

Principals

Anthony Castillo, PE
Fuad Dahan, PhD, PE, LSRP
Franz W. Laki, PE
John M. Nederfield, PE
Justin M. Protasiewicz, PE
Michael St. Pierre, PE

October 22, 2024

Revised December 26, 2024

via email: Alexander.Malamet@dec.ny.gov

Mr. Alexander Malamet, Assistant Geologist
New York State Department of Environmental Conservation, Region 3
Division of Environmental Remediation
21 South Putt Corner Road
New Paltz, NY 12561

**RE: Interim Remedial Measures Work Plan – Addendum (Groundwater)
Pelham House, Inc.
Village of Pelham, Westchester County, New York
NYSDEC BCP Site #C360233
SESI Project No. Project #12335**

Dear Mr. Malamet:

On behalf of Pelham Green, LLC, (the Volunteer), SESI Consulting Engineers (SESI) has prepared this Interim Remedial Measures Work Plan (IRMWP) – Addendum (Groundwater) for the referenced Site to supplement the IRMWP that was submitted in December 2023 and approved by the New York State Department of Environmental Conservation (NYSDEC) in January 2024. The initial IRMWP was submitted to address soil remediation, this addendum is being submitted to present for approval a workplan to remediate groundwater at the Site.

Introduction

Pelham Green, LLC (“Volunteer”) entered into a Brownfield Cleanup Agreement (BCA) with the NYSDEC on March 20, 2023 to investigate and remediate the property at 217 5th Avenue, Pelham, Westchester County, New York (Site), designated NYSDEC Brownfield Cleanup Program (BCP) Site No. C360233. A Site Location Map is presented as **Figure 1** and a Site Plan/Tax Map is presented as **Figure 2**. As noted above, an IRMWP was submitted to the NYSDEC in December 2023 and approved in January 2024. The IRMWP summarized data collected during due diligence at the Site as well as Remedial Investigation data for soil, groundwater and soil vapor and detailed the approach to remediate soil contamination on the Site. The initial IRMWP for this Site included

installation of SOE, soil removal and offsite disposal of contaminated soils above the USCOs to achieve Track 1 remedy. The anticipated remedial excavation depths throughout the Site are presented in **Figure 3** and range from ~10-18 feet below ground surface (ft-bgs) for soil remediation and as deep as 22 ft-bgs for construction purposes. The IRMWP also noted that groundwater would be addressed during future remedial actions. This workplan provides the approach to remediate groundwater contamination at the Site.

Summary of Groundwater Findings at the Site

The primary contaminants of concern in groundwater are chlorinated volatile organic compounds (CVOCs), including tetrachloroethene (PCE), trichloroethene (TCE) and a cis-1,2-dichloroethene (cis-1,2 -DCE) near the Pelham Fire Department (firehouse) and associated parking lot (**Figure 4**) in shallow wells (up to 30 ft-bgs). The current levels of PCE, TCE and cis-1,2-DCE are indicative of a limited source of solvent contamination within the Site, and most likely in the MW-108 location in the parking lot of the firehouse. Although the CVOC levels are currently low, it is unlikely that monitored natural attenuation will be sufficient to achieve in the near future levels of CVOCs that are below the regulatory levels (TOGS AWQS). Thus, an active in situ treatment approach will be necessary to achieve regulatory compliance.

Groundwater was encountered at approximately 6.5 to 7.5 ft-bgs across the Site. Groundwater is anticipated to follow the topography and generally flows to the south/southwest (**Figure 5**). Bedrock geology is described as having “whalebacks” due to the uneven nature of the bedrock formations.

Samples collected from a deeper well in this area (MW-108DD, 54-64 ft-bgs) identified chloroform, however, this is a common municipal water distribution system contaminant. Exceedances for PFAS compounds were also detected at low levels (< 4 ug/L). The source of the PFAS contamination has not been identified and groundwater PFAS concentrations from upgradient areas is not available. Subsequently, this addendum is focused on the remediation of the CVOC contamination detected in the shallow groundwater.

Remedial Approach

To address the shallow CVOC contamination at the Site, SESI proposes to conduct a sodium permanganate in-situ chemical oxidation (ISCO) treatment. This ISCO technology involves injecting a solution of the oxidant into the subsurface and mineralizing (complete destruction) of the target contaminants and their breakdown products. Once injected into the subsurface and consumed by the target contaminants and satisfying soil oxidant demand (SOD) due to reduced conditions and/or high background natural organic matter, sodium permanganate yields benign end-products. The by-products of the reduction of sodium permanganate (NaMnO₄), under typical field conditions, are water, sodium and insoluble manganese dioxide (MnO₂), the latter being a native component of soil.

As noted above, the primary treatment area is in the parking lot of the firehouse (**Figure 6**) and to a depth of approximately 36 ft-bgs (6 feet beyond the approximate total depth of the shallow wells in that area).

ISCO Treatment Preliminary Design

The treatment area and preliminary ISCO design parameters are presented in **Table 1** and **Figure 6**. The ISCO treatment will address the CVOC contamination around MW-108. A 30-ft wide by 30-ft long and 15-ft thick saturated soil will be treated. Monitoring well MW-108 was screened from 15-30 ft-bgs. The excavation in that area is expected to extend to 21 ft ft-bgs (elevator pit elevation). Therefore, groundwater treatment in the firehouse parking lot area around MW-108 will be conducted from 21 ft-bgs to 36 ft-bgs.

The CVOC contaminant mass is approximately 0.0675 lb based on a maximum of 400 ppb CVOC concentration in the saturated treatment area (20,200 gallons of groundwater as calculated in Table 1). The permanganate oxidant demand for the CVOCs is estimated at 0.0878 lb of permanganate based on a permanganate stoichiometric demand of 1.3 lb/lb of CVOCs. Since PCE is the main CVOC in the groundwater, it takes approximately 1.3 lb of permanganate to oxidize 1 lb of PCE based on the general permanganate oxidation reaction below:



The permanganate soil oxidant demand (PSOD) is estimated at 5 g/kg based on the soil matrix that will be treated (coarse to fine sand). Therefore, the total soil oxidant demand is estimated at 2970lbs of permanganate (Table 1). Note that the total SOD is much higher than the total contaminant stoichiometric demand (0.0878 lb). The final treatment design will include an assessment of the soil and groundwater oxidant demand through laboratory testing of Site soil and groundwater. Two soil samples from the treatment area will be collected from the area around MW-108 at 23 and 33 ft-bgs. The groundwater sample will be collected from MW-108. A description of the oxidant demand tests is presented in Attachment A.

