. 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 site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.

- 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, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances 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 in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.

- A site evaluation, which includes the following:

  - The compliance of the remedy with the requirements of the site-specific ROD;

  - 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 and Sampling Plan for the media being monitored;

  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and

  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.

  - The overall performance and effectiveness of the remedy.

5.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"*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;*
- *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 generally accepted engineering practices; and*
- *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 [Owner/Remedial Party or

Owner's/Remedial Party's Designated Site Representative]. [I have been authorized and designated by all site owners/remedial parties to sign this certification] for the site."

5.3 CORRECTIVE MEASURES WORK 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 Work 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 Work Plan until it has been approved by the NYSDEC.

6.0 REFERENCES

NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation". May 3, 2010.

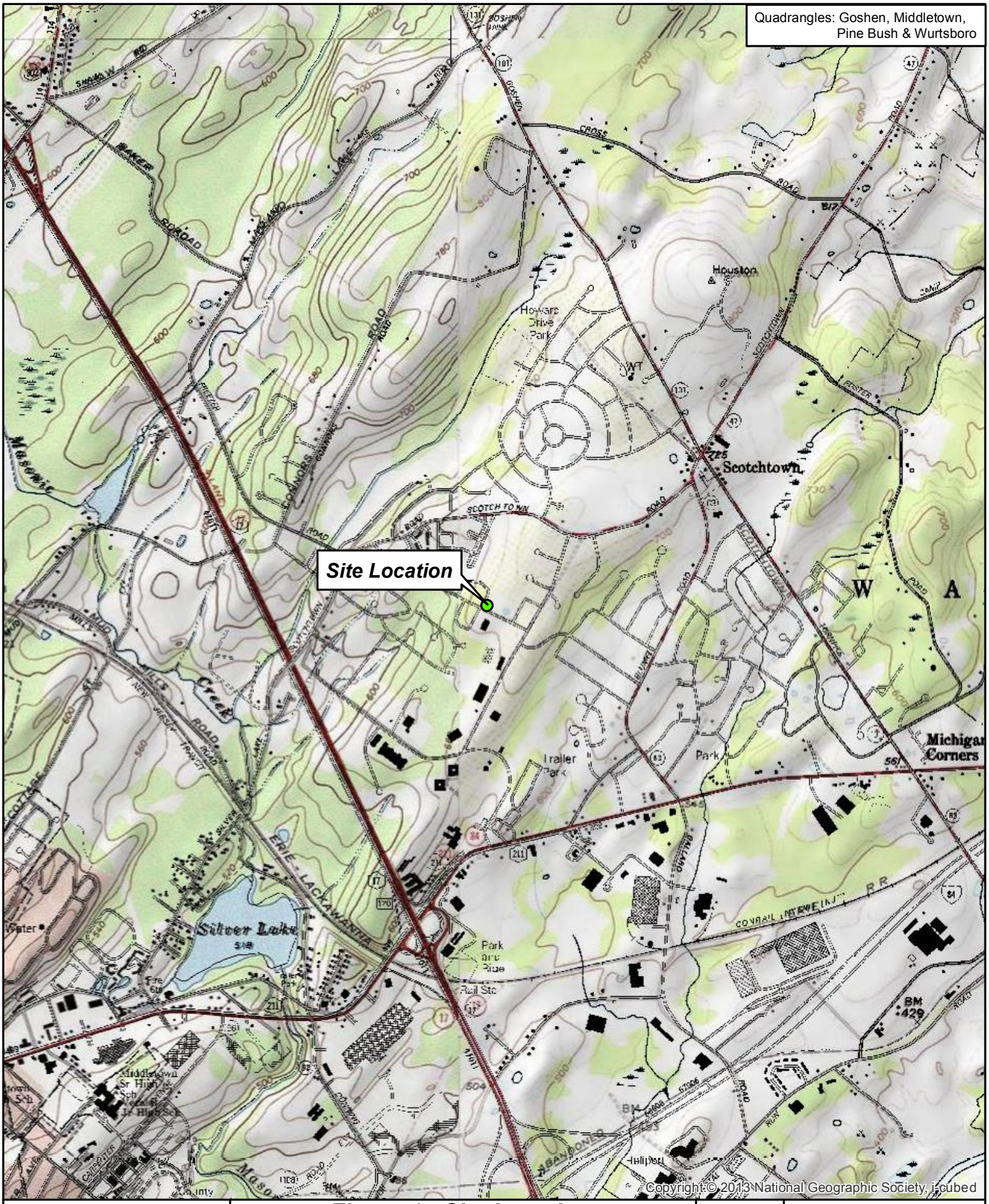
NYSDOH, "Guidance for Evaluating Soil Vapor Intrusion in the State of New York". October 2006.

NYSDEC, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

NYSDEC, "Record of Decision", Interceram, Operable Unit 02: Groundwater and Soil Vapor, State Superfund Project, Wallkill, Orange County, Site No. 336045. March 2015.

CHA Consulting, Inc., "Final Engineering Report", Former Interceram Site, 20 Fortune Road West, Town of Wallkill, Orange County, New York, NYSDEC Site No. 336045. April 7, 2015.

FIGURES



CHA

III Winners Circle, P.O. Box 5269 • Albany, NY 12205-0269
Main: (518)453-4500 • www.cloughharbour.com

Figure 1 - Site Location

Site Management Plan
Former Interceram Site - NYSDEC Site #336045
20 Fortune Road West, Wallkill, NY 10941

N
W E
S
1 inch = 2,000 feet

Project No. : 28574

Date : June 2015

0 1,000 2,000 Feet

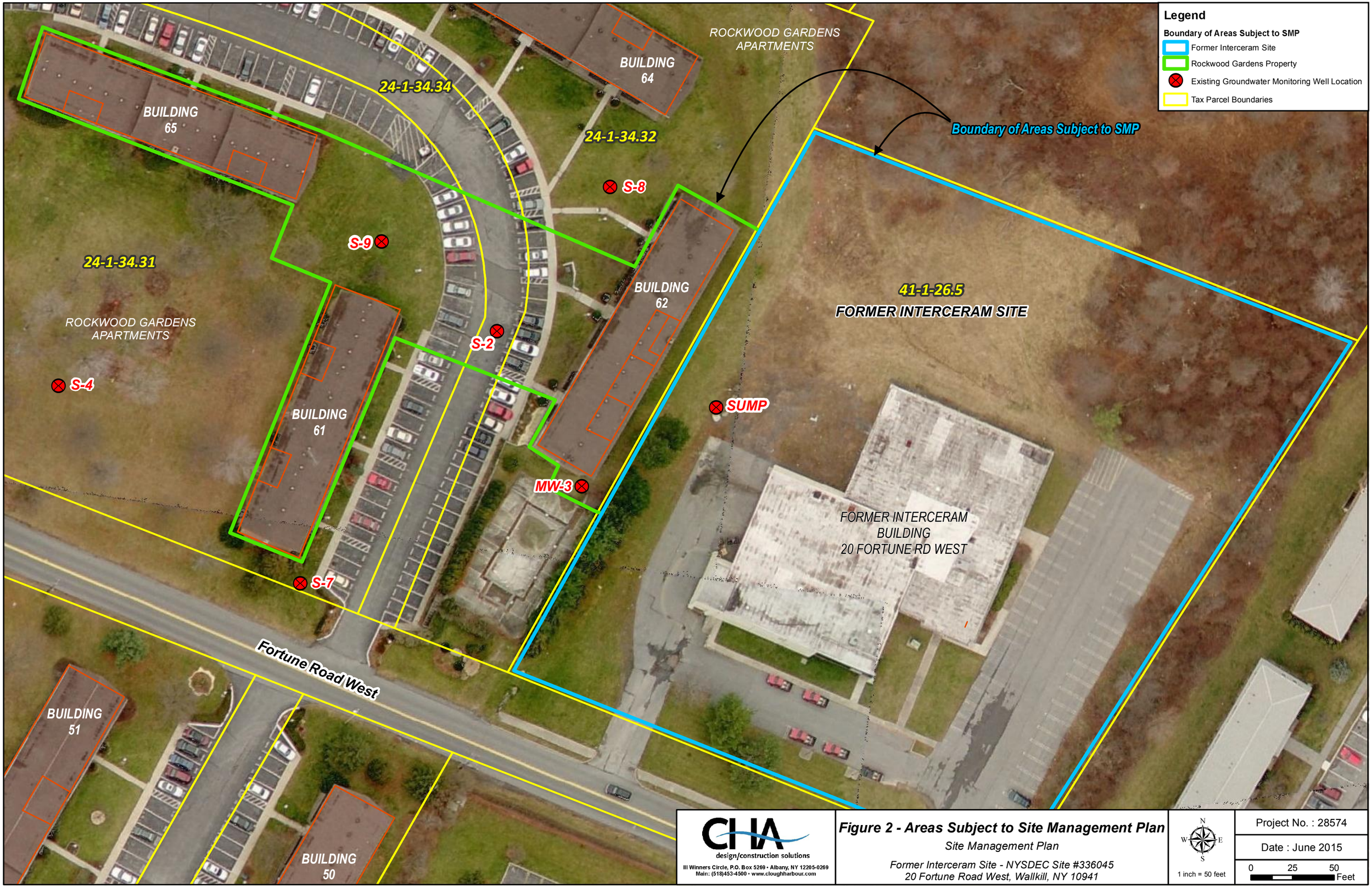


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Figure 2 - Areas Subject to Site Management Plan

Site Management Plan

Former Interceram Site - NYSDEC Site #336045
20 Fortune Road West, Wallkill, NY 10941

