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20 April 2022

TECHNICAL MEMORANDUM

TO: Payson Long, P.E., Project Manager, NYSDEC

FROM: Megan Miller, E.I.T., Project Manager

SUBJECT: Remedial Site Optimization Work Plan
National Heatset Printing Company Site (No. 152140), Babylon, Suffolk County, New York
Contract/Work Assignment No. D009806-18
EA Project No. 1602518

EA Engineering, P.C. and its affiliate EA Science and Technology (EA) were tasked by the New York State Department of Environmental Conservation (NYSDEC) under Work Assignment Number (No.) D009806-18 to perform site management and remedial site optimization (RSO) activities at the National Heatset Printing Company (NHP) State Superfund Site (No. 152140). This is a continuation of work previously assigned under EA Contract No. D007624-16.

At the request of NYSDEC, EA has prepared this memorandum that describes the activities proposed for the RSO Work Plan at the NHP Site. EA will conduct an investigation of the on-site subsurface and downgradient receptors to collect sufficient data to evaluate RSO options that would be effective in aiding remedial efforts. The objectives of the RSO investigation include the following:

- Delineate further and refine the extent of chlorinated volatile organic compound (CVOC) impacts in groundwater on-site for the purpose of evaluating alternative treatment technologies. This includes drilling within the existing building at the NHP Site to close data gaps.
- Define subsurface stratigraphy on-site
- Conduct an off-site downgradient private well survey
- Evaluate potential risk of contamination of downgradient water supply production wells and surface water bodies
- Evaluate on-site soil vapor extraction (SVE) system energy usage.

This RSO Work Plan is prepared based on historical data and the teleconference meeting held with NYSDEC on 10 February 2022.

1. BACKGROUND AND RATIONALE

1.1 SITE DESCRIPTION

The NHP Site is currently a Class 4 Site listed on the NYSDEC Registry of Inactive Hazardous Waste Sites. The Site is located at 1 Adams Boulevard in the Hamlet of Farmingdale, Town of Babylon, Suffolk County, New York, and is identified as Block 1.00 and Lot 20.001 on the Town of Babylon Tax Map No. 132.20-1-3.2. A site location map is provided in **Figure 1**. The Site is currently owned by Brookfield Properties, managed by Finkelstein Realty, and leased by the Sun Dial Corporation. The Site contains one industrial building and is 4.5 acres. The Site is in an industrial area and is bounded by railroad tracks to the north, Adams Boulevard and an industrial property to the south, and industrial properties to the east and west (**Figure 2**).

1.2 SITE HISTORY

The NHP Site occupied a portion of the building at 1 Adams Boulevard from July 1983 to April 1989. Their operations consisted of lithographic tri-color printing of newspaper and periodical advertisements, and the manufacturer of lithographic printing plates. The NHP Site had been using organic solvents at the Site since 1983. An inspection by the Suffolk County Department of Health Services (SCDHS) in 1983 revealed that NHP was discharging photo-plating waste to the on-site sanitary system. In March 1986, an inspection performed by SCDHS revealed strong evidence of dumping from staining of inks and oils on the ground. The inspection report indicated that drums were stored improperly both inside and outside of the building.

NHP filed for bankruptcy in 1987. SCDHS discovered that after filing for bankruptcy, NHP disposed of its chemical inventory by dumping the materials onto the soil and into a leaching pool located off the rear of the building in the northeast side of the property.

In February 1988, a water sample collected by SCDHS from the leaching pool off the northeast side of the building contained elevated levels of volatile organic compounds (VOCs) (i.e., 24,000 parts per billion of *cis*-1,2-dichloroethene and 1,000 parts per billion of p-ethyltoluene). At the request of SCDHS, the leaching pool bottom sediments were excavated to a depth of 15 feet (ft) and end-point samples were collected in November 1988. The end-point soil samples indicated that the remaining leaching pool sediment contained elevated levels of VOCs (i.e., 13,000 parts per million of tetrachloroethene).

1.3 REMEDIAL INVESTIGATION AND SELECTED REMEDY

A remedial investigation (RI)/feasibility study (FS) was performed at the Site in 1999.[1] Potential remedial alternatives for the Site were identified, screened, and evaluated in the FS. Based on the RI and FS, NYSDEC issued the Record of Decision (ROD) document, which identified the selected remedy for the Site.[2] The remedy included groundwater treatment using pump and treat,

[1] Holzmacher, McLendon & Murrel, P.C. (H2M). 1999. *RI/FS Report*.
[2] NYSDEC. 1999. *Record of Decision*. June.

or an alternate technology (i.e., in-well stripping) for 3 locations: (1) source area, (2) downgradient edge of the Site, and (3) downgradient edge of the off-site plume.

The remedy in the ROD was refined during the remedial design. Additional investigation performed during the remedial design concluded that injection of sodium and potassium permanganate would be the most effective source area remedy. Sampling during the remedial design (obtained in 2001) revealed the presence of contaminated soil beneath the slab of the on-site building. NYSDEC installed a SVE system in July 2001, at the on-site commercial building. The SVE system operated from 2002 to 2014, when the vertical extraction well was converted to a buried horizontal screen to accommodate the daily operations of a new building tenant and to improve the capacity for extraction.

1.4 2016 REMEDIAL SYSTEM OPTIMIZATION

In February 2016, sub-slab soil and soil vapor sampling was performed at the 1 Adams Boulevard building as part of an overall RSO program. The results of the 2016 investigation were incorporated into follow-on modifications to the SVE system, which included 5 new horizontal wells connected to the SVE system through a manifold mounted to the south side of the treatment trailer in June 2016. The system was restarted in August 2016 using 5 wells simultaneously. A description of the construction activities (including as-built drawings) associated with the modification of the SVE system was presented in a Construction Completion Report.3

In May 2016, groundwater plume delineation activities were completed using a membrane interface probe and hydraulic profiling tool (HPT) as part of an RSO program. The membrane interface probe was advanced at 25 sample locations over a period of 2 weeks, via direct-push technology. Field data and observations from the membrane interface probe were used to select locations associated with the subsequent HPT sampling program. The HPT was advanced at 10 locations over the course of 4 weeks, and groundwater samples were collected and analyzed for CVOCs. Results from the plume delineation RSO program were presented in a memorandum to NYSDEC issued August 2017.4

1.5 DENSITY DRIVEN CONVECTION SYSTEM OPERATIONAL HISTORY

Density driven convection (DDC) in-well stripping technology was implemented on-site and off-site starting with a pilot test in 2006. The pilot test system consisted of one DDC well (DDC-1) at the downgradient edge of the on-site groundwater plume, just southeast of the building. The intent of the groundwater treatment at the downgradient edge of the Site was to mitigate further migration of contaminants off-site. Additional systems were installed on-site and off-site between 2010 and 2012. The intent of the off-site DDC system is to capture contamination at the end of the plume and mitigate further migration of contaminants to the south-southeast.

[3] EA. 2018. *Interim Remedial Measure Construction Completion Report, National Heatset Printing Site (152140), Suffolk County, Babylon, New York*. March.
[4] EA. 2017. *Groundwater Sampling and Delineation; National Heatset Printing Site*. 25 August.

