ARCADIS Design & Consultancy for natural and built assets

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ENVIRONMENT

Subject:
Results of Second Quarter 2016 System Operation and Monitoring, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York, NYSDEC Site #1-30-003A.

Date:
August 11, 2016

Contact:
David E. Stern

Phone:
631.391.5284

Email:
David E. Stern@arcadis.com

Our ref:
NY001496.1215.OMMI4

Dear Steve:

Enclosed are the results of the Operable Unit 3 Bethpage Park Soil Gas Containment System (OU3 BPSGCS) operation and monitoring, performed in accordance with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2016) and the NYSDEC-approved Sampling and Analysis Plan (SAP; ARCADIS 2016). As we have transitioned to electronic submittals (via PDF) as part of ongoing sustainability and cost savings efforts, hard copies of the report can be provided on request.

If you have any questions, please do not hesitate to contact us.

Sincerely,

Arcadis of New York, Inc.

David E. Stern

Senior Hydrogeologist

Enclosure

Copies:
Steven Karpinski, NYS Dept. of Health
Joseph DeFranco, Nassau County Dept. of Health
Robert Alvey, USEPA Region 2
Carol Stein, USEPA Region 2
Fred Weber, Northrop Grumman Corporation
Edward Hannon, Northrop Grumman Corporation, w/o enclosure
Repository
File

TABLES

Table 1
General System Operating Parameters
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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	DW-7S Parameters			DW-7D Parameters			DW-3S Parameters			DW-3D Parameters			DW-5S Parameters			DW-5D Parameters			DW-6S Parameters			DW-6D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc
09/04/15	105	-21	-1.8	4.0	-10	-0.40	5.5	-6.0	-0.23	13	-7.5	-0.34	95	-17	-1.6	13	-11	-2.2	82	-17	-1.6	6.4	-5.6	-1.3
12/16/15	105	-26	-1.3	8.0	-13	-0.54	8.0	-7.5	-0.27	4.0	-16	-0.23	108	-21	-1.9	14	-12	-2.5	69	-17	-1.6	2.6	-4.5	-0.63
03/08/16	95	-27	-1.6	5.0	-10	-0.55	8.0	-6.0	-0.24	24	-21	-0.58	83	-20	-1.8	13	-12	-2.7	65	-17	-1.5	7.5	-6.0	-1.4
06/01/16	81	-13	-1.7	7.0	-12	-0.50	9.0	-5.8	-0.29	16	-8.0	-0.48	109	-18	-1.7	14	-11	-2.2	79	-15	-1.5	6.6	-5.2	-1.2

Notes and abbreviations on last page.

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Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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	DW-1S Parameters			DW-1D Parameters			DW-4S Parameters			DW-4D Parameters			DW-8S Parameters			DW-9S Parameters			DW-2S Parameters			DW-2D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc
09/04/15	85	-22	-1.7	2.6	-2.3	-1.8	70	-15	-1.3	3.5	-5.0	-0.47	60	-18	-1.7	32	-13	-1.2	28	-24	-1.6	34	-23	-2.2
12/16/15	111	-25	-2.4	2.4	-2.5	-0.79	75	-16	-1.5	5.0	-7.5	-0.64	57	-20	-1.8	37	-15	-1.5	22	-21	-1.4	34	-23	-2.2
03/08/16	82	-24	-2.4	6.3	-3.9	-2.1	63	-15	-1.5	9.0	-7.0	-0.76	59	-18	-1.8	40	-15	-1.6	22	-21	-1.5	35	-24	-2.3
06/01/16	79	-24	-1.7	6.3	-6.0	-1.7	76	-14	-1.4	5.0	-6.3	-0.58	72	-19	-2.0	38	-14	-1.4	29	-23	-1.6	36	-22	-2.1

Notes and abbreviations on last page.