N W E S

1 inch = 50 feet

Project No. : 28574

Date : June 2015

0 25 50 Feet

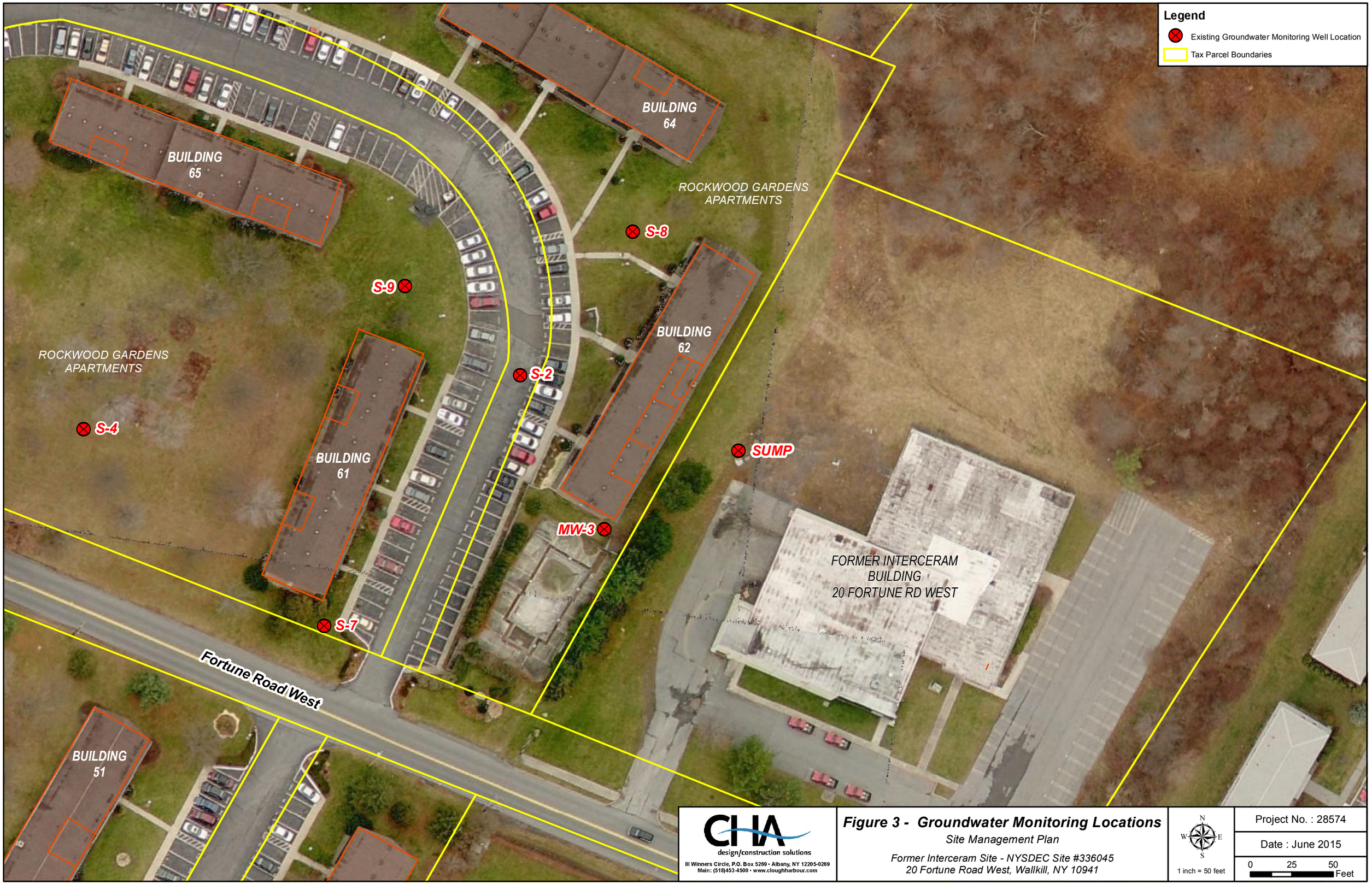

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Figure 3 - Groundwater Monitoring Locations

Site Management Plan

Former Interceram Site - NYSDEC Site #336045
20 Fortune Road West, Wallkill, NY 10941

N W E S

1 inch = 50 feet

Project No. : 28574

Date : June 2015

0 25 50 Feet

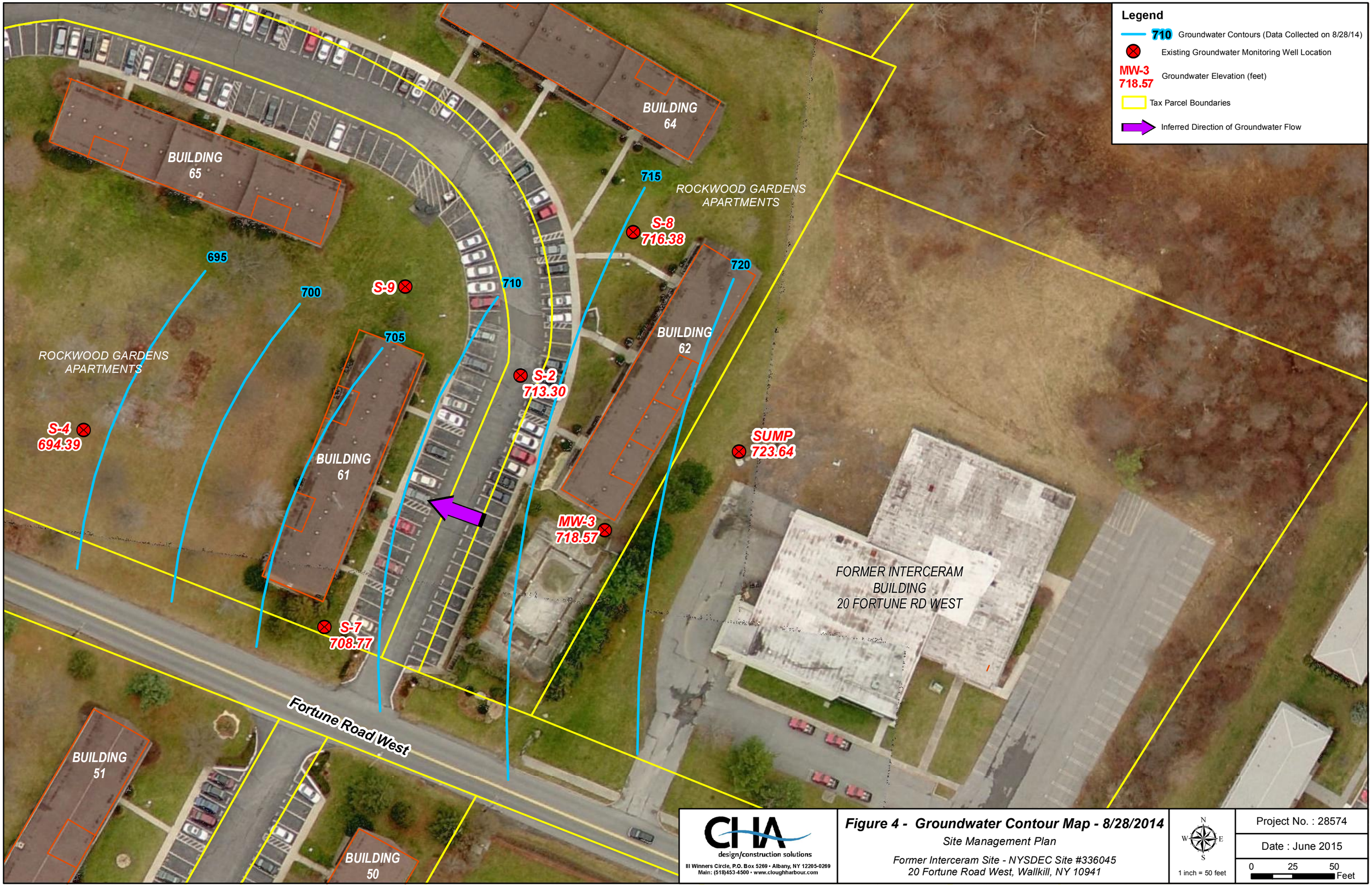

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Figure 4 - Groundwater Contour Map - 8/28/2014

Site Management Plan

Former Interceram Site - NYSDEC Site #336045
20 Fortune Road West, Wallkill, NY 10941

N W E S

1 inch = 50 feet

Project No. : 28574

Date : June 2015

0 25 50 Feet

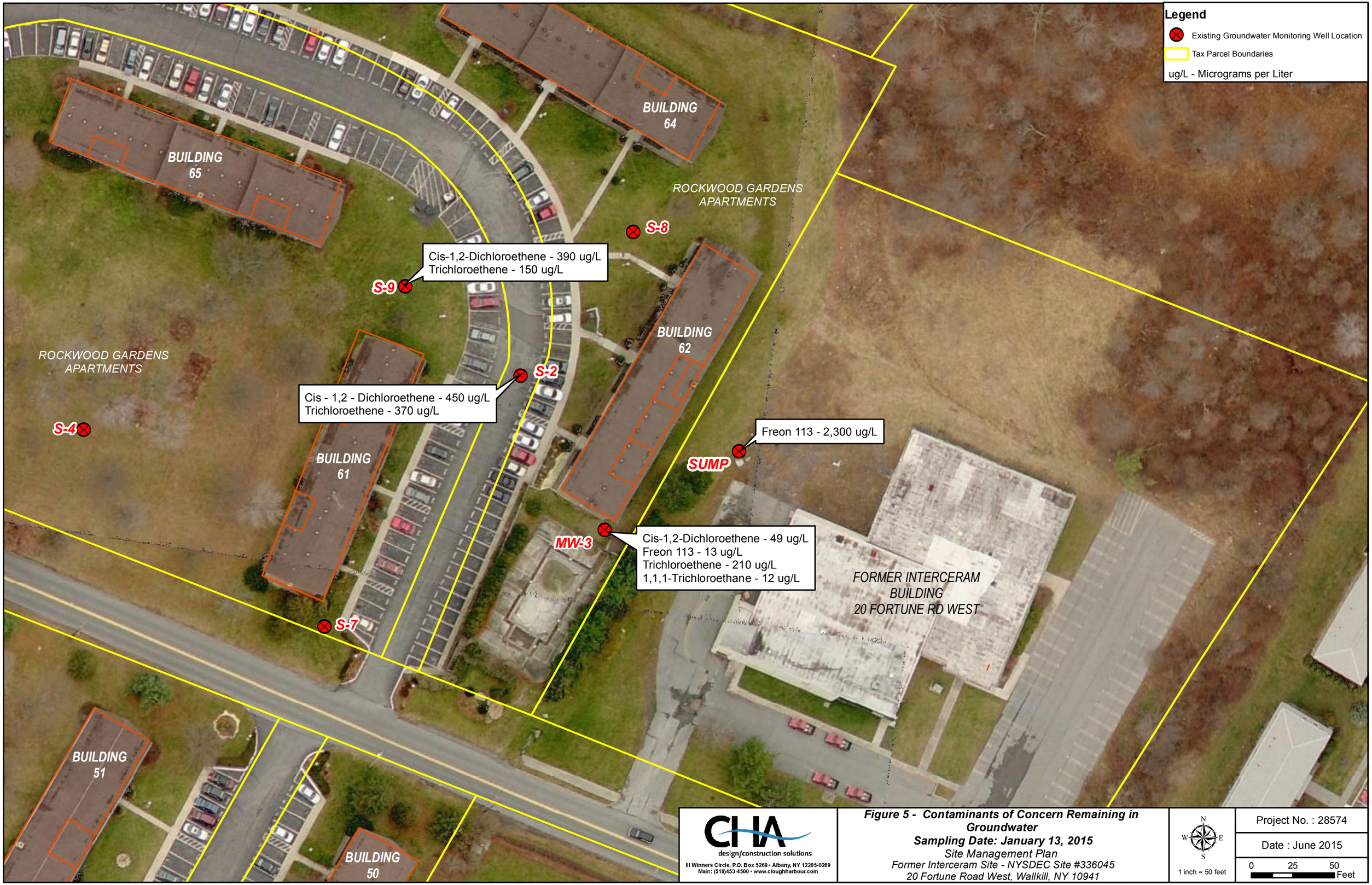

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Figure 5 - Contaminants of Concern Remaining in Groundwater
Sampling Date: January 13, 2015
Site Management Plan
Former Interceram Site - NYSDEC Site #336045
20 Fortune Road West, Wallkill, NY 10941

N W E S
1 inch = 50 feet

Project No. : 28574
Date : June 2015
0 25 50 Feet

APPENDIX A

Environmental Easement

RONALD S. KOSSAR
ATTORNEY AT LAW

402 EAST MAIN STREET
POST OFFICE BOX 548
MIDDLETOWN, NEW YORK 10940

TELEPHONE (845) 343-5111
TELECOPIER (845) 343-5222
E-MAIL rsklaw@frontiernet.net

January 30, 2017

Andrew Guglielmi, Esq.
Section Chief A
Bureau of Remediation
Office of General Counsel
New York State Department
of Environmental Conservation
625 Broadway. 14th Floor
Albany, New York 12233-1500

Re: Ingo Priebke LLC, as Grantor, with New York State Department of Environmental Conservation, as Grantee
Premises located at 20 Fortune Road West, Town of Wallkill, Orange County, New York
Section 41, Block 1, Lot 26.5
Environmental Easement
Interceram Site No.: 336045

Dear Mr. Guglielmi:

Enclosed herein please find a copy of the Environmental Easement filed in the Orange County Clerk's Office on January 26, 2017 for your files.

If you have any questions or wish to discuss this matter further, please do not hesitate to contact my office.

