Honeywell

Shallow Groundwater Interim Remedial Measure Pre-Design Investigation & Treatability Study Work Plan

Former Oak Materials Fluorglas Division
John Street (NYSDEC Site No. 442049)

Village of Hoosick Falls
Rensselaer County, New York

Honeywell

16 March 2018

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SHALLOW GROUNDWATER INTERIM REMEDIAL MEASURE PRE-DESIGN INVESTIGATION & TREATABILITY STUDY WORK PLAN

Site No. 442049

Village of Hoosick Falls, Rensselaer County, New York

I, Chris Wenczel, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Shallow Groundwater Interim Remedial Measure Pre-Design Investigation & Treatability Study Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Chris W. Wenczel, P.G.
ERM Consulting & Engineering, Inc.

16 March 2018

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ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
1,1,1-TCA	1,1,1-trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
APS	Advanced Profiling System
bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
DER	Division of Environmental Remediation
DOT	Department of Transportation
DP	Direct-Push
DWS	Dynamic Work Strategy
EMS	Emergency Response Services
ERM	ERM Consulting and Engineering, Inc.
GPS	Global Positioning Equipment
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
IDW	Investigation-Derived Waste
ISCO	*In Situ* Chemical Oxidation
ISM	*In Situ* Soil Mixing
MSDS	Material Safety Data Sheet
μg/kg	Micrograms per Kilogram (parts per billion {ppb})
μg/L	Micrograms per Liter (parts per billion {ppb})
ng/L	Nanograms per liter (parts per trillion)
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSGS	New York State Geological Survey
PCX	PeroxyChem
PFAS	Per- and Polyfluoroalkyl Substances
PFCs	Perfluorinated Compounds
PID	Photoionization detector
PPE	Personal Protective Equipment
ppmv	Per Million by Volume
PTFE	Polytetrafluoroethylene
PV	Pore Volumes
SCOs	Soil Cleanup Objectives
SSC	Sub-Surface Clearance Procedures
TCE	Trichloroethene
TCL	Target Compound List
TOGS	Technical Operations Guidance Series
TOP	Total Oxidizable Precursors
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This Shallow Groundwater Interim Remedial Measure (IRM) Pre-Design Investigation & Treatability Study Work Plan summarizes the scope of work to acquire additional information for design and implementation of an IRM to address volatile organic compounds (VOCs) in shallow groundwater at the John Street Property (Site) (Figures 1 and 2) in the Village of Hoosick Falls, Rensselaer County, New York (the Site).

Honeywell International Inc. (Honeywell) entered into an Order on Consent and Administrative Settlement with the New York State Department of Environmental Conservation (NYSDEC) dated 3 June 2016 (the Order; Index Number CO 4-20160415-79) for the John Street property (Former Oak Materials Fluorglas Division - John Street (No. 442049) (NYSDEC, 2016a).

Initial Site characterization work detected the presence of VOCs (primarily trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA)) in both soil and groundwater on-Site and in groundwater off-Site. This Work Plan provides for the collection of additional data in support of design and implementation of a source-control IRM to address on-Site VOC concentrations in shallow groundwater and the VOC mass that is transported off-Site in groundwater.

1.1 PURPOSE

The purpose of the IRM is to address on-Site VOC concentrations in shallow groundwater and the VOC mass may be migrating off-Site/downgradient in groundwater. This goal will be achieved via means to promote enhanced degradation and/or removal of VOCs in environmental media to reduce VOC concentrations in off-Site groundwater and soil vapor in downgradient areas.

Selection and design of an appropriate IRM strategy for the Site necessitates an understanding of the distribution, concentration and mechanism(s) of potential migration of residual contaminants in the shallow fine-grained soils and groundwater beneath the Site.

Additional Site characterization activities/pre-design studies will be performed to delineate the extent of VOCs in on-Site shallow soils and groundwater (minimum depth of 20 feet below ground surface (bgs)), as well as gather additional information about the physical and chemical characteristics of the shallow subsurface environment at the Site.

1.2 APPLICABLE GUIDANCE

The following guidance applies to this project:

- NYSDEC Department of Environmental Remediation (DER) DER-10 – Technical Guidance for Site Investigation and Remediation (May 2010) (NYSDEC, 2010a)
- NYSDEC Division of Spills Management - Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program (NYSDEC, 1992)
- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response

1.3 GEOLOGY AND HYDROGEOLOGY

1.3.1 Soil

Native soils in the area, as mapped by the New York State Geological Survey (NYSGS), include alluvium and lacustrine silts and clays. Some coarse-grained soil is associated with channel-sand deposition and glacial outwash sand and gravel (Caldwell and Dineen, 1987). Near-surface soils at the John Street property consists of clean fill, composed sand and gravel. Native soil near the site is predominantly Hamlin silt loam (USDA, 2017).

1.3.2 Geologic Setting

Unconsolidated geologic materials above bedrock (collectively referred to as overburden) typically consist of the following materials in this area:

- Fine-grained alluvium (predominantly silt and clay) deposited in the Hoosic River valley.
- Coarse-grained alluvium, consisting predominantly of sand and gravel, also deposited in the Hoosic River valley.
- Silts and clays deposited in glacial and post-glacial lakes.
- Glacial outwash (predominantly sand and gravel) deposited by glacial meltwaters.
- Glacial till, which is typically a dense, compact, poorly sorted mix of silt, clay, sand, gravel, cobbles, and boulders that was deposited beneath glaciers.

Groundwater flow in overburden in the area is variable but generally flows toward the Hoosic River.

The soil and groundwater sampling locations completed at the Site during the Site Characterization are shown in Figure 3. A generalized geologic cross-section (A-A') depicting the shallow subsurface environment beneath the Site is presented in Figure 4.

1.4 INITIAL SITE MEDIA CHARACTERIZATION

The soil and groundwater sampling activities completed at the Site during the Site Characterization included:

- Five Waterloo APS™ profiler (JS-APS-001 through JS-APS-005) points were pushed to provide continuous soil logging and inferred hydraulic conductivity at individual locations; soil samples were collected at select intervals.
- Twelve split-spoon soil borings (JS-B-001 through JS-B-012) were completed with soil samples collected at select intervals for laboratory analysis. Continuous soil samples were collected and field screened with a Photoionization Ionization Detector (PID).
- Surface (0 to 2 inches) and near-surface (2 to 12 inches) soil samples were collected at JS-SS-001 and boring locations JS-B-003 through JS-B-005; shallow soil samples were also collected at JS-SS-002 (10 to 12 and 12 to 24 inches).
- Five monitoring well cluster locations (JS-MW-001 to JS-MW-005) were installed and sampled.

Site characterization results are summarized in a series of Plan and Cross-section views that present TCE concentrations in shallow soil (Figures 5 and 6) and groundwater (Figures 7 and 8), respectively. VOCs detected in soil and groundwater are presented in Tables 1 through 3 and are compared to the Part 375 Soil Cleanup Objectives and NYS Class GA groundwater quality standards and/or guidance values.

1.4.1 Soil Analytical Results

Eight VOCs (TCE, 1,1,1-TCA, cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE)), acetone, toluene, and vinyl chloride) were detected in shallow on-Site samples at one or more locations. TCE and 1,1,1-TCA were detected at maximum concentrations in soil of 420,000 micrograms per kilogram (μg/kg), and 88,000 μg/kg, respectively. The highest concentrations of TCE and 1,1,1-TCA in soil were found in silt and clay occurring between 10 feet and 18 feet below grade at the locations of on- Site soil borings JS-B-01, JS-B-03, JS-B-06 & JS-B-09.

1.4.2 Groundwater Analytical Results

Three VOCs (TCE, 1,1,1-TCA and cis-1,2-DCE) were detected in shallow groundwater samples collected from on-property WaterlooAPS™ profiler and monitoring wells at concentrations that exceed their respective NY Class GA Standards at one or more locations. TCE is the only VOC that was detected at concentrations exceeding its NYS GA Standard at more than one on-property location in shallow groundwater. TCE concentrations ranged from one microgram per liter (μg/L) to 130 μg/L.

1.5 TECHNOLOGY EVALUATION

The primary VOCs (TCE, 1,1,1-TCA and cis-1,2-DCE) are amenable to treatment by a number of industry-proven physical, chemical and biological technologies including:

- *In situ* chemical oxidation (ISCO)
- Air sparging/soil vapor extraction (AS/SVE)
- Permeable reactive barrier (PRB); and
- Anaerobic bioremediation.

Based on current information, ISCO and anaerobic bioremediation, which are injection technologies that can target both the sand layer, and the clay and silt layer, are the preferred alternatives for the IRM. AS/SVE can be considered as a permeable barrier removal technology but will not effectively remove VOCs from the clay and silt layer. Zero valent iron (ZVI), which is commonly used in PRBs for VOCs, will not degrade 1,1,1-TCA. PRB alternatives that treat 1,1,1-TCA include ISCO and bioremediation barriers; however, treatment of the source mass by these technologies is preferred over long-term barrier technology.

Perfluorinated compounds (PFCs) such as perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS) and lesser amounts of other perfluoroalkyl acids were detected in soil and groundwater at the Site. Neither ISCO, AS/SVE nor anaerobic bioremediation are expected to alter the mobility of PFOA, PFOS or the other perfluoroalkyl acids on-Site.

ISCO and AS/SVE are known to enhance the oxidation of polyfluorinated alkyl substances with the formation of, in some cases, PFOA, PFOS and other perfluoroalkyl acids as end products. However, polyfluorinated alkyl substances are not believed to be associated with the PTFE dispersion coating process performed at the Site. Consequently, polyfluorinated alkyl substances are not expected to be present on-Site, and the implementation of ISCO or AS/SVEs is not expected to result in the formation of PFOA, PFOS or other perfluoroalkyl acids on-Site or off-Site.

As discussed Sections 2.3, five discrete soil samples will be analyzed for Total Oxidizable Precursors (TOP) to confirm the absence of oxidizable polyfluorinated alkyl substances. The TOP analyte list will include both per- and polyfluorinated alkyl substances (PFAS).

Anaerobic bioremediation does not result in the formation of PFOA, PFOS or other perfluoroalkyl acids from polyfluorinated alkyl substances.

The injection of water (for ISCO or anaerobic bioremediation) or air (for AS/SVE) will have limited if any impact on the migration of PFOA or other perfluoroalkyl acids on-Site.

As discussed in Section 2.9, the evaluation of technologies will be reassessed after completion of the pre-design characterization activities.

1.6 SUMMARY OF IRM DESIGN/IMPLEMENTATION

1.6.1 Objectives/Performance Standards

The IRM program is intended to achieve the following objectives:

- Reduce the VOC mass in on-Site soil and shallow groundwater to reduce concentrations in downgradient areas;
- Reduce the mass of VOCs partitioning from soil to shallow groundwater; and
- Decrease the mass flux of VOCs from shallow groundwater to soil vapor.

1.6.2 Approach and Pre-Design Requirements

The selected remedial technology or technologies will be implemented in the areas of highest TCE and 1,1,1-TCA concentration(s) in soil at and/or near the Site. Selection of the appropriate remedial technology and implementation techniques requires an understanding of the distribution of chemicals of concern (defined by the vertical and horizontal extent), geologic/lithologic conditions, and hydrogeologic parameters at the Site. The pre-design activities discussed below were selected to collect this additional information.

