GROUNDWATER INTERIM REMEDIAL MEASURES WORK PLAN

1681-1689 Main Street Site
BCP Site No. C915378
Buffalo, New York

December 2024

Prepared for:

1681-1689 Main Street LLC

Prepared by:

ROUX

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Appendix

1.0 Introduction

On behalf of our client, 1681-1689 Main Street LLC, Roux Environmental Engineering and Geology, DPC (Roux) has prepared this Groundwater Interim Remedial Measures (IRM) Work Plan to present the scope of planned Interim Remedial Measures (IRM) to address elevated groundwater concentrations identified on Site during the Brownfield Cleanup Program (BCP) Remedial Investigation.

1.1 Site Background

The 1681-1689 Main Street Site (C915378) is an approximate 2.04 acre site located in the City of Buffalo, Erie County, New York (see Figures 1 and 2). The Site is bordered by Main Street to the west, East Balcom Street to the south, Masten Avenue to the east. Remedial Investigation fieldwork was completed in accordance with the approved Remedial Investigation Interim Remedial Measures Work Plan (November 2022) and the Addendum to the RI-IRM Work Plan (November 2023). Remedial Investigation field activities were completed on Site between January and July 2024, and Interim Remedial Measures are currently ongoing.

1.2 Remedial Investigation Groundwater Results

Seven (7) groundwater wells, identified as MW-1 through MW-7, were installed across the Site as part of the RI (see Figure 3). Based on the initial round of sampling results (April 2024), elevated volatile organic compounds (VOCs) were detected above NYS Department of Environmental Conservation (NYSDEC) Groundwater Guidance Values. Elevated VOCs, including chlorinated VOCs (cVOCs) were detected in MW-4, MW-5 and MW-6. Additional groundwater sampling completed in May 2024 showed similar results for MW-5 and MW-6, with no elevated detection in MW-4 (see Table 1).

1.3 – Interim Remedial Measures

Interim Remedial Measures, including removal of historic underground storage tanks (USTs) and hydraulic lifts, and impacted soil fill. Post-excavation confirmatory soil sample results have confirmed removal of impacted soil-fill surrounding the tanks and hydraulic lifts and have achieved the Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).

This Groundwater IRM is being completed to address residual groundwater impacts after completion of the IRMs. This groundwater IRM will focus on addressing the residual groundwater concentrations in the vicinity of MW-6 (former Tank 1 area). Additional groundwater monitoring will be completed at MW-4 and MW-5 to assess concentrations after completion of the Tank 2 and Tank 4 IRM activities. Additional groundwater remedial activities may be completed based on the pos-injection groundwater results.

Details of the planned groundwater injection are provided below.

2.0 Pre-Injection Preparation Tasks

2.1 USEPA Underground Injection Control Permit

Roux will prepare and submit an US Environmental Protection Agency (USEPA) Underground Injection Control (UIC) permit prior to field injection activities. Copies of the UIC will be provided to the Department prior to injection activities.

2.2 Site Preparation

A City of Buffalo hydrant permit has been acquired, and water needs for the injection will be supplied by the hydrant. Injection activities will be completed in accordance with the NYSDEC-approved Remedial Investigation Interim Remedial Measures Work Plan, including the Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP).

2.2.1 Site Access Controls

The site is currently surrounded by perimeter construction fencing. The perimeter fencing will remain during the injection activities. Additional exclusion zones, using caution tape and/or traffic cones, may be used on Site to identify planned areas of injection work activities. Work areas will be determined daily based on the planned remedial activities, and may be changed throughout the work day to ensure safe operations.

2.2.2 Material Storage

Planned chemical reagent will be brought to the Site and utilized during the injection activities. Chemicals will be stored on site and covered by plastic sheeting at the end of each workday. Injection related equipment and associated mixing equipment will be stored on Site during the IRM.

2.3 Temporary Monitoring Well Installation

Three (3) temporary groundwater monitoring wells, identified as TW-1, TW-2, and TW-3 will be installed prior to injection activities (see Figure 2). The monitoring wells will be used for evaluating the zone of influence during the injection, and pre- and post injection sampling.

3.0 IRM Groundwater Injection

In-Situ chemical oxidation (ISCO) is an environmental remediation technique which utilizes a strong chemical oxidant to destroy and transform chemical contaminants into less harmful chemical species. For this Groundwater IRM, Regenesis PersulOx will be used to remediate residual VOC impacts. PersulfOx is a sodium persulfate based oxidant utilizing a patented catalyst to activate the reaction. The sulfate reagent is a more stable oxidant with slower reaction times (days to weeks) and does not interact as strongly with soil organic matter, whereby reducing application volumes.

3.1 Injection Reagent - Regenesis PersulfOx®

PersulfOx is a sodium persulfate based oxidant that is capable of destroying chlorinated contaminants at the Site. PersulfOx contains a built-in activation agent, so no additional catalyst will be added during the injection. Approximately 900 lbs of reagent will be mixed with 500-600 gallons of water for an approximate 15% PersulfOx solution will be injected at the manufacturer's suggested rate of 30-gallons per foot across the 20-foot treatment thickness.

Regenesis PersulfOx information including product brochure, Material Safety Data Sheet (MSDS) and application instructions are included in Appendix D. The reagent will be delivered in dry 55lbs bags as a DOT 5.1 Class Oxidizer and staged on-Site in accordance with the manufacturer's storage recommendations. The PersulfOx solution will be mixed on-Site in accordance with the manufacturer's instructions in 275-gallon totes, or similar mixing vessels.

Pre- and post-injection groundwater monitoring will be completed to assess the effectiveness of PersulfOx. Details of the IRM groundwater monitoring plan are described below

3.2 Injection Details

A total of 30 injection points will be spaced approximately 10 ft apart (north to south) and 15 feet apart (east to west) in a grid pattern (see Figure 1). A direct-push drilling probe capable of injecting the reagent will be utilized to deliver the reagent. Injection points will be advanced to an approximate depth range of 20-40 ft below ground surface (fbgs) and reagent will be applied continuously across the application depth range.

Based on the depth to groundwater and the current site conditions, we do not expect reagent daylighting issues. If daylighting of reagent is identified, the injection will be temporarily paused, the area of daylighting will be inspected, and those areas will be sealed with bentonite or equivalent.

3.3 Groundwater Monitoring

A groundwater sampling program will be implemented to evaluate the effectiveness of the IRM groundwater treatment program. Groundwater sampling will be completed utilizing low-flow techniques, in accordance with the approved RI-IRM Work Plan.

Groundwater elevations and laboratory samples will be collected from the groundwater well network prior to injection activities. Field parameters will be collected continuously during the injections. Based on the rate of reaction the post-injection groundwater samples will be collected approximately four (4) weeks after completion of the injection.

Approximately 4 weeks after completion of the groundwater injection, post-injection groundwater samples will be collected from MW-4, MW-5, MW-6, TW-1, TW-2, and TW-3 for TCL VOCs.

Based on the post-injection groundwater results, additional sampling and/or supplemental groundwater remedial measures will be discussed with the Department.

4.0 Remedial Activities Support Documents

4.1 Health and Safety Protocols

The Groundwater IRM will be completed in accordance with the approved Remedial Investigation Interim Remedial Measures Work Plan, and associated Health and Safety Plan (HASP). Additional information related to proper handling and safety measures are included in Appendix A with the product information.

5.0 Reporting and Project Schedule

5.1 Reporting

Post-Injection groundwater sampling results will be summarized and submitted to the Department upon receipt from the laboratory.

Upon completion of injection activities, the USEPA UIC notification will be resubmitted.