The function of the DDC systems relied on consistent groundwater levels; however, the groundwater elevations were observed 1–2 ft higher in early 2018 as compared to the average groundwater elevations when the systems were installed. High groundwater elevations at the Site have resulted in system operational issues; the Periodic Review Report for 2017–2020[5] indicated that the site DDC systems were not operating as designed, and a Corrective Measures Work Plan (CMWP) was required as a result. A Draft CMWP[6] was submitted to NYSDEC in January 2022.

The objective of the CMWP was to evaluate the existing systems and identify potential alternative system operations or remedial technologies to meet remedial objectives as defined by the ROD. The effectiveness of the on-site DDC systems and off-site DDC system were evaluated through discussions of on-site and off-site groundwater concentrations and comparison the vapor influent concentration of tetrachloroethene at the on-site DDC systems (using analytical data) to the calculated vapor influent concentration of tetrachloroethene using Henry's law. In the CMWP, EA recommended to: (1) shut down the on-site and off-site DDC systems, (2) delineate the source within the area of interest (AOI) at 1 Adams Boulevard property, and (3) evaluate other treatment technologies, including in situ chemical oxidation (ISCO), in situ chemical reduction (ISCR), and in situ bioremediation (ISB). The systems were shut down in December 2021 following a meeting held with NYSDEC on 9 December 2021. The activities proposed in this RSO Work Plan will address CMWP's Recommendations 2 and 3.

2. ON-SITE FIELD WORK SCOPE

As part of the anticipated RSO activities, EA's subcontractor will perform groundwater and soil profiling at the Site to further define site-related impacts of CVOCs. Activities will include using an HPT at 4 locations, installation of 10 continuous multi-channel tubing (CMT) wells, profiling with up to 7 target intervals, will then be installed in the AOI at 1 Adams Boulevard property. These locations are identified in **Figure 3**. The installation of the 10 CMT wells will occur following HPT activities.

Field activities described in this section will be documented in a dedicated field logbook that will be maintained for all site activities. Field forms including soil boring logs and groundwater stabilization forms will be used during on-site work. Photographs will also be taken to document field activities, as appropriate.

2.1 PROJECT COORDINATION AND UTILITY MARK-OUT

The proposed HPT and CMT well locations will be marked out by EA with survey paint prior to contacting Dig Safely New York for the exterior underground infrastructure location service. A geophysical survey will also be conducted to identify underground infrastructure both within and outside of the building.

[5] EA. 2021. *Periodic Review Report No. 4; 30 January 2017 – 30 January 2020; National Heatset Printing Co. Site (152140).* June.

[6] EA. 2022. Letter to Mr. Payson Long (NYSDEC, Division of Environmental Remediation), Subject: RE: Contract/WA No.: D009806-18, Site/Spill No./Pin: National Heatset Site, Babylon, New York, Suffolk County, Site No. 152140. 3 January.

2.2 HYDRAULIC PROFILING TOOL

EA will utilize the Waterloo Advanced Profiling System (Waterloo^{APS}) during HPT installation. Waterloo^{APS} is a subsurface data acquisition system that collects both groundwater samples and an integrated set of companion data in a single, continuous direct push. Integrated sensors provide hydrostratigraphic and physiochemical data displayed graphically as the tooling is advanced. Data will be collected using a custom software that provides real-time visual display of Index of Hydraulic Conductivity to determine site stratigraphy in vadose and saturated zones. The depth to potentiometric surface (hydraulic head), rate of penetration, and continuous Index of Hydraulic Conductivity record versus depth will also be reported at each location. Physiochemical properties, such as pH, specific conductance, dissolved oxygen (DO), and oxidation-reduction potential (ORP), will be recorded during sample collection.

Real time, continuous conductivity will be recorded during advancement of the borehole. Following completion of profiling, the borehole will be backfilled to the ground surface with a bentonite grout mixture.

In the AOI, EA's subcontractor will complete hydraulic profiling at 4 locations (**Figure 3**). The target depths of each profiling location will be the top of the Gardiners Clay unit, which is anticipated to be 80–85 ft below ground surface (bgs). The water table is estimated to be at 12.5–15 ft bgs. Discrete groundwater samples will be collected every 10 ft starting at 20 ft bgs to the top of the clay unit at each location to assist in vertical delineation of the Site. Groundwater samples will be analyzed in the field for CVOCs using the FROG-4000™, a portable hand-held micro gas chromatograph.

EA will install soil borings adjacent to each of the HPT locations to classify subsurface soils. This data will be used to fill data gaps below the existing building and assist in expanding on the current conceptual site model (CSM). At these 4 boring locations CMT monitoring wells will be installed as detailed below.

2.3 MONITORING WELL INSTALLATION

Following review of the data from the 4 HPT locations, 10 CMT wells will be installed within the AOI. The proposed locations for the CMT wells are detailed on **Figure 3**. The purpose of the CMT well installation is to refine vertical contaminant mass calculations and likely reduce target volume for treatment. Each CMT well will have up to 7 discrete depth interval sampling ports. The depth of each sampling port will be determined during drilling and will be based on soil boring characterization and groundwater VOC concentrations obtained using the FROG-4000™ during the HPT activities. The drilling subcontractor will be responsible for identifying any subsurface utility lines in locations where wells will be installed. The drilling and installation of CMT wells will be supervised and documented via boring logs by an EA field geologist according to the procedures described below.

CMT wells will be installed using direct-push drilling methods (Geoprobe®) to advance a 2-inch (in.) diameter borehole to the required depth. The CMT device consists of a 1.7-in. outer diameter

polyethylene tube that is internally partitioned to form 7 separate internal channels within the larger tube (i.e., 6 outside channels and 1 central channel). The diameter of the 6 outer channels is 0.4 in. while the diameter of the central channel is 3/8 in. The bottom of the channels will be fitted with stoppers, and a sampling port will be drilled into each channel at the prescribed sampling depth. Ultrafine stainless-steel mesh screen will be fitted over the sample ports, and each channel will be blocked below the port with a polyethylene plug to prevent the accumulation of stagnant water. **Attachment A** provides additional information about the CMT system. Once the CMT has been set in the boring the drill rods will be retracted, and the formation will be allowed to naturally backfill the annulus space around the well. If the formation does not backfill the annulus the annular space will be backfilled with #1 gravel pack or equivalent up to 15 ft below grade. The remaining annular space will be backfilled with a granular bentonite to grade. CMT wells will be completed with a protective CMT wellhead with numbered channels and a well cap specifically designed for CMT wells. All soils generated during soil boring installation will be stored in 55-gallon Department of Transportation drums.

2.4 CONTINUOUS MULTICHANNEL TUBING WELL DEVELOPMENT

The newly installed CMT wells will be developed no sooner than 48 hours following installation. Due to the small size of each channel within the CMT wells, each channel will be developed using a peristaltic pump with dedicated ¼-in tubing. CMT well development will be considered complete when temperature, conductivity, and pH have stabilized and a turbidity of less than 50 nephelometric turbidity units has been achieved within each channel. Development water will be containerized, handled, and disposed of as detailed in Section 13 of the Generic Field Activities Plan,[7] unless otherwise directed by NYSDEC. Well development forms will be completed during purging and development activities.