The pre-design characterization activities will use the real-time United States Environmental Protection Agency (USEPA) TRIAD (observational) approach and collection of confirmatory soil samples for laboratory analyses to construct a more detailed delineation of the shallow soil impacts. The TRIAD approach uses a Dynamic Work Strategy (DWS) in which the real-time results are used to adjust and refine the strategy while in the field.

This soil delineation strategy will use existing data and allow additional delineation to proceed in a timely manner.

Site characterization soil sample analytical data were compared to soil headspace field screening data collected using a PID (calibrated using isobutylene gas). These comparisons, illustrated in the chart presented in Appendix A, indicate that higher soil concentrations were generally present in the soil samples with headspace concentrations greater than 10 parts per million by volume (ppmv). Field screening of soil samples by PID will be used during these pre-design activities to qualitatively define the interval(s) of shallow soils with elevated concentrations of TCE.

2.0 ADDITIONAL PRE-DESIGN CHARACTERIZATION ACTIVITIES

Pre-design additional Site characterization activities described below will be performed in a manner consistent with the existing NYSDEC-approved SC Field Sampling and Analysis Plan (ERM, 2016a).

2.1 PFAS CONSIDERATIONS

As noted above, PFASs were also detected in soil and groundwater samples taken at the John Street property. The following guidelines and procedures will be followed to avoid contamination of environmental samples or site media with PFASs:

- No clothing or clothing treated with stain- or water-resistant coatings will be allowed. Clothing must be washed three to six times before use.
- No Tyvek® clothing will be allowed.
- No Post-It-Notes® will be used during sampling.
- Personnel must not handle pre-wrapped food or snacks before sampling or while working at the property.
- No materials or equipment will be used that contains Teflon® (e.g. Teflon® tubing, sample container cap liners, tape, etc.).
- No materials or equipment will be used that contains polytetrafluoroethylene (PTFE) (e.g. PTFE-coated aluminum foil, Gore-Sorbers™) or any other material known or suspected to contain a fluoropolymer.
- For samples that may be analyzed for PFASs, only sampling containers and caps/tops that have been supplied by the laboratory will be used.
- Sample containers and caps/tops will not be stored for more than 30 days before use.
- Field personnel must wash their hands with soap and potable water prior to sampling activities, especially after contact with any materials potentially containing PFASs.
- Chemical ice packs ("blue ice") will not be used.

Potable water used for sampling and/or IRM implementation will be obtained from a tested source that is shown to contain less than 2 nanograms per liter (ng/L {parts per trillion}) of both PFOA and PFOS based on sampling and laboratory analysis completed prior to field work.

Dedicated water containers will be used in the field throughout the duration of the project. Aqueous field rinse blank samples will be collected from the containers prior to mobilization and during use in the field. Rinse blank samples will be sent for laboratory analysis of PFASs to ensure the water containers are PFAS-free.

The following NYSDEC special precautions for trace contaminant sampling will also be utilized based on review of Section 5.2.9 of the NYSDEC's Sampling Guidelines and Protocols (NYSDEC, 1992):

- A clean pair of new, disposable nitrile gloves will be worn each time a different point or location is sampled; and

- Sample containers shall be placed into separate re-sealable polyethylene plastic bags immediately after collection and labeling.

2.2 *SOIL BORINGS/WELL INSTALLATIONS*

Delineation activities will include an iterative series of approximately 60 shallow soil borings to collect real-time data at the locations surrounding on- Site soil borings JS-B-01, JS-B-03, JS-B-06 & JS-B-09 shown in Figure 9. This process provides an opportunity to use the borings for multiple purposes including the installation of temporary wells that may be useful for subsequent IRM implementation. The generalized scope of work includes the completion of additional soil borings:

- To delineate the source area, each boring will be continuously sampled using the Geoprobe direct push sampling method to a minimum depth of 20 feet-bgs unless refusal is encountered. All soil samples will be screened with a PID to estimate VOC concentrations in soil and facilitate stepwise delineation of the horizontal and vertical extents of impacted soils.
- All borings will extend to a minimum depth of 20 feet. Additionally, each boring will be advanced until five continuous feet of soil exhibiting headspace readings of less than one ppmv are encountered.
- While the boring is open, a small-diameter PVC well screen will be installed in each stratum where PID readings greater than 10 ppmv are recorded. The discrete sampling zones will provide an opportunity to evaluate hydraulic and groundwater conditions and conduct hydraulic testing. Some points may be retained for re-use in the IRM implementation.
- Confirmatory soil samples for laboratory analysis will be collected as discrete samples from the two-foot depth interval with the highest PID reading in at least 50% of the soil borings (estimated 32 soil samples). A discrete soil sample will be collected for laboratory analysis from every boring with a PID reading above 10 ppmv. If PID readings at or above 10 ppmv are recorded in less than 50% of the soil borings, samples will still be collected from at least 50% of the total soil borings, from the depth interval with the highest PID reading.
- Soil samples will also be composited for treatability testing (see Section 2.4).

Deeper soil samples, if necessary, can be collected during the RI as part of the already proposed on-Site overburden temporary well installation/groundwater sampling activities to be performed using a rotosonic drilling rig. Subsurface soil samples would be collected on the basis of PID readings and changes in stratigraphy as follows: a sample from immediately above the water table; at any soil mottling zones (staining or other chemically-related impacts); at the fill/native soil interface; elevated PID readings; as well as any major stratigraphic changes above bedrock.

2.3 *SOIL SAMPLE ANALYSES*

Soil samples submitted for laboratory analysis will confirm that the field data are reflective the Site conditions and provide quality control for analytical confirmation. Selected samples will be analyzed for:

- VOCs by EPA 8260/5335 (32 samples);
- PFASs by USEPA Method 537-1.1 (modified; 21 analytes as listed in Section 2.8, 32 samples);

- Total Organic Carbon (TOC) by Lloyd Kahn method; and
- pH by Standard Method 9045D.
- Metals by EPA 6010B/5335 (2 samples – one from each area);
- Flashpoint by EPA 1010M/1030 (2 samples – one from each area); and
- Grain Size Analyses ASTM D422 or D6913 (2 samples – one from each area).

Duplicates of the soil samples analyzed for PFAS compounds will be reserved. When the preliminary VOC and PFAS results of the primary samples have been received, five samples will be selected in consultation with NYSDEC personnel and analyzed by:

- Total Oxidizable Precursor (TOP) assay.

Since the collection of the soil samples will take place over 14 to 28 days, it will not be possible, even with expedited turnaround times, to select and extract the samples by TOP assay within the 14-day holding time of the method. The TOP assay samples will, therefore, be analyzed outside of holding time. During the extended holding time, it is possible that some polyfluorinated precursor substances, if present, could oxidize under ambient storage conditions. However, since the final oxidation products do not degrade, the total perfluorinated alkyl acid concentrations measured outside of holding time should be the same as the concentrations that would have been measured if the samples were analyzed within holding times. The initial PFAS analyses of the soil samples will be performed within holding time.

2.4 *REMEDIAL TECHNOLOGY TREATABILITY STUDIES*

Samples of soil and groundwater will be collected and analyzed for parameters that will assist in the selection and design of a remedial technology. The infiltration testing described in Section 2.6 will also provide information to support the selection and design process.

Two representative composite soil samples exceeding 10 ppmv by field screening will be provided to:

- PeroxyChem's (PCX) treatability laboratory for oxidant demand testing to establish possible dosing requirements, activation chemistries, longevity and performance of an ISCO alternative:
    - Sodium persulfate – including total oxidant demand, stability, potential activator suites and soil acidity,
    - Permanganate oxidant demand – including short-term oxidant demand and oxidant stability, and
    - PFAS concentrations before and after oxidation will also be measured to assess potential formation of perfluorinated alkyl acids from precursor substances during oxidation.
- A soil mixing contractor to complete benchtop mixing simulations using mechanical equipment. As part of this evaluation, samples will also be analyzed for:
    - Grain size distribution – sieve and hydrometer

- Atterberg limits – clay samples only
- Standard proctor - compaction

This additional information will be used to evaluate possible reagent delivery options including direct injection, fracture emplacement and In-Situ Soil mixing (ISM)/soil stabilization.

To evaluate bioremediation and to provide design information, groundwater samples will be collected from the on-Site shallow monitoring wells (JS-MW-001A, --002A, -003A, -004A and -005A) using low-flow sampling procedures and analyzed for:

- Dissolved gases (methane, ethane, and ethene);
- Geochemical parameters (nitrate, nitrite, sulfate, sulfide, total and dissolved iron, total and dissolved manganese, total organic carbon);
- Field parameters (pH, dissolved oxygen, oxidation-reduction potential (ORP), specific conductance, temperature and turbidity; and
- Microbial analyses (*Dehalococcoides*, TCE and vinyl chloride reductases, *Dehalobacter*, methane oxidizing bacteria, and soluble methane monooxygenase).

Groundwater for microbial analyses will be filtered through Bio-Flo filters and the filters will be submitted to Microbial Insights for analyses.

2.5 SMALL-DIAMETER WELL INSTALLATIONS

Small-diameter PVC well screens will be installed in each boring to span the intervals where headspace screening exceeds 10 ppmv. The number and lengths of well screens cannot be predicted in advance; the lengths and number required will be determined in response to the field screening. To aid in determination of proper screen placement, the following will be considered:

1. Well screens will be small-diameter (~ 0.75-inch, 0.10-inch slot) to fit inside the Geoprobe rods at the conclusion of the soil sampling.
2. Well screens will be set in the intervals exceeding 10 ppmv providing for approximately one-foot of screen above and below those intervals.
3. Each screen will be a minimum of three feet in length and centered in the selected interval exceeding 10 ppmv (additional screen may be added to fully cover the soils exceeding 10 ppmv as needed).
4. Solid riser will be attached to the screen to extend approximately two feet above ground surface.
5. The screened interval will be backfilled with sand that will extend approximately two feet above the top of the screen.
6. The remainder of the boring will be filled with grout or hydrated chipped bentonite to isolate the screen from underlying and overlying strata.
7. The screened interval will be shown on the drill logs prepared by the field supervisors.
8. Each well will be secured with a locking expansion plug and lock and remain as a “stickup” installation for potential use for infiltration or other testing and/or during potential use of injection technology as part of the IRM.

2.6 INFILTRATION TESTING

Hydraulic infiltration testing will be completed on up to six of the wells following completion. Infiltration testing will evaluate the infiltration rate of liquids in the soil strata, specifically the zones with greater than 10 ppmv.

The well bore will be gauged for static/starting depth to water, filled with potable water and the resulting decline to static conditions measured over time. The decline in water table will provide an estimate of the infiltration rate in the target stratum to evaluate the potential use of injection technology.

2.7 GROUNDWATER SAMPLING

Existing on-Site and select off-Site shallow groundwater monitoring wells will be resampled to provide a basis for IRM design. Groundwater samples will be analyzed for:

- Target Compound List (TCL) VOCs using EPA Method 8260C;
- PFASs by USEPA Method 537-1.1 (modified; 21 analytes as listed in Section 2.8);
- Total Organic Carbon (TOC) by Lloyd Kahn method; and
- pH by Standard Method 9045D.

Any significant changes in the VOC characterization from current interpretations outlined in Section 1.0 may require a modification to the IRM design/implementation plan.