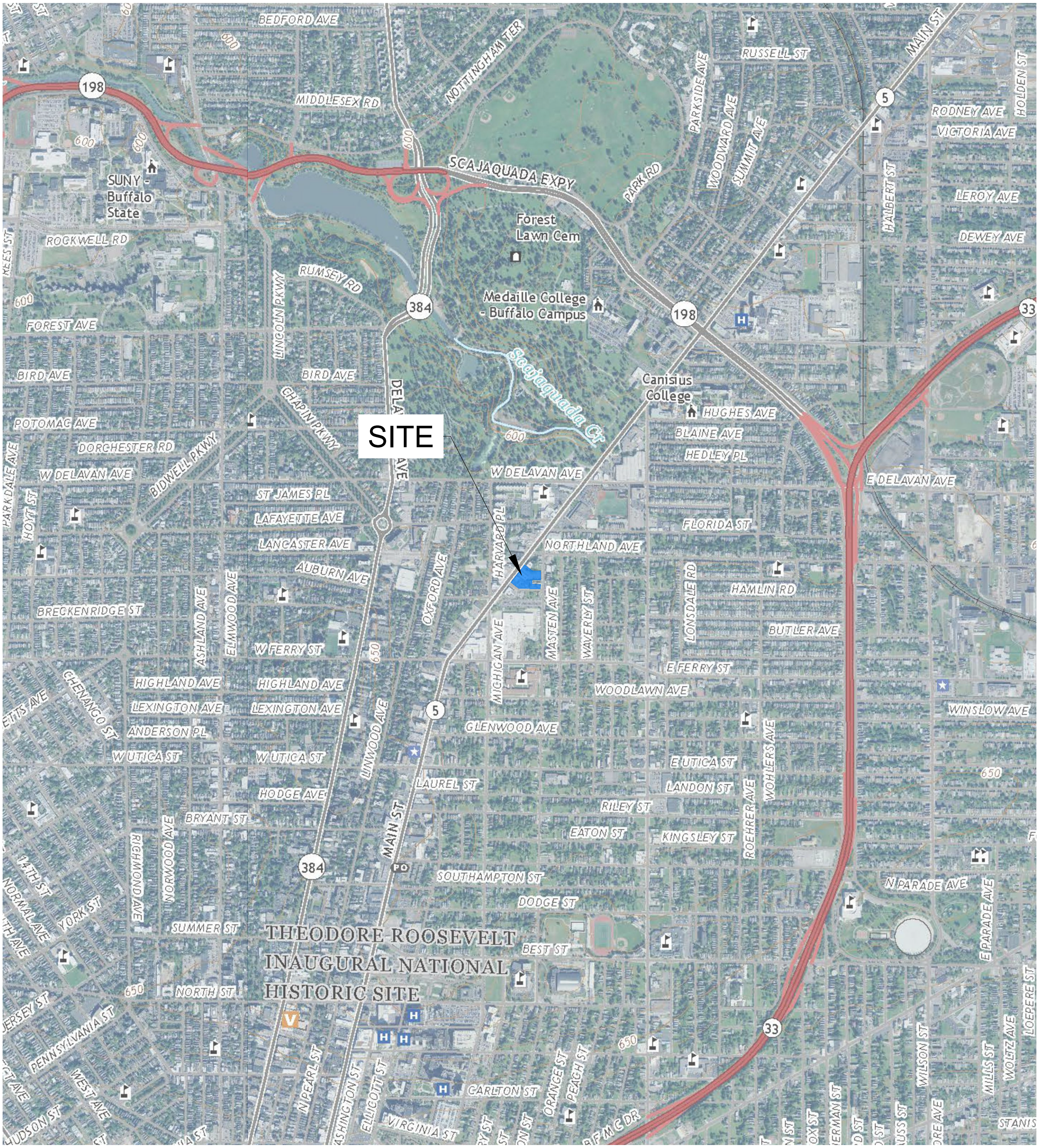
Details of the injection activities will be summarized in a Construction Closeout Report (CCR) and/or included in the Final Engineering Report (FER).

Future groundwater sampling, if necessary, will be included in the conditional Site Management Plan (SMP).

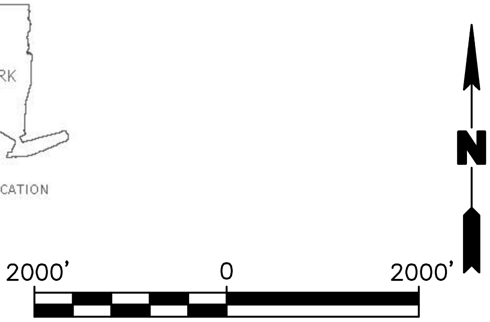
5.2 Tentative Schedule Timeline

- January 2025 – complete Groundwater Injection field activities
- March 2025 – complete post-injection groundwater sampling (4 weeks post-injection).
- April 2025 – Provide post-injection data summary and associated closure notification/reports.

FIGURES



QUADRANGLE LOCATION



Title:

SITE LOCATION AND VICINITY MAP

ADDENDUM TO THE RI/IRM WORKPLAN
GROUNDWATER IRM
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

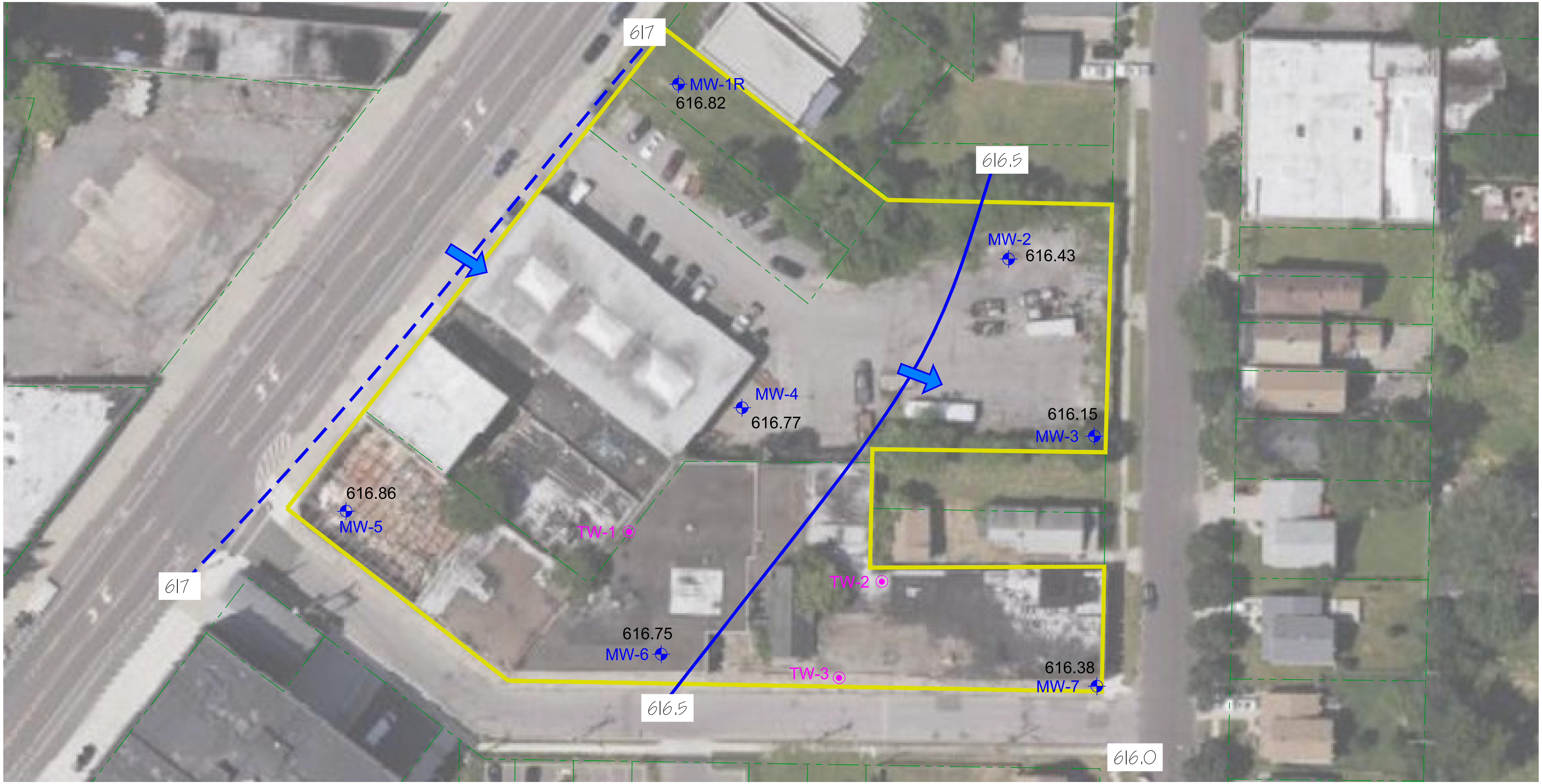
Prepared for:

1681-1689 MAIN STREET LLC

ROUX

Compiled by: CEH	Date: JUNE 2024	FIGURE
Prepared by: CEH	Scale: AS SHOWN	
Project Mgr: NTM	Project: 4461.0001B002	1
File: FIGURE 1 - SITE LOCATION AND VICINITY MAP.DWG		

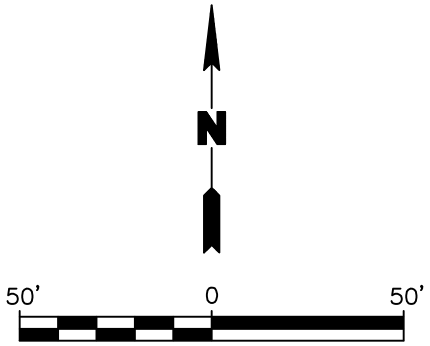
F:\CAD\Benchmark\Pivotal Housing Partners (formerly MVAH Properties)\GW IRM\Figure 2 - Site Plan (Aerial) & GW Network.dwg, 12/23/2024 11:07:18 AM, DWG To PDF.pc3



LEGEND:

▬	BCP BOUNDARY
— - — - —	PARCEL BOUNDARY
MW-1 ⊕	RI MONITORING WELL LOCATION
- - - - - 580	GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
⇨	GROUNDWATER FLOW DIRECTION
TW-1 ⊙	PROPOSED TEMPORARY MONITORING WELL LOCATION

NOTE:
GROUNDWATER ELEVATIONS PER ROUX ON MAY 3, 2024.



Title:

SITE PLAN (AERIAL) & GW NETWORK
ADDENDUM TO THE RI/IRM WORKPLAN
GROUNDWATER IRM
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

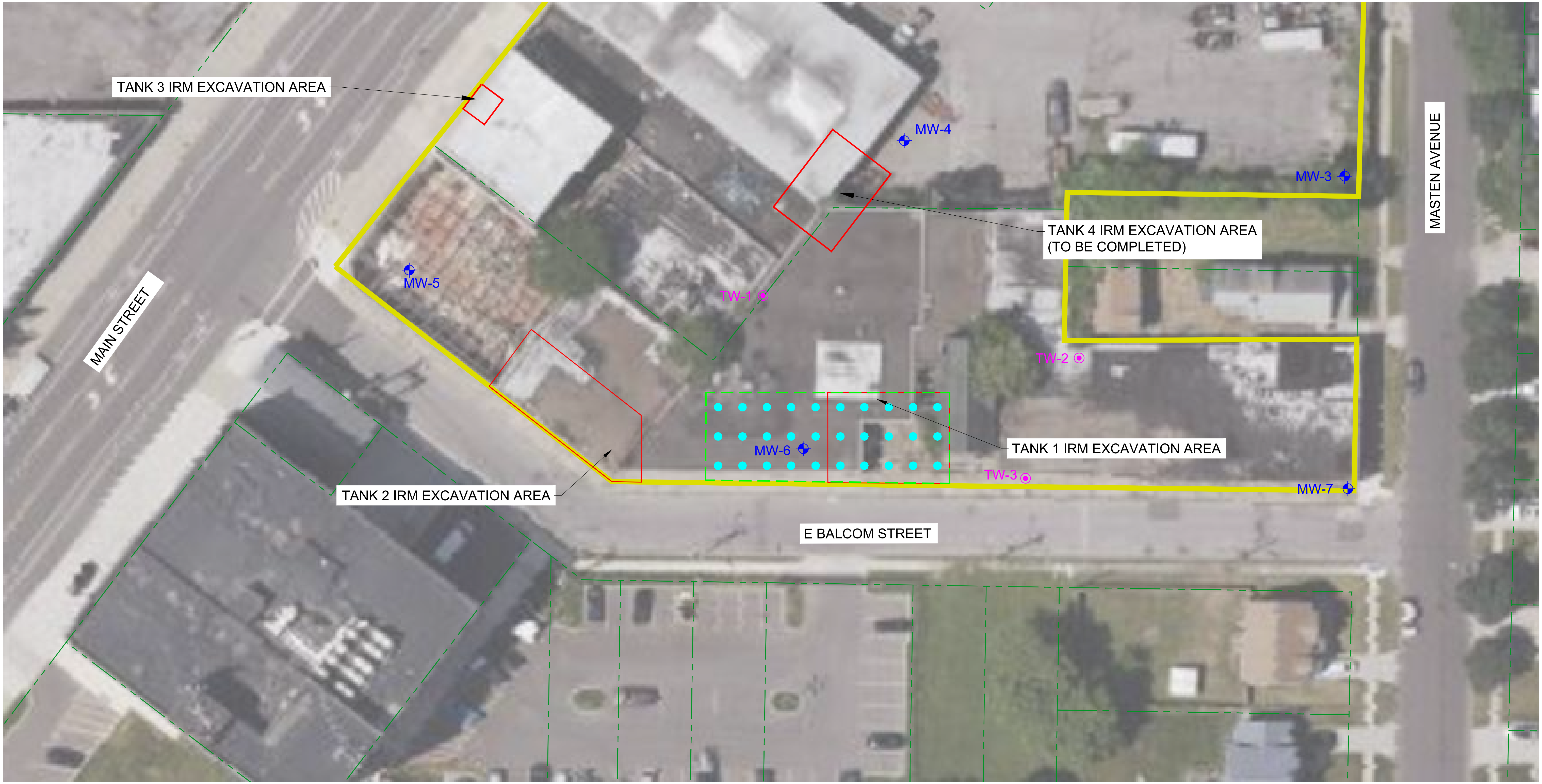
Prepared for:

1681-1689 MAIN STREET, LLC

ROUX

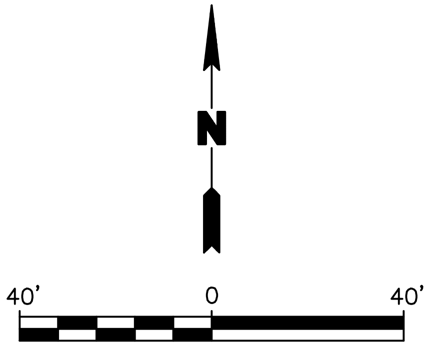
Compiled by: CEH	Date: DECEMBER 2024	FIGURE
Prepared by: CNK	Scale: AS SHOWN	2
Project Mgr: NTM	Project: 4461.001B002	
File: FIGURE 2 - SITE PLAN (AERIAL) & GW NETWORK.DWG		

F:\CAD\Benchmark\Pivotal Housing Partners (formerly MVAH Properties)\GW IRM\Figure 3 - Planned Injection Points.dwg, 12/23/2024 11:06:43 AM, DWG To PDF.pc3



LEGEND:

🟨	BCP BOUNDARY
— - —	PARCEL BOUNDARY
MW-1 ⌖	RI MONITORING WELL LOCATION
TW-1 ◎	PROPOSED TEMPORARY MONITORING WELL LOCATION
●	PLANNED INJECTION POINT
⬚	PLANNED GROUNDWATER INJECTION AREA



Title:

PLANNED INJECTION POINTS

ADDENDUM TO THE RI/IRM WORKPLAN
GROUNDWATER IRM
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Prepared for:

1681-1689 MAIN STREET, LLC

ROUX

Compiled by: CEH	Date: DECEMBER 2024	FIGURE
Prepared by: CNK	Scale: AS SHOWN	3
Project Mgr: NTM	Project: 4461.001B002	
File: FIGURE 3 - PLANNED INJECTION POINTS.DWG		