Very truly yours,

RONALD S. KOSSAR

RSK/sb
Enclosure
cc: Ingo Priebke, LLC (w/encl.)

ORANGE COUNTY CLERK

ANN G. RABBITT

Receipt

Receipt Date: 01/26/2017 03:45:19 PM
RECEIPT # 2262483

Recording Clerk: CH
Cash Drawer: CASH29
Rec'd Frm: RONALD S KOSSAR

Instr#: 20170005926 Bk/Pg: 14173/23
DOC: RIGHT OF WAY (R)
DEED STAMP: 5585
OR Party: INGO PRIEBKE LLC
EE Party: PEOPLE OF THE STATE OF NY

Recording Fees	$100.00
Transfer Tax	$0.00
DOCUMENT TOTAL: ---->	$100.00

Receipt Summary

TOTAL RECEIPT: ---->	$100.00
TOTAL RECEIVED: ---->	$100.00
CASH BACK: ---->	$0.00

PAYMENTS
Check # 26582 -> $100.00
RONALD S KOSSAR

255 Main St., Goshen, NY 10924 Phone (845) 291-2690 Fax (845) 291-2691

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36

OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 18TH day of JANUARY, 2017 between Owner(s) Ingo Priebke, LLC, having an office at 11 Somerset Lane, Warwick, New York 10990, County of Orange, State of New York (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 20 Fortune Road West in the Town of Wallkill, County of Orange and State of New York, known and designated on the tax map of the County Clerk of Orange as tax map parcel numbers: Section 41 Block 1 Lot 26.5, being the same as that property conveyed to Grantor by deed dated December 3, 2004 and recorded in the Orange County Clerk's Office in Liber and Page 11708/0917. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 3.00 +/- acres, and is hereinafter more fully described in the Land Title Survey dated December 20, 1999 prepared by John Lanc, L.S. of Lanc & Tully Engineering and Surveying, P.C., 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 Order on Consent Index Number: W3-0781-96-06, 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. The current Responsible Party to remediate the Controlled Property and implement the SMP is Ceramtec North America Corporation f/k/a Interceram.

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) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Orange County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

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

(6) 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;

(7) All future activities on the property that will disturb remaining

contaminated material must be conducted in accordance with the SMP;

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

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

(10) 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, at such time as NYSDEC may require, 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: 336045
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.

Remainder of Page Intentionally Left Blank

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

Ingo Priebke, LLC:

By: _____

Print Name: Christian Priebke

Title: Manager Date: 1-11-17

Grantor's Acknowledgment

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

On the 11th day of January, in the year 20 17, before me, the undersigned, personally appeared Christian Priebke, 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.

_____
Notary Public - State of New York

SUSAN BUSBY
Notary Public, State of New York
No. 244824186
Qualified in Orange County
Commission Expires January 31, 20 19

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 18th day of January, in the year 2017 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, 2018

SCHEDULE "A" PROPERTY DESCRIPTION

ALL that certain plot, piece or parcel of land, with the buildings and improvements thereon erected, situate, lying and being in the Town of Wallkill, County of Orange, State of New York, and being more accurately bounded and described as follows:

BEGINNING at a point on the northerly side of a Fortune Road West, said point of beginning being located 393.82 feet, as measured along the northerly line of Fortune Road West, from its intersection with the northwesterly line of Industrial Drive; thence from said point of beginning and along the northerly line of Fortune Road West, on a curve to the left, having a radius of 2,772.01 feet, an arc distance of 78.08 feet, as described by the chord North 54°35' 05" West 78.06 feet, to a point of tangency; thence on a tangent, North 55°23' 30" West 258.24 feet to a point, said point being located North 42°18' 31" East 50.45 feet from the northerly corner of the 3.11 acre parcel now occupied by the B.O.C.E.S. School; thence leaving Fortune Road West and through lands of Mills Heights, Inc. on a line which is the prolongation of the northerly line of the existing B.O.C.E.S. School parcel, North 42°18' 31" East 394.55 feet to a point, thence still continuing through lands of Mills Heights, Inc., South 56°21' 12" East 327.43 feet to a point; thence still through lands of Mills Heights, Inc. South 40°54' 45" West 400.00 feet to the point of beginning.

Containing approximately 3.00 acres more or less.

Environmental Easement

Title No. _____

INGO PRIEBKE, LLC

Section 41
Block 1
Lot 26.5
County or Town Town of Wallkill
Orange County
Street Address 20 Fortune Road West
Middletown, NY 10941

To

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL
CONSERVATION

Return By Mail To:

Ronald S. Kossar, Esq.
P.O. Box 548
402 East Main Street
Middletown, NY 10940

Reserve This Space For Use Of Recording Office

APPENDIX B

Site Related Contact List

Appendix B – Site Related Contact List

Company/Agency	Contact Information
New York State Department of Environmental Conservation	Daniel Lanners, Project Manager NYSDEC Division of Environmental Remediation 625 Broadway Albany, NY 12233 (518) 402-9662 daniel.lanners@dec.ny.gov
New York State Department of Health	Nathan Walz NYSDOH Bureau of Environmental Exposure Investigation Empire State Plaza, Corning Tower, Room 1787 Albany, NY 12237 (518) 402-7860 nmw02@health.state.ny.us
CeramTec North America Corporation (Remedial Party)	Patrick McPoland CeramTec North America Corp. One Technology Place Laurens, SC 29360 (864) 682-1198 pmcpoland@ceramtec.com
CHA Consulting, Inc. (Remedial Party's Engineering Consultant)	Margaret Rudzinski, Project Manager CHA Consulting, Inc. 3 Winners Circle Albany, NY 12205 (518) 453-4500 mrudzinski@chacompanies.com
Ingo Priebke LLC (Site Owner, Former Interceram Property)	Chris Priebke, Vice President Medical World 20 Fortune Road West Middletown, NY 10941 (845) 692-4100 mwchris@warwick.net
Rockwood Gardens Associates (Owner, Adjacent Rockwood Gardens Apartments Property)	Erica Arbron, Property Manager Snow Asset Management 287 Hunting Ridge Road Stamford, CT 06903 (203) 322-7170 ricky@snowasset.com

APPENDIX C

Responsibilities of Site Owner(s) and Remedial Party

Appendix C - Responsibilities of Site Owner(s) and Responsible Party

The responsibilities for implementing the Site Management Plan ("SMP") for the Former Interceram Site (the "Site"), NYSDEC Site No. 336045, and affected off-site areas are divided between the site owners and a Remedial Party, as defined below. The current owner of record of the Site is: Ingo Priebke LLC, 11 Somerset Lane, Warwick, New York 10990 (contact is Chris Priebke). The current owner of record of the Rockwood Gardens property is: Rockwood Gardens Associates, 287 Hunting Ridge Road, Stamford, Connecticut 06903 (contact is Erica Arbron).

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is: CeramTec North America Corporation, One Technology Place, Laurens, South Carolina 29360 (contact is Patrick McPoland).

Nothing on this page shall supersede the provisions of an Environmental Notice, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the Site and affected off-site areas.

2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in an Environmental Notice remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the Site's Periodic Review Report (PRR) certification to the NYSDEC.

3) In the event the Site is delisted, the owner remains bound by the Environmental Notice and shall submit, upon request by the NYSDEC, a written certification that the Environmental Notice] is still in place and has been complied with.

4) The owner shall grant access to the site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3 - Notifications.

6) In the event some action or inaction by the owner adversely impacts the Site, the owner must (i) notify the Site's RP and the NYSDEC in accordance with the time frame indicated in Section 1.3 - Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7) The owner must notify the RP and the NYSDEC of any change in ownership of the Site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Site property/ies. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty (60) days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) Until such time as the NYSDEC deems the vapor mitigation system unnecessary, the owner shall operate the system, pay for the utilities for the system's operation, and report any maintenance issues to the RP and the NYSDEC.

9) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Remedial Party Responsibilities

1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.

2) The RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.

3) Before accessing the Site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.

4) If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).

5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html .

6) The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3 - Notifications of the SMP.

7) The RP is responsible for the proper maintenance of any installed vapor intrusion mitigation systems associated with the site, as required in Section 3.3.1 or Appendix D (SSDS Operation and Maintenance Plan) of the SMP.

8) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit to the NYSDEC for approval an amended SMP.

9) Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may

result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX D

SSDS Operations and Maintenance Plan

SSDS OPERATIONS & MAINTENANCE PLAN

Annual inspection procedures for the Sub-Slab Depressurization System (SSDS) and remedies to observed deficiencies are outlined below:

System Fans

Observe the fans during operation. If abnormal noises (i.e. Scraping, buzzing, cyclical pointed sounds, or no operational sound at all, etc.) are observed, replace fan (There are no field serviceable parts in the fan). Observe the exhaust stack for possible obstructions (i.e. tree branches, etc.).

System Piping and Connections

Inspect the exposed system piping and connections for any breach or damage. Repair or replace any observed damage effecting system operation.

Slab/System Interface Seals

Inspect the seal at each accessible extraction point. If breech is observed, caulk with polyurethane caulk.

Electrical

Observe electrical components for damage. Test system electrical disconnects/switches for functionality. Repair/replace damaged components and malfunctioning items.

Pressure Gauges

Test system differential pressure gauges for functionality. Remove input line or shut down sub-system to verify differential pressure gauges return to a zero reading. Replace any dysfunctional differential pressure gauges and restore sub-system operation.

Low Pressure Alarm

Test system low pressure alarm for functionality. Remove input line or shut down sub-system to verify alarm sounds and alarm light illuminates. Replace any dysfunctional alarm and restore sub-system operation.

System Pressure

Observe the pressure differential readings on the pressure gauge for each sub-system. Compare the differential pressure in the sub-system exhaust stack to the indicated operating pressure range. If static pressure is outside the normal range, evaluate the fan for problems. If no problems are identified with the fan, perform sub-slab pressure testing at representative locations to verify the sub-slab pressure field extension (PFE) is sufficient under the "new" static operating pressure.

Adjust system ball valves as needed to redistribute PFE. If acceptable PFE is achieved, the "new" operating pressure becomes the "baseline" pressure. If acceptable PFE cannot be achieved, replace the system fan.

Electric Meter Readings

Record electric usage meter reading. See Section 4 for recorded readings.

Inspection Documentation

Document the inspection and any repairs or modifications made. Maintain a logbook of the inspections for the life of the SSDS. Examples of data tables are shown below:

Building 65	
Item	Observation
System Fan	No Deficiencies observed
System Piping and Connections	No Deficiencies observed
Slab/System Interface Seals	No Deficiencies observed
Electrical Components	No Deficiencies observed
Pressure Gauges	No Deficiencies observed
Low Pressure Alarm	No Deficiencies observed

Building 65					
Sub System ID Fan Model	Baseline Pressure 10/4/2011 Normal Range	Pressure Reading 5/24/2012 5.0" WC	Pressure Reading 9/28/2012 6.0" WC	Pressure Reading 12/19/2013 5.0" WC	Pressure Reading 11/7/14 7.0" WC
1 HS5000	6.0 "WC 3.0 - 9.0 "WC				
2 RP265	0.7 "WC 0.35 - 1.1"WC	1.1" WC	0.7" WC	*0.7" WC	0.7" WC

	Date:	Date:	Date:
Building 65 Sub System ID			
Component (i.e., fan, gauge, etc.)			
Description of the Deficiency or Problem			
Description of the Modification or Repair			

APPENDIX E

SOPs for Groundwater Monitoring

Author: Sarah Johnston
Reviewer: Keith Cowan

STANDARD OPERATING PROCEDURE
MEASUREMENT OF WATER LEVEL/ FREE PRODUCT THICKNESS

A. PURPOSE/SCOPE:

Measurements of static groundwater levels are used to determine the general elevation of groundwater, to evaluate horizontal and vertical hydraulic gradients, and to calculate the volume of water to be purged from a well prior to sampling. Seasonal fluctuations of the water table can also be assessed when water levels are monitored over the long term. Individual measurements of free product thickness are used to evaluate the presence of free product and also to determine the lateral extent of free product contamination in an unconfined aquifer.