2.8 PFAS ANALYTE LIST

The following 21 PFASs will be analyzed using USEPA Method 537.1 (modified):

- Perfluorobutanoic Acid
- Perfluoropentanoic acid
- Perfluorohexanoic acid
- Perfluoroheptanoic acid
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid
- Perfluorodecanoic acid
- Perfluoroundecanoic acid
- Perfluorododecanoic acid
- Perfluoro-n-tridecanoic acid
- Perfluorotetradecanoic acid
- Perfluorobutane sulfonic acid
- Perfluorohexane sulfonic acid
- Perfluoroheptane sulfonic acid
- Perfluorooctane sulfonic acid (PFOS)
- Perfluorodecane sulfonic acid
- 6:2 Fluorotelomersulfonic acid
- 8:2 Fluorotelomersulfonic acid
- Perfluorooctanesulfonamide

- N-methyl perfluoro-1-octanesulfonamidoacetic acid
- N-ethyl perfluoro-1-octanesulfonamidoacetic acid

This analyte list will also be used for the TOP assay.

2.9 TECHNICAL MEMORANDUM

The results of the pre-design characterization investigation and treatability studies will be summarized in a technical memorandum that will:

- Outline the results of the pre-design characterization investigations and treatability studies with supporting graphics and tabular summaries;
- Evaluate the viability of potential *in situ* remedial technologies such as:
  - *In situ* chemical oxidation
  - AS/SVE; and
  - Anaerobic bioremediation.
- Recommend a selected technology and outline the IRM implementation program; and
- Present the post-implementation monitoring approaches to determine the efficacy of the selected remedial technology.

The Technical Memorandum will be submitted to NYSDEC for review.

3.0 GENERAL SCOPE OF WORK REQUIREMENTS

This section describes the general scope of work for the pre-design investigative activities, and the potential design and implementation of an injection remedial technology at the Site. Details regarding aspects of the IRM program cannot be determined until the results of the additional Site characterization activities are completed and appropriately evaluated and a remedial technology is selected.

3.1 PERMITS

Necessary permits for the project may include:

- Village of Hoosick Falls' fire hydrant permit water line access and metering for onsite supply;
- Village of Hoosick Falls' road opening permit for any work that might infringe on village right-of-ways; and
- Honeywell will comply with EPA injection requirements, specifically 40 Code of Federal Regulations Part 144, United States Environmental Protection Agency's Underground Injection Control program. Honeywell will contact the NYSDEC project manager for additional NYSDEC Division of Environmental Remediation guidance on remedial injections.

3.2 SUPPORTING DOCUMENTS

The work will be performed in conformance with the existing SC FSAP/RIWP for the River Road and John Street properties. This includes supporting documents such as the Quality Assurance Project Plan (QAPP), the Community Air Monitoring Plan (CAMP), and the Health and Safety Plan (HASP).

3.3 SITE ACCESS/PREPARATION

Mobilization will involve designating general work zones on the Site and procurement/transport/delivery of the necessary resources to accommodate the project requirements (i.e. labor, materials, and equipment).

General Site preparation activities include the following operations:

- Clearing of debris (e.g. gravel, vegetation, etc.) as necessary to access the work areas. Materials are to be staged in areas identified by ERM.
- A new underground utility markout/subsurface clearance activity will be required in accordance with ERM's Sub-Surface Clearance Procedures (SSC).
- Construction of temporary decontamination pad for personnel and equipment.
- Mobilization of chemical injection and mixing equipment, reagent storage and application equipment, tanker trucks and necessary personnel.

3.3.1 Temporary Facilities

3.3.1.1 Site Access Control

The Site is currently surrounded by a six-foot high steel security fence with locking gates. Work and staging areas will be maintained inside of the perimeter fencing. Access to the Site shall be via Lyman Street.

3.3.1.2 *Storage Areas*

Designated storage areas will be established in a secured portion of the Site that will not interfere with access to the specific areas to be treated and provide secure storage and weather resistance. Materials shall not be stockpiled outside the designated area in preparation for the next day's work. Mobile equipment, such as drilling rigs and trucks, shall be parked within the designated area at the end of each work day, unless otherwise approved by ERM.

The storage areas will be kept in good repair. Grassed or unpaved areas shall be protected as necessary to prevent rutting and the tracking of mud off-Site by construction equipment or other vehicles.

3.3.1.3 *Sanitary Facilities*

Temporary sanitary facilities with regular maintenance services shall be provided for Site workers.

3.3.2 *Security Provisions*

The Site shall be secured against trespass, vandalism and theft by the existing security fencing and vehicle gates that will be locked at the end of each work day. A daily visitor's log will be maintained to document all visitors to the Site.

A Hazard Area Classification Map will be compiled and included in the project HASP and described to personnel working upon the Site. This plan will exhibit existing Site conditions including the location of existing utilities.

Site security will be maintained to control Site access. A minimum two-person field crew will be required on-Site at all times. Additional security measures will include:

- Site personnel should anticipate no/limited pedestrian traffic in the work area; however, field activities shall maintain an exclusion zone, demarked by traffic cones, caution tape or equivalent;
- Site personnel should maintain access around all work areas sufficient to facilitate access for fire and/or emergency vehicles; and
- All non-ERM personnel should be accompanied by an ERM person at all times.

3.3.3 *Erosion and Sediment Control*

During construction activities, erosion and sediment controls will be incorporated to minimize storm water contacting disturbed areas and to control runoff. Silt fences shall be installed around excavation areas and around the soil storage areas.

3.3.4 *Equipment Decontamination*

Equipment in direct contact with contaminated media (e.g., drilling rods and other sampling equipment) must be cleaned using appropriate washing techniques such as pressurized water with a detergent solution (Alconox® or Liquinox®,) between sampling locations and prior to demobilizing from the Site.

A temporary decontamination pad shall be established on-Site that is of suitable size and provides containment of decon liquids and solids. The decon wastes shall be managed in accordance with requirements specified in Section 3.5.

3.3.5 *Survey and Work Stake-out*

The locations of treatment areas will be staked from control points established by a New York-licensed surveyor. Survey crews utilizing traditional survey equipment and/or Global Positioning Equipment (GPS) equipment, as appropriate, will be employed. Each injection point will be numbered for identification purposes and the location will be measured in the field using GPS equipment.

3.3.6 *In Situ Treatment Design Guidelines*

For injection-based remedial technologies such as ISCO or anaerobic bioremediation, general performance guidelines have been established for subsurface amendment formulation and delivery to the treatment zones. These guidelines are intended as preliminary design requirements for implementation of technologies that require injection of amendments to the subsurface at the Site. The pre-work water injection and infiltration tests and full-scale field performance will provide Site-specific data that can be used to modify these guidelines as necessary.

3.3.6.1 *Treatment Zone Pore Volume*

Soil pore volumes (PVs) for the treatment areas will be estimated to provide an indicator of the amendment solution reference volume required to saturate the treatment zone(s).

Effective porosities for well sorted sands and gravels can range 0.25 -0.50 (dimensionless)[1]. Porosities in poorly sorted sands and gravels tend to be lower and thus, PVs will be estimated based on an assumed porosity of 0.3. Unit pore volumes (per/ft.) will be estimated for a range of injection point spacing and infiltration areas (per sq. ft.). PVs will vary throughout the Site based on actual effective porosity, target lithology and treatment zone thickness.

3.3.6.2 *Injection Pressure Guideline*

Maximum *in situ* injection pressures will be estimated over the thickness of the treatment zone, approximately 2 to 25 feet bgs. A shallow zone average hydraulic conductivity will be assumed for estimation purposes based on the Site characterization infiltration testing results.

The mitigating effects of soil tensile strength resistance will not be considered to allow a conservative estimate. Because the injection zone is relatively shallow, injection pressures will need to be monitored and controlled to prevent surface uplift, inadvertent soil fracture and unintended fluid return. For the range of injection depths, maximum injection pressures (*in situ*) will be estimated with the expectation that allowable pressure can be increased with depth of the injection point.

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[1] Davis, S. N. 1969. Porosity and permeability of natural materials. *Flow Through Porous Media*, ed. R. J. M. D Wiest. Academic Press, New York. pp 54-89.

3.3.6.3 *Hydraulic Acceptance Rate*

The hydraulic acceptance rate of the formation will be evaluated based on the Site characterization infiltration testing results to estimate the operating limits to prevent groundwater mounding during injection. The shallow groundwater saturated zone occurs at approximately seven (7) feet bgs.

In general, the acceptance rate will decrease over time as the groundwater levels rise and additional back pressure created by the resultant groundwater mound. For injection, the acceptance rate increases with depth; however the injection rate is not expected to remain constant throughout the injection period; as injections will typically be performed concurrently in several locations using a manifold system.

3.3.6.4 *Amendment Formulation*

The final remedial technology and amendment selection will be based on the results of the Site characterization treatability studies. The final selection of the IRM amendment and application method will be provided after the review of the pre-design and treatability data.

3.3.6.5 *Amendment Dosing*

Amendment dosing is defined as the mass of amendment delivered to the treatment zone. Dosing is based on VOC concentrations, soil and groundwater geochemistry, amendment stability/longevity and acceptance capacity of the treatment zone. The amendment application will be designed to deliver the required dosage throughout the entire treatment zone. Other criteria to also consider include injection pressure and time limitations, and groundwater acceptance limitations.

3.3.6.6 *Amendment Delivery Plan*

Several amendment delivery methods will be considered for the Site depending upon the location and extent of the target strata:

- Surface infiltration – for the shallow, unsaturated coarse grained materials and possibly the deeper finer grained materials;
- Direct injection – for the saturated coarse grained materials where injection pressures and corresponding area of influence is large; and
- Soil fracturing – fracture emplacement in deeper saturated materials.

Specific dosages may be designed for each treatment zone. Lower permeability zones may be challenging and will be considered in dosage planning to achieve acceptable amendment distribution throughout the treatment zone.

3.4 *FIELD MODIFICATIONS*

Field modifications/changes to the scope of work will be communicated to, reviewed and approved by both Honeywell and NYSDEC prior to field implementation.

3.5 *INVESTIGATIVE DERIVED WASTE MANAGEMENT*

Investigation-derived waste (IDW) is anticipated to consist of the following:

- Water - decontamination fluids and groundwater from monitoring well sampling;
- Disposables - personal protective equipment (PPE), HDPE tubing used for groundwater sampling, paper towels and HDPE plastic; and
- Solids - soil cuttings, etc.

IDW previously staged at the John St. property was transported by a Part 364-permitted transporter and placed within secure, heated indoor storage at the River Road property in accordance with Section 2.12 of the NYSDEC-approved John Street/River Road FSAP document.

Pertaining to the up-coming John Street IRM pre-design investigation, composite samples of IDW will be collected following waste generation and sent for analysis of PFASs, TCLP VOCs, TCLP RCRA metals, ignitability/flammability, reactivity, and pH. Analysis of other parameters will be performed if required by the facility receiving the waste.

Following receipt of analytical data, waste determined to be hazardous will remain temporarily staged at the John Street facility. Within 90 days of the waste generation, the containers will be manifested and transported off-site for disposal at a permitted facility.

Waste determined to be non-hazardous and non-regulated may be transported off-site for disposal at a permitted facility or may be moved to the River Road facility for temporary staging prior to final disposal.

3.6 *SITE RESTORATION*

Construction debris, waste materials, and other solid wastes shall be covered and secured at the work site on a daily basis and removed from the work site periodically. Stored material shall be neatly stacked when stored.

Upon completion of the project and after removal of materials and equipment, the areas used for storage and transporting equipment and/or materials between work areas, will be restored to original or better condition.