Table 1: ISCO Design Parameters

Parameters	Units	Estimates
Length	Ft.	30
Width	Ft.	30
Area	Sq. Ft.	900
Thickness	Ft.	15
Total Volume	Cu. Yd.	500
Effective Porosity	%	20
Plume Total Pore Volume	Gal.	20200
Avg. Contaminant Conc.	ppm	0.4
Mass of Contaminant	lb.	0.0675
PSOD	g/kg	5
Effective PSOD %	40	2
PSOD	lb/yd ³	5.94
PSOD Oxidant Demand	lb	2970
Avg. Stoichiometric Demand	lb/lb	1.3
Contaminant Oxidant Demand	lb.	0.0878

Theoretical Oxidant Demand	lb.	2970
Confidence Factor		2
Calculated Oxidant Demand		5940

The ISCO treatment will be conducted by injecting a solution of sodium permanganate in seven (7) injection points using direct push technology (DPT). Details of the injection event are presented in **Table 2** and **Figure 6** based on the current PSOD estimate. An 8% solution of sodium permanganate will be injected at an estimated rate of 3 gallons per minute (gpm) for a total of 1071 gallons per injection point. It is estimated that six (6) days of injection (8 hrs/day) will be necessary to complete the injection event. The ISCO injection details will be revised as the calculated oxidant demand will change with the SOD test results obtained from the laboratory (Tables 1 and 2 in Attachment A).

Table 2: ISCO Injection Details

Parameters	Units	Estimates
Radius of Influence	ft	10
Number of Injection Points	Ea	7
NaMnO ₄ Injection Concentration	% wt/wt	0.08
Flow Rate - Per Injection Point	gpm	3
40% NaMnO ₄ solution	Gallon	1160
Total dilution water	Gallon	6339
Injection Volume/Point	Gallon	1071

Groundwater Monitoring

Performance monitoring of the ISCO injection will be conducted to verify that the groundwater remedy is effective. The goal of the groundwater remedy is to achieve the TOGS AWQS or to reach asymptotic levels. Following the ISCO injection, groundwater sampling events will be conducted to assess the reductions of CVOC concentrations achieved in the contaminated area in the parking lot of the firehouse. Groundwater will be tested for CVOCs at MW-108, MW-108DD (**Figure 6**).

Baseline groundwater sampling for VOCs will be conducted prior to the ISCO injection event. Groundwater parameters such as pH, ORP, DO and specific conductance will also be recorded during the sampling event. Post-ISCO injection groundwater monitoring will be performed after eight (8) weeks, and then quarterly for up to two years after the injection, or until compliance with the AWQS is achieved. Groundwater monitoring results will be assessed using a multiple lines of evidence approach. The primary indicator of ISCO effectiveness will be a reduction in CVOC concentrations over time. Higher ORP and visual presence of residual sodium permanganate are expected along with a reduction in CVOC concentrations. Further ISCO treatment may be conducted if the desired CVOC reductions are not achieved.

Governing Documents and Other Considerations

The direct push technology used to inject the sodium permanganate solution is an intrusive activity. The governing documents included with the December 27, 2023 Interim Remedial

Measure Work Plan (IRMWP) and approved by the NYSDEC on January 02, 2024 will be used during these interim measures. In particular, the Community Air Monitoring Plan (CAMP) and Health and Safety Plan (HASP) will be adhered to during the groundwater chemical injections. CAMP monitoring will be implemented using an upwind and downwind volatile organic compound and dust meter.

Materials used for injection will be stored in accordance with the manufacturer's recommendations (i.e., on pallets, in secure totes, etc.) and a material safety data sheet will be provided from the manufacturer prior to initiating work.

If there are any significant changes to the injection plan as result of the soil oxidant demand tests, the NYSDEC will be notified. Acknowledgement of these changes will be communicated prior to the initiation of the injection program.

Finally, the NYSDEC Project Manager will be notified at least one week prior to the implementation of the injection program. Should you have any questions regarding this workplan, please do not hesitate to contact me at 201.452.2735.

Sincerely,

SESI CONSULTING ENGINEERS



James Vander Vliet, PE
Senior Project Engineer

Attachments: Figures & Design Revisions Approach

Cc: Mallory Warner (Pelham Green, LLC)
F. Dahan (SESI)

CERTIFICATIONS

I, James Vander Vliet, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measures 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) and Green Remediation (DER-31).

James Vander Vliet

12.26.2024



NYS Professional Engineer
(# 091466)

Date

Signature

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education.

CERTIFICATIONS

I, James Vander Vliet, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measures 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) and Green Remediation (DER-31).

James Vander Vliet

12.26.2024

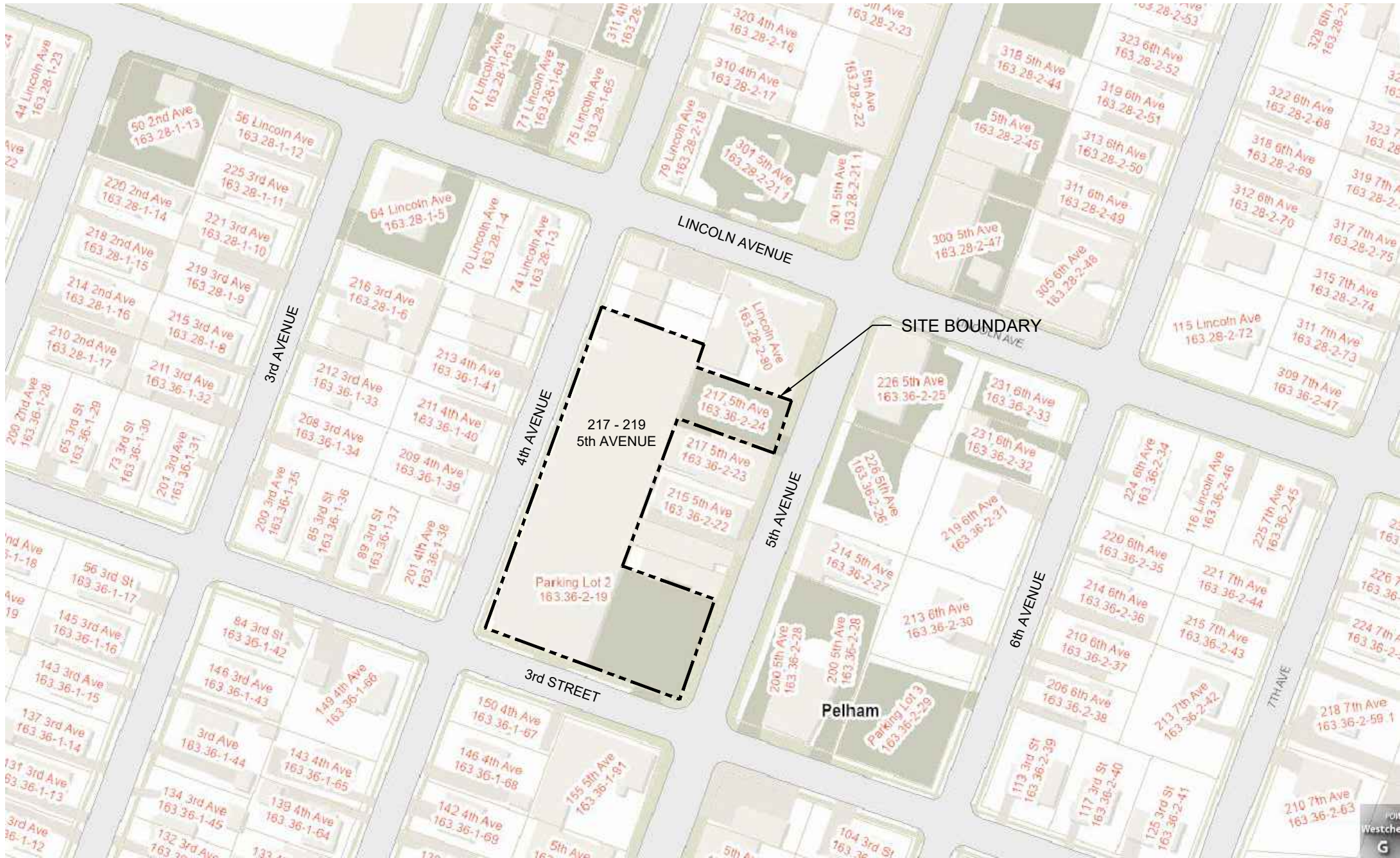


NYS Professional Engineer
(# 091466)

Date

Signature

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education.