Table 1
General System Operating Parameters
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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	DW-10S Parameters			DW-11S Parameters			Knock Out Tank Parameters - Vacuum			Condensate Water Collected[1]	Blower Parameters BL-200			Blower Parameters BL-300			Blower Parameters BL-400			Combined Effluent Parameters				
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Influent KO-200	Influent KO-300	Influent KO-400	Influent ST-510	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Total Effluent Flow Rate[2]	Total Effluent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	Heat Exchanger Effluent Temp.
Date	scfm	iwc	iwc	scfm	iwc	iwc	iwc	iwc	iwc	Gallons	iwc	iwc	Hz	iwc	iwc	Hz	iwc	iwc	Hz	scfm	ppmv	°F	iwc	°F
09/04/15	32	-16	-1.7	33	-24	-2.3	--	--	-38	105	--	--	--	--	--	--	-37	1.0	60	664	0.0	107	2.0	104
12/16/15	35	-16	-1.8	26	-23	-2.3	--	--	-38	0.0	--	--	--	--	--	--	-41	1.5	60	763	0.0	105	2.5	87
03/08/16	48	-19	-2.6	31	-24	-2.2	--	-40	--	0.0	--	--	--	-43	2.0	60	--	--	--	719	0.1	105	2.5	98
06/01/16	33	-14	-2.0	33	-23	-2.3	--	--	-32	110	--	--	--	--	--	--	-38	1.5	60	727	0.0	110	2.5	101

Notes and abbreviations on last page.

Notes and Abbreviations:

°F	degrees Fahrenheit
DW	depressurization well
gal	gallons
Hz	Hertz
iwc	inches of water column
--	not applicable
PID	photoionization detector
ppmv	parts per million by volume
scfm	standard cubic feet per minute

1. Total gallons of water accumulated at storage tank ST-510 per quarter.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in scfm was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.

Table 2
Induced Vacuum Readings at Compliance Monitoring Points
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York. [1,2]

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Well ID:	DW-7S		DW-7D	DW-3S	DW-3D	DW-5S		DW-5D	DW-1S			DW-1D	DW-4D	DW-8S		DW-2S		DW-2D		DW-11S	
MP ID:	VMWC-14A	VMWC-14B	VMWC-14D	VMWC-11B	VMWC-12D	VMWC-15A	VMWC-15B	VMWC-15D	VMWC-3A	VMWC-3B	VMWC-3C	VMWC-3D	VMWC-16D	VMWC-16A	VMWC-16B	VMWC-7A	VMWC-7B	VMWC-13D	VMWC-17D	VMWC-18A	VMWC-18B
Date	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc
09/04/15	-0.11	-0.18	-0.19	-0.12	-0.13	-0.15	-0.15	-0.15	-0.13	-0.14	-0.13	-0.18	-0.18	-0.13	-0.14	-0.11	-0.10	-0.25	-0.30	-0.10	-0.11
12/16/15	-0.14	-0.23	-0.19	-0.16	-0.13	-0.18	-0.17	-0.16	-0.17	-0.17	-0.18	-0.19	-0.20	-0.16	-0.17	-0.10	-0.10	-0.13	-0.25	-0.10	-0.11
03/08/16	-0.11	-0.15	-0.15	-0.12	-0.14	-0.14	-0.14	-0.15	-0.15	-0.16	-0.17	-0.18	-0.16	-0.15	-0.15	-0.14	-0.13	-0.10	-0.15	-0.11	-0.13
06/01/16	-0.10	-0.15	-0.17	-0.15	-0.17	-0.16	-0.16	-0.15	-0.20	-0.13	-0.13	-0.20	-0.18	-0.16	-0.17	-0.13	-0.15	-0.11	-0.18	-0.11	-0.11
Time Weighted Rolling Average[3]	**-0.12**	**-0.18**	**-0.18**	**-0.14**	**-0.14**	**-0.16**	**-0.16**	**-0.15**	**-0.16**	**-0.15**	**-0.15**	**-0.19**	**-0.18**	**-0.15**	**-0.16**	**-0.12**	**-0.12**	**-0.15**	**-0.22**	**-0.10**	**-0.11**

Gross Average Compliance Points [4]	
06/01/16	-0.15

Notes and Abbreviations:

DW	depressurization well
VMWC	vapor monitoring well cluster
iwc	inches of water column

1 All induced vacuum measurements units in iwc. Values shown have been rounded to two significant figures.

2 Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average.

