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ENVIRONMENT

Mr. Brian Jankauskas, Environmental Engineer
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A, 12th Floor
625 Broadway
Albany, New York 12233-7015

Subject:
Site Management Plan Addendum
25 Melville Park Road Site
Melville, New York

Date:
July 24, 2015

Contact:
Peter Millionis

Phone:
(267) 685-1815

Email:
Peter.Milionis@arcadis-us.com

Our ref:
NY001332.2012.NB012

Dear Mr. Jankauskas:

This Site Management Plan (SMP) Addendum has been prepared for the 25 Melville Park Road Site (hereinafter referred to as the "Site") in Melville, New York. The Site is being remediated in accordance with the Voluntary Cleanup Agreement (VCA) Index # W1-0778-96-11, Site # 1-52-169, Voluntary Cleanup Site V00128-1, which was issued on January 13, 1998, and the Record of Decision (ROD), which was issued on March 29, 2004. A SMP was submitted to the New York State Department of Environmental Conservation (NYSDEC) in August 2010.

On March 28, 1997, WHCS Melville, L.L.C. (WHCS) entered into a VCA with the NYSDEC that required WHCS to investigate the Site. Because WHCS qualified for "innocent owner" status, WHCS was only required to address the on-site contamination under the VCA. Preliminary results of the investigation performed by WHCS indicated that on-site remediation was required. Therefore, on January 13, 1998, WHCS and the NYSDEC entered into a new VCA to remediate to the extent practical the on-site portion of the groundwater that is impacted with volatile organic compounds (VOCs). The property was sold by WHCS on October 9, 2002. As a result of this property transaction, the executed VCA between WHCS and the NYSDEC was transferred to the new property owner, 25 MPR, LLC (25 MPR), who also qualified for innocent owner status. 25 MPR's obligations under the VCA are limited to the on-site portion of the VOC plume, and they are not responsible for the investigation and remediation of off-site conditions. As a result of the conveyance of the property from 25 MPR to BP Moby Holdings LLC in 2012, BP Moby Holdings LLC

is the fee owner of the property. BP Moby Holdings LLC requested of NYSDEC that it be added as a Co-Volunteer pursuant to the VCA.

This SMP Addendum has been prepared to provide the following updates to the SMP:

- Notifications to the NYSDEC;
- Installation of additional injection wells;
- Revised groundwater monitoring program; and,
- Optimized enhanced reductive dechlorination (ERD) program.

Notifications

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

- Notice within 5 days of any damage or defect to the foundation's structures that reduces or has the potential to reduce the effectiveness of the remedy and likewise any action to be taken to mitigate the damage or defect. Notification shall also be provided to the certifying engineer.
- Notice within 5 days of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of the remedy, including a summary of actions taken, or to be taken. Notification shall also be provided to the certifying engineer.
- Sixty day advance notice of any change in ownership of the Site or the responsibility for implementing the SMP. This notification shall certify that the prospective purchaser has been provided with a copy of approved work plans, reports and the SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing.

- Ten day advance notice of any proposed ground intrusive activities. This notice shall also include a brief description of the work to be performed and that the SMP will be followed by all parties conducting the work. Notification shall also be provided to the certifying engineer.

Installation of Additional Injection Wells

Two (2) additional angle injection wells (IW-28 and IW-29) were installed beneath the northeast portion of the building. The locations of IW-28 and IW-29 are shown on Figure 1. The two additional angle injection wells were drilled and installed using sonic drilling techniques. The injection wells are constructed of 2-inch diameter, internally flush threaded, Schedule 40 stainless steel casing and thirty (30) feet of 2-inch diameter, internally flush threaded, 0.020-inch (20 slot) Johnson Screens Muni-Pak™ pre-packed well screens.