3.7 *DEMOBILIZATION*

Following completion and acceptance of the work, equipment, materials, supplies, debris/waste generated by the IRM activities, temporary utilities and facilities, and manpower will be removed from the Site.

4.0 SCHEDULE

A draft schedule for the pre-design investigation and treatability study activities is presented in Figure 10 showing key tasks including critical path activities and expected regulatory review and approval time periods. The schedule starts with submittal to the NYSDEC for review and approval of the Work Plan. This schedule is contingent upon securing access to any required permits or other approvals, cooperation of stakeholders, and does not contemplate significant delays due to weather or other conditions beyond ERM and/or Honeywell's control.

ERM anticipates that the investigative work described in this Pre-design Investigation and Treatability Study Work Plan will require approximately 10 to 12 days of field effort, with 9 days of Geoprobe equipment to collect and retrieve the soil samples. The Treatability Study work will require approximately four to six weeks.

5.0 REFERENCES

Cadwell, D.H. and Dineen, R.J., 1987. Surficial Geologic Map of New York: Hudson-Mohawk Sheet. New York State Museum and Science Service, Map and Chart Series Number 40, Albany.

ERM, 2016a. Final Site Characterization Field Sampling and Analysis Plan – Phase 1: Oak Materials – River Road 1, 2 and 3 (No. 442008) and Former Oak Materials Fluorglas Division – John Street (No. 442049): Town of Hoosick and Village of Hoosick Falls, Rensselaer County, New York. ERM Consulting and Engineering, Inc., Syracuse, 20 July 2016.

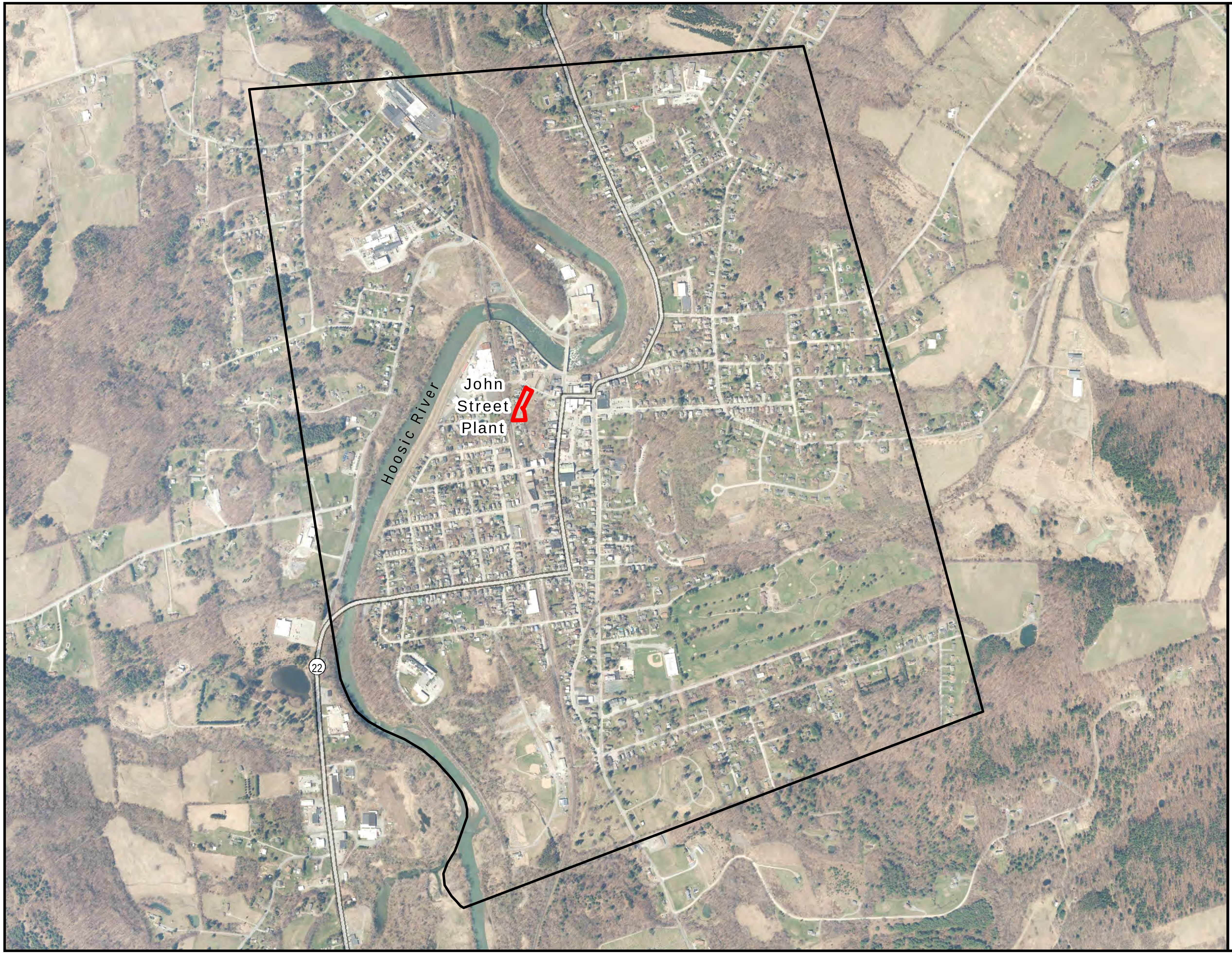
NYSDEC, 1992. Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program. Division of Spills Management, Albany, September 1992.

NYSDEC, 2010a. DER-10: Technical Guidance for Site Investigation and Remediation. NYSDEC Division of Environmental Remediation, Albany, May 2010.

NYSDEC, 2016a. Order on Consent and Administrative Settlement Index Number CO 4-20160415-79: Oak Materials Fluorglas Division – John Street (No. 442049) and Oak Materials – River Road 1, 2 and 3 (No. 442008). Division of Environmental Remediation, Albany, 3 June 2016.

USDA, 2017. Natural Resources Conservation Service Web Soil Survey for Rensselaer County, New York.

FIGURES



Legend

- Approximate Property Boundary
- Village of Hoosick Falls Boundary
- State Route 22

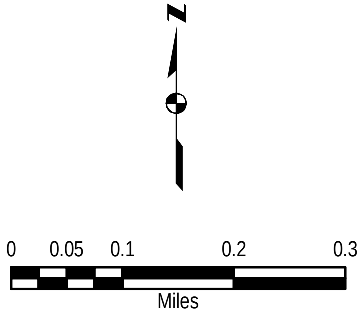


Figure 1: Property Location

Former Oak Materials Fluorglas Division

John Street Property

Village of Hoosick Falls

New York

ERM

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Legend

- Approximate Site Boundary
- Village of Hoosick Falls Boundary
- Waterbody
- Hoosick Town Boundary
- Elevation Contours (10 foot)
- Elevation Contours (2 foot)