3 Time weighted rolling average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.

4 Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.

Table 3
Total Effluent Vapor Sample Analytical Results
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.[1]

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Compound (units in µg/m³)		Sample ID: Sample Date:	VSP-601 9/4/2015	VSP-601 12/16/2015	VSP-601 3/8/2016	VSP-601 6/1/2016
Project VOCs	CAS No.	SGC				
1,1,1-Trichloroethane	71-55-6	9,000	**13**	**8.7**	**11**	**8.2**
1,1-Dichloroethane	75-34-3	NS	**11**	**8.5**	**9.7**	**6.1**
1,1-Dichloroethene	75-35-4	19,800[3]	**1.0**	**0.83**	**1.5**	**0.87**
1,2-Dichloroethane	107-06-2	NS	<0.81 U	<0.81 U	**137**	<0.81 U
Benzene	71-43-2	1,300	**23**	**0.38 J**	**9.3**	**0.38 J**
cis-1,2-Dichloroethene	156-59-2	190,000[4]	**424 D**	**251 D**	**488 D**	**268 D**
Tetrachloroethene	127-18-4	300	**24**	**12**	**11**	**12**
Toluene	108-88-3	37,000	**24**	**4.5**	**38**	**0.75**
trans-1,2-Dichloroethene	156-60-5	190,000[4]	**4.8**	**2.4**	**2.1**	**1.7**
Trichloroethylene	79-01-6	14,000	**513 D**	**233 D**	**461 D**	**284 D**
Vinyl chloride	75-01-4	180,000	**0.84**	**0.77**	**3.8**	**0.89**
Xylene-O	95-47-6	22,000	**11**	<0.87 U	<0.87 U	**2.8**
Xylenes - M,P	1330-20-7	22,000	**51**	**0.83 J**	<0.87 U	**5.2**
Subtotal Project VOCs			**1,101**	**523**	**1173**	**591**
Non-Project VOCs						
1,1,2,2-Tetrachloroethane	79-34-5	NS	<1.4 U	<1.4 U	<0.69 U	<0.69 U
1,1,2-Trichloroethane	79-00-5	NS	<1.1 U	<1.1 U	<0.55 U	<0.55 U
1,2-Dichloropropane	78-87-5	NS	<0.92 U	<0.92 U	<0.92 U	<0.92 U
1,3-Butadiene	106-99-0	NS	<0.44 U	<0.44 U	<0.44 U	<0.44 U
2-Butanone	78-93-3	13,000	**1.1**	<0.59 U	**0.97**	**0.65**
2-Hexanone	591-78-6	4,000	**1.8**	<0.82 U	<0.82 U	<0.82 U
4-Methyl-2-Pentanone	108-10-1	31,000	<0.82 U	<0.82 U	<0.82 U	<0.82 U
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	**337 D**	**88**	**140**	**124**
Acetone	67-64-1	180,000	**3.3**	<0.48 U	**8.6**	**4.0**
Bromodichloromethane	75-27-4	NS	<1.3 U	<1.3 U	<0.67 U	<0.67 U
Bromoform	75-25-2	NS	<2.1 U	<2.1 U	**9.3**	<0.41 U
Bromomethane	74-83-9	3,900	<0.78 U	<0.78 U	<0.78 U	<0.78 U
Carbon Disulfide	75-15-0	6,200	<0.62 U	<0.62 U	**1.6**	<0.62 U
Carbon Tetrachloride	56-23-5	1,900	**1.1 J**	<1.3 U	**0.62**	**0.63**
Chlorobenzene	108-90-7	NS	<0.92 U	<0.92 U	<0.92 U	<0.92 U
Chlorodibromomethane	124-48-1	NS	<1.7 U	<1.7 U	**2.6**	<0.85 U

Notes and abbreviations on last page.