The total depth of wells IW-28 and IW-29 is approximately 95 feet below land surface (ft bls), with screen intervals from approximately 69 to 95 ft bls (80 feet of casing and 30 feet of screen [110 feet of well material]) and 68 to 95 ft bls (75 feet of casing and 30 feet of screen [105 feet of well material]), respectively. Well IW-28 was installed at a 30 degree angle and well IW-29 was installed at a 25 degree angle.

Revised Groundwater Monitoring Program

The groundwater monitoring program is provided in Table 1. The revised groundwater program was approved by the NYSDEC in a letter dated November 21, 2014. Quarterly groundwater monitoring will continue to confirm the concentration of total organic carbon (TOC) within select injection areas and to confirm the aquifer pH is appropriate to sustain ERD. In addition, two groundwater monitoring wells (MW-28M and MW-23) located on the edge of the downgradient in-situ reactive zone (IRZ) will continue to be monitored for VOCs on a quarterly basis. Semi-annual monitoring will include the quarterly groundwater monitoring elements with additional monitoring at monitoring wells MW-7, MW-31, MW-34, and MW-18D. Finally, the annual groundwater monitoring program is generally consistent with the previous annual groundwater monitoring program and includes groundwater plume configuration monitoring and groundwater compliance monitoring.

In addition to the formal groundwater monitoring program presented on Table 1, ARCADIS may periodically sample select injection and/or monitoring wells for sulfate

and dissolved iron to confirm that a reduction in both sulfate and dissolved iron are observed.

Optimized ERD Program

The following sections describe the elements of the optimized ERD program, which includes the following:

- An optimized injection well network to facilitate treatment of the full lateral extent of the source area;
- The use of emulsified vegetable oil (EVO) as the electron donor;
- The injection of sulfate to promote the formation of reactive iron sulfides for abiotic degradation of VOCs; and,
- A revised groundwater monitoring program to incorporate the influence of historical data trends and to incorporate the optimized injection methodology.

A description of each of the optimized ERD program elements is provided below.

Injection Well Network

The optimized ERD injection program includes ten (10) wells with screen lengths ranging from 15 to 30 feet and screened intervals between 45 and 100 ft bls. A summary of the well construction details for the revised injection well network is provided in Table 2. The injection well locations are shown on Figure 1. The optimized ERD program includes the expansion of the source area injection program through the use of additional existing wells. Specifically, the expansion of the injection program will involve incorporating six additional injection wells (wells IW-3, IW-17, IW-20, IW-25, IW-28, and IW-29) into the source area IRZ, in conjunction with injection well IW-27 that is currently used for injections. Injection well IW-24 will no longer be used for injections based upon data from groundwater samples collected at injection well IW-24 and monitoring well IW-21 that demonstrate the source area between IW-24 and IW-21 has been adequately remediated.

The downgradient IRZ injection well network will not change and will consist of the three (3) injection wells (IW-6, IW-11, and IW-15) that are currently used for injections.

Electron Donor Selection and Loading Rate

The bromide tracer test completed as part of the mol-whey pilot program indicates that the average groundwater velocity in the source area is extremely slow. Based upon these data, a more persistent carbon substrate such as EVO may be more efficient at providing excess electron donor to support the ERD process. The commercially available EVO product that was selected for remediation is EOS Pro by EOS Remediation, LLC. Sodium bicarbonate will be added to the EVO by the manufacturer to maintain the pH of the subsurface within the target range for optimal microbial activity.

EVO has been extensively studied and used as an electron donor. The volume of EVO is typically calculated by using soil specific retention factors. Specifically, as EVO is injected, it coats the aquifer materials and is "strained" (e.g., retained) within the aquifer pore throats. Typical EVO retention factors are provided in the Protocol for Enhanced In-Situ Bioremediation Using Emulsified Edible Oil (DOD 2006). Table 3 summarizes the design injection volumes and quantity of EVO for the Site. As shown in Table 3, approximately 22,582 pounds (lbs) of EOS Pro will be injected at an estimated target concentration of 2.9% by volume. As a conservative measure, the total solution injection volume at each injection well has been increased by a straining factor of 1.2. As shown in Table 3, the target volume of injection solution applied to each well varies between 5,900 gallons and 15,400 gallons, with a total target injected volume of 95,500 gallons. These injection volumes and concentrations will be targeted as closely as possible; however, the exact volumes and concentrations added to each well may be increased or decreased depending on the capacity of each injection well to accept fluid.