B. PRIOR PLANNING AND PROCEDURES

1. Review the Work Plan and Health and Safety Plan.
2. Assemble and inventory necessary equipment/supplies as per the equipment and supply checklist (Section C).
3. Sign out equipment.
4. Determine if free product is expected to be present at the site and if an oil/water interface meter is required based on the Work Plan, prior site knowledge, or based on communication with the CHA project manager. If required, arrange rental from a supplier such as Field Environmental Instruments, Inc. (http://www.fieldenvironmental.com/index.html). A probe commonly used by CHA is the Heron Sm.OIL Interface meter.
5. Check that all meters are operational and have working batteries.
6. Obtain any well or site access keys required for the project.

C. EQUIPMENT/MATERIALS

- Electronic water level meter
- Clear polyethylene or Teflon bailer (for free product measurement only)
- Oil/water interface meter (for free product measurement only)
- Field data sheets
- Well keys if necessary
- Water Level Measurement Completion Checklist
- Water Level Measurement Equipment and Supply Checklist – Field staff should review the project Work Plan to determine the exact type of equipment (including the equipment's material of construction) that will be used for a specific project.
- Decontamination Supplies

D. CALIBRATION

Not Applicable

E. PROCEDURE:

1. Identify and inspect the well. Determine if the well cap and lock are present and in good working order. Note any defects in the well casing or surface seal in field notes.

2. a) If it is known that free product is not present in the well, the electronic water level indicator may be used to measure the depth to water according to the meter instructions.

   Every well should have an established measuring point on the inner well casing that is clearly marked and used during each monitoring event. Measure the depth to the water from the established reference point to the nearest 0.01 foot. For any site, all measurements should be made during the same day, prior to any purging activities that will affect water levels (see Section J, Special Conditions).

   b) If it is unknown whether free product is present in a well, collect a water level measurement as per Step A above. Then lower a dedicated clear bailer into the well until liquid is encountered, being careful not to fully submerge the bailer. Remove the bailer from the well and measure the thickness of the free product, if present, using a tape measure or ruler. Record the measurement to the nearest 0.01 foot.

   c) If free product is known to exist in a well, the use of an oil/water interface meter is recommended. The meter incorporates both optical and conductivity sensors to determine if the probe is in product or water, respectively. The probe typically emits two different types of signals; one for free product and one for water. Slowly lower the probe until the first signal indicates the interface between air and free product has been reached. Then continue to lower the probe until the second signal indicates the interface between free product and water. The water/product interface measurement is actually best taken while moving the probe back up from the water toward the floating product interface, as this minimizes the effects of product coating the conductivity probe. Repeat the measurements and record all measurements to the nearest 0.01 foot. In the event that an oil/water interface probe is not available, free product measurements may be collected using a clear bailer as described in Step B above.

3. Record all data on the Field Data Sheet. This includes all measured depths and notation of the measuring point on the well casing (i.e., top of inner PVC casing, top of steel protective casing, etc.). Water level measurements are eventually used to calculate water elevations above mean sea level using the surveyed elevations of each well.

4. Decontaminate the probe after each use according to the complete procedures in SOP #501, Small Equipment Decontamination. Field decontamination procedures generally include removal of gross contamination by scraping/brushing and rinsing, followed by a wash with Alconox® to remove all visible contamination, and a re-rinse with potable water to remove the detergent. The water level meter probe and the entire length of tape subject to contamination should be decontaminated. The meter should be decontaminated between each well. Field staff should also consult the site specific work plan for any specialized decontamination requirements.

F. FIELD NOTES

Note the measuring point on the well casing, the date and time, and the determined depths as stated in above procedure. Record any deviation from this SOP. Document all field decontamination procedures. Relevant field logs/ checklists are identified below:

Water level checklists:

Water Level Measurement Completion Checklist
Water Level Measurement Equipment and Supply Checklist

Logs:

Product Level Data Log
Well Level Data Log

G. CALCULATIONS

Not Applicable

H. FOLLOW UP ACTIVITIES

Ensure that all forms/paperwork have been properly filled out. Arrange return of rented equipment back to supplier.

I. QA/QC REQUIREMENTS:

Not Applicable

J. SPECIAL CONDITIONS

When measuring water levels in multiple wells on a site, all measurements should be collected in as short of time as possible to minimize the effects of daily fluctuations in water levels. This is particularly important in areas where groundwater levels may be tidally-influenced. Other possible causes of fluctuations include precipitation events, changes in barometric pressure, pumping of nearby wells, and changes in river stage or flow in unlined ditches. If any of these conditions are observed they should be recorded in field notes.

For newly installed wells or piezometers, a period of 24 hours should be allowed prior to measurement so water levels stabilize following development. Additionally, any well with a cap capable of producing an air tight seal on the casing may contain a vacuum or pressurized zone that can measurably affect water levels. In this instance, water level measurements should be repeated until the level has stabilized following cap removal.

K. REFERENCES

U.S. EPA Environmental Response Team, 2000: *Standard Operating Procedures, SOP #2043, Manual Water Level Measurements*

L. CONTACT INFORMATION

Author:	Sarah Johnston	518-453-8795	sjohnston@chacompanies.com
Reviewer:	Keith Cowan	518-453-2899	kcowan@chacompanies.com

M. APPENDICES

Not Applicable

STANDARD OPERATING PROCEDURE
CONVENTIONAL GROUNDWATER SAMPLING

A. PURPOSE/SCOPE:

Groundwater sampling can be required for a variety of reasons including, but not limited to, characterizing a site where groundwater is thought to be contaminated, investigating potable or industrial water supplies, and tracking possible contaminant plume movement. This SOP is specifically intended for monitoring well sampling. Alternate sampling procedures are used for municipal, industrial, and residential wells.

The very essence of any successful ground water monitoring program is a good sampling program, specifically, the field procedures and sampling techniques utilized. Without a sound sampling program and good field practices, the analytical results generated may not fully represent the quality of the ground water. Subsequently, errors in collection of the sample, practices which introduce contamination to the sample, errors in field tests, or inadequate preservation methods will compromise the validity of analytical data. As such, training of field personnel and a stringent field and laboratory QA/QC Program is necessary to the success of the sampling program.

This document was developed to define the general ground water sample collection procedures utilized by CHA. In addition, this document is used to supplement the training provided to field personnel to ensure consistent and accurate sample collection. However, any required site-specific procedures should be outlined in the work plan developed for the project. If no work plan is available, sampling will be conducted in accordance with this SOP and/or any site-specific requirements set forth by the Project Manager. Regardless of the availability of a site-specific work plan, the project manager (PM) shall conduct a meeting with the ground water field supervisor, field services manager, and other personnel as deemed necessary by the PM to discuss and schedule the upcoming sampling event. At this meeting, site specifics will be addressed, such as problem area(s) encountered during previous sampling or lab analysis; sample holding time, special handling, additional work to be performed; and any deviation from the work plan or this SOP.

B. PRIOR PLANNING AND PROCEDURES

1. Review site-specific work plan and Health and Safety Plan with project manager.

2. Inquire about field conditions at Site (e.g. terrain, facilities/utilities available, obstacle removal) and determine safety requirements.

3. Notify necessary people (e.g. property owner, client, regulatory groups, laboratory) and obtain property authorization to groundwater sample the Site.

4. Assemble and inventory necessary equipment and supplies as per the equipment and supply checklist.

5. Determine the number and locations of the wells to be sampled. Obtain site plan, well logs, and previous sampling and purging data. Arrange access to the Site and assemble wells and site keys.

6. Contact the project manager or the contract laboratory to coordinate sampling bottleware and shipping coolers.

7. Pre-plan sampling sequence to ensure wells will be sampled from least contaminated to most contaminated.

C. EQUIPMENT/MATERIALS:

CHA owns and maintains a variety of purging/sampling devices for groundwater removal and sample collection. Field personnel must familiarize themselves with each type of pump/device available, and understand the pump/device limitations and use. In choosing purge/sampling equipment, consideration must be given (but not limited to) depth of well, bore volume, required sample flow rate, turbidity, site accessibility, rate of recharge, and purge water handling and disposal. When the proper purging and sampling device is selected based on site conditions, the time required to perform the sampling is minimized.

As a note, it is highly desirable to have dedicated equipment for purge and sampling; however, this may be cost-prohibitive at some sites. In these cases, portable/reusable equipment must be utilized.

Sample collection devices must be chosen after careful review of the sample parameter list in order to minimize the potential for altering the quality of the sample. While some devices are very useful for purging (i.e. high flow rates), they are not permissible for sampling sensitive parameters (i.e. volatiles cannot be collected with a turbine or suction type pump). In these situations, two separate methods for purging and sampling may be selected.

Appropriate sampling equipment must be selected by the project manager and will typically be addressed in the work plan. The following sub-sections describe the equipment available, their appropriate use, and advantages/disadvantages.

1. Peristaltic Pumps

A peristaltic pump is acceptable for purging wells and for most analyte sample collection with the exception of VOCs/SVOCs. Like most suction pumps, the peristaltic pump is only capable of lifting water up to 25 feet below the pump. A peristaltic pump is a self-priming, low volume, suction pump which consists of a

rotor with ball-bearing rollers. Flexible tubing (silicone) is inserted around the pump rotor and squeezed by the heads as they revolve in a circular pattern. In general, the section of silicone tubing cannot exceed 36 inches in length. Additional rigid polyethylene or Teflon tubing (as required) is attached to the flexible tubing and placed into the well. This tubing shall be dedicated to that well location for future use. If samples are to be collected using the pump, then the flexible tubing should also be dedicated to that well location for future use. The tubing should be secured to the top of the casing and suspended within the well. The flexible or rigid tubing is not to be re-used at other well sites due to potential cross-contamination issues.

The peristaltic pump moves the liquid within the sample tube by creating a vacuum as the rotor head turns. No part of the pump comes in contact with the liquid. A peristaltic pump can provide a low sampling rate (i.e. typically less than one gallon per minute) with less agitation than other suction pumps as long as the tubing is secured to the well casing and not allowed to move up and down within the casing. The flow rate may be regulated by adjusting the rotor head speed.

Peristaltic pumps are easily transported, require minimum set-up, do not require decontamination and require minimal maintenance. Disadvantages with peristaltic pumps are the limited lift and flow capabilities and the sample limitations on the collection of VOCs/SVOCs.

If VOC/SVOC sampling is required but the groundwater sampler wishes to use the peristaltic pump for purging and other analyte sample collection, it is common practice to collect the initial VOC/SVOC analytes with a bottom loading bailer and then utilizing the peristaltic pump for the remaining sample analytes.

2. Suction Pumps

A number of suction-type pumps (i.e. centrifugal) exist which are typically used for purging applications only. A suction-type pump draws water through the pump suction line by creating a vacuum within the suction tubing or hose. The groundwater comes in direct contact with the pump rotor/chamber area and is undesirable for groundwater sampling because the water is highly agitated (i.e. aerated). In addition, decontamination of this type of pump is more difficult than other sampling devices. Similar to the peristaltic pump, this type of pump is limited to a lift of 25 feet. Larger suction pumps, such as a 2-inch “trash pump” can achieve very high flow rates under low head conditions. Flow rates of 15 to 20 gallons per minute can be achieved, minimizing purge time. A new, clear suction line is needed for each well.