REFERENCE

1. EXIST CONDITIONS & TAX BOUNDARY ARE TAKEN FROM "WESTCHESTER COUNTY GEOGRAPHIC INFORMATION SYSTEM" MUNICIPAL TAX PARCEL VIEWER, DATA: 2021.

LEGEND:

----- SITE BOUNDARY

© SESI CONSULTING ENGINEERS 2023
This drawing and all information contained here on is proprietary information of SESI CONSULTING ENGINEERS and may not be copied or reproduced, either in whole or in part, by any method, without written permission of SESI CONSULTING ENGINEERS.

project:

217-219 5TH AVENUE
PELHAM, NY 10803

title:

SITE PLAN

job no: 12335
drawing no:

FIG 2

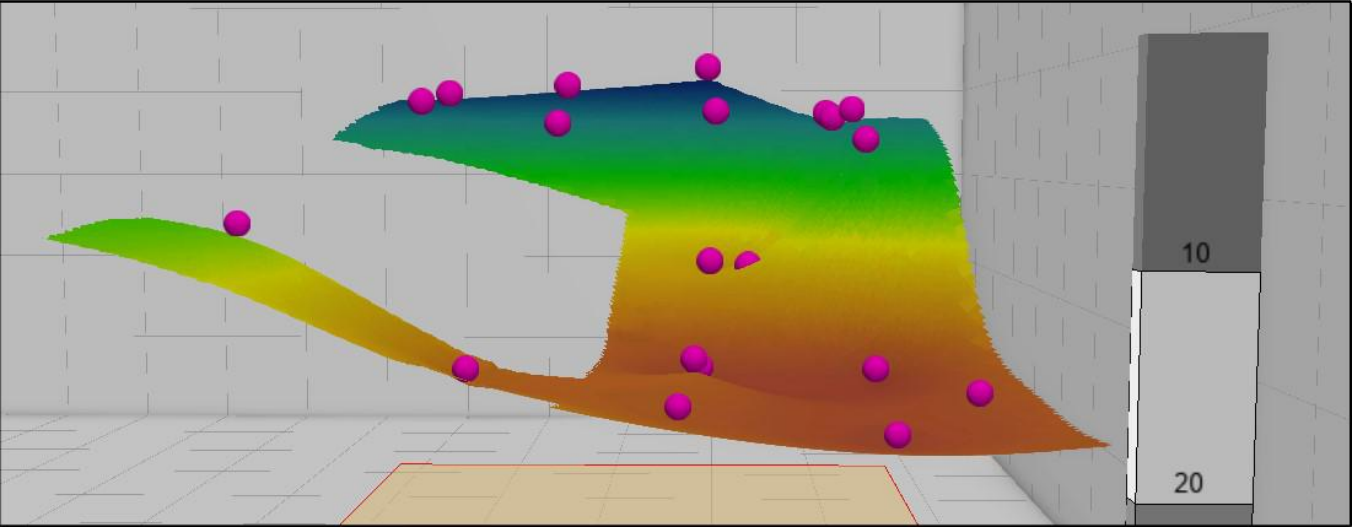
SESI CONSULTING ENGINEERS

GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 route 46e, 3rd floor, parsippany, nj 07054 ph: 973.808.9050

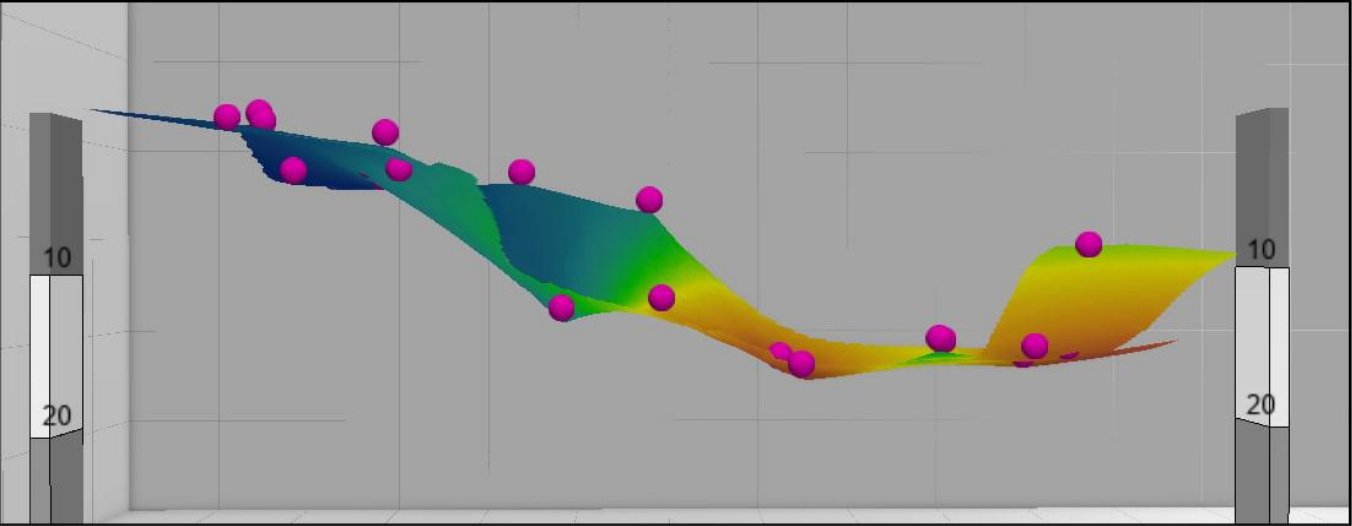
dwg by: AW
chk by: JRN
scale: NTS
date: 06/29/2023

U:\Kim Vanderklein\GIS\excavation_plan_models\FINAL_MAPS_9/28/2023 12:00 PM_Kim Vanderklein_LAYOUT: FIG-