TABLES

ROUX

TABLE 8
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
RI-IRM-AA REPORT
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameters [1]	Class GA GWQS/GV[2,3]	Sample Location												
		MW-1	MW-2		MW-3		MW-4		MW-5		MW-6		MW-7	
		4/1/2024	4/1/2024	5/23/2024	4/1/2024	5/23/2024	4/1/2024	5/23/2024	4/4/2024	7/10/2024	4/4/2024	7/10/2024	4/4/2024	7/10/2024
Volatile Organic Compounds (VOCs) - ug/L														
1,1-Dichloroethene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**10**	ND	ND
2-Butanone	**50**	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	3.6 J
1,1-Dichloroethane	**5**	ND	1.8 J	1.4 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	**0.6**	ND	ND	ND	ND	ND	0.15 J	ND	0.2 J	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	**50**	ND	ND	5.4	**54**	24	4.6 J	ND	4.5 J	ND	ND	ND	31	3.3 J
Benzene	**1**	ND	ND	ND	ND	ND	**1.6**	0.27 J	0.29 J	0.18 J	ND	ND	ND	ND
Bromomethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	**6.4**	ND	ND	ND	ND
Cyclohexane	**--**	ND	ND	1.2 J	ND	ND	ND	ND	0.65 J	ND	ND	ND	ND	ND
Methyl tert butyl ether (MTBE)	**10**	ND	2.7	2.5	ND	ND	4.1	1.3 J	ND	ND	ND	ND	ND	ND
Methyl cyclohexane	**--**	ND	ND	1.3 J	ND	1.3 J	ND	ND	1.1 J	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	**5**	ND	ND	ND	ND	ND	**11**	1.2 J	ND	ND	**1,300**	**1,600**	ND	ND
Toluene	**5**	ND	ND	ND	ND	ND	ND	ND	0.71 J	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	**5**	ND	ND	ND	ND	ND	2.5	ND	ND	ND	**49 J**	**53**	ND	ND
Trichloroethene	**5**	ND	ND	ND	ND	ND	2.7	1	**7.2**	**9.1**	**3,300**	**3,000**	1.6	0.92
Vinyl Chloride	**2**	ND	ND	ND	ND	ND	0.6 J	0.22 J	ND	ND	**79**	**94**	ND	ND
Total TICs	**--**	ND	ND	1.01 J	1.85 J	ND	ND	ND	4.89 J	15.1 J	ND	ND	1.23 J	1.50 J
Semivolatile Organic Compounds (SVOCs) - ug/L														
2-Methylnaphthalene	**--**	ND	ND	ND	ND	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND
3-Methylphenol/4-methylphenol*	**5**	ND	ND	ND	ND	2.3 J	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND
Acetophenone	**--**	ND	ND	ND	ND	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND
Anthracene	**50**	ND	ND	ND	ND	0.03 J	ND	ND	0.02 J	ND	ND	ND	ND	ND
Benzo(a)anthracene	**0.002**	ND	ND	ND	**0.02 J**	ND	ND	ND	**0.04 J**	ND	ND	ND	ND	ND
Benzo(a)pyrene	**0**	ND	ND	ND	ND	ND	ND	ND	**0.03 J**	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	**0.002**	ND	ND	ND	ND	ND	ND	**0.04 J**	**0.05 J**	ND	ND	ND	ND	ND
Benzo(ghi)perylene	**--**	ND	ND	ND	ND	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.002**	ND	ND	ND	ND	ND	ND	ND	**0.02 J**	ND	ND	ND	ND	ND
Chrysene	**0.002**	ND	ND	ND	ND	ND	ND	ND	**0.03 J**	ND	ND	ND	ND	ND
Fluoranthene	**50**	ND	ND	ND	0.06 J	0.03 J	0.04 J	0.09 J	0.09 J	ND	ND	ND	ND	ND
Fluorene	**50**	ND	ND	ND	ND	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND
Hexachlorobenzene	**0.04**	ND	ND	ND	ND	0.04 J	ND	ND	0.01 J	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.002**	ND	ND	ND	ND	ND	ND	ND	**0.02 J**	ND	ND	ND	ND	ND
Naphthalene	**10**	0.08 J	ND	ND	0.06 J	ND	ND	ND	0.06 J	ND	ND	ND	ND	ND
Pentachlorophenol	**1**	ND	ND	0.08 J	0.16 J	0.08 J	ND	ND	ND	ND	ND	ND	0.03 J	ND
Phenanthrene	**50**	0.03 J	ND	ND	0.04 J	ND	0.04 J	0.07 J	0.07 J	ND	ND	ND	ND	ND
Pyrene	**50**	ND	ND	ND	0.05 J	ND	0.03 J	0.06 J	0.07 J	ND	ND	ND	ND	ND
Phenol	**1**	ND	ND	ND	ND	1.1 J	ND	**1.20 J**	ND	ND	ND	ND	ND	ND
Total TICs	**--**	34.6 J	45.5 J	16.3 J	87.7 J	32.8 J	67.6 J	36.8 J	34.4 J	ND	21.9 J	140 J	108 J	4 J
Total Metals - ug/L [4]														
Aluminum	**--**	3.27 J	ND	8.85 J	7 J	9.84 J	3.87 J	11.7	8.02 J	12.3	ND	10.9	6.25 J	22.4
Antimony	**3**	ND	0.76 J	0.48 J	1.114 J	0.630 J	ND	ND	ND	ND	ND	1.24 J	ND	0.43 J
Arsenic	**25**	1.84	1.44	2.28	5.63	0.95 J	3.26	1.48	1.74	0.55	8.02	3.73	5.4	4.05
Barium	**1000**	122.2	70.04	69.55	175.8	110.4	59.51	63.35	45.68	59.62	137.5	106.1	101.6	90.55
Calcium	**--**	161,000	49,900	49,300	39,300	33,300	35,000	32,200	135,000	148,000	125,000	86,100	54,400	37,900
Chromium	**50**	ND	ND	ND	0.2 J	ND	ND	ND	0.31 J	ND	0.21 J	ND	0.35 J	ND
Cobalt	**--**	0.56	0.16 J	0.16 J	1	ND	ND	ND	ND	ND	0.17 J	ND	0.38 J	ND
Copper	**200**	0.66 J	0.87 J	0.64 J	0.62 J	ND	0.42 J	ND	0.59 J	0.42 J	ND	ND	0.40 J	ND
Iron	**300**	24.2 J	ND	34.4 J	218	27.2 J	ND	32.1 J	**1,070**	24.6	**1,360**	99.7	178	21.9 J
Lead	**25**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37 J	ND	ND
Magnesium	**35000**	**36,600**	**73,500**	**68,600**	**62,100**	**51,600**	30,300	20,800	**54,600**	**94,700**	**154,000**	**89,900**	**81,400**	**58,100**
Manganese	**300**	105.1	46.95	30.33	140.8	22.47	20.02	12.64	66.6	41.86	35.67	26.6	47.31	35.9
Mercury	**0.7**	ND	ND	ND	ND	ND	ND	ND	ND	0.11 J	ND	0.11 J	ND	0.11 J
Nickel	**100**	1.12 J	ND	0.57 J	1.71 J	ND	0.9 J	0.8 J	0.64 J	0.69 J	2.67	2.8	ND	ND
Potassium	**--**	8190	5400	4030	5560	3820	2130	1,580	10400	5720	4320	3220	4650	2100
Sodium	**20000**	18,900	**52,600**	**51,300**	**24,500**	**20,800**	**62,200**	**53,900**	**395,000**	**46,000**	**238,000**	**414,000**	**674,000**	**50,300**
Thallium	**0.5**	ND	ND	ND	ND	ND	ND	0.26 J	ND	ND	ND	ND	ND	ND
Zinc	**2000**	6.02 J	ND	ND	5.38 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pesticides - ug/L														
4,4'-DDT	**0.2**	ND	ND	ND	ND	ND	ND	ND	0.021 JIP	ND	ND	ND	ND	ND
Total Pesticides	**--**	ND	ND	ND	ND	ND	ND	ND	0.021	ND	ND	ND	ND	ND
Herbicides - ug/L														
Herbicides were not detected at concentrations above laboratory detection limits														
Polychlorinated Biphenyls - ug/L														
PCBs were not detected at concentrations above laboratory detection limits														
Perfluorinated Alkyl Acids - ng/L														
Perfluorobutanoic acid (PFBA)	**--**	1.22 J	1.11 J	1.63 J	1.72 J	2.02 J	6.83	8.52	9.16	4.04 J	3.28 J	4.02 J	7.45	5.96
Perfluoropentanoic acid (PFPeA)	**--**	1.29 J	2.30 J	1.76 J	2.26 J	1.47 J	5.03	6.42	12.20	0.91 J	ND	1.56 J	3.50	4.16
Perfluorobutanesulfonic acid (PFBS)	**--**	0.535 J	ND	ND	ND	ND	0.838 J	0.925 J	ND	ND	ND	ND	ND	ND
Perfluorohexanoic acid (PFHxA)	**--**	1.75	1.42 J	0.804 J	2.07	1.33 J	5.09	6.89	7.38	0.531 JF	ND	0.781 J	2.91	1.69
Perfluoroheptanoic acid (PFHpA)	**--**	0.968 J	0.469 JF	ND	0.602 JF	0.298 J	3.29	5.23	2.04	ND	ND	ND	0.567 J	0.359 J
Perfluorooctanoic acid (PFOA)	**6.7**	3.92	1.43 J	ND	1.19 J	0.789 J	3.38	4.68	ND	ND	ND	ND	0.675 J	ND
Perfluorooctanesulfonic acid (PFOS)	**2.7**	ND	ND	ND	ND	1.06 J	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
1. Only parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards/Guidance Values (GWQS/GV).
3. Values per NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substance (PFAS) Under NYSDEC's Part 375 Remedial Programs (April 2023).
4. Total Metals for MW-2, MW-3, and MW-4 represent the dissolved metals concentrations for the samples dated 5/28/2024.