It is estimated that a single EVO injection will provide sufficient TOC to drive ERD for approximately 2 to 3 years based upon experience at similar sites. Similar to the current methodology for the Site, groundwater samples will be periodically collected for TOC to evaluate and confirm the injection frequency. Supplemental injections may be optimized through the use of alternative amendments including different EVO formulations, alternative pH buffers (e.g., CoBupHMg) or dechlorinating microbial cultures. If different amendments are used during supplemental injection events the NYSDEC will be notified prior to completion of the injection event.

Sulfate Amendment and Loading Rate

Degradation of CVOCs can occur both biologically and abiotically. Recent literature has demonstrated that abiotic degradation of CVOCs can serve as a significant destruction pathway within the right geochemical environments. Abiotic degradation occurs when reactive iron sulfides, such as pyrite, abiotically reduce the target contaminant at the surface of the iron mineral, similar to the process used with zero-valent iron.

The historical operation of the existing anaerobic IRZ has developed the conditions appropriate for the generation of reactive iron minerals. Specifically, as documented through historical site groundwater data, dissolved iron at the site has been observed at concentrations greater than 500 milligrams per liter (mg/L). The dissolved iron is chemically available for reaction with sulfides and the subsequent formation of iron sulfide bearing minerals. Sulfate is quickly converted to hydrogen sulfide, which reacts with dissolved iron to form pyrite.

To maximize the generation of iron sulfide bearing minerals and subsequent abiotic degradation of CVOCs, a source of sulfate (commercially available Epsom salt, also known as magnesium sulfate heptahydrate) will be injected. Table 3 provides a summary of the calculations used to determine the appropriate quantity of Epsom salt.

As shown in Table 3, sufficient Epsom salt will be injected to create a sulfate concentration of approximately 662 mg/L within the injection solution. A concentration of 662 mg/L represents the stoichiometric equivalent concentration to react with 200 mg/L of in-situ dissolved iron. The total quantity of Epsom salt that will be injected at the Site is approximately 1,347 lbs.

Injection Methodology

EVO, sodium bicarbonate, and sulfate will be injected using the same in-line mixing system currently used for the molasses injections. The sodium bicarbonate will be added to the EVO by the manufacturer prior to shipment. To facilitate the injection of Epsom salt a concentrated stock solution will be created in dedicated mixing tanks by adding the appropriate amount of raw material with potable water and continuously mixing it through a recirculation process. The concentrated stock solution will then be added directly to the EVO tanks prior to injection.

A certification statement is provided as Attachment 1. If you have any questions or require additional information, please do not hesitate to contact Peter Milionis at (267) 685-1815.

Sincerely,

ARCADIS of New York, Inc.

Peter Milionis
Project Manager

Copies:
Diana Marrone, Philips International Holding Corp.
Scott Furman, Sive Paget & Riesel, P.C.
Dawn Hettrick, NYSDOH
Geralyn Rosser, SCDHS
Rosalie Rusinko, NYSDEC
Gary Hayes, Goldman Sachs Group, Inc.
File

Attachment 1

Certification Statement

Certification Statement

I, Christina Berardi Tuohy, P.E. certify that I am currently a NYS registered professional engineer and that this *Site Management Plan Addendum* 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).

Christina Berardi Tuohy Date 7/24/15

Christina Berardi Tuohy, P.E.
NYS PE License Number 078743

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Tables

Table 1. Long-Term Groundwater Monitoring Program, 25 Melville Park Road Site, Melville, New York.