The groundwater sampler must be alert to preventing the siphoning of purged water from a bulk container (purge water tank or bucket) back into the well. This can result in cross contamination with waste from other Sites/wells which have been purged either:

- into the tank/bucket,
- through the pump, or
- through the discharge line.

All discharge lines/groundwater purge pumps must be provided with a check valve to prevent this situation.

In summary, suction pumps are useful for high rate purging, require no equipment (other than a suction line) down the well and are easily transported from site to site. Their use is limited to a lift of 25 feet, decontamination is difficult and only a limited number of sample analyses can be collected from a suction-type pump.

3. Submersible Pumps

Submersible pumps provide high discharge rates for water withdrawal at depths beyond the capability of suction pumps. Submersible pumps can pump water from substantial depths with pumping rates varying from low-flow (<500 milliliters per minute) up to hundreds of gallons per minute or more depending on depth, size and type of pump. A submersible pump provides higher extraction rates than any other method. Sample agitation and aeration does occur eliminating the use of submersible pumps for the collection of VOCs/SVOCs unless using low-flow methods.

Submersible pumps require decontamination before use elsewhere, including the electrical cable and lowering cable used to install the pump.

When installing a submersible pump in bedrock locations or within deeper well installations, it is advantageous to use rigid piping (i.e. ¾ inch steel), which permits exact pump depth placement, allows pushing and pulling of the pump should a narrow or "tight" spot exist within the well, provides a solid/secure grip for holding the pump in place during installation and retrieval, and is used for affixing the electrical cable onto and lowering cable/safety line. If rigid pumping is used, a safety line or cable affixed to the pump head should still be used in the event the piping unthreads or connection to the pump is lost.

In summary, submersible pumps provide high flow rates and are useful in deep purging locations. Submersible pump use is labor intensive, poses decontamination problems, and has sample analyte limitations.

4. Air Lift Pumps

Air lift pumps utilize compressed air in direct contact with the groundwater to force the groundwater from the pump cylinder through a series of check balls into the discharge line. The pump operation is cyclic, having alternating pump filling and pump discharging cycles which are regulated by a control device at the ground surface. Air lifting is possible from deeper depths with moderate to low return flow rate achievable (two to three gallons per minute) depending on depth of installation, static head, tubing size and the air pressure available.

As the air has direct contact with the groundwater, VOC/SVOC sampling is not permissible.

Generally, air lift pumps are used for deep purging applications only. Sampling is typically accomplished with an alternate device (i.e. bailers or bladder pump).

5. Bladder Pumps

Bladder pumps are air driven but the air/groundwater contact is eliminated by the presence of a Teflon or natural rubber bladder. The pump operation is cyclic, controlled at the ground surface by a control device which alternates the pump filling and discharge cycles. Bladder-type pumps are ideal for VOCs/SVOC collection as well as most other analytes.

The bladder pump operation is typically very "quiescent", imparting little formation/well disturbance. Consequently, sediment-free groundwater is easily achieved using a bladder-type pump. The flow rates achievable from a bladder pump vary from 100 milliliters per minute up to one (1) to two (2) gallons per minute but are reduced for deeper sampling locations.

Both well purging and sampling can be performed with a bladder-type pump. Once sampling is complete, the pump must be disassembled and cleaned before sampling elsewhere occurs. The sample tubing including air line is typically suspended in the well for future use (well dedicated) or discarded.

In summary, bladder-type pumps provide excellent sample quality, can collect all groundwater analytes, and are useful for deeper sampling needs. Disadvantages include labor intensive set-up, difficult decontamination, and low flow rates.

6. Inertia Pump

The inertia pump or "Wattera" pump is a manually operated or mechanically driven system which utilizes only a foot valve on the sample/purge tubing to lift the groundwater out of the well. The rapid raising and lowering action of the tubing imparts inertia to the water column within the tubing, which causes the water column to rise to the ground surface and discharge out of the end of the tube. The foot valve holds the water column within the tubing on the up stroke and allows groundwater entry on the down stroke.

CHA owns both manual and mechanical gas-powered systems. Flow rates are variable depending on cycle speed, tubing size and depth to groundwater. This type of pump is useful for purging and may be used for sample collection of most analytes. Acceptability of VOC and SVOC sampling is gaining approval in select areas when using an inertia type system. Project managers shall provide approval for using the inertia pump as a sampling device prior to sampling.

The inertia pump is very useful for extracting dense NAPLs because no equipment (except the foot valve) is exposed to this type of gross contamination. However, inertia pumps excessively disturb the water column in the well making it almost

impossible to collect sediment free samples.

7. Bailers

Bailers are manual sampling devices typically consisting of a hollow tube (i.e. Teflon, PVC, or stainless steel) with a lower check ball to permit water entry and prevent water loss. As the bailer is lowered into the well, water enters the chamber through the bottom. The weight of the water column closes the check valve upon retrieval. A rope or cable is affixed to the bailer to permit lowering and retrieval of the bailer within the monitoring well. Bailing is generally very disruptive to the formation and well screen. Consequently, sediment-free samples are difficult, if not impossible, to achieve when using a bailer device. VOC/SVOC sampling, as well as all other groundwater analytes, can be collected using a bailer. Compatibility of the bailer material and the groundwater analytes must be reviewed and approved prior to bailer use. Teflon bailers are generally acceptable for all analyte needs.

Power winches to raise and lower the bailer in conjunction with an overhead tripod are available. The flow rate attainable from a bailer is a function of the bailer size and frequency of retrieval.

Bailers will provide representative samples once the well has been adequately developed and purged. Rope used for suspending the bailers must be kept off the ground and free of other contaminating material that could be carried into the well. Once used, the rope is either well dedicated or discarded. In addition, care should be taken not to touch the bailer to anything other than the well (i.e. the purge water bucket, ground surface, etc.). Bailers are not practical for deep wells or for removal of large volumes of water.

Once the proper purging and sampling equipment has been selected, prepare any equipment necessary for groundwater sampling which may include the following:

- Proper pump (e.g. inertial pump, submersible pump, peristaltic pump, 2-inch Grundfos Rediflow pump and controller)
- Tubing
- Disposable bailers
- Generator
- Sample bottles
- Sample tags or labels
- Sample preservation supplies
- Polyethylene or nylon bailing twine or rope
- Field parameter monitoring instruments for pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature
- PID or FID
- Nitrile or Latex gloves
- Water level meter

- Interface probe (if needed)
- Groundwater filtration system
- Decontamination supplies
- Groundwater Monitoring Field Logs
- Water Level Measurement Field Log

D. CALIBRATION:

Field instruments such as pH meters, multimeters, conductance meters, turbidity meters, and others require calibration for accurate readings. Calibration of most field equipment must be performed daily. Please refer to each equipment SOP for detailed calibration instructions, or refer to the operator's manual for more detailed information. Employees shall be familiar with the calibration procedures prior to commencing field activities.

Calibration data is to be recorded in the Groundwater Monitoring Field Log or in the field log book.

E. PROCEDURE:

After the planning and preparation activities are completing, the groundwater purging and sampling event can proceed. The typical procedure is detailed in the following steps.

1. Well Preparation, Identification and Inspection

When maneuvering to the monitoring well site by vehicle, every effort should be made to approach the well from down-wind and to park the vehicle downwind of the well. Generators or other gas-powered equipment must also be operated downwind and as far as possible away from the monitoring well. Identify the proper well locations by referring to well log details, field ties and Site plans. Thoroughly inspect each well to determine if the well is suitable for sampling and record the inspection in the field book. Determine if the gripper plug and lock are secure or if they have been tampered with. Replace gripper plug and lock, if needed. Note any cracks in the protective casing and/or surface seal of the well. Inform the project manager of any repairs that are required. If wells are unmarked, arrange to have the unmarked wells permanently stamped for identification and temporarily mark them at the time of sampling.

2. Air Monitoring *(when required)*

If required by the work plan or requested by the PM, the atmosphere around and in the well is to be monitored to determine the potential for fire, explosion, toxic effects on sampling personnel, or presence of organic vapors. A combustible gas detector and/or photoionization detector will be used for this purpose (see equipment-specific SOPs for operating instructions or refer to the operators manuals for more detailed instruction). Atmospheric samples should first be

taken of the area surrounding the monitoring well or above the well casing with a to establish baseline levels. If the area is found to be safe and baseline levels have been established, then the monitoring well itself should be unlocked, uncapped, and checked. Probe samples should be taken from the monitoring well riser, approximately 6" below the top. Record the measurements in the field logbook or Groundwater Monitoring Field Log. Once assured the atmosphere is safe, the technician may proceed with the purging operation.

3. Water Level Monitoring

Water level measurements of site wells should be performed prior to purging and sampling activities. Using a decontaminated measurement probe (IS-3), determine the water level in the well in site wells in accordance with SOP #313.

Each water level reading should be checked two times before removing the tape from the well. Record the water level measurement in the field book and/or Water Level Measurement Field Log. If available, compare the water level reading to previous measurements. Recheck water level if a significant difference (i.e. > 2 feet) is measured. Decontaminate water level measuring equipment between each well in accordance with SOP #501.

4. Well Volume Calculation

After recording the static water levels in each well, the volume of water in each well must be calculated to evaluate the number of well volumes to be removed. To determine the volume of water in a well, see Section G.

5. Conventional Well Purging and Stabilization Monitoring

Note: This SOP refers only to conventional groundwater sampling and purging. For low-flow purging and sampling procedures, please refer to SOP #317).

Prior to groundwater sample collection, each well must be purged of the standing volume of stagnant water which is not representative of the formation groundwater. The objective of purging is to pump the well until water that is representative of the formation groundwater is obtained. Monitoring well purging is accomplished by using submersible, peristaltic, bladder, or other appropriate pump, depending on depth. A bailer may be used for purging although bailing may stir up sediment in the well and therefore should be avoided, if possible. Section C summarizes the equipment available to complete purging tasks.

To properly evacuate stagnant water from the monitoring well, a total of three (3) bore volumes, as calculated in Section G, need to be purged unless low-flow-methods are to be used (SOP #317). Purging should be conducted at the lowest rate possible to purge the well within a reasonable time frame and decrease the potential for elevating the turbidity of the well.

Purging should occur from the bottom of the water column. Tubing and/ or pumps should be slowly lowered to the mid-point of the screen to ensure a representative formation sample is collected. If the height of the water column is above the filter pack and screened interval, this portion of the water column can be considered stagnant and, therefore, unsuitable for representative samples.

At initiation of the purge operation, the water should be tested for pH, specific conductance, and temperature, with testing for these parameters after each bore volume is evacuated or every five minutes, whichever is more frequent. Groundwater parameter readings, with the exception of turbidity, should be collected using a flow-through cell whenever possible.

Purging is considered complete once sediment free groundwater is obtained and the specific conductance, temperature, and pH of the groundwater stabilizes. Groundwater stabilization has occurred if three consecutive well volume measurements of temperature and specific conductivity are approximately ±10%, if the pH values are within 1 pH unit of the last three value averages, and groundwater turbidity values are less than 50 NTU. Once the required number of well volumes to reach stabilization is known for a particular well, the need to establish stabilization for future sample events is eliminated or at least reduced. Extended purging will usually result in achieving sediment-free groundwater.

If stabilization has not occurred within the first five well volumes removed, continue purging and monitoring until eight well volumes have been pumped. If stabilization has still not occurred, it may be dropped as a pre-condition to sampling.

In low-yield formations, the well should be purged at a rate of less than 0.5 gallons per minute. If the well is purged to dryness, the well should be allowed to recover completely before sampling. A well purged to dryness is considered sufficient evacuation. Record the field parameter data during purging and again immediately before sampling in the field log. No less than two tests will be considered sufficient.