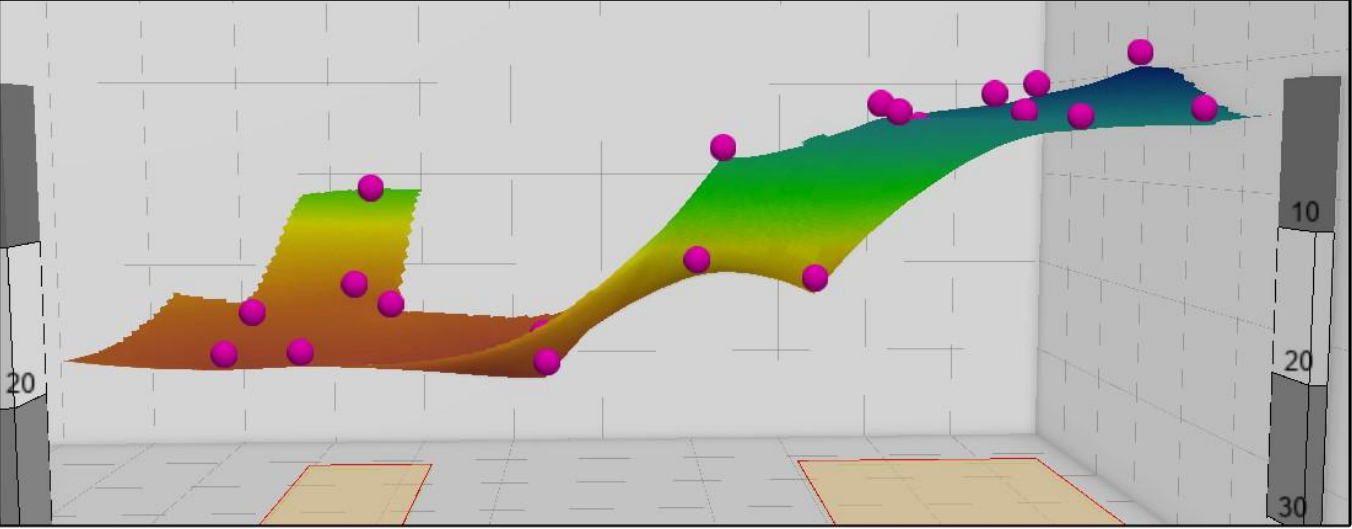
VIEW FROM LINCOLN AVENUE



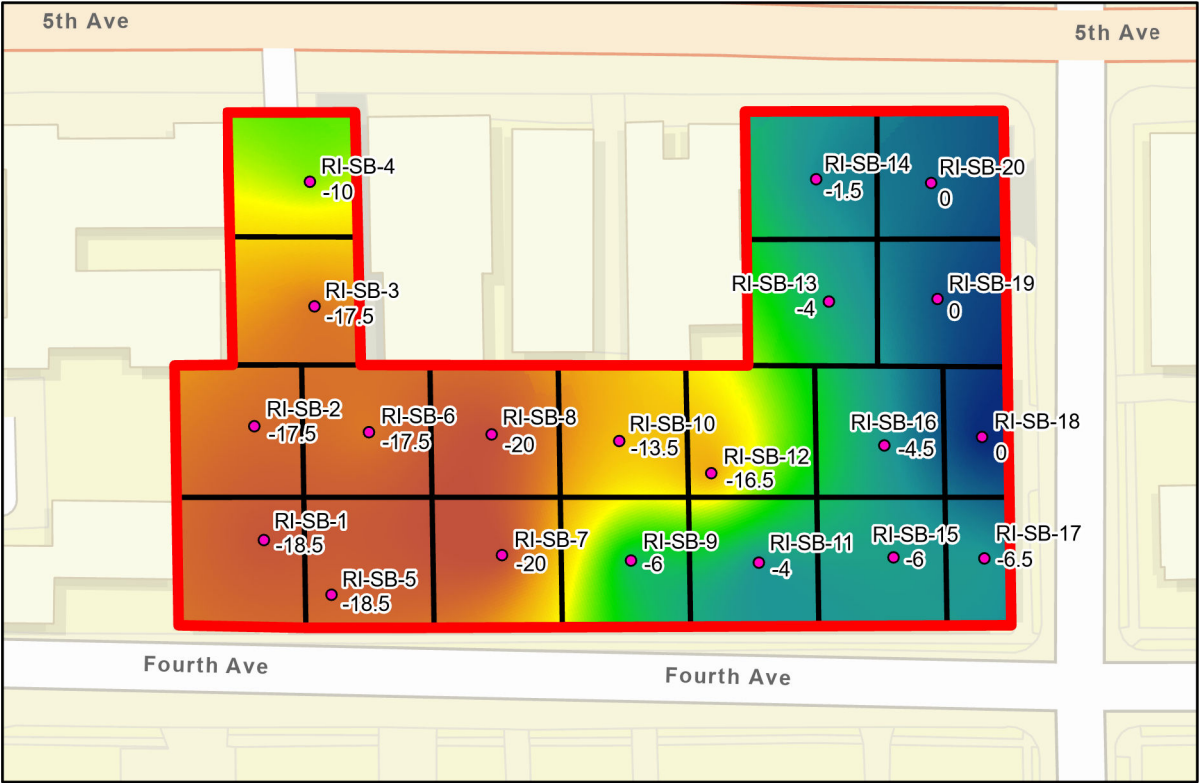
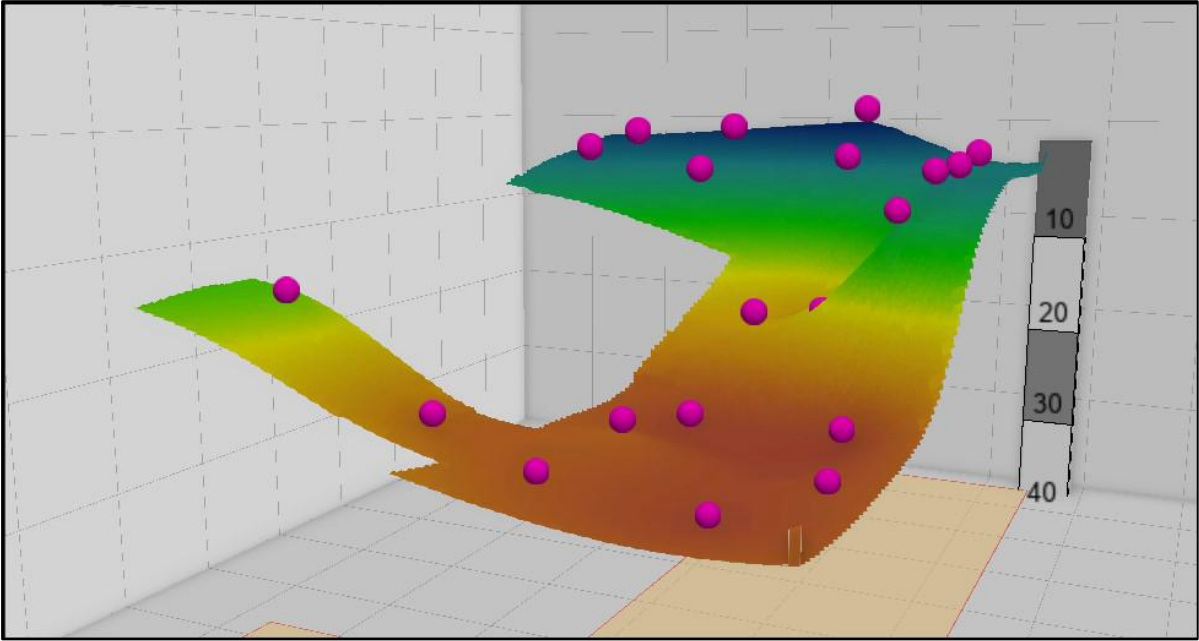
VIEW FROM 5TH AVENUE