			Analysis/Parameter			
		Well	VOCs	LH	TOC	pH
Quarter 1	S	IW-6	--	--	L	F
		IW-17	--	--	L	F
		MW-28M [1]	L	L	L	F
	I	IW-11	--	--	L	F
		IW-18	--	--	L	F
		IW-27	--	--	L	F
		MW-23	L	L	L	F

			Analysis/Parameter			
		Well	VOCs	LH	TOC	pH
Quarter 2	S	IW-6	--	--	L	F
		IW-17	--	--	L	F
		MW-7	L	--	L	F
		MW-28M [1]	L	L	L	F
		MW-31	L	L	--	--
	I	IW-11	--	--	L	F
		IW-18	--	--	L	F
		IW-27	--	--	L	F
		MW-23	L	L	L	F
		MW-34	L	L	--	--
	D	MW-18D	L	--	--	--

			Analysis/Parameter			
		Well	VOCs	LH	TOC	pH
Quarter 3	S	IW-6	--	--	L	F
		IW-17	--	--	L	F
		MW-28M [1]	L	L	L	F
	I	IW-11	--	--	L	F
		IW-18	--	--	L	F
		IW-27	--	--	L	F
		MW-23	L	L	L	F

			Analysis/Parameter			
		Well	VOCs	LH	TOC	pH
Quarter 4 [4]	S	IW-1	--	--	L	F
		IW-6	--	--	L	F
		IW-17 [2]	L	L	L	F
		IW-22	L	--	L	F
		MW-3	L	--	--	--
		MW-4	L	--	--	--
		MW-7	L	--	L	F
		MW-13	L	--	L	F
		MW-14	L	--	--	--
		MW-15	L	--	--	--
		MW-17	L	--	--	--
		MW-28M [1]	L	L	L	F
		MW-31	L	L	--	--
	I	IW-18	L	L	L	F
		IW-23	L	--	L	F
		IW-28 [2]	L	L	L	F
		IW-29 [2]	L	L	L	F
		MW-13D	L	--	L	F
		MW-16D	L	--	L	F
		MW-23	L	L	L	F
		MW-34	L	L	--	--
		MW-35	L	--	--	--
	D	MW-18D	L	--	--	--
		FDW	L	--	--	--
		MW-36	L	--	--	--
		MW-19D [3]	L	--	--	--
		MW-20D [3]	L	--	--	--

See footnotes on last page.

Table 1. Long-Term Groundwater Monitoring Program, 25 Melville Park Road Site, Melville, New York.

Notes:

VOCs - Volatile Organic Compounds
TOC - Total Organic Carbon
LH - Light Hydrocarbons
L - Laboratory analysis

S - Shallow Zone Injection or Monitoring Well
I - Intermediate Zone Injection or Monitoring Well
D - Deep Zone Monitoring Well
F - Field Measurement using a water quality meter

[1] MW-28D was modified (i.e., lower screen was abandoned) and is now identified as MW-28M.

[2] Well will only be sampled for VOCs and light hydrocarbons during the baseline groundwater monitoring event because they will be used as injection wells.

[3] Well will be sampled and analyzed for VOCs only if increasing trends in VOCs are observed in MW-18D.

[4] The Quarter 4 groundwater monitoring event also generally serves as the baseline groundwater monitoring event for the optimized ERD program.

The agency review team may request additions and/or modifications to a sampling round, as needed, based on the results of previous sampling or NAPL monitoring.

Table 2. Injection Well Construction Details, 25 Melville Park Road Site, Melville, New York.