Qualifiers:
ND = Parameter not detected above laboratory detection limit.
-- = No GWGS/GV or NYSDEC Action Level available, or parameter not analyzed for.
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.
I = The lower value for the two columns has been reported due to obvious interference.
J = Estimated Value - Below calibration range.
P = The RPD between the results for the two columns exceeds the method-specified criteria.

BOLD	= Result exceeds GWQS/GV

APPENDIX A

REGENESIS PERSULFOX®
PRODUCT INFORMATION

Project Summary

REGENESIS appreciates the opportunity to provide Roux our remedial design and cost estimate for the 1681-1689 Main Street project. This proposal includes an overview of our proposed solution, the project goals, technologies proposed, application design summary table and a treatment area map.

Proposed Solution

We propose treatment with PersulfOx to address residual contamination within the target treatment zone. These reagents should be applied via direct push technologies.

Project Goals

- Reduce residual groundwater contamination within the treatment interval
- Achieve Track 1 cleanup

Technologies Proposed

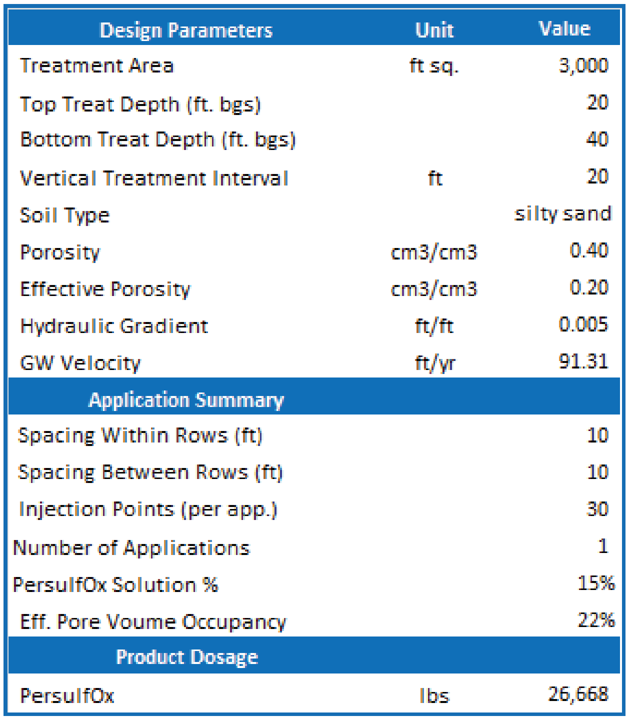
- PersulfOx®

Click above to access product specification sheets

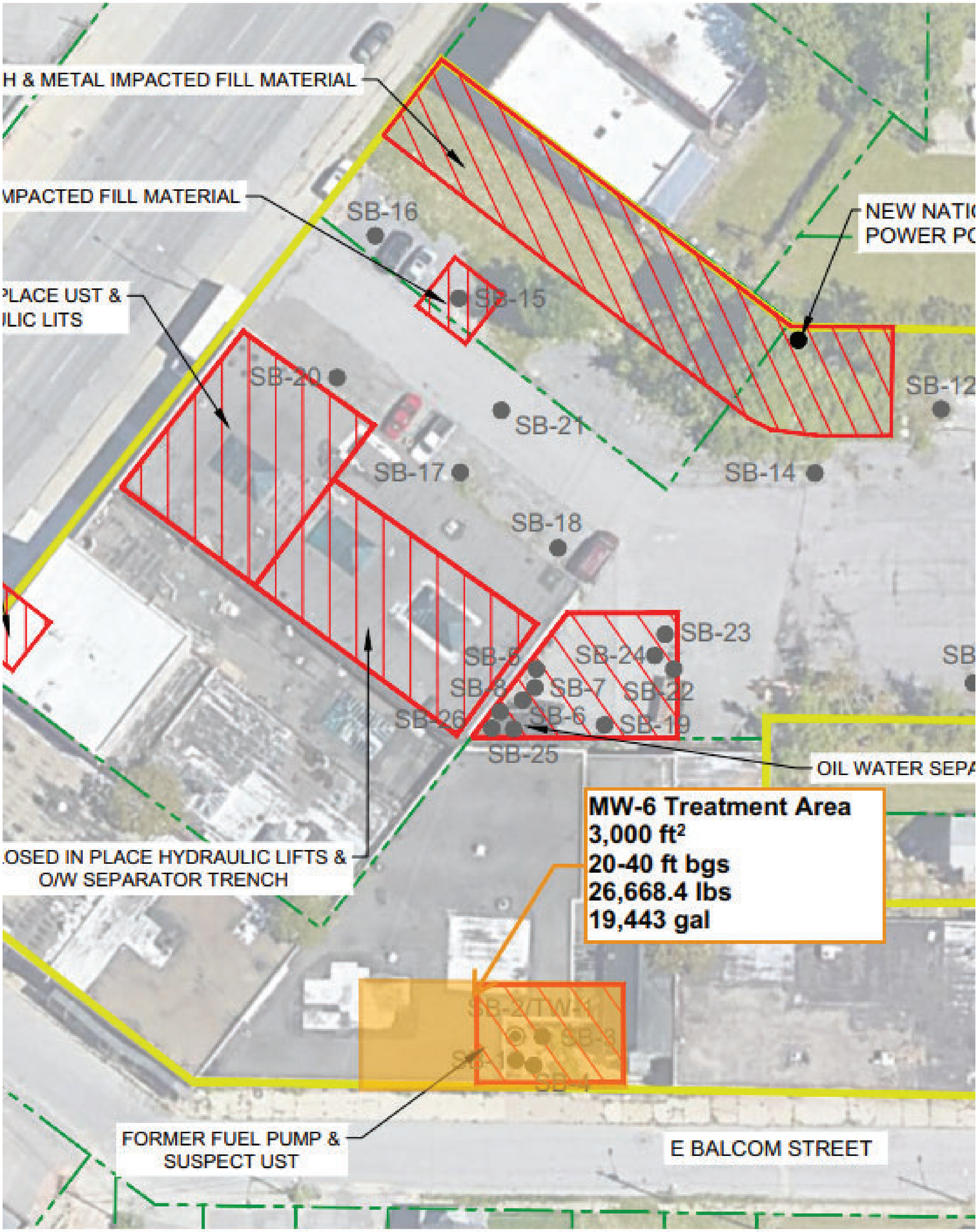
Technical Resources

- PersulfOx® Technical Bulletin: Advantages of the Persulfox Catalyst
- PersulfOx® Technical Bulletin: Contaminant Oxidation Data
- PersulfOx SDS

Design Summary



Design Parameters	Unit	Value
Treatment Area	ft sq.	3,000
Top Treat Depth (ft. bgs)		20
Bottom Treat Depth (ft. bgs)		40
Vertical Treatment Interval	ft	20
Soil Type		silty sand
Porosity	cm3/cm3	0.40
Effective Porosity	cm3/cm3	0.20
Hydraulic Gradient	ft/ft	0.005
GW Velocity	ft/yr	91.31
Application Summary		
Spacing Within Rows (ft)		10
Spacing Between Rows (ft)		10
Injection Points (per app.)		30
Number of Applications		1
PersulfOx Solution %		15%
Eff. Pore Voume Occupancy		22%
Product Dosage		
PersulfOx	lbs	26,668