2.5 SITE SURVEY

An updated site survey will be completed by a licensed surveyor at the end of the groundwater delineation event, which will include the locations of completed HPT and CMT wells. Vertical control will be established to the nearest +/-0.1 ft for all ground surface elevations. Monitoring well road box and polyvinyl casing elevations will be recorded to the nearest +/-0.01 ft. Elevations will be determined relative to the North American Vertical Datum of 1988 (NAVD 88), with reference made to an existing monument in the vicinity of the Site. Horizontal coordinates will be given in the State Plane East Zone (feet), North American Datum (NAD) of 1983, to an accuracy of +/-0.5 ft.

2.6 GROUNDWATER SAMPLING

A total of 10 newly installed CMT wells with up to 7 discrete sampling depths per well will be sampled at least once during the RSO investigation. A full round of sampling will be conducted, including the CMT wells and the existing on-site monitoring well network. All samples will be analyzed for VOCs and samples from up to 6 monitoring wells will be sent to the selected laboratory to be analyzed for monitored natural attenuation parameters. Samples from 3

[7] EA. 2020. *Generic Field Activities Plan for Work Assignments.* April.

monitoring wells will be sent to Microbial Insights of Knoxville, Tennessee for microbial testing as well. Sample analytical methods are detailed in **Table 1**.

Prior to sampling, a full round of gauging will be conducted at site monitoring wells to prepare a groundwater contour map and evaluate groundwater flow patterns across the Site. Groundwater sampling procedures will include water level measurements, well purging, field water quality measurements (including DO and ORP), and sample collection at each well location. Purging and sampling log forms will be used to record well purging, water quality measurements, and sampling flow rates. The objective of the groundwater sampling protocol is to obtain samples that are representative of the aquifer at each discrete sampling depth so that the analytical results reflect the composition of the groundwater at each depth interval as accurately as possible. Rapid and significant changes can occur to groundwater samples upon exposure to sunlight, temperature, and pressure changes at ground surface. Therefore, groundwater sampling will be conducted in a manner that will minimize interaction of the sample and the surface environment. The equipment and protocol for collection of groundwater samples are described below.

2.7 PURGING AND SAMPLING EQUIPMENT

CMT purging and sampling will be performed using a peristaltic pump and dedicated section of ¼-in. polyethylene tubing. Equipment for purging and sampling will include the following:

- Solinst® Peristaltic Pump
- Solinst® 102 Electronic Water Level Indicator with an accuracy of 0.01 ft
- Flow measurement device (containers graduated in milliliters [mL]) and stopwatch
- Water quality meter (Horiba U-52 or similar) with flow-through cell (flushed with distilled water before use at each well) for field measurement of pH, specific conductance, temperature, ORP, turbidity, and DO
- Photoionization detector instrument (MiniRAE or similar) to monitor vapor concentrations during purging and sampling.

2.7.1 Groundwater Sampling Purge Method

The following procedures will be used for sampling the private downgradient wells and each channel within all newly installed CMT wells:

- Wear appropriate personal protective equipment. In addition, samplers will use new nitrile sampling gloves for the collection of each sample.
- Unlock and remove the well cap.

- Obtain photoionization detector readings from each channel or well and record them on the field sampling forms.

- Measure the static water level within each channel or well with an electronic water level indicator. The water level indicator will be washed with Alconox® detergent and water, then rinsed with deionized water between individual monitoring wells to prevent cross-contamination.

- Calculate the volume of water in each channel or well.

- Place polyethylene sheeting around the well casing to prevent contamination of sampling equipment in the event sampling equipment is dropped.

- Pump with a Solinst® Peristaltic Pump equipped with new polyethylene tubing dedicated to each channel or well. Set the pump intake at the sample port depth or screened interval specific to each channel or well and start the pump.

- Allow field parameters of pH, ORP, DO, specific conductivity, turbidity, and temperature to stabilize before sampling. Purging will be considered complete if the following conditions are met:

  — Consecutive pH readings are ±0.1 pH units of each other
  — Consecutive DO readings are ±10 percent of each other
  — Consecutive redox readings are ±0.10 units of each other
  — Consecutive measured specific conductance is ±3 percent of each other
  — Turbidity <50 nephelometric turbidity units
  — Purge rate of 250 mL per minute with a drawdown less than 0.3 ft.

The flow rate during CMT and downgradient well purging will not exceed 250 mL per minute. Following stabilization of field parameters, the following steps will be completed:

- Collect the sample aliquot for VOC analysis at a flow rate not exceeding 250 mL per minute.

- Obtain field measurement of pH, DO, temperature, and specific conductivity, and record it on the purging and sampling form. The instruments will be decontaminated between wells to prevent cross-contamination.

- Place analytical samples in a cooler and chill to 4 degrees Celsius. Samples will be shipped to the analytical laboratories within 24 hours.

- Re-lock well cap.

- Fill out field sampling form, labels, custody seals, and chain-of-custody forms with the analyses listed below.

All groundwater samples will be analyzed for VOCs by U.S. Environmental Protection Agency [EPA] Method 8260B. A subset of up to 6 samples collected will also be analyzed for total and dissolved iron, total and dissolved manganese (EPA 6010); nitrate, sulfide and chloride (SM4500); biological oxygen demand (SM5210B); chemical oxygen demand (DM5220D); nitrogen as ammonia (350.1); total organic carbon (415.1); sulfate (375.2); alkalinity (EPA SM2320B); and methane, ethane, ethene, and carbon dioxide (RSK-175). All samples will be analyzed in accordance with the NYSDEC Analytical Services Protocol. Analytical results will be validated by a third-party data validator.

2.8 DECONTAMINATION

All downhole equipment will be decontaminated between drilling locations. Any fluids produced during decontamination will be stored in 55-gallon Department of Transportation drums.

2.9 SITE RESTORATION

EA anticipates 4 borings from the HPT activities that will require restoration to existing conditions. For the 3 borings inside the industrial building at 1 Adams Boulevard, restorations will include sealing with concrete and the boring located outside of the industrial building will be restored with asphalt.

3. EVALUATION OF ALTERNATIVES

Following receipt of validated data, EA will process data and do an initial screening of the proposed technologies (ISCO, ISCR, and ISB). To evaluate the proposed alternative treatment technologies, a bench-scale study will potentially be conducted with groundwater and soil samples collected from the most contaminated area. EA will determine whether additional groundwater sampling data is required to complete the CSM. Subsequent field activities will be proposed in a letter work plan, if needed.

4. OFF-SITE DOWNGRADIENT RECEPTORS INVESTIGATION

EA will conduct an off-site downgradient receptor investigation in the area identified on **Figure 4**. The receptor investigation will include a survey of private wells, Suffolk County water supply production wells, and surface water bodies within the area of identified.

5. SOIL VAPOR EXTRACTION ENERGY USAGE EVALUATION

EA will conduct an energy usage analysis of the SVE system at the NHP Site. The purpose of the evaluation will be to provide site-specific energy conservation measures and associated energy and cost savings. EA will explore potential operation changes or uses of renewable energy to reduce costs.

6. CONCEPTUAL SITE MODEL UPDATE

The data collected during the RSO field activities will be used to update the CSM. The anticipated data collected will further define the horizontal and vertical bounds of contamination and the subsurface stratigraphy. The CSM will be used to determine the target treatment objective and evaluate recommended remedial technologies (i.e., ISCO, ISCR, and ISB).