N

0 25 50 100 150 200
Feet

Figure 2: Site Layout
Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

ERM

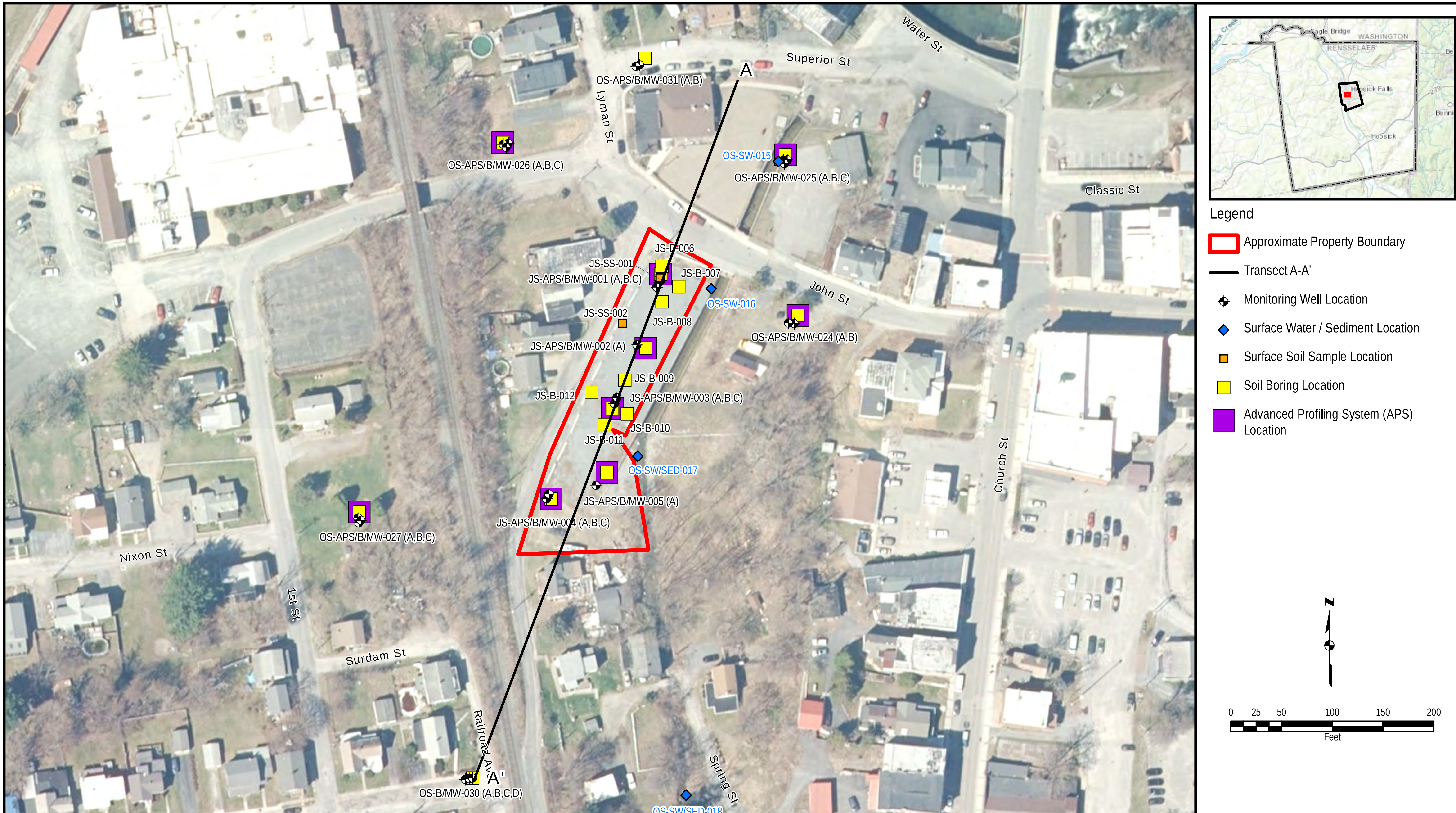


Figure 3: Sample Locations
Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

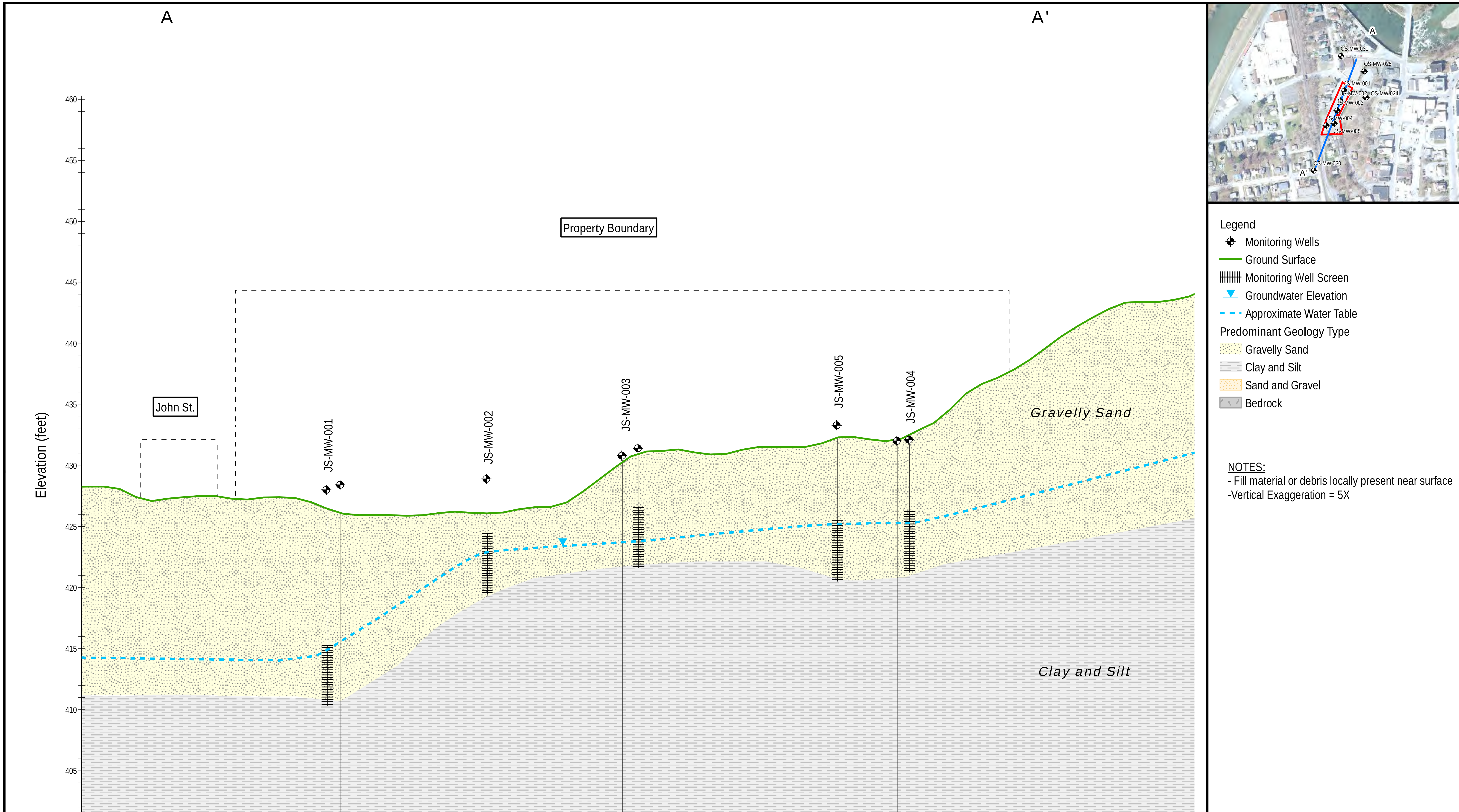


Figure 4: Cross Section A-A'
Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

ERM

Legend

- Approximate Site Boundary
- Village of Hoosick Falls Boundary
- Hoosick Town Boundary

TCE in Soil (ug/kg)

- <10
- 10 - 100
- 100 - 1,000
- 1,000 - 10,000
- 10,000 - 100,000
- >100,000
- Non-Detect

N

0 12.5 25 50 75 100
Feet

Figure 5: TCE in Shallow Soil
Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

ERM

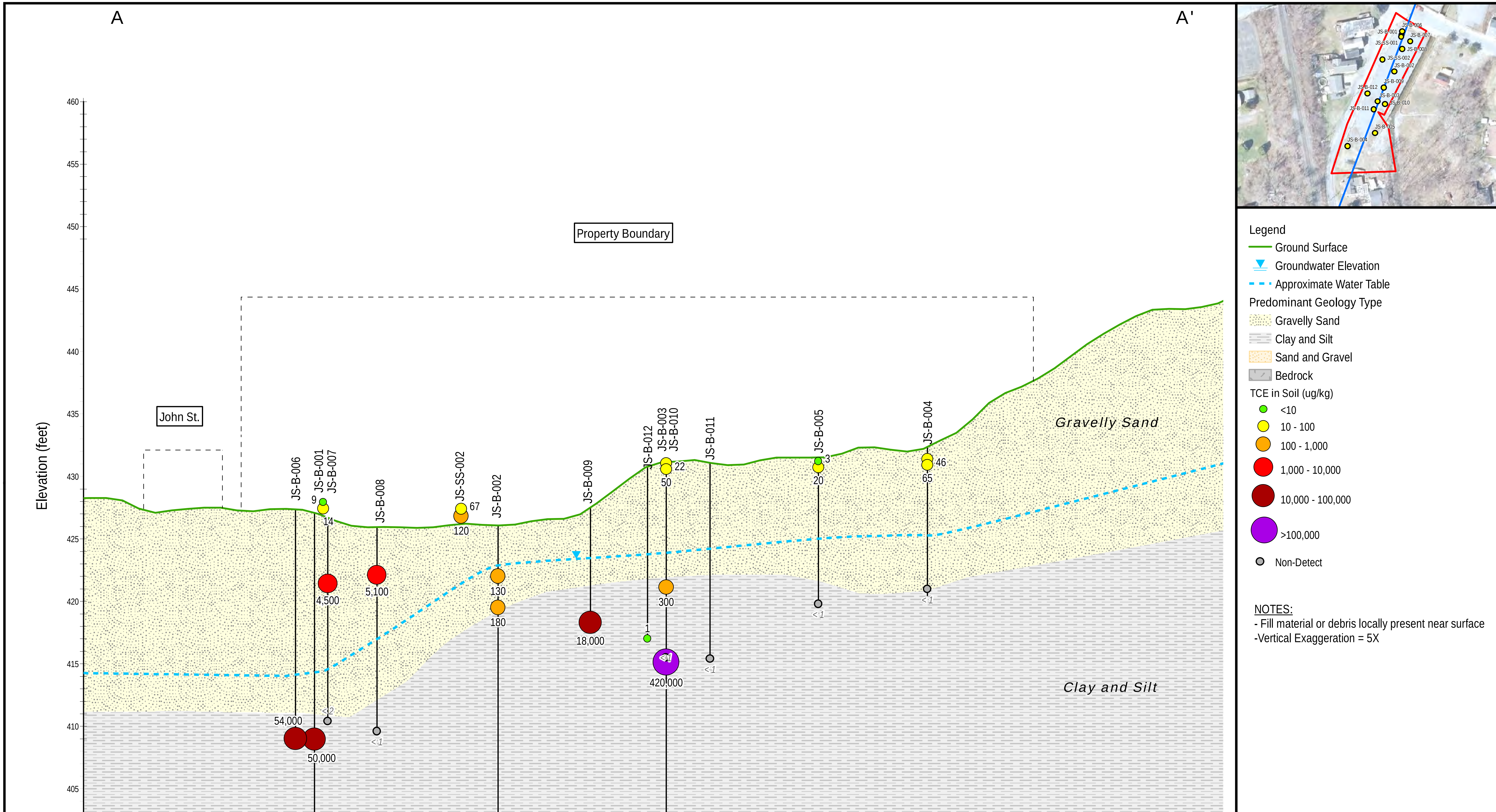
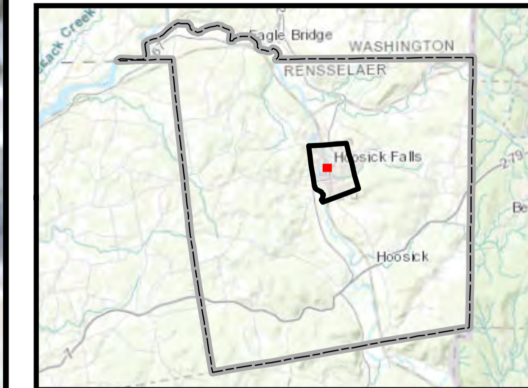


Figure 6: TCE in Soil
Cross Section A-A'
Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York



Legend

- Approximate Site Boundary
- Village of Hoosick Falls Boundary
- Hoosick Town Boundary

TCE in Groundwater (ug/L)

- <10
- 10 - 100
- 100 - 1,000
- Non-Detect

0 12.5 25 50 75 100
Feet

Figure 7: TCE in Shallow Groundwater

Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

ERM

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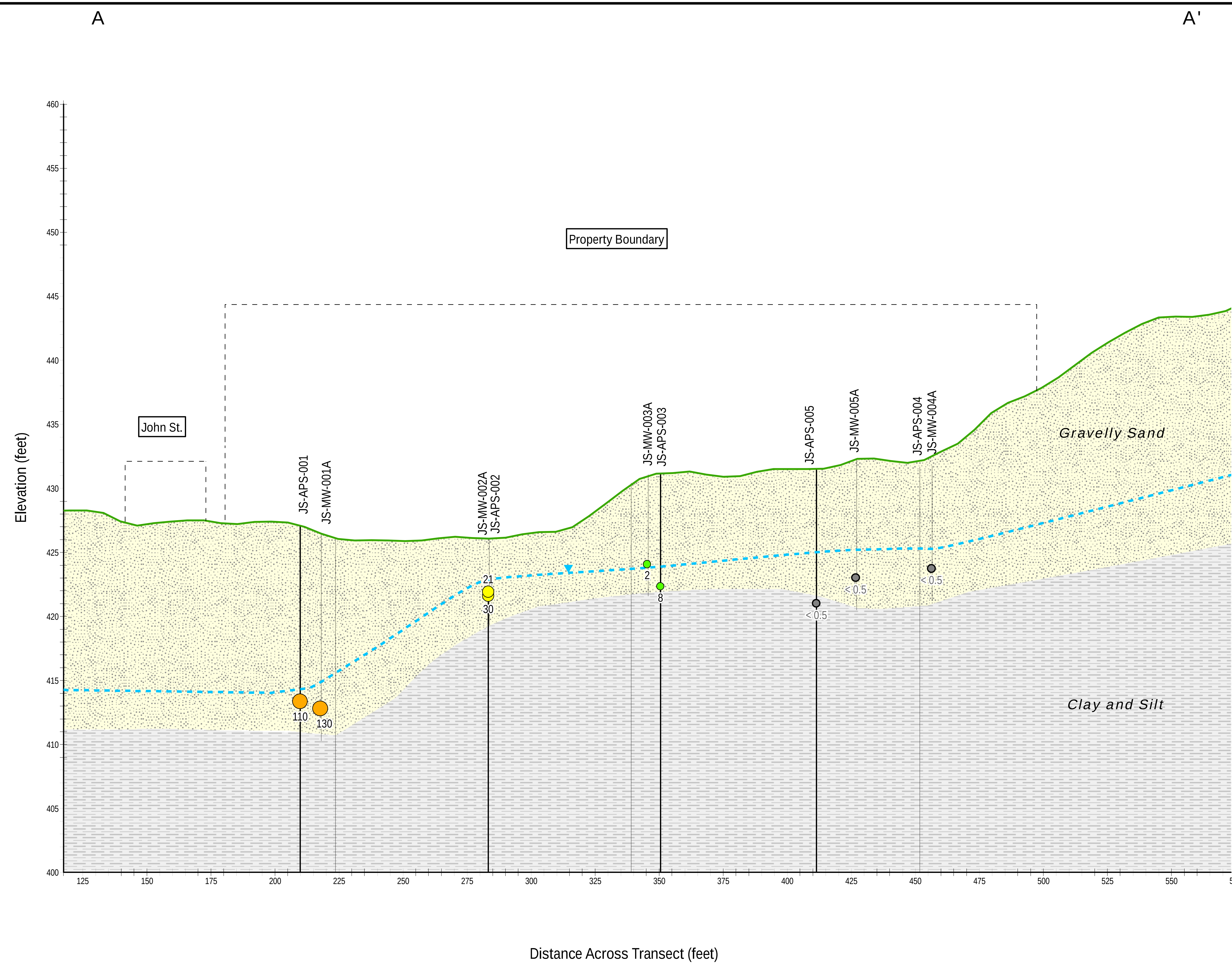