1681-1689 Main Street

Roux

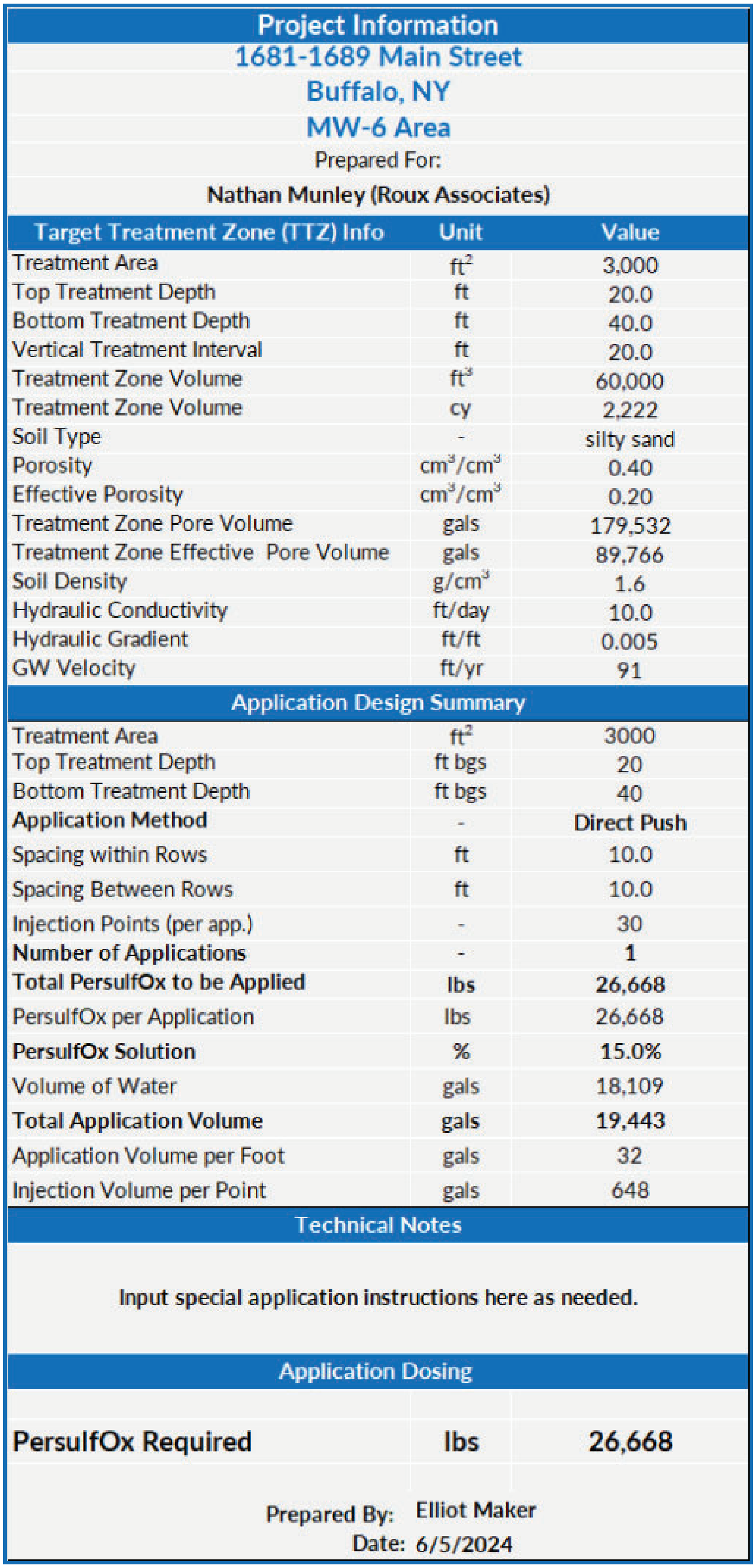
June 05, 2024

Figure 1-Treatment Area Map

REGENESIS

Technology-Based Solutions for the Environment

Detailed Design Table



Project Information

1681-1689 Main Street
Buffalo, NY
MW-6 Area
Prepared For:
Nathan Munley (Roux Associates)

Target Treatment Zone (TTZ) Info	Unit	Value
Treatment Area	ft^2	3,000
Top Treatment Depth	ft	20.0
Bottom Treatment Depth	ft	40.0
Vertical Treatment Interval	ft	20.0
Treatment Zone Volume	ft^3	60,000
Treatment Zone Volume	cy	2,222
Soil Type	-	silty sand
Porosity	cm^3/cm^3	0.40
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	179,532
Treatment Zone Effective Pore Volume	gals	89,766
Soil Density	g/cm^3	1.6
Hydraulic Conductivity	ft/day	10.0
Hydraulic Gradient	ft/ft	0.005
GW Velocity	ft/yr	91

Application Design Summary

Treatment Area	ft^2	3000
Top Treatment Depth	ft bgs	20
Bottom Treatment Depth	ft bgs	40
Application Method	-	**Direct Push**
Spacing within Rows	ft	10.0
Spacing Between Rows	ft	10.0
Injection Points (per app.)	-	30
Number of Applications	-	**1**
Total PersulfOx to be Applied	**lbs**	**26,668**
PersulfOx per Application	lbs	26,668
PersulfOx Solution	**%**	**15.0%**
Volume of Water	gals	18,109
Total Application Volume	**gals**	**19,443**
Application Volume per Foot	gals	32
Injection Volume per Point	gals	648

Technical Notes

Input special application instructions here as needed.

Application Dosing

PersulfOx Required	**lbs**	**26,668**

Prepared By: Elliot Maker
Date: 6/5/2024

PersulfOx® Technical Description

Example of PersulfOx

PersulfOx is an *In Situ* Chemical Oxidation (ISCO) reagent that destroys organic contaminants found in groundwater and soil through powerful, yet controlled, chemical reactions. A sodium persulfate-based technology (figure 1), PersulfOx employs a patented catalyst to enhance the oxidative destruction of both hydrocarbons and chlorinated contaminants in the subsurface.

Typically, sodium persulfate is activated with the addition of heat, chelated metals, hydrogen peroxide, or base in order to generate sulfate radicals. These activation processes are inherently complex, costly and can pose additional health and safety risks. In comparison, PersulfOx is a relatively safe and easy-to-use ISCO agent with a built-in catalyst which activates the persulfate component, generating contaminant-destroying free radicals without the need for the addition of a separate activator. The equation below shows the net complete oxidation of toluene, a constituent of gasoline, by PersulfOx:

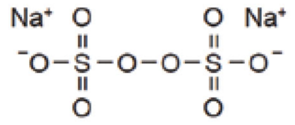


FIGURE 1: SODIUM PERSULFATE CHEMICAL STRUCTURE

For a list of treatable contaminants with the use of PersulfOx, view the Range of Treatable Contaminants Guide

Chemical Composition

- Sodium Persulfate - CAS #7775-27-1
- Sodium Silicate - CAS #1344-09-8

Properties

- pH - 7 to 11.5 at 25°C
- Appearance – White, free-flowing powder, clear to cloudy when mixed with water
- Odor – Not detectable
- Vapor Pressure – None
- Chemical Hazard Classification - Class 5.1 Oxidizer

Storage and Handling Guidelines

Storage
Store locked up
Keep away from heat
Store in a cool, dry place out of direct sunlight

Handling
Minimize dust generation and accumulation
Routine housekeeping should be instituted to ensure that dust does not accumulate on surfaces

PersulfOx® Technical Description

Storage (continued)
Store in original tightly closed container
Store in a well-ventilated place
Do not store near combustible materials
Store away from incompatible materials
Recommended to store at less than 40°C
Provide appropriate exhaust ventilation in places where dust is formed

Handling (continued)
Avoid mixing with combustibles
Avoid contamination
Keep away from clothing and other combustible materials
Wear appropriate personal protective equipment
Avoid breathing dust
Avoid contact with eyes, skin, and clothing
Avoid prolonged exposure
Do not taste or swallow
When using, do not eat, drink or smoke
Wear appropriate personal protective equipment
Wash hands thoroughly after handling
Observe good industrial hygiene practices

Applications

- PersulfOx is mixed with water at a rate of 5% to 20% prior to application.
- For most applications, REGENESIS suggests a 10-15% solution. The resulting mixture has viscosity similar to water.
- Injects into formation through direct push injection points, injection wells or other injection delivery systems.

Application instructions for this product are contained here PersulfOx Application Instructions.