VIEW FROM 4TH AVENUE



ORTHAGONAL VIEW FROM LINCOLN AVENUE



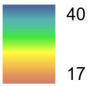
LEGEND:

- SITE LOCATION
- SAMPLING GRID
- SAMPLING LOCATIONS
- APPROX. DEPTH OF EXCAVATION (FT BGS)

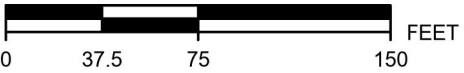
REFERENCE:

NJ STATE IMAGERY SERVICE - 2020
ESRI STREETS BASEMAP

APPROX. EXCAVATION
PLAN (ELEV. IN FT)



SCALE: 1" = 75'



NOTES:

THIS PLAN IS FOR REPRESENTING THE EXCAVATION PLAN AND SAMPLING LOCATIONS ONLY. ELEVATIONS WITHIN MODEL ARE APPROXIMATE AND NOT INTENDED FOR CONSTRUCTION. ELEVATIONS IN EXCAVATION PLAN ARE RELATIVE TO TOPOGRAPHY (NAD83 NY STATE PLANE EAST)

© SESI CONSULTING ENGINEERS ---- 2023
This Drawing and all information contained here on is proprietary information of SESI CONSULTING ENGINEERS and may not be copied or reproduced, either in whole or in part, by method, without written permission of SESI CONSULTING ENGINEERS.

dwg by: KBV
chk by: JN
scale: AS NOTED
date: 9/28/2023

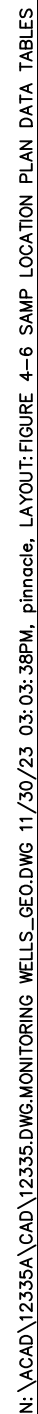
SESI CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 ROUTE 46E, 3RD FLOOR, PARSIPPANY, NJ 07054 PH: 973.808.9050

219 5TH AVENUE
PELHAM, NEW YORK

EXCAVATION PLAN

job no.: 12335
drawing no:

FIG 3



SAMPLE ID:	R-MW-1080BD		
LAB ID:	L2361034-04		
COLLECTION DATE:	10/1/2023		
SAMPLE MATRIX:	WATER		
ANALYTE			
(ug/l)	Conc	Q	
VOLATILE ORGANICS BY GC/MS			
Chloroform	13		
PERFLUORINATED ALKYL ACIDS BY EPA 1631A			
Perfluorooctanoic Acid (PFOA)	0.0174		
Perfluorooctanesulfonic Acid (PFOS)	0.0243		
SEMI-VOLATILE ORGANICS BY GC/MS			
Benzo(a)anthracene	0.03	0.3	
Benzo(a)pyrene	0.03	0.3	
Benzo(b)fluoranthene	0.03	0.3	
Benzo(k)fluoranthene	0.02	0.2	
Chrysene	0.03	0.3	
Indeno(1,2,3-cd)pyrene	0.02	0.2	
TOTAL METALS			
Iron, Total	489		
Sodium, Total	74700		

SAMPLE ID:	RI-MW-02	RI-MW-02	DUP-MW-02
LAB ID:	L234665-01	L2360719-02	L2360719-04
COLLECTION DATE:	8/22/2023	10/12/2023	10/12/2023
SAMPLE TYPE:	WATER	WATER	WATER
ANALYTE			
(µg/l)	Conc	Q	Conc
VOLATILE ORGANICS BY GC/MS			
1,2,4,5-Tetrahalogenobenzenes	11		
PERFLUORINATED ALKYL ACIDS BY EPA 1633			
Perfluorooctanoic Acid (PFOA)	0.0219	0.0282	0.0337
Perfluorooctanesulfonic Acid (PFOS)	0.00712	0.00543	0.00791
SEMI-VOLATILE ORGANICS BY GC/MS			
Benzo(a)anthracene	0.02	J	ND
Benzo(a)pyrene	0.02	J	ND
Benzo(b)fluoranthene	0.02	J	ND
Benzo(k)fluoranthene	0.02	J	ND
Chrysene	0.02	J	ND
Indeno(1,2,3-cd)pyrene	0.01	J	ND
TOTAL METALS			
Iron Total	702	508	551
Sodium Total	491500	434600	433000

SAMPLE ID:	R-MW-102	
LAB ID:	L2360719-05	
COLLECTION DATE:	10/12/2023	
SAMPLE MATRIX:	WATER	
ANALYTE		
(ug/l)	Conc	Q
PERFLUORINATED ALKYL ACIDS BY EPA 1633		
Perfluorooctanoic Acid (PFOA)	0.0233	
Perfluorooctanesulfonic Acid (PFOS)	0.025	
TOTAL METALS		
Iron, Total	3860	
Sodium, Total	562000	

SAMPLE ID:	R-WM-108D	R-MW-108D		
LAB ID:	L2345127-02	L2361034-03		
COLLECTION DATE:	8/3/2023	10/13/2023		
SAMPLE MATRIX:	WATER	WATER		
ANALYTE (ug/l)				
	Conc	Q	Conc	Q
VOLATILE ORGANICS BY GC/MS				
Tetrachloroethene	16		7.1	
Trichloroethene	5.8		3.4	
cis-1,2-Dichloroethene	30		12	
1,2,4,5-Tetramethylbenzene	ND		ND	
PERFLUORINATED ALKYL ACIDS BY EPA 1633				
Perfluorooctanoic Acid (PFOA)	0.0268		0.033	
Perfluorododecanoic Acid (PFOS)	0.0236		0.0224	
SEMIVOLATILE ORGANICS BY GC/MS				
Benzo(a)pyrene	ND	0.02	0.02	J
Benzo(b)fluoranthene	ND	0.02	0.02	J
Benzo(k)fluoranthene	ND	0.01	0.01	J
Chrysene	ND	0.01	0.01	J
Indeno(1,2,3-cd)pyrene	ND	0.01	0.01	J
TOTAL METALS				
Iron, Total	906		2140	
Sodium, Total	92100		160000	

SAMPLE ID:	MW-108	DUP-1	R-MW-108			
LAB ID:	L2345127-01	L2345127-04	L2361034-02			
COLLECTION DATE:	8/3/2023	8/3/2023	10/3/2023			
SAMPLE MATRIX:	WATER	WATER	WATER			
ANALYTE						
(ug/l)	Conc	Q	Conc	Q	Conc	Q
VOLATILE ORGANICS BY GC/MS						
Tetrachloroethene	5.3		4.8		150	
Trichloroethene	2.3		2.3		17	
cis-1,2-Dichloroethene					16	82
PERFLUORINATED ALKYL ACIDS BY EPA 1633						
Perfluorooctanoic Acid (PFCA)	0.0312		0.0318		0.0326	
Perfluorododecanoic Acid (PFDO)	0.0814		0.0915		0.0281	
SEMI-VOLATILE ORGANICS BY GC/MS						
Benzo(a)anthracene	ND		0.03	J	ND	
Benzo(a)pyrene	ND		0.03	J	ND	
Benzo(b)fluoranthene	ND		0.03	J	0.02	J
Benzo(k)fluoranthene	ND		0.02	J	ND	
Chrysene	ND		0.03	J	ND	
Indeno(1,2,3-cd)pyrene	ND		0.02	J	ND	
TOTAL METALS						
Iron, Total	335		398		871	
Sodium, Total	338000		352000		135000	