Well Designation	Well Diameter (inches)	Screened Interval (feet bls)	Total Depth (feet bls)	Screen Length (feet)	Vertical Zone Designation	Comments
IW-3	2	45 to 60	60	15	Shallow Zone	Existing Well
IW-6	2	45 to 60	60	15	Shallow Zone	Existing Well
IW-11	2	75 to 90	90	15	Intermediate Zone	Existing Well
IW-15	2	60 to 75	75	15	Intermediate Zone	Existing Well
IW-17	2	50 to 70	70	20	Shallow Zone	Existing Well
IW-20	2	70 to 100	100	30	Intermediate Zone	Existing Well
IW-25 [1]	2	77 to 97	97	20	Intermediate Zone	Existing Well
IW-27 [1]	2	77 to 97	97	20	Intermediate Zone	Existing Well
IW-28 [1]	2	69 to 95	95	30	Intermediate Zone	Existing Well
IW-29 [1]	2	68 to 95	95	30	Intermediate Zone	Existing Well

1. Angle well.
bls = below land surface

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Table 3: Target Injection Volumes

25 Melville Park Road, Melville, New York

Assumptions:

Design Straining Factor =	1.2		Typical Dissolved Iron Concentration in Injection Area =	200	mg/L
EVO Loading Rate =	0.0015	lb/lb	Mg-Moles of Dissolved Iron=	3.448275862	mg-moles/L
Shallow Zone Mobile Porosity =	10%		Solubility of Epsom Salt =	5.9	lb/gallon
Intermediate Zone Mobile Porosity =	7%		% Sulfate in Epsom Salt=	39%	% sulfate in MgSO4*7H20
Soil Bulk Density =	85	lb/cuft	Target Sulfate Concentration =	662.07	mg/L 2 moles required per mole of iron
EVO fraction in vendor product =	60%		Milligrams of Epsom Salt Per Gallon of Fluid =	6412.97	mg/gallon
Design Injection Concentration = (of vendor product)	2.9%				

Well Designation	Total Depth (feet bls)	Screen Length (feet)	Design ROI (feet)	Theoretical Non-Strained Volume (gallons)	Theoretical Strained Volume (gallons)	Theoretical Raw Vegetable Oil Volume (gallons)	Theoretical Vendor Product Volume (gallons)	Theoretical Vendor Product Mass (lbs)	Epsom Salt Required per Well To Achieve Target Concentration (lbs)
IW-3	60	15	16.50	9596	11500	198	330	2726	162.25
IW-6	60	15	16.50	9596	11500	198	330	2726	162.25
IW-11	90	15	16.50	6718	8100	139	231	1908	114.28
IW-15	75	15	16.50	6718	8100	139	231	1908	114.28
IW-17	70	20	16.50	12795	15400	264	440	3635	217.27
IW-20	100	30	14.00	9672	11600	200	333	2748	163.66
IW-25 [1]	97	20	13.00	5560	6700	115	191	1580	94.53
IW-27 [1]	97	20	13.00	5560	6700	115	191	1580	94.53
IW-28 [1]	95	30	13.00	8340	10000	172	287	2369	141.09
IW-29 [1]	95	30	10.00	4935	5900	102	170	1402	83.24
					95500		2735	22582	**1347**