Table 3
Total Effluent Vapor Sample Analytical Results
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.[1]

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Compound (units in µg/m³)		Sample ID: Sample Date:	VSP-601 9/4/2015	VSP-601 12/16/2015	VSP-601 3/8/2016	VSP-601 6/1/2016
Non-Project VOCs	CAS No.	SGC				
Chloroethane	75-00-3	NS	<0.53 U	<0.53 U	<0.53 U	<0.53 U
Chlorodifluoromethane (Freon 22)	75-45-6	NS	**2.0**	<0.70 U	<0.70 U	**1.3**
Chloroform	67-66-3	150	**21**	**15**	**11**	**7.3**
Chloromethane	74-87-3	22,000	<0.41 U	<0.41 U	<0.41 U	<0.41 U
cis-1,3-Dichloropropene	10061-01-5	NS	<0.91 U	<0.91 U	<0.91 U	<0.91 U
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	**4.1**	**2.2**	**3.3**	**2.2**
Ethylbenzene	100-41-4	NS	**4.8**	<0.87 U	<0.87 U	**0.39 J**
Trichlorotrifluoroethane (Freon 113)	76-13-1	960,000	<1.5 U	<1.5 U	<0.77 U	<0.77 U
Methyl Tert-Butyl Ether	1634-04-4	NS	<0.72 U	<0.72 U	<0.72 U	<0.72 U
Methylene Chloride	75-09-2	14,000	**0.80**	**1.3**	**1.1**	**3.1**
Styrene	100-42-5	17,000	<0.85 U	<0.85 U	<0.85 U	<0.85 U
Trans-1,3-Dichloropropene	10061-02-6	NS	<0.91 U	<0.91 U	<0.91 U	<0.91 U
Trichlorofluoromethane (Freon 11)	75-69-4	9,000	**1.9**	**1.2**	**1.7**	**2.0**
Subtotal Non-Project VOCs			**379**	**107**	**181**	**146**
TVOC[2]			**1,480**	**630**	**1,354**	**737**

Notes and abbreviations on last page.

Table 3
Total Effluent Vapor Sample Analytical Results
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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Notes and Abbreviations:

Bold	Bold data indicates that the analyte was detected at or above its reporting limit.
ELAP	Environmental Laboratory Approval Program.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014. An interim SGC was not developed for these compounds because they have low toxicity ratings, as specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
CAS No.	Chemical Abstracts Service list number.
DAR-1	Division of Air Resources-1 Air Guide-1.
NYSDEC	New York State Department of Environmental Conservation.
NYSDOH	New York State Department of Health.
AGC	Allowable Annual Guideline Concentration.
SGC	Short-term Guideline Concentrations.
TVOC	total volatile organic compounds
D	Based on diluted sample analysis
J	Estimated.
--	Not analyzed.
U	Compound was analyzed for but not detected
USEPA	U.S. Environmental Protection Agency.
VOC	volatile organic compound
$\mu g/m^3$	micrograms per cubic meter
<	Compound not detected above its laboratory quantification limit.

1. Vapor samples collected by ARCADIS on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.
3. An SGC was not provided in the DAR-1 AGC/SGC Tables, revised February 28, 2014. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for 1,1- dichloroethene, which is not defined as a high-toxicity compound, the Interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2. or 1,600 $\mu g/m^3$ / 4.2 = approximately 380 $\mu g/m^3$. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, revised February 28, 2014.
4. An SGC was not provided in the DAR-1 AGC/SGC Tables, revised February 28, 2014. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for cis-1,2 dichloroethene and trans-1,2 dichloroethene, which are not defined as a high-toxicity compounds, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 $\mu g/m^3$ / 4.2 = approximately 190,000 $\mu g/m^3$. An interim SGC was developed for these compounds because they have moderate toxicity ratings, as specified in the DAR-1 AGC/SGC Tables, revised February 28, 2014.