7. PROJECT SCHEDULE

This Scope of Work will be completed in one mobilization and is estimated to require 3 weeks to complete during Spring 2022. A preliminary schedule of milestones is provided in **Attachment B**. Key milestones are identified to monitor work progress throughout the duration of the project.

If you have any questions or require additional information, please do not hesitate to contact me at 315-565-6557.

Tables

1	Groundwater Laboratory Analyses

Figures

1	Site Location Map
2	Site, Surrounding Area, and Monitoring Well Network
3	HPT and CMT Locations (Existing SVE System)
4	Downgradient Receptor Investigation Focus Area

Attachments

A	Continuous Multichannel Tubing Data Sheet
B	Project Schedule

cc: M. Cruden (NYSDEC)
D. Conan (EA)
J. Von Uderitz (EA)

Tables

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Table 1. Groundwater Laboratory Analyses

Analysis	No. of Samples	Field Duplicates	Trip Blank	Matrix Spike/ Matrix Spike Duplicate	Total No. of Analyses	Sample Hold Time
EPA Method 6010 Total Iron	6	1	---	2	9	6 months
EPA Method 6010 Dissolved Iron	6	1	---	2	9	6 months
EPA Method 6010 Total Manganese	6	1	---	2	9	6 months
EPA Method 6010 Dissolved Manganese	6	1	---	2	9	6 months
SM4500 (Nitrate and Sulfide)	6	1	---	2	9	48 hours
SM5210B BOD	6	1	---	2	9	48 hours
DM5220D COD	6	1	---	2	9	28 days
Method 350.1 Nitrogen as ammonia	6	1	---	2	9	28 days
EPA Method 415.1 TOC	6	1	---	2	9	28 days
SM4500 Chloride	6	1	---	2	9	28 days
EPA Method 375.2 Sulfate	6	1	---	2	9	28 days
EPA Method SM2320B Alkalinity	6	1	---	2	9	14 days
RSK-175 (methane, ethane, ethene, carbon dioxide)	6	1	---	2	9	14 days
SW-846 Method 8260D VOCs	99	5	1	10	115	14 days
Microbial Analysis (QuantArray®)	3	---	---	---	3	48 hours

Notes:
BOD = Biological oxygen demand
COD = Chemical oxygen demand
No. = Number
TOC = Total organic carbon
VOC = Volatile organic compound
Dash (—) indicates no sample taken
Laboratory quality control samples will be collected at a rate of 1 per 20 samples per matrix.

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Figures

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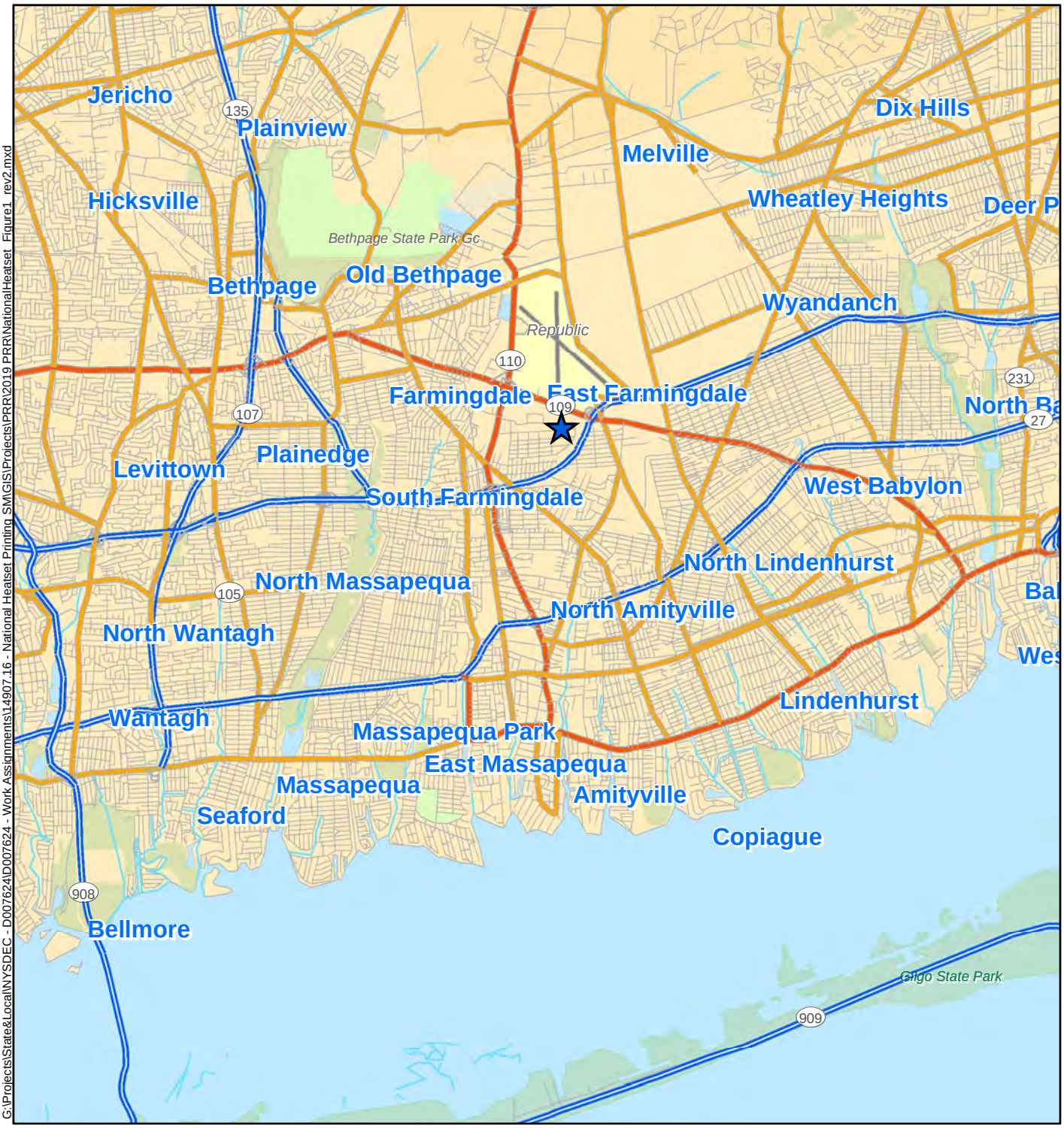

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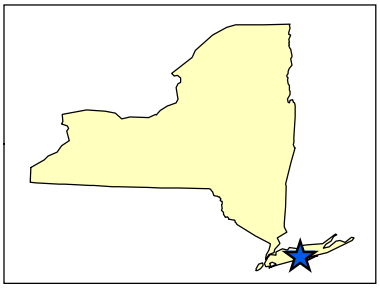

0 0.75 1.5 3
Miles

1 inch = 1.5 miles

N

Legend

★ Site Location

Figure 1
SITE LOCATION MAP
NATIONAL HEATSET PRINTING CO. SITE (152140)
BABYLON, NEW YORK
SUFFOLK COUNTY

Map Date: 1/3/2020
Source: ESRI, 2011

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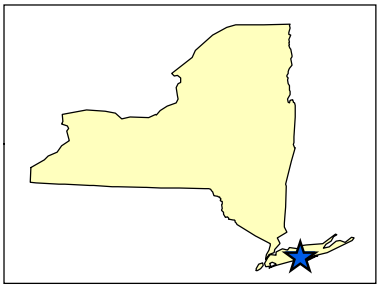
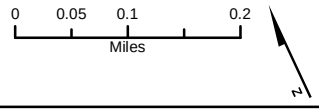
\\SYRACUSEFP\Syracuse\Projects\State&Local\NYSDEC - D009806\Work Assignments\1602518 National Heatset Printing Co. SM\06 GIS\01 MXD\NationalHeatset Figure2 Site Boundary.mxd