Groundwater turbidity should be tested at the conclusion of the purging operation and before the collection of groundwater samples. In most cases a reading of 50 NTU or less is acceptable for groundwater sample collection, although some regulatory areas/districts have established a lower criteria (i.e. <5 NTU), before sampling proceeds or groundwater filtration is required.

6. Sample Collection

Once the purging activities are complete and the groundwater stabilization/clarity is acceptable (i.e. no sediment presence), the collection of samples can proceed. Ideally, samples should be collected as soon as the monitoring well recovers from the purging operation. However, consideration should be given to turbidity of the

samples. More time for stabilization may be required, particularly in low yield formations. Many states have established a maximum time limit of twenty-four (24) hours between purge and sample collection. If the monitoring well does not recharge sufficiently in this time frame, no sample will be collected, and the Groundwater Monitoring Field Log will bear the entry "Insufficient Volume for Sample Collection".

It is imperative that all sampling equipment be clean and kept clean during all phases of purging and sample collection. The sample team should be divided into "clean hands" and "dirty hands" tasks. Only personnel with "clean hands" must touch equipment that will come into contact with the sample. Consideration should be given to special handling procedures. If using a pump, the pumping rate for VOC sample collection should not exceed 100 ml/min to avoid agitation of the sample and to reduce the loss of volatiles.

Sample collection devices should be chosen carefully to minimize the potential for altering the quality of the sample. Sample collection may be accomplished by dedicated pumps or bailers, as well as by use of decontaminated portable pumps, bailers, or disposable bailers. When bailers are utilized, they must not be dropped with force into the well. This could cause degassing and increased turbidity of the water. Bailers should be lowered gently into the water column and extracted in like manner.

The sampling may occur directly from the purging pump, when permissible, or an alternate device (i.e. pump or bailer) is installed to collect the samples. If a bailer or alternate pump is utilized, the first few bails or first pump discharge volumes should be discarded to allow the new equipment a period of "acclimation" to the groundwater.

Samples should be transferred directly to the final container for laboratory submittal and not collected in a larger container with subsequent transfer to smaller containers. Exceptions on occasion are required for filtration and/or sample compositing. The sample must be transferred from the sampling device to the sample container in a manner which minimizes agitation/aeration. Whatever device is being used, the sampling device intake needs to be located so that samples are taken from the screened interval of the monitoring well.

Care must be taken to avoid handling the interior of the bottle or bottle cap. A new pair of disposable gloves must be worn for each well sampled. The bottle cap must not be placed on the ground or in a pocket to avoid contamination.

It is imperative that no air bubbles or headspace remain in containers containing water for volatile compounds analysis in order to prevent the loss of volatiles from the sample. Air bubbles can be checked for by inverting the vial and tapping the side of the bottle. If any bubbles are present, the sample should be discarded and retaken. The container should not be "topped-off" to fill the additional head

space.

Note: Gas bubbles may appear in the VOC container after collection due to degassing. If this occurs, note this occurrence on the COC; re-sampling is not required.

7. Sample Preservation and Handling

Personnel performing groundwater sampling tasks must check the sample preparation and preservation requirements to ensure compliance with the project related QA/QC. Typical sample preparation may involve pH adjustment (i.e. preservation), sample filtration and preservation, or simply cooling to 4◦C. Sample preparation requirements vary from site to site and vary depending upon the analytical method for which the samples will be analyzed. If pre-preserved bottles have not been provided by the laboratory, add the appropriate preservatives to the samples as described in SOP #603.

The sampling personnel must also confirm, before the sample event, the volume required for the respective sample containers. As discussed previously, VOC samples must not have any headspace within the sample collection vial whereas when collecting select analyte (i.e. metals) a headspace must be provided to allow addition of the required preservative.

8. Order of Sample Collection

Samples should generally be collected and containerized in the order of the following volatilization sensitivity:

- Volatile Organic Compounds (VOCs)
- Semi-Volatile Organic Compounds (SVOCs)
- Purgeable organic carbon (POC)
- Purgeable organic halogens (POX)
- Total organic carbon (TOC)
- Total organic halogens (TOX)
- Extractable organics
- Total metals
- Dissolved metals
- Phenols
- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides

9. Sample Preparation and Packaging

All samples must be labeled with:

- A unique sample number (never to be re-used, nor likely to be),
- Date and time,
- Parameters to be analyzed,
- Job number, and
- Sampler's initials.

Labels should be secured to the bottle and should be written in indelible inks. It is also desirable to place wide clear tape over the label before packing in a cooler for label protection during transport. Labels may be prepared in advance at a CHA office if the office has a labeling-generating program or by the laboratory. Refer to SOP #103 for detailed labeling procedures.

A chain of custody form must be completed and accompany the samples for transport to the appropriate laboratory. A chain of custody should include the sample IDs, date and time of sample collection, sampler name/s, sampler signature/s, number of bottles and preservation used, sample matrix, as well as a record of sample custody with signatures at time of relinquishment of samples with the date and time recorded. Placed the properly labeled and sealed sample bottles in a cooler with ice and maintain at 4°C for the duration of the sampling and shipment to the laboratory. Other sample handling procedures have been detailed in SOP #607.

8. Equipment Removal and Well Securement

Remove any equipment from the well and replace the gripper cap, lock and manway cover (if applicable).

9. Equipment Decontamination

- Following sampling of each well, decontaminate sampling equipment in accordance with SOP# 501.

F. FIELD NOTES

During the groundwater monitoring event, field notes should be recorded to document the activities. Items that should be recorded include:

- Well identification
- Well depth and measurement technique
- Static water level depth, date, time, and measurement technique
- Presence and thickness of immiscible liquid (NAPL) layers and detection method
- Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped

- Sample appearance and any odors noted
- Well sampling sequence and time of each sample collection
- Types of sample bottles used and sample identification numbers
- Preservatives used
- Parameters requested for analysis
- Field observations during sampling event
- Name of sample collector(s)
- Weather conditions
- QA/QC data for field instruments
- Problems encountered should be highlighted
- Description of sampling equipment used, including trade names, model number, diameters, material composition, etc.

Field book entries should be made in indelible ink and any changes/corrections should be crossed out with a single line and initialed and dated to indicate who and when the correction was made.

G. CALCULATIONS

To calculate the volume of water (in gallons) that is the equivalent of one casing volume, use the following procedure:

Calculate the distance (in feet) from the bottom of the well to the static water level. Measure the inside diameter (in feet) of the well. Obtain the volume of water by using the following formula:

$$V = \Pi r^2 h$$

Where:

V = volume of water (in gallons)
Π = 3.142
r = radius of well (feet)
h = depth of water column (feet)

H. FOLLOW UP ACTIVITIES

1. Double check work plan to ensure all samples have been collected and confirm with project manager.

2. Clean and return any field equipment used.

3. Return Site/well keys

4. Place field notes in the proper project files

I. QA/QC REQUIREMENTS:

The following is a brief discussion defining the common types of field derived quality control samples which may be required for a groundwater sampling program. It should be noted that specific QAPP's may include all or only some of the following quality control procedures.

When possible, the samples should be collected using the same type of equipment and in the same manner to ensure comparability of data. Field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation.

- Temperature Blank: One temperature blank is required per cooler of investigative samples. Temperature blanks are prepared by the laboratory and are to be kept in the cooler with the investigative samples.

- Trip Blank: Required for the VOC samples at a frequency of one set per VOC sample cooler. The trip blank is prepared by the laboratory before the sampling event and sent to the site in the shipping container(s) designated for the project. The samples should not be opened and are to be kept with and submitted for analysis with the project samples. The trip blank(s) should not be open and are intended to determine if the sample shipping or storage procedures influence the analytical results. The frequency of trip blank submission will be determined by the project QAPP.

- Field Duplicate: Field duplicates are collected and submitted to assess the potential for laboratory data inconsistency and the adequacy of the sampling and handling procedures. A duplicate sample (or replicate) is collected from the same source utilizing identical collection procedures.

  During groundwater sample aliquot collection the original and duplicate sample are collected simultaneously by partially filling the original and then the duplicate and alternating back and forth until both samples have been fully collected. This will provide two representative samples for analyses. Transferring the sample aliquot from a bulk container to the respective sample containers is typically not permissible.

  Field duplicates are typically submitted "blind" to the laboratory by providing a false identification number. The sampling key to ensure proper sample identification must be submitted to the appropriate personnel to enable completion of the QA/QC review process.

- Matrix Spike and Matrix Spike Duplicate (MS/MSD): MS/MSD sample volumes are additional sample aliquots provided to the laboratory to evaluate the accuracy and precision of the sample preparation and analysis technique. Typically three times the normal sample aliquot is required to

conduct MS/MSD procedures. Sample collection is identical to the technique described for collection of field duplicates. Sample labeling identifies the respective sample location and each additional container which is labeled as the "MS/MSD".

J. SPECIAL CONDITIONS:

If sample turbidity cannot be reduced below 50 NTUs, then the samplers should collect sample aliquots for all sample parameters except for the metals. The samplers should then allow the well to sit for a maximum of 24 hours to allow settlement of particulates before returning to collect a sample for total metals analysis from the top of the water column. The project manager should then be contacted to determine if a filtered sample will need to be collected and submitted to the laboratory for dissolved metals analyses.

K. REFERENCES:

1. New Jersey Department of Environmental Protection (August 2005), *Field Sampling Procedures Manual*, Chap. 6, retrieved January 5, 2009 from http://www.nj.gov/dep/srp/guidance/fspm/.

2. United States Environmental Protection Agency (July 30, 1996), *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, retrieved January 2, 2009, from http://www.epa.gov/region1/measure/well/lowflow8.pdf.

3. U.S. Geological Survey, 2006, Collection of water samples (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, September, retrieved January 5, 2009 from http://pubs.water.usgs.gov/twri9A4/.

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M. APPENDICES

Groundwater Monitoring Field Log
Water Level Measurement Field Log

LOW-FLOW GROUNDWATER PURGING/SAMPLING

A. PURPOSE/SCOPE:

Low-flow purging is purging using a pumping mechanism that produces low-flow rates [less than 1 liter per minute (lpm) or less than 0.26 gallon per minute (gpm)] that cause minimal drawdown of the static water table and usually employs a flow cell in which geochemical parameters are continuously monitored. These parameters may include dissolved oxygen content, oxidation-reduction potential (redox), conductivity, turbidity, and/or pH.

The intent of this sampling protocol is to collect a representative sample from the monitored groundwater zone. A representative sample may be obtained when all the monitored chemical parameters have stabilized, thus qualitatively demonstrating that the groundwater being purged is in equilibrium (refer to Table 3). Samples are collected directly from the pumping mechanism with minimum disturbance to the aquifer groundwater. The low-flow/low volume purging method (purging to parameter stability) tends to isolate the interval being sampled, which provides more accurate water quality measurements and reduces the volume of purge water generated. This method has an advantage in that it can limit vertical mixing and volatilization of volatile organic compounds in solution within the well casing or borehole as compared to high-flow purging and sampling.

The low-flow purging and sampling method has been described in groundwater monitoring literature since the mid-1980s with a defined methodology being accepted by the U.S. EPA in 1995. An overview of this methodology is presented in an U.S. EPA Ground Water Issue paper titled *" Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures"* by Robert Puls and Michael J. Barcelona dated April 1996. Low-flow purging and sampling is appropriate for collection of groundwater samples for all groundwater contaminants, including inorganic compounds, metals, pesticides, PCBs, volatile and semi-volatile organic compounds (VOCs and SVOCs), other organic compounds, radiochemical and microbiological constituents. This method is not applicable to the collection LNAPL or DNAPL.