SAMPLE ID:		R-MW-01	R-MW-01
LAB ID:		L2344695-03	L2360719-03
COLLECTION DATE:		8/2/2023	10/12/2023
SAMPLE MATRIX:		WATER	WATER
ANALYTE			
(ug/l)			
	Conc	Q	Conc
	Conc	Q	Q
PERFLUORINATED ALKYL ACIDS BY EPA 1633			
Perfluorooctanoic Acid (PFOA)	0.00874		0.00914
TOTAL METALS			
Iron, Total	13600		11600
Magnesium, Total	69400		62100
Manganese, Total	2757		3695
Sodium, Total	366000		346000

SAMPLE ID:		RW-SOUTH
LAB ID:		L2344695-02
COLLECTION DATE:		8/2/2023
SAMPLE MATRIX:		WATER
ANALYTE		
(ug/l)	Conc	Q
PERFLUORINATED ALKYL ACIDS BY EPA 1633		
Perfluorooctanoic Acid (PFOA)	0.0216	
Perfluorooctanesulfonic Acid (PFOS)	0.0294	
TOTAL METALS		
Sodium, Total	518000	

J - Estimated Value. The Target analyte concentration is below the quantification limit (RL), but above the Method Detection Limit (MDL).
 ND - Not detected at the MDL for the sample
 F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration
 Shading indicates the concentration is above the Ambient Water Quality Standard (AWQS) for the compound

REFERENCE
1. EXISTING CONDITIONS & BOUNDARY ARE TAKEN FROM "ALTA/ACSM LAND TITLE SURVEY" - VILLAGE OF PELHAM FOURTH AVENUE VILLAGE OF PELHAM WESTCHESTER COUNTY, NEW YORK - DRAWING NO. SU-101 - PREPARED BY TECTONIC ENGINEERING & SURVEYING CONSULTANTS P.C. - DATED 09/09/2019.

© SESI CONSULTING ENGINEERS 2023
This drawing and all information contained here on is proprietary information of SESI CONSULTING ENGINEERS and may not be copied or reproduced, either in whole or in part, by any method without written permission of SESI CONSULTING ENGINEERS

Scale: 1" = 30'



A horizontal graphic scale bar with alternating black and white segments. Above the bar, numerical values are placed at intervals: 0, 15, 30, 60, 90, and 120. The text 'Scale: 1" = 30\'' is centered above the bar.

chk by: JN
scale: AS SHOWN
date: 11/20/2023

SES | CONSULTING
ENGINEERS

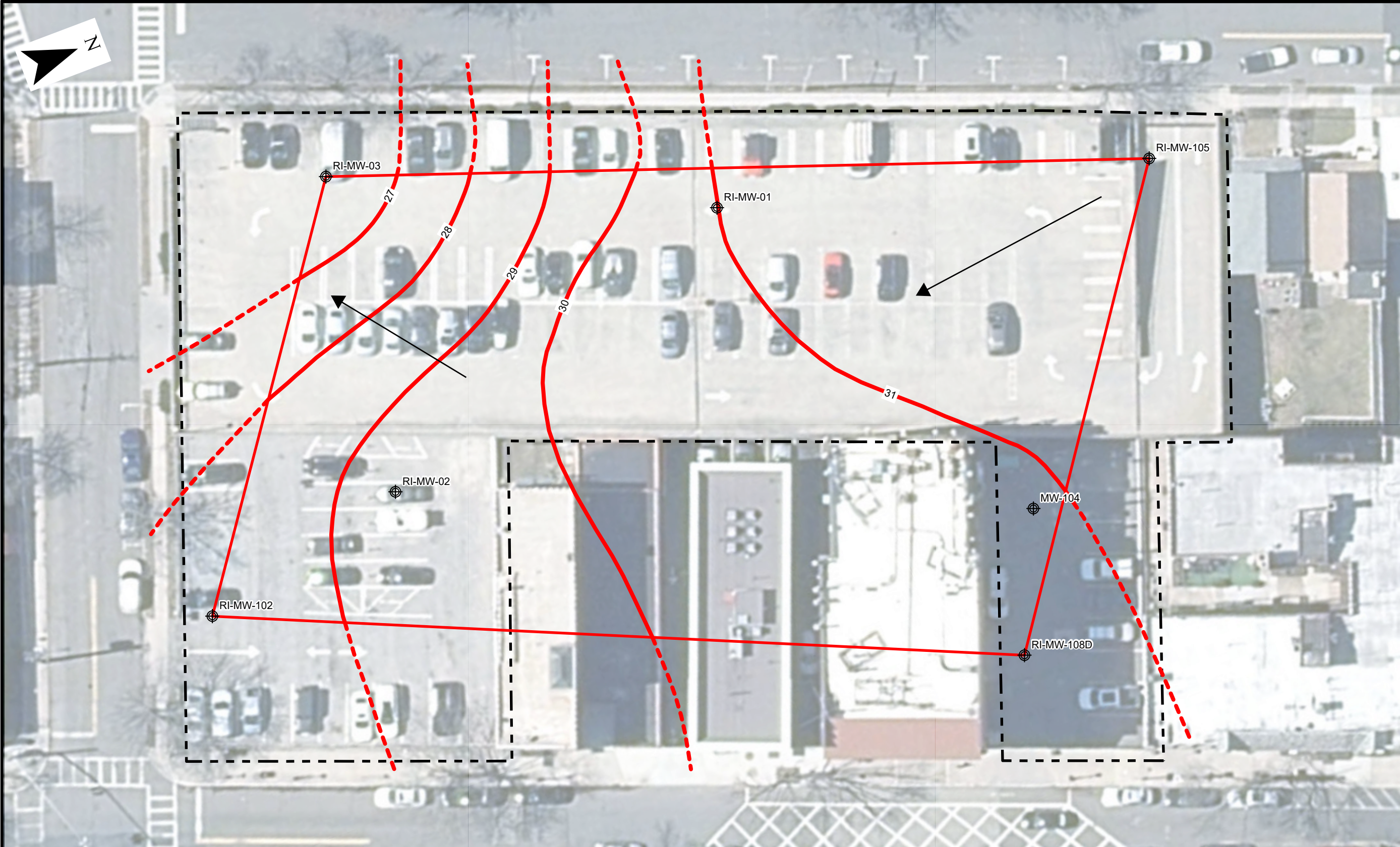
GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 route 46e, 3rd floor, parsippany, nj 07054 ph: 973.808.9050

job no.	12335
drawing no.	