1. Angle well.

ROI = radius of influence

feet bls = feet below land surface

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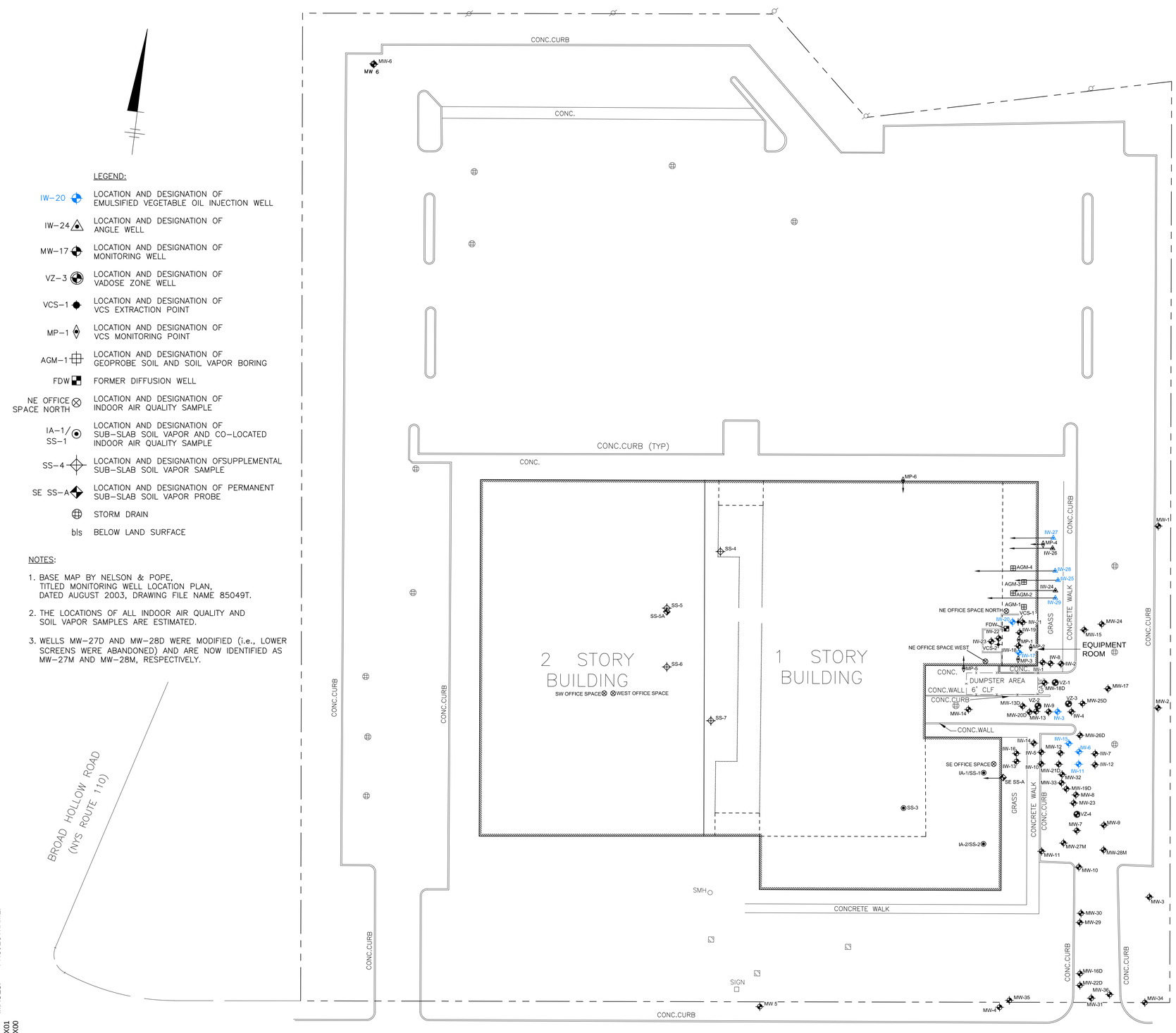
Figures