Legend

- DDC Well Cluster
- Groundwater Monitoring Well
- Vapor Extraction Point
- Permanganate Injection Area
- Site Location

Figure 2
SITE, SURROUNDING AREA, AND MONITORING WELL NETWORK
NATIONAL HEATSET PRINTNG CO. SITE (152140)
BABYLON, NEW YORK
SUFFOLK COUNTYY

Map Date: 12/21/2021
Source: ESRI, 2011

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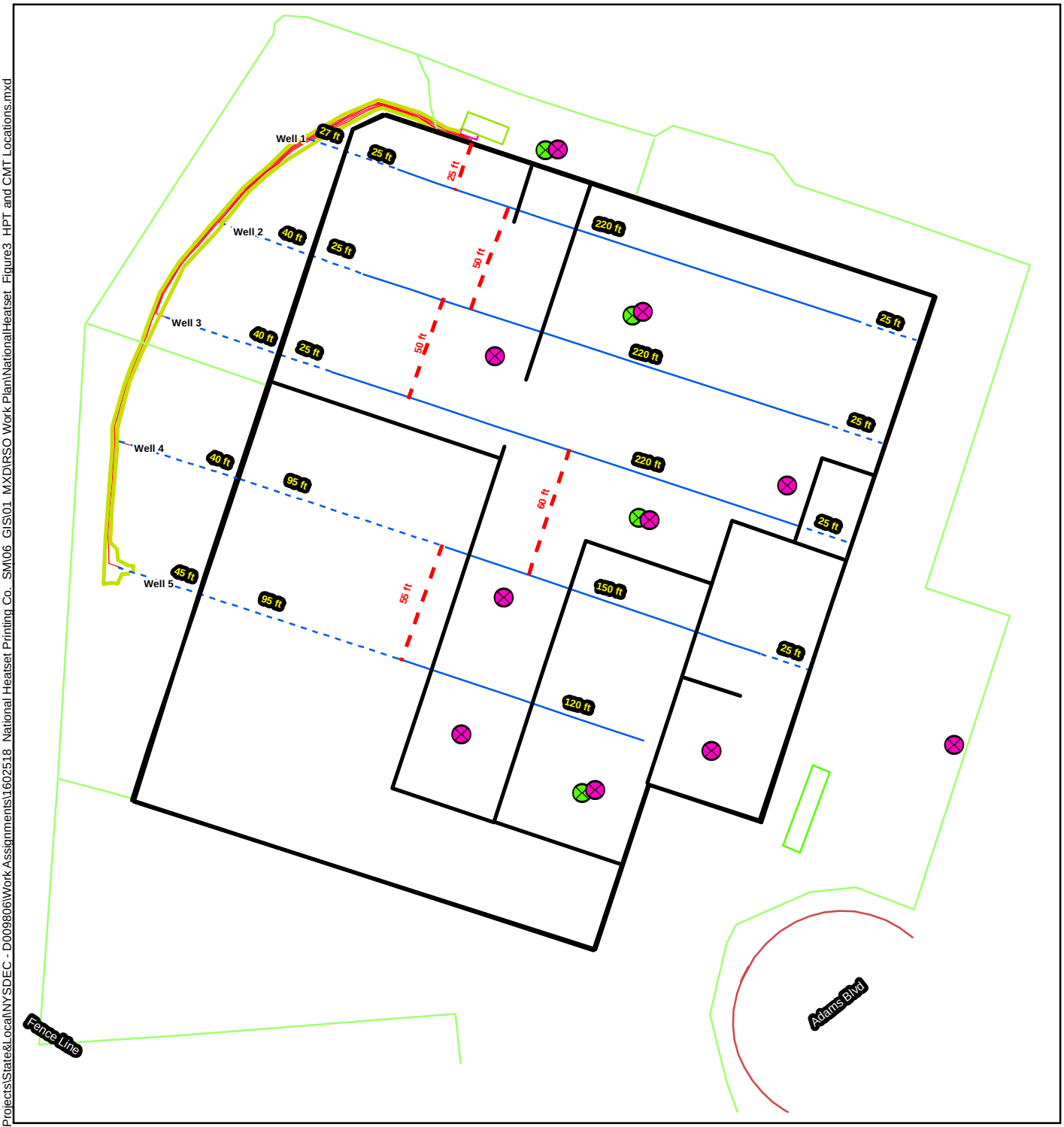

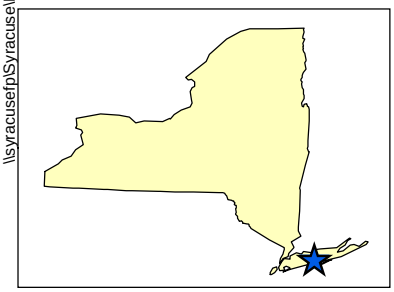

0 15 30 60
Feet

1 inch = 66.67 feet

N

Legend

- HSVE Solid PVC Pipe
- HSVE Well Screen
- HSVE Well Piping (EA Installed)
- HSVE Trench
- HSVE Manifold Shed
- 1 Adams Blvd Building Outline
- Continuous Multichannel Tubing (CMT) wells
- Hydraulic Profiling Tool (HPT)/CMT Location
- Site Location

Figure 3
HPT AND CMT LOCATIONS
EXISTING SVE SYSTEM
NATIONAL HEATSET PRINTING CO. SITE (152140)
BABYLON, NEW YORK
SUFFOLK COUNTY