Legend

- Ground Surface
- Groundwater Elevation
- Approximate Water Table

TCE in Groundwater (ug/L)

- <10
- 10 - 100
- 100 - 1,000

Predominant Geology Type

- Gravelly Sand
- Clay and Silt
- Sand and Gravel
- Bedrock

NOTES:
- Fill material or debris locally present near surface
-Vertical Exaggeration = 5X

Figure 8: TCE in Groundwater Cross Section A-A'

Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

ERM

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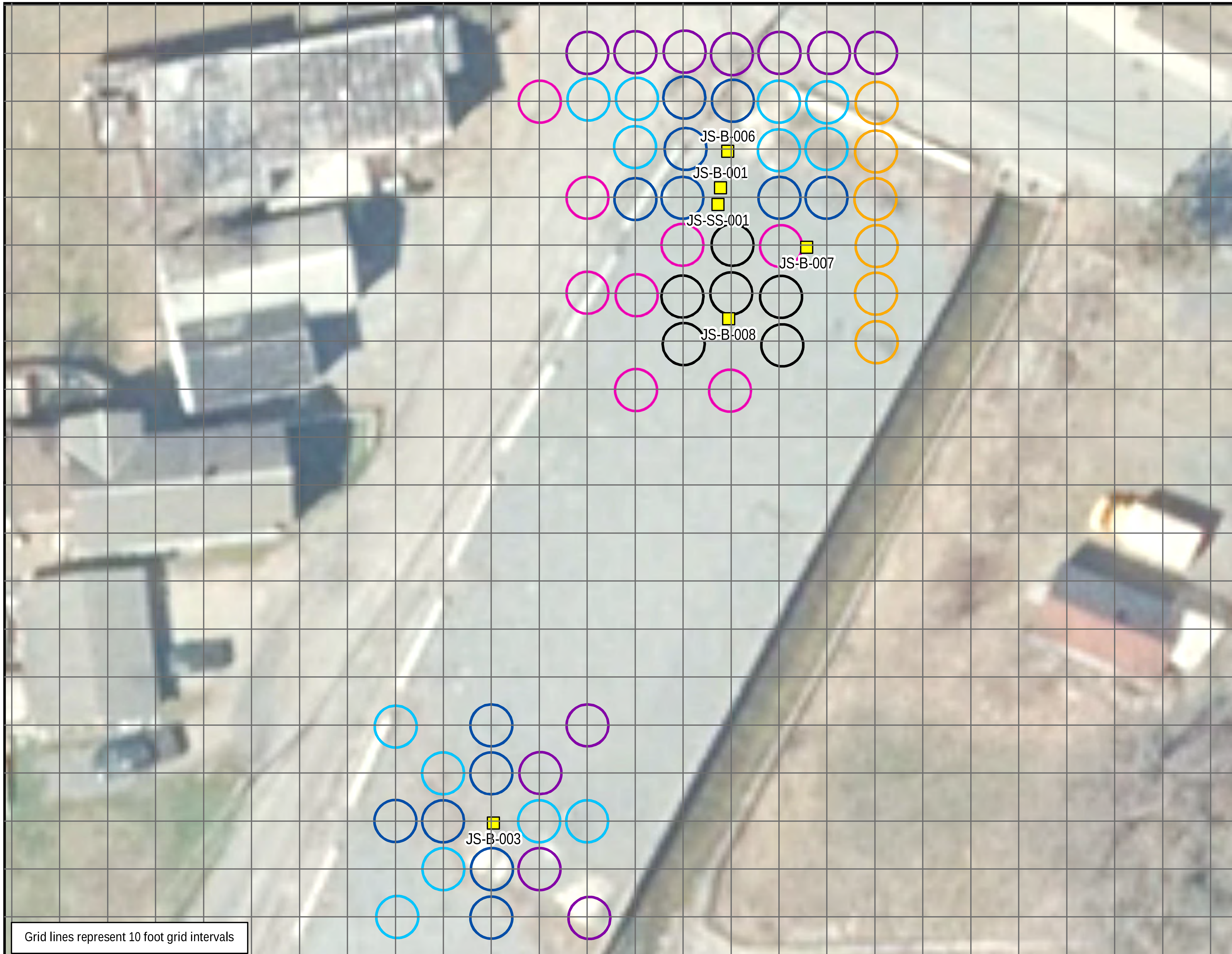


Legend

■ Soil Boring Location

Proposed Soil Boring Location/Day

- Day 1
- Day 2
- Day 3
- Day 4
- Day 5
- Day 6

N

0 5 10 20 30 40 Feet

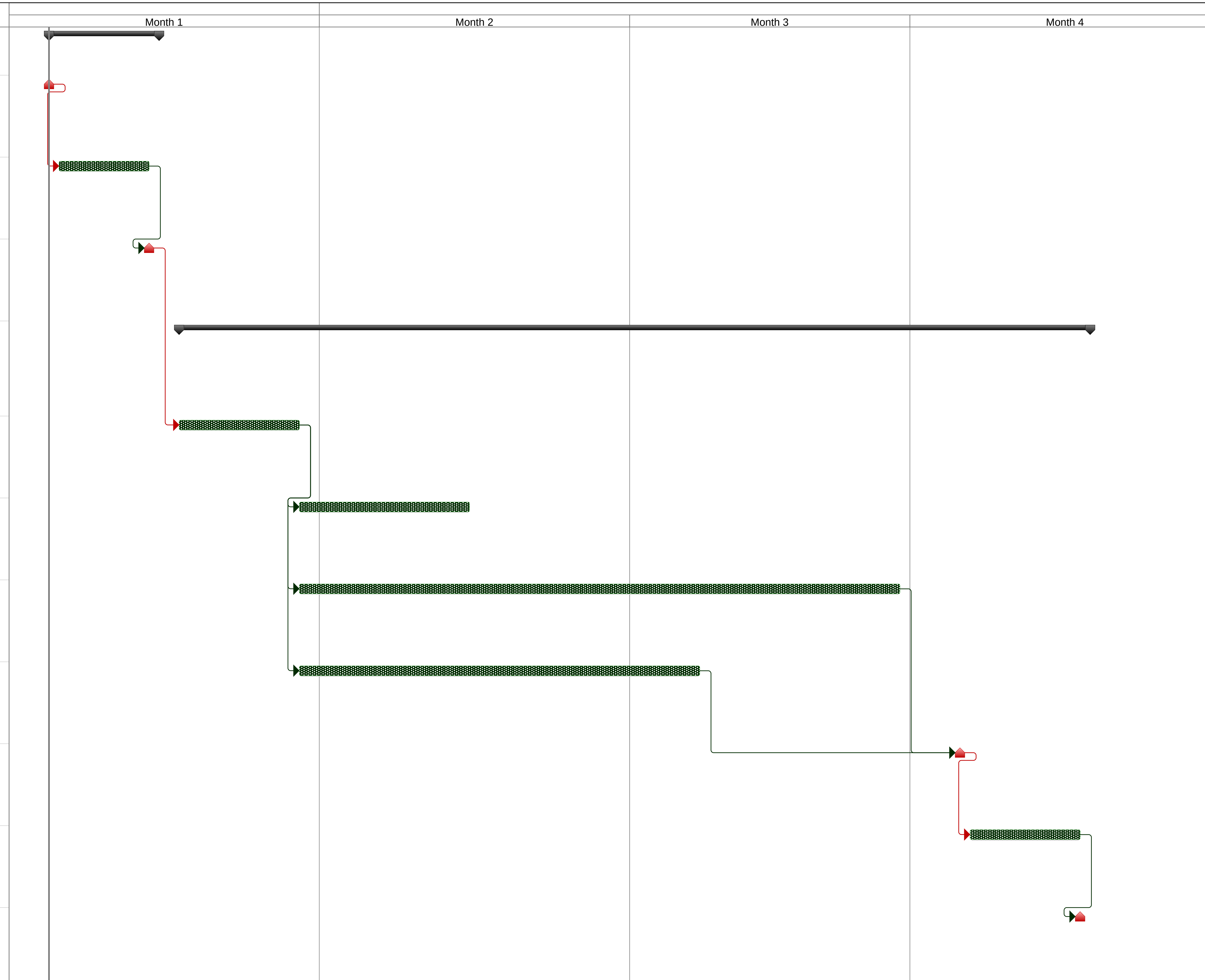
Figure 9: Treatment Areas and Supplemental Characterization Soil Boring Locations

Former Oak Materials Fluorglas Division
John Street Property
Village of Hoosick Falls
New York

ERM

FIGURE 10
SHALLOW GROUNDWATER INTERIM REMEDIAL MEASURE PRE-DESIGN INVESTIGATION AND TREATABILITY STUDY SCHEDULE
FORMER OAK MATERIALS FLUORGLAS DIVISION - JOHN STREET PROPERTY
HOOSICK FALLS, NEW YORK

ID	Task Name	Duration
1	**Shallow Groundwater IRM Work Plan**	**11 days**
2	Submit Work Plan To NYSDEC	1 day
3	NYSDEC Review of Work Plan	9 days
4	NYSDEC Approval of IRM Work Plan	1 day
5	**Pre-Design Characterization Activities**	**91 days**
6	Planning/Access/Mobilization	12 days
7	Borings/Well Installations & Testing	17 days
8	Laboratory Analysis, Validation & Evaluation	60 days
9	Treatability Study	40 days
10	Submit Technical Memorandum to NYSDEC	1 day
11	NYSDEC Review of Technical Memorandum	11 days
12	NYSDEC Approval of Technical Memorandum	1 day



Date: Tue 12/5/17 | Task | Milestone | Recurring Task | Summary

TABLES

Table 1
Detected VOC Analytical Results from Shallow Soil Samples
Former Oak Materials Fluorglas Division - John Street