FIG 4

1 of 1

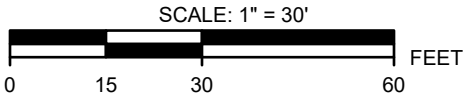
Y:\GIS\Project_Numbers\12335\FINAL_MAPS, 11/30/2023 3:27 PM, Kim Vanderklein, LAYOUT: FIG-4.9



© SESI CONSULTING ENGINEERS ---- 2023
This Drawing and all information contained here on is proprietary information of SESI CONSULTING ENGINEERS and may not be copied or reproduced, either in whole or in part, by method, without written permission of SESI CONSULTING ENGINEERS.

REFERENCE:
NEW YORK STATE, MAXAR, MICROSOFT, NYS OFFICE OF INFORMATION TECHNOLOGY SERVICES - GIS PROGRAM OFFICE, NYS DEPT OF TAXATION AND FINANCE'S OFFICE OF REAL PROPERTY TAX SERVICES

- LEGEND:**
-  MONITORING WELL NO. & APPROX. LOCATION
 -  [31.03] GROUND WATER ELEVATION
 -  GROUND WATER FLOW DIRECTION
 -  INTERPOLATED GROUND WATER CONTOURS
 -  INFERRED GROUND WATER CONTOURS
 -  SITE LOCATION



job no.: 12335
drawing no:

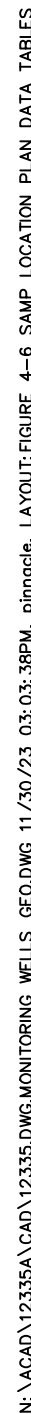
FIG 5

219 5TH AVENUE
PELHAM, NEW YORK

OCTOBER GROUNDWATER CONTOURS

dwg by: KBV
chk by: JN
scale: AS NOTED
date: 11/30/2023

SESI CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 ROUTE 48E, 3RD FLOOR, PARSIPPANY, NJ 07054 PH: 973.808.9050



SAMPLE ID:	R-MW-1080BD		
LAB ID:	L2361034-04		
COLLECTION DATE:	10/1/2023		
SAMPLE MATRIX:	WATER		
ANALYTE			
(ug/l)	Conc	Q	
VOLATILE ORGANICS BY GC/MS			
Chloroform	13		
PERFLUORINATED ALKYL ACIDS BY EPA 1631A			
Perfluorooctanoic Acid (PFOA)	0.0174		
Perfluorooctanesulfonic Acid (PFOS)	0.0243		
SEMI-VOLATILE ORGANICS BY GC/MS			
Benzo(a)anthracene	0.03	0.3	
Benz(a)pyrene	0.03	0.3	
Benz(b)fluoranthene	0.03	0.3	
Benz(g)fluoranthene	0.02	0.2	
Chrysene	0.03	0.3	
Indeno(1,2,3-cd)pyrene	0.02	0.2	
TOTAL METALS			
Iron, Total	489		
Sodium, Total	74700		

SAMPLE ID:	RI-MW-02	RI-MW-02	DUP-MW-02
LAB ID:	L234665-01	L234670-02	L234670-04
COLLECTION DATE:	8/22/2023	10/12/2023	10/12/2023
SAMPLE TYPE:	WATER	WATER	WATER
ANALYTE			
(µg/l)	Conc	Q	Conc
VOLATILE ORGANICS BY GC/MS			
1,2,4,5-Tetrahalogenated Aroclor	11		
PERFLUORINATED ALKYL ACIDS BY EPA 1633			
Perfluorooctanoic Acid (PFOA)	0.0219	0.0282	0.037
Perfluorooctanesulfonic Acid (PFOS)	0.00712	0.00543	0.00791
SEMI-VOLATILE ORGANICS BY GC/MS			
Benzo(a)anthracene	0.02	J	ND
Benzo(a)pyrene	0.02	J	ND
Benzo(b)fluoranthene	0.02	J	ND
Benzo(k)fluoranthene	0.02	J	ND
Chrysene	0.02	J	ND
Indeno(1,2,3-cd)pyrene	0.01	J	ND
TOTAL METALS			
Iron Total	702	508	551
Sodium Total	491500	434600	433000

SAMPLE ID:	R-MW-102	
LAB ID:	L2360719-05	
COLLECTION DATE:	10/12/2023	
SAMPLE MATRIX:	WATER	
ANALYTE		
(ug/l)	Conc	Q
PERFLUORINATED ALKYL ACIDS BY EPA 1633		
Perfluorooctanoic Acid (PFOA)	0.0233	
Perfluorooctanesulfonic Acid (PFOS)	0.025	
TOTAL METALS		
Iron, Total	3860	
Sodium, Total	562000	

SAMPLE ID:	R-WM-108D	R-WM-108D		
LAB ID:	L234512-02	L2361034-03		
COLLECTION DATE:	8/3/2023	10/13/2023		
SAMPLE MATRIX:	WATER	WATER		
ANALYTE (ug/l)	Conc	Q	Conc	Q
VOLATILE ORGANICS BY GC/MS				
Tetrachloroethene	18	7.1		
Trichloroethene	5.8	3.4		
cis-1,2-Dichloroethene	30	12		
1,2,4,5-Tetrachlorobenzene	ND	ND		
PERFLUORINATED ALKYL ACIDS BY EPA 1633				
Perfluorooctanoic Acid (PFCA)		0.0268		0.933
Perfluorododecanoic Acid (PFDA)		0.0236		0.0224
SEMIVOLATILE ORGANICS BY GC/MS				
Benz(o)a(p)yrene	ND	0.02	J	
Benz(o)b(1)fluoranthene	ND	0.01	J	
Benz(o)k(1)fluoranthene	ND	0.01	J	
Chrysene	ND	0.01	J	
Indeno(1,2,3-cd)pyrene	ND	0.01	J	
TOTAL METALS				
Iron, Total	906		2140	
Sodium, Total	92100		160000	

SAMPLE ID:	MW-106	DUP-1	R-MW-106
LAB ID:	L2345127-01	L2345127-04	L2361034-02
COLLECTION DATE:	8/3/2023	8/3/2023	10/13/2023
SAMPLE MATRIX:	WATER	WATER	WATER
ANALYTE			
(ug/l)	Conc	Q	Conc
VOLATILE ORGANICS BY GC/MS	Conc	Q	Conc
Tetrachloroethene	5.3	4.8	150
Trichloroethene	2.3	2.3	17
per-1,2-dichloroethene	16	16	82
POLYFLUORINATED ALKYL ACIDS BY EPA 1633			
Perfluorooctanoic Acid (PFCA)	0.0312	0.0318	0.0328
Perfluorotetrasulfonic Acid (PFOS)	0.0194	0.0195	0.0281
SEMI-VOLATILE ORGANICS BY GC/MS			
Benzol/ganthrene	ND	0.03	J ND
Benzol/ganthrene	ND	0.03	J ND
Benzol/gfluoranthene	ND	0.03	J 0.02
Benzol/gfluoranthene	ND	0.02	J ND
Chrysene	ND	0.03	J ND
Indenol 1,2,3-cd/glyrene	ND	0.02	J ND
TOTAL METALS			
Iron, Total	335	398	871
Sodium, Total	338000	352000	135000