Map Date: 2/17/2022
Source: ESRI, 2011

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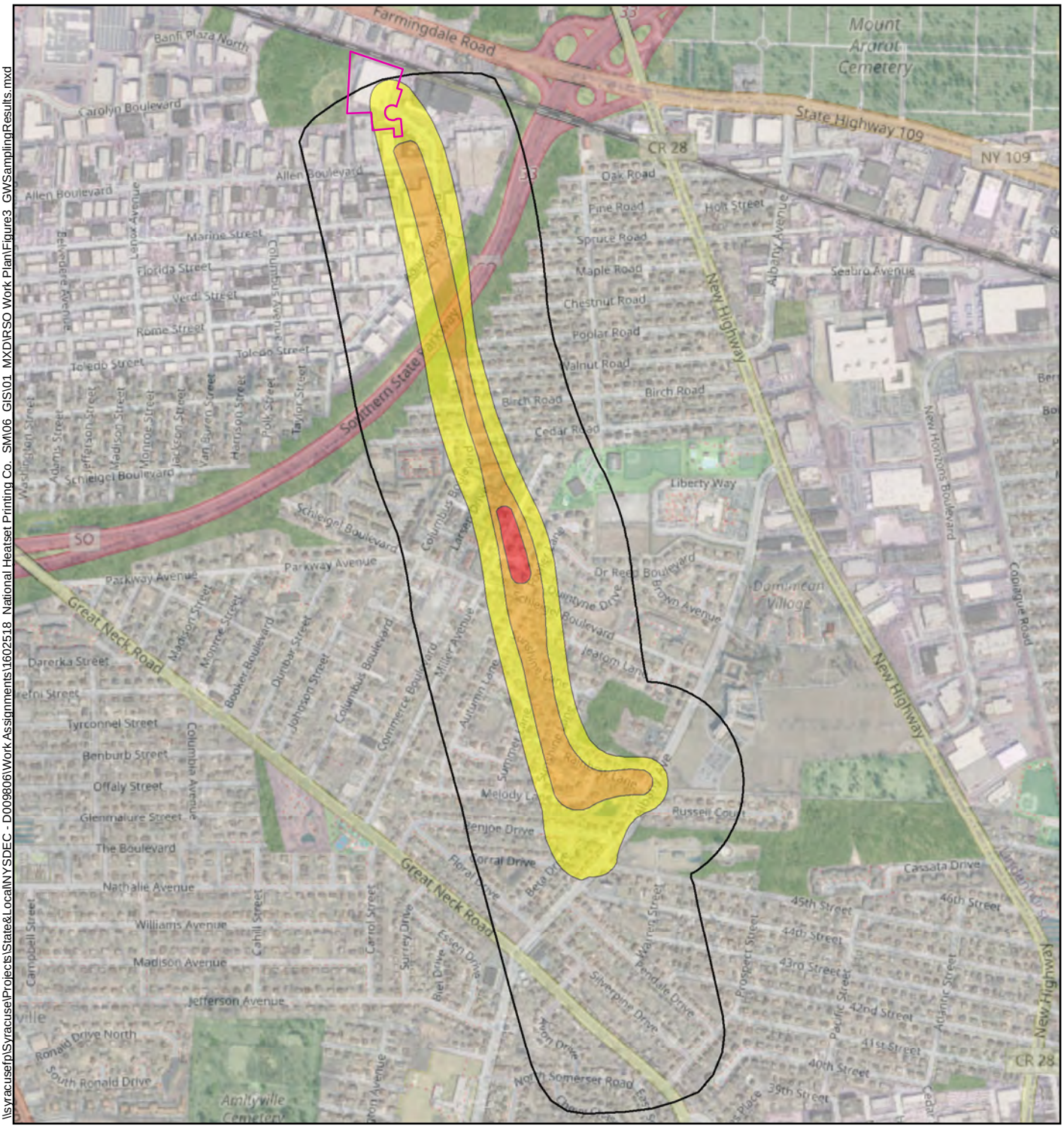
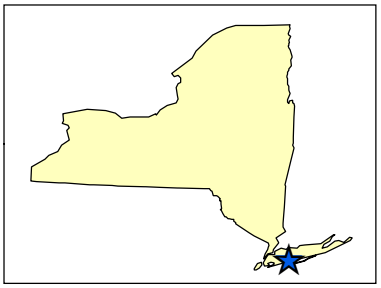
EA

\\syracusefp\Syracuse\Projects\State&Local\NYSDEC - D009806\Work Assignments\1602518 National Heatset Printing Co. SM\06 GIS\01 MXD\RSO Work Plan\NationalHeatset Figure3 HPT and CMT Locations.mxd





0 575 1,150 2,300
Feet

1 in = 1,150 ft

N

Legend

Downgradient Receptor Investigation Focus Area

Note: Contaminant plume boundaries are based on 2016 groundwater delineation investigation and do not reflect current conditions at the Site.

Contaminant Plume

- Concentration of 5 to 100 µg/L
- Concentration of 100 to 500 µg/L
- Concentration > 500 µg/L

Figure 4
Downgradient Receptor Investigation Focus Area
National Heatset Site (152140)
Babylon, New York

Map Date: 2/25/2022
Projection: NAD 1983 2011 StatePlane New York LI FIPS 3104 Ft US

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

\\syracusefp\Syracuse\Projects\State&Local\NYSDEC - D009806\Work Assignments\1602518 National Heatset Printing Co. SM\06 GIS\01 MXD\RSO Work Plan\Figure3 GWSamplingResults.mxd

Attachment A

Continuous Multichannel Tubing Data Sheet

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CMT Multilevel System*

Model 403

This multilevel system is reliable, easy to install and inexpensive. It provides site assessors with a better understanding of three-dimensional groundwater flow and the distribution of contaminants in the subsurface. Remediation strategies can then be targeted more precisely, focusing efforts in the most effective manner.

The CMT Multilevel System makes the accurate monitoring of contaminant plumes much more affordable. It provides detailed vertical as well as horizontal data. Monitoring zones are set where needed and the single tube design allows reliable seals between zones.

Two systems are available. The 1.7" (43 mm) OD polyethylene tubing, segmented into seven channels, allows groundwater monitoring at up to 7 depth-discrete zones. The 3-Channel System uses the same material and construction, but it is only 1.1" (28 mm) in diameter. This narrow tube was developed for smaller diameter installations, especially direct push where the annulus for seal placement is narrow.

Construction of CMT ports in a 7-Channel system installed in Silsoe, England.

CMT® Multilevel
Continuous Multichannel Tubing

Get Quote | More Info

Advantages of Multilevel Systems

- Provide the most accurate 3-D assessment of a site
- Vital to understanding vertical contaminant distribution
- Allow documentation of changes in the concentration and delineation of contaminant plumes
- Low cost compared to multiple individual wells
- Minimize site disturbance

Research has shown that contaminant plumes are often thin and highly stratified. It has also been documented that traditional monitoring wells, with long screened intervals blend the groundwater over the entire length of the screen**. This can mask the true contaminant concentrations and distribution. Multilevel wells with short screened intervals overcome this problem. This high-resolution data gives unprecedented definition of the subsurface contamination, resulting in more effective and less expensive remediation. Water quality data from short-screened wells yield high quality, defensible data.

Applications

- Identify vertical as well as horizontal contaminant distribution with transect monitoring
- Ideal for shallow wells in high water table environments
- Multilevel water sampling and level monitoring in unconsolidated soils or bedrock
- Dewatering impact assessments at construction & mining sites
- Mass transport calculations and mass flux estimation
- Monitoring of natural attenuation or remediation processes, and documentation of its effectiveness
- VOC, MTBE and Perchlorate monitoring at NAPL sites
- Determination of the best location for reactive barrier walls, the Waterloo Emitter and other remediation methodologies
- Vapor monitoring with special wellhead seals
- Helps optimize design and performance assessment of remedial options

***Elci et al (2001). Implications of observed and simulated ambient flow in monitoring well. Ground Water 39, no. 6: 853-862*

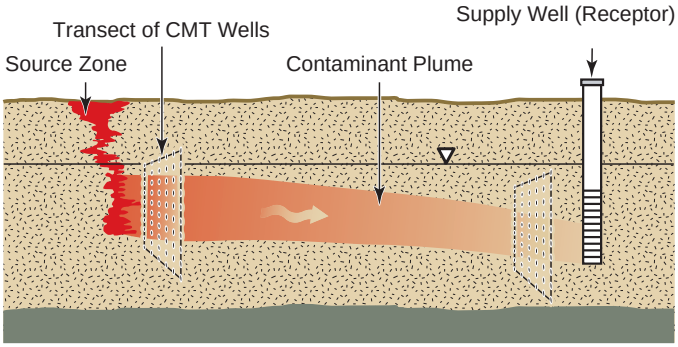
Multilevel Monitoring is Essential

Multilevels provide the most reliable, detailed data for accurate 3-D site assessment. Important advantages include:

Eliminates contaminant mixing in long screened wells – which averages out heads and contaminants, masks narrow zones of contamination and vertical variations, underestimates the extent and concentration levels due to dilution. Multilevels monitor discrete intervals.