									JS-B-001	JS-B-001	JS-B-002	JS-B-002	JS-B-003	JS-B-003	JS-B-003	JS-B-003	JS-B-004	JS-B-004
								Location ID:	JS-B-001	JS-B-001	JS-B-002	JS-B-002	JS-B-003	JS-B-003	JS-B-003	JS-B-003	JS-B-004	JS-B-004
								Sample Date:	08/16/2016	08/16/2016	08/11/2016	08/11/2016	07/21/2016	07/21/2016	08/08/2016	08/08/2016	07/21/2016	07/21/2016
								Sample Depth:	18 - 19 ft	18 - 20 ft	6 - 8 ft	9 - 10 ft	0 - 2 in	2 - 12 in	9 - 11 ft	15 - 17 ft	0 - 2 in	2 - 12 in
								Sample Type:	N	N	N	N	N	N	N	N	N	N
Constituent	**Units**	**NY375 1UNRES**	**NY375 2RPGW**	**NY375 3RRES**	**NY375 4RRRES**	**NY375 5RCOMM**	**NY375 6RINDU**	**NY375 7PER**										
Volatile Organic Compounds (VOCs) by USEPA Method 8260																		
1,1,1-Trichloroethane	µg/kg	680	680	100000	100000	500000	1000000	-	**480**	na	**3 J**	1 U	**1 J**	**1 J**	1 U	510 U	0.9 U	0.8 U
1,1,2-Trichloroethane	µg/kg	-	-	-	-	-	-	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
1,1-Dichloroethane	µg/kg	270	270	19000	26000	240000	480000	-	**1400**	na	1 U	**5 J**	0.9 U	0.9 U	**27**	510 U	0.9 U	0.8 U
1,1-Dichloroethene	µg/kg	330	330	100000	100000	500000	1000000	-	**310 J**	na	**1 J**	**7**	0.9 U	0.9 U	**15**	510 U	0.9 U	0.8 U
1,2,4-Trimethylbenzene	µg/kg	3600	3600	47000	52000	190000	380000	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
1,3,5-Trimethylbenzene	µg/kg	8400	8400	47000	52000	190000	380000	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
2-Butanone	µg/kg	120	120	100000	100000	500000	1000000	100000	260 U	na	4 U	5 U	4 U	4 U	4 U	2100 U	**16**	**6 J**
Acetone	µg/kg	50	50	100000	100000	500000	1000000	2200	**780 J**	na	**24**	**9 J**	**27**	**19**	8 U	3600 U	**190**	**73**
Benzene	µg/kg	60	60	2900	4800	44000	89000	70000	32 U	na	0.5 U	0.6 U	0.4 U	0.4 U	0.5 U	260 U	0.4 U	0.4 U
Carbon Disulfide	µg/kg	-	-	-	-	-	-	-	65 U	na	**7**	1 U	0.9 U	0.9 U	1 U	510 U	**0.9 J**	0.8 U
cis-1,2-Dichloroethene	µg/kg	250	250	59000	100000	500000	1000000	-	**150 J**	na	**13**	**180**	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
Ethylbenzene	µg/kg	1000	1000	30000	41000	390000	780000	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
Methyl Acetate	ug/kg	-	-	-	-	-	-	-	130 U	na	2 U	2 U	2 U	2 U	2 U	1000 U	2 U	2 U
n-Butylbenzene	µg/kg	12000	12000	100000	100000	500000	1000000	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
p-Isopropyltoluene	µg/kg	-	-	-	-	-	-	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	**2 J**	0.8 U
sec-Butylbenzene	µg/kg	11000	11000	100000	100000	500000	1000000	-	65 U	na	1 U	1 U	0.9 U	0.9 U	1 U	510 U	**0.9 J**	0.8 U
Tetrachloroethene	µg/kg	1300	1300	5500	19000	150000	300000	2000	65 U	na	**2 J**	**2 J**	**2 J**	**3 J**	1 U	510 U	0.9 U	0.8 U
Toluene	µg/kg	700	700	100000	100000	500000	1000000	36000	**170 J**	na	**2 J**	1 U	0.9 U	0.9 U	1 U	510 U	**1 J**	0.8 U
trans-1,2-Dichloroethene	µg/kg	190	190	100000	100000	500000	1000000	-	65 U	na	**2 J**	**2 J**	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U
Trichloroethene	µg/kg	470	470	10000	21000	200000	400000	2000	**50000**	na	**130**	**180 J**	**22**	**50 J**	**300**	**420000**	**46 J**	**65**
Vinyl Chloride	µg/kg	20	20	210	900	13000	27000	-	65 U	na	1 U	**33**	0.9 U	0.9 U	1 U	510 U	0.9 U	0.8 U

Notes and Abbreviations
µg/kg - microgram per kilogram
U - Compound not detected
J - Estimated value
N - Primary sample
FD - Field duplicate sample
na - Sample not analyzed for this parameter
Bold value indicates detected value
Shaded value indicates value equal to, or greater than, standard or guidance
NY Part 375 = NYS Soil Cleanup Objective (SCO) in Title 6 of Official Compilation of New York Codes, Rules and Regulations (6 NYCRR) Subpart 375-6.8(a).
NYS Unrestricted Use SCO
NYS Protection of Groundwater SCO
NYS Residential Use SCO
NYS Restricted Residential SCO
NYS Commercial Use SCO
NYS Industrial Use SCO
NYS Protection of Ecological Resources SCO

Table 1
Detected VOC Analytical Results from Shallow Soil Samples
Former Oak Materials Fluorglas Division - John Street

								Location ID:	JS-B-004	JS-B-004	JS-B-005	JS-B-005	JS-B-005	JS-B-006	JS-B-007	JS-B-007	JS-B-008	JS-B-008
								Sample Date:	08/17/2016	08/17/2016	07/21/2016	07/21/2016	08/23/2016	11/29/2016	11/30/2016	11/30/2016	12/01/2016	12/01/2016
								Sample Depth:	10 - 11 ft	10 - 12 ft	0 - 2 in	2 - 12 in	11 - 12 ft	18 - 19 ft	6 - 7 ft	17 - 18 ft	5 - 7 ft	5 - 7 ft
								Sample Type:	N	N	N	N	N	N	N	N	FD	N
Constituent	**Units**	**NY375 1UNRES**	**NY375 2RPGW**	**NY375 3RRES**	**NY375 4RRRES**	**NY375 5RCOMM**	**NY375 6RINDU**	**NY375 7PER**										
Volatile Organic Compounds (VOCs) by USEPA Method 8260																		
1,1,1-Trichloroethane	µg/kg	680	680	100000	100000	500000	1000000	-	1 U	na	1 U	1 U	1 U	**88000**	**700**	2 U	**60**	**59**
1,1,2-Trichloroethane	µg/kg	-	-	-	-	-	-	-	1 U	na	1 U	1 U	1 U	120 U	46 U	2 U	1 U	1 U
1,1-Dichloroethane	µg/kg	270	270	19000	26000	240000	480000	-	1 U	na	1 U	1 U	1 U	**1400**	46 U	**2 J**	**4 J**	**3 J**
1,1-Dichloroethene	µg/kg	330	330	100000	100000	500000	1000000	-	1 U	na	1 U	1 U	1 U	**2500**	46 U	2 U	**1 J**	**1 J**
1,2,4-Trimethylbenzene	µg/kg	3600	3600	47000	52000	190000	380000	-	1 U	na	1 U	1 U	1 U	**2100**	46 U	2 U	1 U	1 U
1,3,5-Trimethylbenzene	µg/kg	8400	8400	47000	52000	190000	380000	-	1 U	na	1 U	1 U	1 U	**510 J**	46 U	2 U	1 U	1 U
2-Butanone	µg/kg	120	120	100000	100000	500000	1000000	100000	5 U	na	**34**	**14**	4 U	500 U	180 U	7 U	4 U	4 U
Acetone	µg/kg	50	50	100000	100000	500000	1000000	2200	13 U	na	**540**	**200**	**12 J**	870 U	320 U	**17 J**	**18 J**	**14 J**
Benzene	µg/kg	60	60	2900	4800	44000	89000	70000	0.7 U	na	**1 J**	**0.7 J**	0.5 U	62 U	23 U	0.8 U	0.5 U	0.5 U
Carbon Disulfide	µg/kg	-	-	-	-	-	-	-	1 U	na	1 U	**1 J**	1 U	120 U	46 U	2 U	**1 J**	1 U
cis-1,2-Dichloroethene	µg/kg	250	250	59000	100000	500000	1000000	-	1 U	na	1 U	1 U	1 U	120 U	46 U	2 U	**19**	**13**
Ethylbenzene	µg/kg	1000	1000	30000	41000	390000	780000	-	1 U	na	**7**	**4 J**	1 U	120 U	46 U	2 U	1 U	1 U
Methyl Acetate	ug/kg	-	-	-	-	-	-	-	3 U	na	**3 J**	2 U	2 U	250 U	92 U	3 U	2 U	2 U
n-Butylbenzene	µg/kg	12000	12000	100000	100000	500000	1000000	-	1 U	na	1 U	1 U	1 U	**960**	46 U	2 U	1 U	1 U
p-Isopropyltoluene	µg/kg	-	-	-	-	-	-	-	1 U	na	**11**	**5**	1 U	**160 J**	46 U	2 U	1 U	1 U
sec-Butylbenzene	µg/kg	11000	11000	100000	100000	500000	1000000	-	1 U	na	1 U	1 U	1 U	**150 J**	46 U	2 U	1 U	1 U
Tetrachloroethene	µg/kg	1300	1300	5500	19000	150000	300000	2000	1 U	na	1 U	1 U	1 U	120 U	46 U	2 U	**2 J**	1 U
Toluene	µg/kg	700	700	100000	100000	500000	1000000	36000	1 U	na	**2 J**	**1 J**	1 U	**740**	46 U	2 U	1 U	1 U
trans-1,2-Dichloroethene	µg/kg	190	190	100000	100000	500000	1000000	-	1 U	na	1 U	1 U	1 U	120 U	46 U	2 U	**2 J**	**1 J**
Trichloroethene	µg/kg	470	470	10000	21000	200000	400000	2000	1 U	na	**3 J**	**20 J**	1 U	**54000**	**4500**	2 U	**3400**	**5100**
Vinyl Chloride	µg/kg	20	20	210	900	13000	27000	-	1 U	na	1 U	1 U	1 U	120 U	46 U	2 U	1 U	1 U

Notes and Abbreviations
µg/kg - microgram per kilogram
U - Compound not detected
J - Estimated value
N - Primary sample
FD - Field duplicate sample
na - Sample not analyzed for this parameter
Bold value indicates detected value
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NY Part 375 = NYS Soil Cleanup Objective (SCO) in Title 6 of Official Compilation of New York Codes, Rules and
NYS Unrestricted Use SCO
NYS Protection of Groundwater SCO
NYS Residential Use SCO
NYS Restricted Residential SCO
NYS Commercial Use SCO
NYS Industrial Use SCO
NYS Protection of Ecological Resources SCO

Table 1
Detected VOC Analytical Results from Shallow Soil Samples
Former Oak Materials Fluorglas Division - John Street