Health and Safety

Material is relatively safe to handle; however, avoid contact with eyes, skin and clothing. OSHA Level D personal protection equipment including: vinyl or rubber gloves, eye protection, and dust mask are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: PersulfOx SDS.

Advantages of the PersulfOx® Catalyst

When combined with an appropriate activation or catalysis technology, sodium persulfate ($Na_2S_2O_8$) is known to be an effective oxidant for organic contaminants in soil and groundwater. This *in situ* chemical oxidation (ISCO) process is chemically complex and can vary in effectiveness, ease of application, and safety profile depending on the activation technology selected.
In addition, there are both catalytic and stoichiometric (sacrificial) methods of activating persulfate. This bulletin outlines the primary commercially-available activation technologies and distinguishes the advantages of using REGENESIS' PersulfOx®-a catalyzed sodium persulfate ISCO product.

PersulfOx Catalysis

PersulfOx is composed of the oxidant sodium persulfate, mixed with a patented silica-based heterogeneous catalyst for contaminant oxidation. The term "heterogeneous" refers to the fact that the catalyst is composed of microscopic solid particles rather than a dissolved species. Liquid-phase oxidation reactions are facilitated repeatedly on the surface of the catalyst. This catalyst is related to the RegenOx® technology and has the ability to perform the following functions:

- Generates sulfate radical and other oxidizing species
- Absorbs both contaminant molecules and oxidizing species on its surface to accelerate oxidation
- Catalyzes direct and free-radical-mediated oxidation of contaminants by sodium persulfate
- Is a true catalyst, and is therefore considered to be "green" under the USEPA Green Chemical definition

Alkaline Activation

The use of caustic sodium hydroxide is sometimes employed in field ISCO applications to activate sodium persulfate. Alkaline activation requires the pH of the aquifer to be maintained above pH 11, which can be challenging given the high buffering capacity of many soils and the generation of acids by persulfate oxidation. This method is a stoichiometric process by which hydroxide ions are consumed as sulfate radical and other oxidizing species are formed. Because of the sacrificial nature of alkaline activation, this process may deactivate as pH is lowered. There are also significant health and safety concerns surrounding on-site handling of 25% sodium hydroxide, a strongly caustic material.

Hydrogen Peroxide Activation

In this method of activation, hydrogen peroxide is mixed with sodium persulfate in water before injection into the subsurface. The mechanisms of this process are not well known, however it is postulated that soil minerals may play a part in hydrogen peroxide reactivity. In addition, the temperature increase associated with hydrogen peroxide decomposition may actually provide some thermal activation of the persulfate.

Hydrogen peroxide is an unstable and sacrificial activator which will be totally depleted in most sites within 1 to 2 days. In addition, the heat and gas pressure associated with hydrogen peroxide injection can present significant health and safety concerns as they have with traditional Fenton's ISCO applications.

Heat Activation

It is well known in the chemical and environmental literature that heating persulfate in water causes generation of sulfate radicals and aggressive promotes oxidation of most organics. However, in the remediation industry this has very little practicality due to the high costs of infrastructure and energy required to heat soil and groundwater *in situ*.

Chelated Iron Activation

Ferrous iron (Fe^{2+}) can react with sodium persulfate to generate sulfate radicals. This reaction is the basis for chelated iron activation – another commercially available method of persulfate activation for ISCO. The term "chelated" refers to the fact that the iron is stabilized by a ligand or "chelator", usually an organic molecule like EDTA (ethylene diamine tetraacetate). The purpose of the chelation is to keep the iron in solution and allow continuous repeated activation of persulfate. Chelated iron is a catalytic activation technology. There are a couple conceptual limitations to the chelated iron activation approach. Chelated iron has the ability to oxidize a limited range of contaminants. For example it is not effective for destruction of aliphatic hydrocarbons or chlorinated ethanes. In addition, the chelating agent is an organic compound that can be degraded by the activated persulfate. This can cause loss of efficacy over time.

Sacrificial Activation vs. Catalysis

There is an important distinction among persulfate activation technologies in that some are catalytic while others are stoichiometric (sacrificial). The following definitions are based in chemistry and the specific context of persulfate-based ISCO:

activation: *n.* the process of facilitating the oxidation of contaminants by persulfate. This is a general term that may refer to either catalytic or stoichiometric transformations.

catalysis: *n.* the process of facilitating the oxidation of contaminants by persulfate, specifically using a chemical (catalyst) that is conserved in the reactions. The catalyst is neither created or destroyed and can be recycled indefinitely. It is not depleted over time.

With these definitions in mind, one can see several advantages of a catalyst over a sacrificial activation technology. For example, regardless of how long the ISCO process takes in a given site, the PersulfOx catalyst will persist and be active toward contaminant and oxidant. In contrast, alkaline activation consumes hydroxide ions with each molecule of sodium persulfate activated. Over time the oxidation reactions can be inhibited by the absence of hydroxide ions and the corresponding drop in pH.

Conclusions

In summary, the PersulfOx catalyst effectively facilitates oxidation of a wide range of groundwater and soil contaminants. Catalytic oxidation by PersulfOx is persistent over time, as the catalyst is reusable and not depleted in the subsurface over many oxidation cycles. In contrast, alkaline activation is subject to the limitations of stoichiometric activation. The combination of high buffering capacity in soils and the depletion of hydroxide activator over time can limit the ability to establish and maintain necessary pH conditions for contaminant oxidation. Table 1 below summarizes some of the attributes discussed here for each ISCO persulfate activation technology.

Table 1. Comparison of Persulfate Activation Technologies

	Reactive Species					Contaminants Treated				
Activation Technology	Sulfate Radicals	Other Oxygen Radicals	Cost Prohibitive	Catalytic	Sacrificial	Aliphatic Hydrocarbons (TPH)	BTEX	Chlorinated Ethenes	Chlorinated Ethanes	Oxygenates
PersulfOx	✓	✓		✓		✓	✓	✓	✓	✓
Heat	✓	✓	✓			✓	✓	✓	✓	✓
Alkaline	✓	✓			✓	✓	✓	✓	✓	✓
Chelated Iron	✓	✓		✓			✓	✓		✓
Hydrogen Peroxide	✓	✓			✓	✓	✓	✓	✓	✓

Contaminant Oxidation Data

PersulfOx® is a catalyzed form of sodium persulfate ($Na_2S_2O_8$) for use in the destruction of groundwater and soil contaminants. Commonly encountered contaminants that can be treated by PersulfOx include hydrocarbons, chlorinated ethenes, oxygenates, and chlorinated ethanes. To demonstrate the efficacy of PersulfOx for treating these compounds, a series of laboratory contaminant oxidation experiments were performed on representative contaminants.

Experimental Procedure

For each contaminant tested, a contaminant stock solution was prepared in distilled water to deliver between 100 mg/L and 250 mg/L of a given contaminant to each sample vial. A stock solution of PersulfOx (1.0 M as sodium persulfate) was prepared in distilled water. A control condition and a PersulfOx-treated condition were run in parallel for each study, in triplicate. 10 mL of the contaminant stock solution and 10 mL of the PersulfOx mixture were added to each treated sample vial yielding a final persulfate concentration of 0.5 M. For each control sample, 10 mL of contaminant solution was combined with 10 mL of distilled water. The vials were then stored in the dark at room temperature. After 7 days, the contaminant concentrations in water were measured. The data are reported in table 1 as averages of the triplicate samples.

Table 1. Contaminant Oxidation Data

Contaminant	Starting Concentration (mg/L)	Control 7 d (mg/L)	PersulfOx 7 d (mg/L)	% Oxidized vs. Control
BTEX	232	204	7	96%
trichloroethene (TCE)	226	144	< 1	> 99%
1,4-dioxane[1]	175	105	< 1	> 99%
1,2-dichloroethane (DCA)	101	87	< 10	> 88%

Summary

The data in Table 1 demonstrates the efficacy of PersulfOx for oxidation of the common classes of organic groundwater contaminants: hydrocarbons, chlorinated ethenes, chlorinated ethanes, and oxygenates. As described in PersulfOx Tech bulletin 1.0, PersulfOx is widely applicable to treat a range of organic contaminants and provides significant safety, convenience, and efficacy benefits when compared with other persulfate activation technologies.