Prevents biases due to ambient flow – cross communication of contaminants can occur when different zones in a borehole are not isolated. Properly sealed multilevels avoid ambient flow within a well.

Provides data for Mass Flux Calculations – Calculating the contaminant concentration and flow rate helps determine the maximum contaminant concentration and risk to receptors. A transect of multilevels across the groundwater flow path provides data for mass flux calculations.



CMT Transects for Mass Flux Assessment

Allows optimized remediation design – Using data from multilevels to accurately define the thickness, concentration variations and extent of a plume.

Saves Cost – through reduced permitting and drilling costs; and because narrow tubes allow smaller purge volumes, reduced disposal costs, efficient low flow sampling and rapid response to pressure changes, all reduce field time.

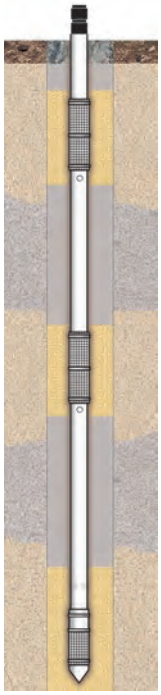
Advantages of the CMT Multilevel System

- Low cost and easy to install and use
- No joints - one smooth surface for easy, effective sealing
- Up to 7 depth-discrete zones in a single tube
- Locate ports and seals exactly where desired
- Installs quickly in large direct push casing and boreholes
- One 7-Channel CMT System can be completed by two people in under 3 hours, 3-Channel even faster
- Borehole not left open to allow cross contamination
- Isolated zones ensured using sand and bentonite layers or 3-Channel Cartridges - reliable and inexpensive
- Minimizes the risk of producing new contaminant pathways

One CMT System - Two Sizes		
Features	**7 Channel**	**3 channel**
Tubing diameter	1.7" (43 mm)	1.1" (28 mm)
Monitoring zones	up to 7	up to 3
Channel diameter	6-Pie: 0.4" (10 mm) 1-Hex: 3/8" (9.5 mm)	3-Hex: 3/8" (9.5 mm)
Channel volume	40 mL/ft. 30 mL/ft. (center)	30 mL/ft.
Installation options	Sand & bentonite backfill Natural formation collapse	Bentonite & sand cartridges Sand & bentonite backfill Natural formation collapse
Coil lengths (Coil 4 ft. dia.)	100 ft. (30 m), 200 ft (60 m) & 300 ft. (90 m)	100 ft. (30 m), 200 ft. (60 m) & 500 ft. (150 m)
Centralizer sizes (other sizes optional)	4.4" standard (112 mm)	3.3" standard (84 mm)
Borehole diameter recommended for backfill installations	4" (100 mm) and larger	3.5" (89 mm) and larger
Borehole diameter for installations with seal and sand cartridges	N/A	2.8" - 3.5" (71 mm - 89 mm)

Mechanical Plugs Seal Channels Securely

Typical 3-Channel CMT Installation in Overburden with Bentonite and Sand Cartridges



Typical 3 or 7-Channel CMT Installation using Layers of Bentonite and Sand Backfilled from Surface

Multichannel Tubing

A multilevel well that uses a continuous length of multichannel tubing has the advantage over other multilevels in that there are no joints. This significantly reduces the time and cost of installing wells and at the same time increases the reliability of the system. The CMT is very simple and convenient to use, as it gives full flexibility as to where monitoring zones are located.

The number and location of ports may be determined in advance, or after drilling the borehole. A Port Cutting Guide is used to create a port in a given channel, at the specified depth to be monitored. A plug is positioned and sealed in the channel just below the port opening and a stainless steel screen is fixed in place over the port to prevent fines from entering. Each channel is also sealed at the bottom of the tubing to avoid cross communication between monitoring zones.

Seals and Sand Packs

The CMT can be installed using standard sand and bentonite layers placed via a tremie pipe, or poured directly from the surface. The Model 103 Tag Line is ideal for accurate placement of sand and bentonite during borehole completion. If the installation is in loose sands, natural collapse can be used, allowing the sand to collapse around the tubing.

3-channel CMT Sand and Bentonite Cartridges

3-Channel Sand and Bentonite Cartridges

For direct push installation of the 3-Channel System, the annulus available is often too small to accurately place sand and bentonite layers. Therefore, bentonite cartridges have been developed to give reliable seals between zones, and accompanying sand cartridges to complete the installation.

These cartridges are approximately 2.4" (61 mm) in diameter and will fit inside various direct push drill rods. Ideally, the borehole diameter these bentonite cartridges are used in should not exceed a nominal 3.5" (90 mm), to ensure proper expansion and sealing.

CMT Installation at UK Chlorinated Solvents Site (Source: Waterra. UK)

Monitoring CMT Multilevel Wells

Water levels and samples can be accurately obtained using the following quality Solinst instruments:

Water Levels: The narrow, laser marked, coaxial cable Model 102 Water Level Meter and 102M Mini Water Level Meter with a 1/4" (6.3 m) dia. probe can be used to monitor water levels in any CMT channel.

Samples: Sampling can be performed using the Solinst Peristaltic Pump, which has a suction lift limit of approximately 25 ft (7.5 m). The Mini Inertial Pump can be used with inexpensive polyethylene tubing to depths of 50 ft (15 m), or using PTFE tubing to depths of 150 ft (45 m). The Micro Double Valve Pump (DVP) is ideal for low flow VOC sampling in narrow applications. The Micro DVP is made of flexible PTFE or polyethylene tubing which is 3/8" (9.5 mm) in diameter. A manifold at the surface has a quick-connect fitting for attachment to the Solinst Electronic Control Unit and a bypass for easy sample collection. Operation is easy, as the Electronic Control Unit has built in pre-sets. A multi-purge manifold is also available for the Micro DVP.

Vapor Samples: A special Vapor Wellhead Assembly can be used to obtain depth discrete vapor samples.

Mini Inertial Pump 1/4" (6 mm)

Model 410 Peristaltic Pump

Model 408M DVP 3/8" (9.5 mm)

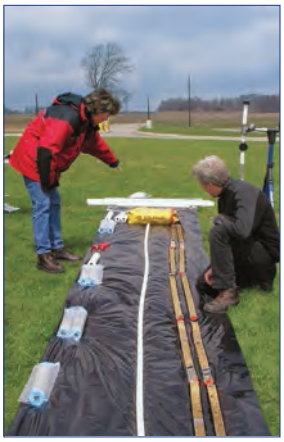
Model 102 Water Level Meter

Model 403 Vapor Wellhead

Model 464 Electronic Control Unit

CMT Field Applications

3-Channel CMT installation at a plant in Zeitz, Germany. Systems were completed using natural collapse and are being used to assess natural attenuation of BTEX.