								Location ID:	JS-B-008	JS-B-009	JS-B-010	JS-B-011	JS-B-012	JS-SS-001	JS-SS-001	JS-SS-002	JS-SS-002
								Sample Date:	12/01/2016	11/30/2016	11/29/2016	11/29/2016	11/30/2016	07/21/2016	07/21/2016	07/21/2016	07/21/2016
								Sample Depth:	18 - 19 ft	11 - 12 ft	15 - 17 ft	15 - 17 ft	12 - 14 ft	0 - 2 in	2 - 12 in	10 - 12 in	12 - 24 in
								Sample Type:	N	N	N	N	N	N	N	N	N
Constituent	**Units**	**NY375 1UNRES**	**NY375 2RPGW**	**NY375 3RRES**	**NY375 4RRRES**	**NY375 5RCOMM**	**NY375 6RINDU**	**NY375 7PER**									
Volatile Organic Compounds (VOCs) by USEPA Method 8260																	
1,1,1-Trichloroethane	µg/kg	680	680	100000	100000	500000	1000000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	**2 J**	**4 J**
1,1,2-Trichloroethane	µg/kg	-	-	-	-	-	-	-	1 U	61 U	1 U	1 U	**5 J**	0.9 U	0.9 U	0.8 U	0.8 U
1,1-Dichloroethane	µg/kg	270	270	19000	26000	240000	480000	-	1 U	61 U	1 U	1 U	**4000**	0.9 U	0.9 U	0.8 U	0.8 U
1,1-Dichloroethene	µg/kg	330	330	100000	100000	500000	1000000	-	1 U	61 U	1 U	1 U	**2 J**	0.9 U	0.9 U	0.8 U	0.8 U
1,2,4-Trimethylbenzene	µg/kg	3600	3600	47000	52000	190000	380000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
1,3,5-Trimethylbenzene	µg/kg	8400	8400	47000	52000	190000	380000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
2-Butanone	µg/kg	120	120	100000	100000	500000	1000000	100000	5 U	240 U	5 U	6 U	6 U	**11**	**5 J**	**5 J**	3 U
Acetone	µg/kg	50	50	100000	100000	500000	1000000	2200	9 U	430 U	**20 J**	**13 J**	**14 J**	**170**	**47**	**39**	**33**
Benzene	µg/kg	60	60	2900	4800	44000	89000	70000	0.7 U	30 U	0.7 U	0.7 U	0.7 U	0.5 U	0.4 U	0.4 U	0.4 U
Carbon Disulfide	µg/kg	-	-	-	-	-	-	-	1 U	61 U	1 U	1 U	1 U	**6**	**1 J**	0.8 U	**2 J**
cis-1,2-Dichloroethene	µg/kg	250	250	59000	100000	500000	1000000	-	1 U	**630**	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
Ethylbenzene	µg/kg	1000	1000	30000	41000	390000	780000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
Methyl Acetate	ug/kg	-	-	-	-	-	-	-	3 U	120 U	3 U	3 U	3 U	2 U	2 U	2 U	2 U
n-Butylbenzene	µg/kg	12000	12000	100000	100000	500000	1000000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
p-Isopropyltoluene	µg/kg	-	-	-	-	-	-	-	1 U	61 U	1 U	1 U	1 U	**42**	**30**	0.8 U	0.8 U
sec-Butylbenzene	µg/kg	11000	11000	100000	100000	500000	1000000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
Tetrachloroethene	µg/kg	1300	1300	5500	19000	150000	300000	2000	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	**1 J**
Toluene	µg/kg	700	700	100000	100000	500000	1000000	36000	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
trans-1,2-Dichloroethene	µg/kg	190	190	100000	100000	500000	1000000	-	1 U	61 U	1 U	1 U	1 U	0.9 U	0.9 U	0.8 U	0.8 U
Trichloroethene	µg/kg	470	470	10000	21000	200000	400000	2000	1 U	**18000**	1 U	1 U	**1 J**	**9**	**14**	**67**	**120**
Vinyl Chloride	µg/kg	20	20	210	900	13000	27000	-	1 U	61 U	1 U	1 U	**7 J**	0.9 U	0.9 U	0.8 U	0.8 U

Notes and Abbreviations
µg/kg - microgram per kilogram
U - Compound not detected
J - Estimated value
N - Primary sample
FD - Field duplicate sample
na - Sample not analyzed for this parameter
Bold value indicates detected value
Shaded value indicates value equal to, or greater than, standard or guidance
NY Part 375 = NYS Soil Cleanup Objective (SCO) in Title 6 of Official Compilation of New York Codes, Rules and

NYS Unrestricted Use SCO
NYS Protection of Groundwater SCO
NYS Residential Use SCO
NYS Restricted Residential SCO
NYS Commercial Use SCO
NYS Industrial Use SCO
NYS Protection of Ecological Resources SCO

Table 2
Detected VOC Analytical Results from Shallow Groundwater Samples by Waterloo APS
Former Oak Materials Fluorglas Division - John Street

			Location ID:	JS-APS-001	JS-APS-002	JS-APS-003	JS-APS-005
			Sample Date:	08/09/2016	08/04/2016	08/03/2016	08/03/2016
			Sample Depth:	14.1 ft	7.4 ft	8.8 ft	10.3 ft
			Sample Type:	N	N	N	N
Constituent	**Units**	**NYSDEC TOGS111 GA GUIDANCE**	**NYSDEC TOGS111 GA STANDARD**				
Volatile Organic Compounds (VOCs) by USEPA Method 8260							
1,1,1-Trichloroethane	µg/l	-	5	**9**	**3**	**3**	0.5 U
1,1-Dichloroethane	µg/l	-	5	**0.8 J**	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	µg/l	-	5	**6**	**2**	0.5 U	0.5 U
Tetrachloroethene	µg/l	-	5	**0.6 J**	0.5 U	**1**	0.5 U
Trichloroethene	µg/l	-	5	**110**	**30**	**8**	0.5 U

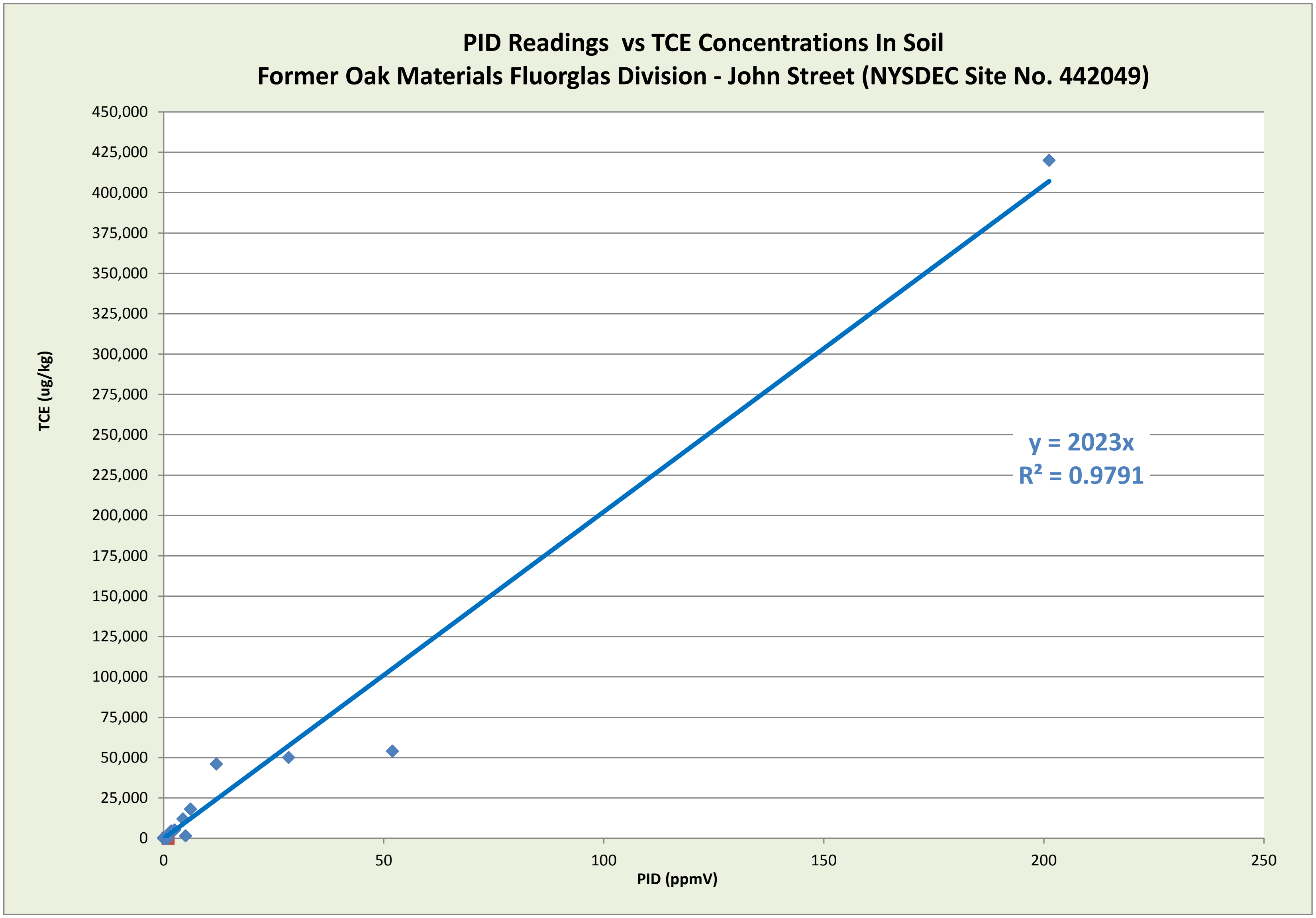
Notes and Abbreviations
µg/L - micrograms per liter
U - Compound not detected
J - Estimated value
N - Primary sample
FD - Field duplicate sample
na - Sample not analyzed for this parameter
Bold value indicates detected value
Shaded value indicates value equal to, or greater than, standard or guidance
NYSDEC TOGS111 - Standards listed are from NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 val
Exceedance of NYS GA Guidance
Exceedance of NYS GA Standard

Table 3
Detected VOC Analytical Results for Groundwater Samples from Shallow Monitoring Wells
Former Oak Materials Fluorglas Division - John Street

Constituent	Units	NYSDEC TOGS111 GA GUIDANCE	NYSDEC TOGS111 GA STANDARD	JS-MW-001A	JS-MW-001A	JS-MW-002A	JS-MW-003A	JS-MW-004A	JS-MW-005A
			Sample Date:	01/09/2017	01/09/2017	01/04/2017	01/10/2017	01/10/2017	01/04/2017
			Sample Type:	FD	N	N	N	N	N
Volatile Organic Compounds (VOCs) by USEPA Method 8260									
1,1,1-Trichloroethane	µg/l	-	5	**19**	**19**	**1**	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	µg/l	-	5	**2**	**1**	**0.6 J**	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	µg/l	-	5	**0.6 J**	**0.6 J**	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	µg/l	-	5	**8**	**8**	**4**	0.5 U	0.5 U	0.5 U
Tetrachloroethene	µg/l	-	5	**0.6 J**	**0.6 J**	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	µg/l	-	5	**130**	**130**	**21**	**2**	0.5 U	0.5 U
Vinyl Chloride	µg/l	-	2	0.5 U	0.5 U	**0.9 J**	0.5 U	0.5 U	0.5 U

Notes and Abbreviations
µg/L - micrograms per liter
U - Compound not detected
J - Estimated value
N - Primary sample
FD - Field duplicate sample
na - Sample not analyzed for this parameter
Bold value indicates detected value
Shaded value indicates value equal to, or greater than, standard or guidance
NYSDEC TOGS111 - Standards listed are from NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 values for Class G/
Exceedance of NYS GA Guidance
Exceedance of NYS GA Standard

APPENDIX A - PID Readings vs TCE Concentrations In Soil



Site characterization soil sample analytical data were compared to soil headspace field screening data collected using a photoionization detector (PID) (calibrated using isobutylene gas). Higher soil concentrations were generally present in the soil samples with the headspace concentrations greater than 10 parts per million by volume (ppmv). Correlation coefficients generated a relationship of the field screening values versus the laboratory soil concentrations:

PID (ppmv) * 2.023 ~ TCE concentration in soil (milligrams per kilogram)

Field screening of soil samples to define the interval(s) of shallow soils exceeding 10 ppmv may be correlated with areas where the highest concentrations of TCE are present in the soils and will assist in the field delineation of horizontal and vertical impact.