Table 4
Total Effluent Vapor Sample Analytical Results,
Tentatively Identified Compounds
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Bethpage, New York.[1,2,3]

Sample ID: Sample Date: Units:	VSP-601 9/4/2015 ppbv	VSP-601 12/16/2015 ppbv	VSP-601 3/8/2016 ppbv	VSP-601 6/1/2016 ppbv
1,2,4-Trimethylbenzene	**2.9 JN**	--	--	--
1,2-Dibromoethane	--	--	**170 JN**	--
1-Bromo-2-chloroethane	--	--	**22 JN**	--
2,3-Dimethylpentane	--	**1.4 JN**	--	--
2-Methyl butane	--	**2.3 JN**	--	--
2-Methylpentane	--	**3.8 JN**	--	--
3-Methylhexane	--	**1.4 JN**	--	--
3-Methylpentane	--	**2.2 JN**	--	--
alkane	**3.8 JN**	**2.5 JN**	--	**31 JN**
alkane	--	--	--	**21 JN**
Bromobenzene	--	--	**2.8 JN**	--
C3 alkyl benzene	**1.4 JN**	--	--	--
Ethyl Acetate	--	--	--	**4.9 JN**
Methyl styrene (alpha)	--	--	**1.8 JN**	--
Methylcyclopentane	--	**3.8 JN**	--	--
Pentane	**1.8 JN**	**1.5 JN**	--	--
UNKNOWN VOA ALKENE1	**2.4 JN**	--	--	--
UNKNOWN VOA ALKENE2	**1.3 JN**	--	--	--
UNKNOWN VOA ALKENE3	**1.3 JN**	--	--	--
Vinyl bromide	--	--	**3.1 JN**	--

Notes and Abbreviations:

--	Not analyzed.
B	Indicates analyte found in associated method blank
ELAP	Environmental Laboratory Approval Program.
J	Indicates an estimated value.
JN	Compound tentatively identified, concentration is estimated.
NYSDOH	New York State Department of Health.
ppbv	parts per billion by volume
USEPA	U.S. Environmental Protection Agency.
VOC	volatile organic compound

1. Vapor samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15.
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds.
3. All results are estimated.

Table 5
Summary of SCREEN3 Model Input and Outputs
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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Parameters / Date Sampled:	09/04/15	12/15/15	03/03/16	06/01/16
SCREEN3 Model Input				
Source Type	Point	Point	Point	Point
Emission Rate (g/s)	1	1	1	1
Stack Height (m)	10.1	10.1	10.1	10.1
Stack Inside Diameter (m)	0.41	0.41	0.41	0.41
Air Flow Rate (scfm @ 530 degrees)(1)	664	763	719	727
Air Flow Rate (acfm @ stack temp)(2)	706	787	756	769
Stack Gas Exit Temperature (K)(1)	313	304	310	311
Ambient Air Temperature (K)(3)	297	281	282	295
Receptor Height (m)(4)	1.5	1.5	1.5	1.5
Urban/Rural	Urban	Urban	Urban	Urban
Building Height (m)	2.4	2.4	2.4	2.4
Min Horizontal Bldg Dim (m)	4.9	4.9	4.9	4.9
Max Horizontal Bldg Dim (m)	5.0	5.0	5.0	5.0
Consider Bldg Downwash?	Yes	Yes	Yes	Yes
Simple/Complex Terrain Above Stack	Simple	Simple	Simple	Simple
Simple/Complex Terrain Above Stack Base	Simple	Simple	Simple	Simple
Meteorology	Full	Full	Full	Full
Automated Distances Array	Yes	Yes	Yes	Yes
Terrain Height Above Stack Base	0	0	0	0
SCREEN3 Model Output				
1-HR Max Concentration at Receptor Height ($\mu g/m^3$)(5)	1248	1183	1121	1197
Annualization Factor(6)	0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ($\mu g/m^3$)(7)	99.8	94.6	89.7	95.8
Distance To Max Concentration (m)(8)	46	47	48	47

Notes and abbreviations on last page.