B. EQUIPMENT/MATERIALS:

Depending on the purging method to be used, there are specific equipment limitations. Table 1 provides a description of the various methodologies and their applicability. The proper selection of sampling devices or pumps is critical to the quality and representation of the sampling results. The following table provides a summary of the acceptable sampling methods for the various compounds of concern.

Table 1
Acceptable Sampling Methods for Compounds of Concern

Analytical Sampling						
Method	**VOCs**	**Semi-VOCs**	**Metals and Inorganics**	**Petroleum Hydrocarbons C3-C16**	**C16+**	**General Chemistry**
Peristaltic Pump	X	1	3	X	1	2
Centrifugal Pump	2	3	3	2	2	3
Submersible Impeller Pump	2 3 IF LOW FLOW	3	3	2	3	3
Bailer	2	2	2	2	2	2
Bladder Pump	3	3	3	3	3	3
Vacuum Truck	X	X	X	X	X	X
DPIS	3	3	2	2	2	2
Diffusion Sampler	2	2	X	2	2	X
Grab Sampler	2	2	2	2	2	2

1 - Not recommended, better methods exist
2 - Useful with limitations
3 - Recommended method
X – Unacceptable
Note: Centrifugal pump—assumed at a low-flow rate (no greater than 1 Lpm)

Inertial pump, submersible pump, disposable bailers, generator, sample bottles, bailing twine and rope, field analyses meters, sampling gloves, water level meters, filtration system, 2-inch Grundfos Rediflow pump and controller, well sampling forms.

C. PROCEDURE:

1. The wells will be sampled in order from the least contaminated well to the most contaminated well (if applicable).

2. Using a decontaminated measurement probe, determine the water level in the well; then calculate the fluid volume in the casing.

3. Setting up the Pump:

   - Dedicated Systems

   Studies have shown that the installation of any device into a well disturbs the stratification typically exhibited in a well due to laminar flow of groundwater in the well. Insertion also potentially mobilizes suspended solids in the water column due to disturbance of settled and adhered solids in the casing and agitation of water in the filter pack. Therefore, low-flow purging and sampling techniques are more accurate when dedicated systems are used. Dedicated systems result in lower initial turbidity values and lower purge volumes to achieve stabilized indicator parameter readings, and should be considered when a well will be sampled multiple times.

   - Portable Systems

   If portable systems are used, they must be placed carefully into the well and lowered into the screen zone as slowly as possible. Placement of the portable pump can disturb the groundwater flow conditions resulting in non-equilibrium conditions. As a result, longer purge times and greater purge volumes may be necessary to achieve indicator parameter stabilization. In general, this may require that after installation, the portable pump should remain in place for a minimum of 1-2 hours to allow settling of solids and re-establishment of horizontal flow through the screen zone. If initial turbidity readings are excessive (>50 NTU), pumping should cease and the well should rest for another 1-2 hours before initiating pumping again. In wells set in very fine-grained formations, longer waiting periods may be required.

4. The flow rate used during purging must be low enough to avoid increasing the water turbidity. The following measures should be taken to determine the appropriate flow rate:

- The flow rate shall be determined for each well, based on the hydraulic performance of the well.
- The flow must be adjusted to obtain stabilization of the water level in the well as quickly as possible.
- The maximum flow rate used should not exceed 1 liter per minute (0.26 gpm).
- Once established, this rate should be reproduced with each subsequent sampling event.
- If a significant change in initial water level occurs between events, it may be necessary to re-establish the optimum flow rate at each sampling event.

5. Water Level Monitoring: Should not fluctuate more than 0.1 meters (~4 inches).

   After stable, then collect indicator parameters.

6. Measurement of indicator parameters (dissolved oxygen content, redox potential, specific conductance, temperature and pH) is required. Continuous monitoring of water quality indicator parameters is used to determine when purging is competed and sampling should begin. Stabilized values, based on selected criteria listed in Table 3 should be met prior to sampling. The use of an in-line flow cell (closed) system is recommended for measuring indicator parameters, except for turbidity. For turbidity measurement, a separate field nephalometer should be used. Indicator parameter collection is more important when low-flow purging is used and additional parameters are needed as compared to the high-flow purging method. Generally measurements are taken every 3 to 5 minutes and water chemistry parameters are considered to be stable when they are within the following ranges for three (3) consecutive readings:

Table 2
Stability Criteria for Low-Flow Purging

Constituent	Criteria
Dissolved Oxygen Content (DO)	± 0.2 mg/L
Oxidation-Reduction Potential (redox)	± 20 mv
Turbidity	± 10 % (optional depending on instruments)

Specific Conductance	± 03-05% of reading
Temperature	± 3% of reading (min. of ± 0.2 C)
PH	± 0.2 units, minimum

Turbidity should be below 50 NTU, if possible. If sample turbidity can not be reduced below 50 NTU, a field filtered sample shall be collected for metals analysis in addition to an unfiltered sample. Record these readings on the well sampling log.

Because the methodology requires that disturbance to the water column in the well be minimized, the same pumping device used for purging should be used for sampling

7. Sample collection will be performed utilizing either an inertial pump system or disposable bailer. If the inertial pump system is used, samples will be obtained through the dedicated polyethylene tubing while maintaining a low-flow. Should disposable bailers be utilized, the sampling will be performed as follows:

   Attach a new bailer line to the disposable bailer equipped with a single check valve. Check the operation of the check valve assembly to confirm free operation. Lower the single check valve bailer slowly into the well until it contacts the water surface. Then lower the bailer just below the water surface with a minimum of disturbance. When filled with groundwater, slowly raise the bailer to the surface. Discharge the first bailer to the ground. Tip the bailer to allow the water to slowly discharge from the top and to flow gently down the inside of the sample bottle with minimum entry turbulence and aeration.

8. The order in which samples are to be collected is as follows:

   - volatile organic compounds,
   - bacteriological,
   - purgable organic carbon,
   - purgeable organic halogens
   - total organic halogens
   - total organic carbon
   - extractable organic
   - total metals
   - dissolved metals
   - phenols
   - cyanide
   - sulfate and chloride
   - turbidity

- nitrate and ammonia
- radionuclides.

9. When collecting aliquots for analysis of volatile organic compounds, make absolutely certain that there are no bubbles adhering to the walls or the top of the VOA container.

10. Add appropriate preservatives to samples as described in SOP #605.

11. Label the sample containers with all necessary information and complete all chain-of-custody documents and seals.

12. Place the properly labeled and sealed sample bottles in a cooler with ice and maintain at 4^{o}C for the duration of the sampling and transportation period. Do not allow samples to freeze.

D. QA/QC REQUIREMENTS:

To the extent possible, all samples should be collected using the same type of equipment and in the same manner to ensure comparability of data.

E. SPECIAL CONDITIONS:

Step 4 can be replaced if purging and sampling is being performed with a Grundfos Rediflow pump. In this case, after well purging was completed, the discharge rate for the pump would be reduced to approximately 40 ml/minute. Sampling can then proceed as described above.

F. REFERENCES:

None.

SOP #501
REV. #2
June 22, 2015
Author: Matt Renko
Reviewer: John Favreau

STANDARD OPERATING PROCEDURE
SMALL EQUIPMENT DECONTAMINATION

A. PURPOSE/SCOPE:

Proper decontamination of small equipment prevents cross-contamination of samples, introduction of contaminants to clean sites, and the mixture of incompatible substances. Equipment decontamination also assures the health and safety of all equipment users. Procedures for decontamination procedures vary depending on the matrix sampled, level of contamination, type of contaminants, and the target analytes of the sampling event. The procedure outlined in this SOP is a general procedure for field/ warehouse decontamination of equipment associated with water, soil and other surficial sampling activities. Additional decontamination procedures may be required for particular contaminants or when samples are to be analyzed at very low concentrations.

Decontamination should be preformed before sampling work is begun and after each sampling event. Decontaminated equipment should be protected from contact with surroundings during storage and transport, and should be handled as little as possible before its use and always with disposable gloves. Note that all waste generated by decontamination procedures including liquids, solids, rags, gloves, etc., will be collected and disposed of properly according to the procedures outlined in SOP #507.

B. PRIOR PLANNING AND PROCEDURES

1. Review the Work Plan and Health and Safety Plan. Determine what analytes are to be measured (e.g., inorganic, organic, or both), what contaminants are known to be present on-site and if any special handling is required, if possible. Review the site history to determine the least and most contaminated sampling areas and plan to sample from clean/ least contaminated to most contaminated areas, if known.

2. Assemble general decontamination equipment listed in Section C according to matrix and analyte requirements.

C. EQUIPMENT/MATERIALS

Alconox®, tap water, distilled and deionized water, 10% nitric acid rinse, acetone (or other pesticide grade organic solvent), 1 gallon pressure spray bottles, long-handled brushes, 5 gallon plastic buckets.

E. CALIBRATION

Not Applicable

D. PROCEDURE:

Note that if it is logistically impractical/ impossible to complete all steps listed below at the field site, Steps 1-4 should be preformed prior to transport of equipment to a facility where all steps can be completed if required. All field decontamination should take place over a container and liquids should be properly disposed of.

1. Disassemble equipment as necessary

2. Remove gross contamination from equipment by scraping, brushing and rinsing with tap water

3. Wash with Alconox® or other laboratory grade detergent to remove all visible particulate matter and residual oils and grease.

4. Rinse with tap water to remove detergent.

5. If sampling for inorganics: Rinse with 10% nitric acid rinse.

6. If sampling for organics: Rinse with acetone, methanol, or other organic solvent. Allow equipment to air dry

7. If sampling for both organic and inorganic analytes, rinse with 10% nitric acid solution, distilled and deionized water, and then organic solvent. Allow equipment to air dry.

8. Rinse with distilled and deionized water.

9. Field personnel will use a new pair of outer gloves before handling sample equipment after it is cleaned.

10. If equipment will not be used immediately, wrap in aluminum foil (unless sampling for metals analysis) or seal in plastic bags (unless sampling for organics analysis) and store.

11. Record the date and method of decontamination on foil/bag and equipment log.

F. FIELD NOTES

Document field decontamination activities, particularly any deviations from the above procedure. Document collection of equipment rinsate blanks.

G. CALCULATIONS

Not Applicable

H. FOLLOW UP ACTIVITIES

Arrange for proper disposal of decontamination procedure waste.

I. QA/QC REQUIREMENTS:

When necessary, field equipment rinsate blanks will be collected by pouring analyte-free water over decontaminated equipment and submitting them to the lab with the other blanks and samples. These blanks are used to asses the quality of equipment decontamination.

J. SPECIAL CONDITIONS

Reusable PPE such as respirators, chemical-resistant overboots and gloves shall also undergo the equipment decontamination sequence. See SOP #505 for related information on Personnel decontamination.

If acetone is a known or expected contaminant another solvent may be substituted. Note that methanol cannot be used for decontamination when sampling gasoline or its by-products.

When trace levels of organic, inorganic, biological or toxicity constituents are target analytes for aqueous sampling, and extraneous contamination has to be highly controlled decontamination procedures developed by the USGS for aqueous sampling (Wilde, 2004) may be considered more appropriate than those listed here. See reference below.

K. REFERENCES

New Jersey Department of Environmental Protection, August 2005. *Field Sampling Procedures Manual*.

USEPA, 1994. *Sampling Equipment Decontamination*. Environmental Response Team SOP #2006, Revision #0.0. Edison, NJ. http://www.ert.org.