SAMPLE ID:	R-MW-01	R-MW-01
LAB ID:	L2344695-03	L2360719-03
COLLECTION DATE:	8/2/2023	10/12/2023
SAMPLE MATRIX:	WATER	WATER
ANALYTE		
(ug/l)	Conc	Q
PERFLUOROANTHACENIC ACID (PFCA) EPA 1633	Conc	Q
Perfluorooctanoic Acid (PFCA)	0.00874	0.00914
TOTAL METALS		
Iron, Total	13600	11600
Magnesium, Total	69400	62100
Manganese, Total	2757	3695
Sodium, Total	366000	346000

SAMPLE ID:		RW-SOUTH	
LAB ID:		L2344695-02	
COLLECTION DATE:		8/2/2023	
SAMPLE MATRIX:		WATER	
ANALYTE			
(ug/l)		Conc	Q
PERFLUORINATED ALKYL ACIDS BY EPA 1633			
Perfluorooctanoic Acid (PFOA)		0.0216	
Perfluorooctanesulfonic Acid (PFOS)		0.0294	
TOTAL METALS			
Sodium, Total		518000	

NY-AWQS	
ANALYTE	(ug/l)
VOLATILE ORGANICS BY GC/MS	
Chloroform	7
Tetrachloroethene	5
Trichloroethene	5
Methyl tert butyl ether	10
cis-1,2-Dichloroethene	5
1,2,4,5-Tetramethylbenzene	5
PERFLUORINATED ALKYL ACIDS BY EPA #1633	
Perfluorooctanoic Acid (PFOA)	0.0067
Perfluorooctanesulfonic Acid (PFOS)	0.0027
SEMIVOLATILE ORGANICS BY GC/MS	
Benzo(a)anthracene	0.002
Benzo(a)pyrene	0.002
Benzo(b)fluoranthene	0.002
Benzo(k)fluoranthene	0.002
Chrysene	0.002
Indeno(1,2,3-cd)pyrene	0.002
TOTAL METALS	
Iron, Total	300
Magnesium, Total	35000
Manganese, Total	300
Sodium, Total	20000

LEGEND:

W-01		- MONITORING WELL NUMBER & APPROX. LOCATION
W-106		- HISTORIC MONITORING WELL NUMBER & APPROX. LOCATION
SOUTH		- RECOVERY WELLS INSTALLED PER PUMPING TEST

REFERENCE
1. EXISTING CONDITIONS & BOUNDARY ARE TAKEN FROM "ALTA/ACSM LAND TITLE SURVEY" - VILLAGE OF PELHAM FOURTH AVENUE VILLAGE OF PELHAM WESTCHESTER COUNTY, NEW YORK - DRAWING NO. SU-101 - PREPARED BY TECTONIC ENGINEERING & SURVEYING CONSULTANTS P.C. - DATED 09/09/2019.

NYS Education Law
Unauthorized alterations or additions to this plan are a violation of section 7209 (2) of the New York State Education Law. Copies of this map not having the seal of the engineer shall not be valid.

© SESI CONSULTING ENGINEERS 2023
This drawing and all information contained here on is proprietary information of SESI CONSULTING ENGINEERS and may not be copied or reproduced, either in whole or in part, by any method, without written permission of SESI CONSULTING ENGINEERS

SES | CONSULTING
ENGINEERS

GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 route 46e, 3rd floor, parsippany, nj 07054 ph: 973-808-9050

VILLAGE OF PELHAM
 FOURTH AVENUE
 VILLAGE OF PELHAM
 WESTCHESTER COUNTY, NEW YORK

Title: **SAMPLING LOCATION PLAN & CONTAMINANT
DISTRIBUTION IN GROUNDWATER**

FIG. 6

1 of 1

Oxidant Demand Tests and ISCO Design

The Permanganate Soil Oxidant Demand (PSOD) for permanganate will be determined for the two soil samples collected from the area around MW-108 at 23 and 33 ft-bgs. The groundwater oxidant demand will be tested on a groundwater sample collected from MW-108.

The PSOD will be determined using a series of jar experiments at two oxidant/soil ratios under a water/soil ratio of 1:1 (by weight) at room temperature. 250-mL jars will be used for the experiments. See [Table 1 and 2](#) for details. All samples will be measured for the oxidant level at the end of a 5-day test period. Consumption of the oxidant (at the two oxidant concentrations) by the aquifer soil will be determined at the end of the tests. The PSOD will be determined using equation 1:

$$\text{PSOD} = V(C_o - C_s)/m_{\text{soil}} \quad (1)$$

Where V = the total volume of oxidant solution in the reactor; C_o = initial oxidant concentration; C_s = the oxidant concentration at the reaction period of 5 days; m_{soil} = the mass of soil used in the reaction.

Table 1: Test Conditions

ID	amount of soil	amount of solution	solution	permanganate concentration
IA & IAd	50 g	50 mL	DI water	30 g/L
IB & IBd	50 g	50 mL	DI water	50 g/L
IC & ICd	none	50 mL	groundwater	50 g/L
ID & IDd	50 g	50 mL	DI water	none

Table 2: Soil and Groundwater Oxidant Demand

	IA soil & DI water 30 g/L permanganate	IAd soil & DI water 30 g/L permanganate	IB soil & DI water 50 g/L permanganate	IBd soil & DI water 50 g/L permanganate	IC 50 g/L permanganate	ICd GW 50 g/L permanganate	ID soil & DI water	IDd soil & DI water
pH								
ORP, mV								
Conductivity, mS/cm								
Permanganate, g/L								
Oxidant Demeand	g/kg	g/kg	g/kg	g/kg	g/L	g/L	N/A	N/A

The PSOD results will be used to revise the ISCO design parameters presented in Tables 1 and 2 of the IRMWP letter as follows:

Table 1: ISCO Design Parameters

Parameters	Units	Estimates
Length	Ft.	30
Width	Ft.	30
Area	Sq. Ft.	900
Thickness	Ft.	15
Total Volume	Cu. Yd.	500
Effective Porosity	%	20
Plume Total Pore Volume	Gal.	20200
Avg. Contaminant Conc.	ppm	0.4
Mass of Contaminant	lb.	0.0675
PSOD	g/kg	TBD
Effective PSOD %	40	TBD
PSOD	lb/yd ³	TBD
PSOD Oxidant Demand	lb	TBD
Avg. Stoichiometric Demand	lb/lb	1.3
Contaminant Oxidant Demand	lb.	0.0878
Oxidant Demand	lb.	TBD
Confidence Factor		2
Calculated Oxidant Demand		TBD

Table 2: ISCO Injection Details

Parameters	Units	Estimates
Radius of Influence	ft	10
Number of Injection Points	Ea	7
NaMnO ₄ Injection Concentration	% wt/wt	0.08
Flow Rate - Per Injection Point	gpm	3
40% NaMnO ₄ solution	Gallon	TBD
Total dilution water	Gallon	TBD
Injection Volume/Point	Gallon	TBD