Well Designation	Well Diameter (inches)	Screened Interval (feet bls)	Total Depth (feet bls)	Vertical Zone Designation
IW-1	2	45 to 60	60	Shallow Zone
IW-2	2	45 to 60	60	Shallow Zone
IW-3	2	45 to 60	60	Shallow Zone
IW-4	2	45 to 60	60	Shallow Zone
IW-5	2	45 to 60	60	Shallow Zone
IW-6	2	45 to 60	60	Shallow Zone
IW-7	2	45 to 60	60	Shallow Zone
IW-8	2	75 to 90	90	Intermediate Zone
IW-9	2	75 to 90	90	Intermediate Zone
IW-10	2	75 to 90	90	Intermediate Zone
IW-11	2	75 to 90	90	Intermediate Zone
IW-12	2	75 to 90	90	Intermediate Zone
IW-13	2	75 to 90	90	Intermediate Zone
IW-14	2	60 to 75	75	Intermediate Zone
IW-15	2	60 to 75	75	Intermediate Zone
IW-16	2	45 to 60	60	Shallow Zone
IW-17	2	50 to 70	70	Shallow Zone
IW-18	2	70 to 100	100	Intermediate Zone
IW-19	2	50 to 70	70	Shallow Zone
IW-20	2	70 to 100	100	Intermediate Zone
IW-21	2	50 to 70	70	Shallow Zone
IW-22	2	50 to 70	70	Shallow Zone
IW-23	2	70 to 100	100	Intermediate Zone
IW-24	2	56 to 75	75	Shallow Zone
IW-25	2	77 to 97	97	Intermediate Zone
IW-26	2	56 to 75	75	Shallow Zone
IW-27	2	77 to 97	97	Intermediate Zone
IW-28	2	69 to 95	95	Intermediate Zone
IW-29	2	68 to 95	95	Intermediate Zone
MW-1	4	40 to 60	60	Shallow Zone
MW-2	4	40 to 60	60	Shallow Zone
MW-3	4	40 to 60	60	Shallow Zone
MW-4	4	40 to 60	60	Shallow Zone
MW-5	4	40 to 60	60	Shallow Zone
MW-6	4	40 to 60	60	Shallow Zone
MW-7	2	40 to 60	60	Shallow Zone
MW-8	2	40 to 60	60	Shallow Zone
MW-9	2	40 to 60	60	Shallow Zone
MW-10	2	40 to 60	60	Shallow Zone
MW-11	2	40 to 60	60	Shallow Zone
MW-12	2	46.5 to 56.5	56.5	Shallow Zone
MW-13	2	48 to 58	58	Shallow Zone
MW-13D	2	80 to 90	90	Intermediate Zone
MW-14	2	46 to 56	56	Shallow Zone
MW-15	2	48.5 to 58.5	58.5	Shallow Zone
MW-16D	2	79.5 to 89.5	89.5	Intermediate Zone
MW-17	2	50 to 60	60	Shallow Zone
MW-18D	4	133 to 143	143	Deep Zone
MW-19D	4	160 to 170	170	Deep Zone
MW-20D	4	175 to 185	185	Deep Zone
MW-21D	4	50 to 160	160	Abandoned
MW-22D	4	48 to 138	138	Abandoned
MW-23	2	70 to 85	85	Intermediate Zone
MW-24	2	45 to 60	60	Shallow Zone
MW-25D	4	40 to 55	90	Abandoned
	4	75 to 90	90	Abandoned
MW-26D	4	35 to 50	85	Abandoned
	4	70 to 85	85	Abandoned
MW-27M [3]	4	40 to 55	90	Shallow Zone
	4	75 to 90	90	Abandoned
MW-28M [3]	4	40 to 55	90	Shallow Zone
	4	75 to 90	90	Abandoned
MW-29	2	45 to 60	60	Shallow Zone
MW-30	4	75 to 90	90	Intermediate Zone
MW-31	4	60 to 70	70	Shallow Zone
MW-32	4	45 to 60	60	Shallow Zone
MW-33	4	70 to 85	85	Intermediate Zone
MW-34	4	70 to 80	80	Intermediate Zone
MW-35	4	70 to 80	80	Intermediate Zone
MW-36	2	115 to 135	135	Deep Zone

25 MELVILLE PARK ROAD
MELVILLE, NEW YORK

INJECTION WELL LOCATIONS

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FIGURE 1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:S.FELDMAN PM:S.FELDMAN TM:C.KEEN LYR:(Op)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTNY\001332\2012\NB012\NY1332B02.dwg LAYOUT: 1 SAVED: 6/19/2015 2:51 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 6/22/2015 7:52 AM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----
X1332X01
X1332X00