USEPA, 1996. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. Region 4, Science and Ecosystem Support Division. Athens, GA. http://www.epa.gov/region04/sesd/eisopqam/eisopqam.html

Wilde, F.D., ed., 2004. *Cleaning of Equipment for water sampling (ver. 2.0)*: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, April, accessed January 5, 2009 at http://pubs.water.usgs.gov/twri9A3/

L. APPENDICES

Not Applicable

APPENDIX F

Excavation Plan

EXCAVATION PLAN

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:

Randy Whitcher
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233
(518) 402-9662
randy.whitcher@dec.ny.gov

This notification will include:

- A detailed description of the work to be performed, including the location and areal 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;
- 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;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

SOIL SCREENING METHODS

Visual, olfactory and instrument-based soil screening will be performed by a QEP during all remedial and development excavations into known or potentially contaminated material (remaining contamination). 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.

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.

STOCKPILE METHODS

If temporary stockpiling of Site soils is determined to be necessary, all excavated materials from a depth greater than 2 feet below grade, on the Site or affected off-site areas, will be required to be stockpiled on a temporary containment pad. The temporary containment pad will be of sufficient size to store a minimum of 110 percent of the maximum amount of soil that will be stockpiled prior to re-use or off-Site disposal. At a minimum, any soil containment pads will include the following:

- A sufficiently large area with accessibility for trucks and construction equipment. The area shall be relatively flat and away from drainage inlets.
- A 10-mil thick polyethylene sheeting liner with a minimum of two-foot wide overlaps between successive rows.
- A minimum of a one-foot high soil berm shall be constructed around the perimeter of each pad to control runoff/run-on to and from the stockpiles. Gravel/stone ramps with gentler slopes will be constructed at locations of ingress and egress for each pad.
- Soil stockpiles that will remain in place for more than one (1) week will also be continuously encircled with silt fence.
- Hay bales and other erosion and sediment controls will be installed as needed near catch basins and other discharge points.
- Stockpiles 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 shall be maintained at a maximum height of 15 feet above surrounding surface subgrade elevation with a maximum slope of 1.5:1 to maintain stability. However, the appropriate slope may vary by material and the contractor performing stockpiling activities will be responsible for determining the safe allowable slopes for each material stockpiled on Site in accordance with all applicable regulations.

Stockpiles 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.

MATERIAL EXCAVATION & LOAD-OUT

A QEP, or person under their supervision, will oversee all invasive work and the excavation and load-out of all excavated material. The QEP will be identified in the notification to the NYSDEC. In some instances, an engineering consultant may serve as the QEP and in other cases it may be the contractor. If both an engineering consultant and contractor are part of the excavation work team, the roles of each party will be identified to the NYSDEC as part of the notification process.

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 QEP. 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 NYS Department of Transportation (NYSDOT) requirements (and all other applicable transportation requirements).

A truck wash will be operated on-Site if the trucks come in contact with contaminated soils at the Site. The QEP will be responsible for ensuring that all outbound trucks which come into contact with remaining contamination 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 QEP 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.

MATERIAL TRANSPORT OFF-SITE

All transport of materials 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 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.

All trucks which come into contact with remaining contamination will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of off-Site in an appropriate manner.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site. Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during Site development.

MATERIAL DISPOSAL OFF-SITE

All soil/fill/solid waste excavated from the saturated zone and removed from 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 the unsaturated zone from this 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).

MATERIAL RE-USE ON-SITE

"Re-use on-Site" means re-use on-Site of material that originates from the Site and which does not leave the Site during the excavation. Soils excavated from grade to a depth of 2 feet below grade, on the Site and affected off-site areas (as shown on Figure 3) and segregated from Site soils greater than 2 feet below grade may be reutilized on-Site without restriction. Under no circumstances shall any materials such as large boulders, vegetation (e.g. trees, stumps, brush, lawn clippings, etc.), construction and demolition debris (e.g. brick, concrete foundations, or other building materials) or other waste materials be buried or reused on-Site. Any such materials must be disposed off-Site at a properly permitted facility. The following table summarizes the requirements for allowable reuse of material on-Site.

Requirements for Reuse of Existing Materials On-Site

Original Location of Soil	Allowable Reuse
From grade to 2 feet below grade (on the Site and affected off-site areas)	Reuse allowed without restriction provided that soils are properly segregated.
From depths greater than 2 feet below grade (on the Site and affected off-site areas)	Reuse allowed at depths greater than 2 feet below grade, provided that the soil exhibits no evidence of gross-contamination. As previously indicated, soils that exhibit gross-contamination will be properly stockpiled, characterized, and disposed off-site at a properly permitted facility.

All materials excavated from depths greater than 2 feet below grade, on the Site or affected off-site areas, shall be placed onto temporary soil containment pads. In order for soil to be reused on-Site, the soil must be free of gross-contamination. Grossly-contaminated media is defined by the NYSDEC as "soil, sediment, surface water or groundwater which contains sources of substantial

quantities of mobile contamination in the form of NAPL that is identifiable either visually, through strong odor, by elevated contaminant vapor levels, or is otherwise readily detectable without laboratory analysis."

The QEP will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-Site. 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 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 NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site will not be reused on-Site.

LIQUIDS MANAGEMENT

All liquids to be removed from the Site and affected off-site areas, including groundwater from excavation dewatering, groundwater monitoring well purge and development waters, decontamination water, etc. will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Liquids produced during dewatering operations will not be recharged back to the land surface or subsurface of the Site, but will be managed/disposed of 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 under a SPDES permit.

Pumping and collection of water on-Site will be done in a manner to prevent the migration of particulates or soil/fill, and to prevent damage to the existing subgrade materials. The collected water will be collected and stored in drums or temporary storage tanks (e.g. polyethylene tanks or frac tanks) that are approved and labeled in accordance with USDOT requirements.

The water collected will be sampled by the contractor, or persons performing the intrusive activity, on a frequency of one sample per every ten drums or one sample per every 2,000 gallons of water collected in larger vessels. However, more frequent sampling may be directed by the NYSDEC or the disposal facility (e.g. a local publicly-owned treatment works (POTW)), should observable changes in the water quality be identified in the field. The water samples will be analyzed for TCL VOCs (and any other parameters required by the selected disposal facility for characterization

purposes). It is anticipated that pretreatment of particulate matter in the water will be required such that the turbidity of the water is at or below 50 Nephelometric turbidity units (NTUs) through filtering of settling processes prior to shipment.

Additionally, appropriate controls will be used to prevent spills and overflows, including but not limited to, monitoring, gauging, quick-close shut-off valves, and secondary containment. All storage containers will be decontaminated following disposal or discharge activities. Any residual sediment in the storage containers will be dewatered/stabilized, if necessary, and disposed of off-site in a similar manner as other materials requiring off-site disposal.

BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by the QEP 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.

All imported soils will meet the backfill soil quality standards established in 6NYCRR 375-6.7(d). All off-site borrow/imported fill soils will be from a documented source of "virgin" soil/rock or from off-site borrow soils that do not exceed the lower of the NYSDEC's Soil Cleanup Objectives (SCOs) for the protection of groundwater and the SCOs for the protection of public health for residential, commercial or industrial use as established in Table 375-6.8(b) of 6 NYCRR Subpart 375-6. The following documentation should be submitted to the NYSDEC to demonstrate compliance with these requirements and with the NYSDEC's DER-10:

1. **General documentation for <u>all</u> sources of fill:**
    a. The name of the person providing the documentation and relationship to the source of the fill.
    b. The location of where the fill is to be obtained.
    c. Identification of any state or local approvals as a fill source.
    d. A brief history of the use of the property for the proposed fill source.
2. **Imported soil for use as backfill material:** All soil imported for use as backfill must be:
    a. Free of extraneous debris and solid waste.

b. Be recognizable soil or other unregulated material as set forth in 6 NYCRR Part 360 and materials for which the NYSDEC has issued a beneficial use determination (BUD). Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

c. Free of contaminant concentrations exceeding the lower of the NYSDEC's SCOs for the protection of groundwater and the SCOs for the protection of public health for residential (140 State Street only), commercial or industrial use as established in Table 375-6.8(b) of 6 NYCRR Subpart 375-6.

Sampling is also required for all imported soils, with a minimum of one (1) sample analyzed for every new source of material, at the following frequency:

a. Soil or sand imported from a "virgin" mine or pit, at least one round of characterization samples for the initial 1,000 cubic yards of material imported in accordance with Table 5-2 below. For material designated as "virgin," written documentation shall be provided to the Site owner or owner's representative and the NYSDEC to document that the soil is native material from areas not having supported any known prior industrial or commercial development or agricultural use and is not now, nor has ever been, identified as a suspected depository for chemical, toxic, hazardous, or radioactive wastes.

b. Material sources other than virgin mine/pit (e.g. a formerly developed Site) must be sampled in accordance with Table 9 below.

c. The sampling frequency can be reduced from those specified in Table 5-2 below for projects involving large amounts of cover material and/or backfill, once a trend of compliance is established and the NYSDEC provides written authorization to reduce the sampling frequency.

Sampling Frequency Requirements for Imported Soils

Analysis Required	**VOCs**	**SVOCs, PCBs, Pesticides & Inorganics**	
Soil Quantity (Cubic Yards)	**Discrete Samples**	**Composite Samples**	**Requirements for Preparation of Composite Samples**
0-50	1	1	Five (5) discrete samples from different locations within the fill being provided will comprise a composite sample for analysis. Additional requirements for composite sampling are described
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	

Analysis Required	VOCs	SVOCs, PCBs, Pesticides & Inorganics	
Soil Quantity (Cubic Yards)	**Discrete Samples**	**Composite Samples**	**Requirements for Preparation of Composite Samples**
400-500	5	2	previously in this SMP.
500-800	6	2	
800-1,000	7	2	
>1,000	Add an additional two (2) VOC grab samples and one (1) composite sample for each additional 1,000 cubic yards of material required, unless otherwise approved in writing by the NYSDEC.		

As indicated in Table 8, VOC analysis must be performed on discrete samples only, while all other testing parameters will be analyzed for from composite samples. The following analyses will be performed on the imported fill characterization samples:

- TCL VOCs by EPA Method 8260 (grab samples only).
- TCL SVOCs by EPA Method 8270.
- TCL PCBs by EPA Method 8082.
- Pesticides by EPA Method 8081.
- TAL metals and cyanide by EPA Methods 6010 and 7471.

The results of this chemical testing will be compared to the lower of the NYSDEC's SCOs for the protection of groundwater and protection of public health for residential (140 State Street only), commercial or industrial use as established in Table 375-6.8(b) of 6 NYCRR Subpart 375-6 as well as the supplemental soil cleanup objectives in the NYSDEC's *CP-51: Soil Cleanup* Guidance dated October 2010 and/or any future pertinent soil cleanup guidance document. The source shall be rejected if any of these SCO's are exceeded.

3. **Non-soil Material Imported to the Site:** Gravel, rock or stone, consisting of virgin material from a permitted mine or quarry may be imported without chemical testing, to be used as backfill beneath paved surfaces, buildings, or as part of the final soil cover layer, provided that it contains less than ten (10) percent by weight material which would pass through a size No. 80 sieve.

   For material designated as "virgin," written documentation shall be provided to the Site owner or owner's representative and the NYSDEC to document that the soil is native material from areas not having supported any known prior industrial or commercial development or agricultural use and is not now, nor has ever been, identified as a suspected depository for chemical, toxic, hazardous, or radioactive wastes.

The environmental professional and/or engineer will be responsible for determining the need for additional material testing, such as particle size analysis, maximum dry density determination, moisture content, Atterberg limits, etc. for geotechnical purposes.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases. Stockpiles will be limited to a maximum size of 500 cubic yards. Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced. Bills of lading should be provided to the Site owner or owner's representative to document that the fill was delivered from a NYSDEC-approved source. The bills of lading will be included with Periodic Review Reports.

EXCAVATION CONTINGENCY PLAN

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

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

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 Review Report.