REGENESIS
Technology-Based Solutions for the Environment

SAFETY DATA SHEET

1. Identification

Product identifier	**PersulfOx®**
Other means of identification	None.
Recommended use	Soil and Groundwater Remediation.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Company Name	Regenesis
Address	1011 Calle Sombra San Clemente, CA 92673
Telephone	949-366-8000
E-mail	CustomerService@regenesis.com
Emergency phone number	CHEMTREC® at 1-800-424-9300 (International)

2. Hazard(s) identification

Physical hazards	Oxidizing solids	Category 3
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2A
	Sensitization, respiratory	Category 1
	Sensitization, skin	Category 1
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
OSHA defined hazards	Not classified.	

Label elements

Signal word Danger

Hazard statement May intensify fire; oxidizer. Harmful if swallowed. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause respiratory irritation.

Precautionary statement

Prevention Keep away from heat. Keep/Store away from clothing and other combustible materials. Avoid breathing dust. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Contaminated work clothing must not be allowed out of the workplace. Wear protective gloves/eye protection/face protection. In case of inadequate ventilation wear respiratory protection.

Response If swallowed: Call a poison center/doctor if you feel unwell. If on skin: Wash with plenty of water. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a poison center/doctor if you feel unwell. Rinse mouth. If skin irritation or rash occurs: Get medical advice/attention. If eye irritation persists: Get medical advice/attention. If experiencing respiratory symptoms: Call a poison center/doctor. Take off contaminated clothing and wash before reuse. In case of fire: Use appropriate media to extinguish.

Storage Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) None known.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Silicic Acid, sodium salt, sodium silicate	1344-09-8	≤10
Sodium Persulfate	7775-27-1	≥90

Composition comments	All concentrations are in percent by weight unless otherwise indicated.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
Skin contact	Remove contaminated clothing immediately and wash skin with soap and water. In case of eczema or other skin disorders: Seek medical attention and take along these instructions.
Eye contact	Do not rub eyes. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Never give anything by mouth to a victim who is unconscious or is having convulsions. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical advice/attention if you feel unwell.
Most important symptoms/effects, acute and delayed	Irritation of eyes. Exposed individuals may experience eye tearing, redness, and discomfort. Dusts may irritate the respiratory tract, skin and eyes. Difficulty in breathing. Skin irritation. May cause redness and pain. May cause an allergic skin reaction. Dermatitis. Rash.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Take off all contaminated clothing immediately. Contact with combustible material may cause fire. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media	Water spray, fog (flooding amounts).
Unsuitable extinguishing media	Do not use water unless flooding amounts are available. Material reacts with water. Do not use carbon dioxide or other gas filled fire extinguishers; they will have no effect on decomposing persulfates.
Specific hazards arising from the chemical	Greatly increases the burning rate of combustible materials. Containers may explode when heated. During fire, gases hazardous to health may be formed. Combustion products may include: sulfur oxides.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers.
Specific methods	Cool containers exposed to flames with water until well after the fire is out. Avoid dust formation.
General fire hazards	May intensify fire; oxidizer. Contact with combustible material may cause fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep away from clothing and other combustible materials. Wear appropriate protective equipment and clothing during clean-up. Avoid inhalation of dust. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Collect dust using a vacuum cleaner equipped with HEPA filter. If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with the product. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Ventilate the contaminated area. Stop the flow of material, if this is without risk. Spillage collected should be monitored for signs of reaction or decomposition (fuming/smoking). If spilled material is wet, dissolve with large quantity of water. Large Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Minimize dust generation and accumulation. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. Place all material into loosely covered plastic containers for later disposal. For waste disposal, see section 13 of the SDS. Wear appropriate protective equipment and clothing during clean-up.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Keep away from heat. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Avoid contamination. Wear appropriate personal protective equipment (See Section 8). Avoid breathing dust. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Do not taste or swallow. When using, do not eat, drink or smoke. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Keep away from heat. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Store in a well-ventilated place. Do not store near combustible materials. Store away from incompatible materials (see Section 10 of the SDS). Recommended storage temperature: less than 40°C.

8. Exposure controls/personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium Persulfate (CAS 7775-27-1)	TWA	0.1 mg/m3

Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If engineering measures are not sufficient to maintain concentrations of dust particulates below the Occupational Exposure Limit (OEL), suitable respiratory protection must be worn. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection	Use dust-tight, unvented chemical safety goggles when there is potential for eye contact.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier. Frequent change is advisable. Rubber, neoprene or PVC gloves are recommended.
Other	Wear appropriate chemical resistant clothing.
Respiratory protection	Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Respirator type: approved respirator with P100 filters.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Contaminated work clothing should not be allowed out of the workplace.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Free-flowing powder
Color	White.
Odor	Odorless.
Odor threshold	Not available.
pH	11.5 (10% suspension/water) (10 % solution, 77 °F (25 °C))
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not applicable.
Evaporation rate	Not available.
Flammability (solid, gas)	Oxidizer.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	1.5 - 1.8 (68 °F (20 °C))
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Decomposition will occur upon heating.
Viscosity	Not available.
Other information	
Flammability	Non-combustible.

10. Stability and reactivity

Reactivity	Greatly increases the burning rate of combustible materials.
Chemical stability	Decomposes on heating.
Possibility of hazardous reactions	Oxidizing, avoid contact with reducing agents.
Conditions to avoid	Heat. Contact with incompatible materials. Avoid dust formation.
Incompatible materials	Acids. Bases. Combustible material. Reducing agents. Metals. Organic compounds.
Hazardous decomposition products	Oxygen. Sulfur oxides.

11. Toxicological information

Information on likely routes of exposure	
Inhalation	May cause allergy or asthma symptoms or breathing difficulties if inhaled. Dust may irritate respiratory system.
Skin contact	Causes skin irritation. May cause an allergic skin reaction.
Eye contact	Causes serious eye irritation.
Ingestion	Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics	Severe eye irritation. Dusts may irritate the respiratory tract, skin and eyes. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Difficulty in breathing. Skin irritation. May cause redness and pain. May cause an allergic skin reaction. Dermatitis. Rash.

Information on toxicological effects

Acute toxicity	Harmful if swallowed. May cause allergic respiratory and skin reactions. May cause respiratory irritation.

Components	**Species**	**Test Results**
Silicic Acid, sodium salt, sodium silicate (CAS 1344-09-8)		
Acute		
Oral		
LD50	Rat	1280 mg/kg
Sodium Persulfate (CAS 7775-27-1)		
Acute		
Dermal		
LD50	Rabbit	> 10000 mg/kg
Inhalation		
LC50	Rat	> 5.1 mg/l, 4 Hours
Oral		
LD50	Rat	895 mg/kg

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye irritation.
Respiratory or skin sensitization	
Respiratory sensitization	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin sensitization	May cause an allergic skin reaction.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.
Chronic effects	Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		**Species**	**Test Results**
Silicic Acid, sodium salt, sodium silicate (CAS 1344-09-8)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	247 mg/l, 4.2 days
Sodium Persulfate (CAS 7775-27-1)			
Aquatic			
Crustacea	EC50	Daphnia	133 mg/l, 48 hours
Fish		Bluegill (Lepomis macrochirus)	771 mg/l, 96 hours

Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.

Other adverse effects	None known.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT	
UN number	UN1479
UN proper shipping name	Oxidizing solid, n.o.s. (Sodium Persulfate Mixture)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
Packing group	III
Environmental hazards	
Marine pollutant	No
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	62, IB8, IP3, T1, TP33
Packaging exceptions	152
Packaging non bulk	213
Packaging bulk	240
IATA	
UN number	UN1479
UN proper shipping name	Oxidizing solid, n.o.s. (Sodium Persulfate Mixture)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	III
Environmental hazards	No
ERG Code	5L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
IMDG	
UN number	UN1479
UN proper shipping name	OXIDIZING SOLID, N.O.S. (Sodium Persulfate Mixture)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No
EmS	F-A, S-Q
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - Yes Pressure Hazard - No Reactivity Hazard - Yes

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Sodium Persulfate (CAS 7775-27-1)

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	12-February-2015
Revision date	02-April-2015
Version #	02
Further information	HMIS® is a registered trade and service mark of the American Coatings Association (ACA).
HMIS® ratings	Health: 2* Flammability: 0 Physical hazard: 1
NFPA ratings	
Disclaimer	Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

APPENDIX B

US ENVIRONMENTAL PROTECTION AGENCY (USEPA) UNDERGROUND INJECTION CONTROL (UIC) PERMIT