ARCADIS Design & Consultancy for natural and built assets

Notes and Abbreviations:

acfm	actual cubic feet per minute
ft	feet
g/s	grams per second
°K	degrees Kelvin
m	meter
scfm	standard cubic feet per minute
$\mu g/m^3$	micrograms per cubic meter
USEPA	U.S. Environmental Protection Agency

1. The stack air flow rate (in scfm) and exit temperature were measured using a handheld thermo-anemometer. Values were measured at the stack effluent location.
2. The stack air flow rate at the stack temperature (in acfm) was calculated by dividing the stack air flow rate in scfm by the ratio of the standard temperature to the actual stack gas exit temperature.
3. The ambient temperature was recorded from the wunderground.com website for the Long Island Mac Arthur Airport, Ronkonkoma, New York. The mean actual temperature from the website was used in model calculation.
4. The receptor height corresponds to the average inhalation level.
5. SCREEN3 calculated constituent concentration at listed conditions at the specified inhalation level.
6. A USEPA time averaging conversion factor of 0.08 was used to convert the 1-hour maximum concentration output to an annual average.
7. Average annual constituent concentration at the receptor height was calculated by multiplying the one hour maximum concentration by the annualization factor.
8. SCREEN3 calculated distance to the 1-hour maximum concentration.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

Compound	Actual Effluent Concentrations[1] (µg/m^3)			
	9/4/2015	12/16/2015	3/8/2016	6/1/2016
1,1,1-Trichloroethane	13	8.7	11	8.2
1,1-Dichloroethane	11	8.5	9.7	6.1
1,1-Dichloroethene	1.0	0.83	1.5	0.87
1,2-Dichloroethane	0	0	137	0
1-Chloro-1,1-difluoroethane (Freon 142b)	337	87.5	140	124
2-Butanone	1.1	0	0.97	0.65
2-Hexanone	1.8	0	0	0
Acetone	3.3	0	8.6	4.0
Benzene	23	0.38	9.3	0.38
Bromoform	0	0	9.3	0
Carbon disulfide	0	0	1.6	0
Carbon tetrachloride	1.1	0	0.62	0.63
Chlorodibromomethane	0	0	2.6	0
Chlorodifluoromethane (Freon 22)	2.0	0	0	1.3
Chloroform	21	15	11	7.3
cis-1,2-Dichloroethene	424	251	488	268
Dichlorodifluoromethane (Freon 12)	4.1	2.2	3.3	2.2
Ethylbenzene	4.8	0	0	0
Methylene Chloride	0.8	1.3	1.1	3.1
Tetrachloroethene	24	12	11	12
Toluene	24	4.5	38.4	0.75
trans-1,2-Dichloroethene	4.8	2.4	2.1	1.7
Trichloroethylene	513	233	461	284
Trichlorofluoromethane (Freon 11)	1.9	1.2	1.7	2.0
Vinyl chloride	0.84	0.77	3.8	0.89
Xylene-O	11	0	0	2.8
Xylenes - M,P	51.3	0.83	0	5.2

Notes and abbreviations on last page.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