Installation of a 3-Channel CMT System with bentonite and sand cartridges. Three zones were monitored over a 20 ft (6 m) depth. The installation was completed in glacial till at the University of Waterloo, Ontario Canada.

CMT System installed to a 60 m (200 ft) depth with seven monitoring zones. Installation was completed by placing layers of sand and bentonite to monitor a BTEX/MTBE plume in a Chalk aquifer, United Kingdom.

A gas station site in Watsonville, California. Five 3-Channel CMT Systems were installed to monitor gasoline contamination and MTBE plume. Installations were completed within hollow stem augers using bentonite and sand layers to isolate each monitoring zone.

CMT Training Programs

Solinst offers CMT courses that provide both instruction and hands-on training for CMT construction and installation. Contractors who attend and complete the course are "Trained CMT Contractors" and can be listed on the Solinst website at: **http://www.solinst.com/Prod/403/training.html**

As well as the Environmental Drilling Contractors who are training to become "Trained CMT Contractors", attendees often include regulators, consultants, and Solinst Agents and their clients. In some states, these training courses qualify for continuing education credits.

Courses are offered at various environmental conferences throughout the year, such as those put on by the NGWA, Battelle and others. For larger groups Solinst can set up a training session at the group's own facility.

Please contact Solinst should you wish to attend or set up a training session.

Instructing drilling contractors and consultants on CMT installation techniques at Battelle Bio-Symposium, Baltimore, Maryland.

CMT Installation and training as part of a "Multilevel Course" given by the University of Cranfield at Silsoe, U.K., in conjunction with Waterra (UK), British Geological Survey & Norwest Holst.

The first CMT contractor training course, conducted at the NGWA Expo in Las Vegas, December 2004. Contractors are being instructed on proper port construction.

Outdoor installation/ demonstration at premises of Parrat-Wolff, Environmental and Geotechnical Drilling Services, Syracuse, New York.

Printed in Canada
May 1, 2015

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Attachment B

Project Schedule

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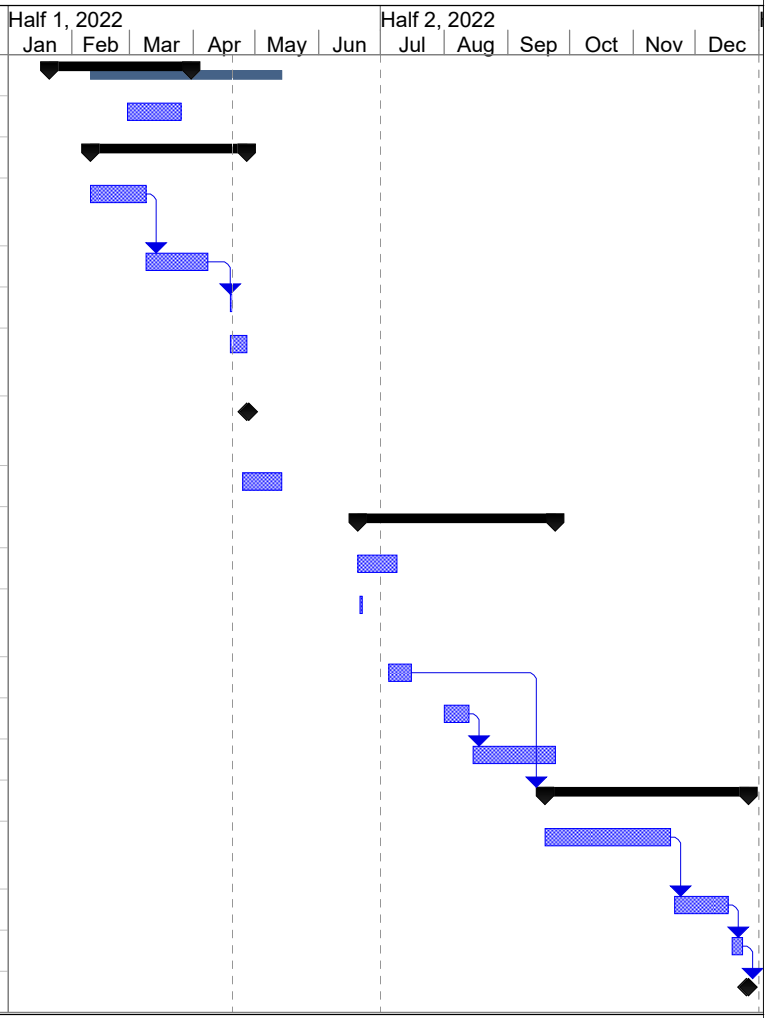
National Heatset Printing Co. Remedial Site Optimization
NYSDEC Site No. 152140
EA Project No. 16025.18

ID	Task Name	Duration	Start	Finish	Predecessors
1	**RSO Planning**	**49 days?**	**Fri 1/21/22**	**Wed 3/30/22**	
2	**Subcontractor Procurement**	20 days	Mon 2/28/22	Fri 3/25/22	
3	**Letter Work Plan**	**54 days**	**Thu 2/10/22**	**Tue 4/26/22**	
4	Draft Letter Work Plan (Proposed locations and analyses)	19 days	Thu 2/10/22	Tue 3/8/22	
5	NYSDEC Review	22 days	Wed 3/9/22	Thu 4/7/22	4
6	Edit and Submit Final RSO Letter WP	1 day	Tue 4/19/22	Tue 4/19/22	5
7	1 Adams Blvd Owner and Tennant Review of WP	6 days	Tue 4/19/22	Tue 4/26/22	
8	**Coordination Call with 1 Adams Blvd Tennant**	1 day	Wed 4/27/22	Wed 4/27/22	
9	Downgradient Receptors Investigation	15 days	Mon 4/25/22	Fri 5/13/22	
10	**RSO Field Activities**	**70 days**	**Mon 6/20/22**	**Fri 9/23/22**	
11	Drilling - HPT and CMT Well Installation	15 days	Mon 6/20/22	Fri 7/8/22	
12	Downgradient Private Well Field Verification	1 day	Tue 6/21/22	Tue 6/21/22	
13	CMT Well Development	9 days	Tue 7/5/22	Fri 7/15/22	
14	CMT and Existing MW Sampling	10 days	Mon 8/1/22	Fri 8/12/22	
15	Laboratory Analysis and Validation	30 days	Mon 8/15/22	Fri 9/23/22	14
16	**RSO Report**	**71 days**	**Mon 9/19/22**	**Mon 12/26/22**	**13**
17	Draft RSO Report - Eval of Options and Concenptual Design	45 days	Mon 9/19/22	Fri 11/18/22	
18	NYSDEC Review	20 days	Mon 11/21/22	Fri 12/16/22	17
19	Edit and Submit Revised RSO Report	5 days	Mon 12/19/22	Fri 12/23/22	18
20	NYSDEC Review and Approval	1 day	Mon 12/26/22	Mon 12/26/22	19



Project: National Heatset Printing Co.
Date: April 2022

Task	Inactive Task	Manual Summary	
Split	Inactive Task	Start-only	
Milestone	Inactive Milestone	Finish-only	
Summary	Inactive Summary	Progress	
Project Summary	Manual Task	Deadline	
External Tasks	Duration-only		
External Milestone	Manual Summary Rollup		

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