Compound	AGC[3] (µg/m³)	Annual MASC[3] (µg/m3)			
		9/4/2015	12/16/2015	3/8/2016	6/1/2016
1,1,1-Trichloroethane	5,000	1.5E+08	1.4E+08	1.6E+08	1.4E+08
1,1-Dichloroethane	0.63	1.9E+04	1.8E+04	2.0E+04	1.8E+04
1,1-Dichloroethene	200	6.0E+06	5.7E+06	6.2E+06	5.8E+06
1,2-Dichloroethane	0.038	1.1E+03	1.1E+03	1.2E+03	1.1E+03
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	1.5E+09	1.4E+09	1.6E+09	1.4E+09
2-Butanone	5,000	1.5E+08	1.4E+08	1.6E+08	1.4E+08
2-Hexanone	30	9.0E+05	8.5E+05	9.4E+05	8.6E+05
Acetone	30,000	9.0E+08	8.5E+08	9.4E+08	8.6E+08
Benzene	0.13	3.9E+03	3.7E+03	4.1E+03	3.7E+03
Bromoform	0.91	2.7E+04	2.6E+04	2.8E+04	2.6E+04
Carbon disulfide	700	2.1E+07	2.0E+07	2.2E+07	2.0E+07
Carbon tetrachloride	0.17	5.1E+03	4.8E+03	5.3E+03	4.9E+03
Chlorodibromomethane	NS	--	--	--	--
Chlorodifluoromethane (Freon 22)	50,000	1.5E+09	1.4E+09	1.6E+09	1.4E+09
Chloroform	14.7	4.4E+05	4.2E+05	4.6E+05	4.2E+05
cis-1,2-Dichloroethene	63	1.9E+06	1.8E+06	2.0E+06	1.8E+06
Dichlorodifluoromethane (Freon 12)	12,000	3.6E+08	3.4E+08	3.7E+08	3.5E+08
Ethylbenzene	1,000	3.0E+07	2.8E+07	3.1E+07	2.9E+07
Methylene Chloride	60	1.8E+06	1.7E+06	1.9E+06	1.7E+06
Tetrachloroethene	4.0	1.2E+05	1.1E+05	1.2E+05	1.2E+05
Toluene	5,000	1.5E+08	1.4E+08	1.6E+08	1.4E+08
trans-1,2-Dichloroethene	63	1.9E+06	1.8E+06	2.0E+06	1.8E+06
Trichloroethylene	0.2	6.0E+03	5.7E+03	6.2E+03	5.8E+03
Trichlorofluoromethane (Freon 11)	5,000	1.5E+08	1.4E+08	1.6E+08	1.4E+08
Vinyl chloride	0.068	2.0E+03	1.9E+03	2.1E+03	2.0E+03
Xylene-O	100	3.0E+06	2.8E+06	3.1E+06	2.9E+06
Xylenes - M,P	100	3.0E+06	2.8E+06	3.1E+06	2.9E+06

Notes and abbreviations on last page.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

Compound	Percent of Annual MASC[4]				Cumulative % MASC[5]
	9/4/2015	12/16/2015	3/8/2016	6/1/2016	
1,1,1-Trichloroethane	0.0%	0.0%	0.0%	0.0%	0.0%
1,1-Dichloroethane	0.058%	0.047%	0.049%	0.034%	0.047%
1,1-Dichloroethene	0.0%	0.0%	0.0%	0.0%	0.0%
1,2-Dichloroethane	0.0%	0.0%	12%	0.0%	2.7%
1-Chloro-1,1-difluoroethane (Freon 142b)	0.0%	0.0%	0.0%	0.0%	0.0%
2-Butanone	0.0%	0.0%	0.0%	0.0%	0.0%
2-Hexanone	0.0%	0.0%	0.0%	0.0%	0.0%
Acetone	0.0%	0.0%	0.0%	0.0%	0.0%
Benzene	0.59%	0.010%	0.23%	0.010%	0.20%
Bromoform	0.0%	0.0%	0.033%	0.0%	0.0076%
Carbon disulfide	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon tetrachloride	0.022%	0.0%	0.012%	0.013%	0.011%
Chlorodibromomethane	--	--	--	--	--
Chlorodifluoromethane (Freon 22)	0.0%	0.0%	0.0%	0.0%	0.0%
Chloroform	0.0048%	0.0036%	0.0024%	0.0017%	0.0031%
cis-1,2-Dichloroethene	0.022%	0.014%	0.025%	0.015%	0.019%
Dichlorodifluoromethane (Freon 12)	0.0%	0.0%	0.0%	0.0%	0.0%
Ethylbenzene	0.0%	0.0%	0.0%	0.0%	0.0%
Methylene Chloride	0.0%	0.0001%	0.0001%	0.0002%	0.0001%
Tetrachloroethene	0.020%	0.011%	0.0088%	0.010%	0.012%
Toluene	0.0%	0.0%	0.0%	0.0%	0.0%
trans-1,2-Dichloroethene	0.0003%	0.0001%	0.0001%	0.0001%	0.0001%
Trichloroethylene	8.5%	4.1%	7.4%	4.9%	6.1%
Trichlorofluoromethane (Freon 11)	0.0%	0.0%	0.0%	0.0%	0.0%
Vinyl chloride	0.041%	0.040%	0.18%	0.046%	0.074%
Xylene-O	0.0004%	0.0%	0.0%	0.0001%	0.0001%
Xylenes - M,P	0.0%	0.0%	0.0%	0.0002%	0.0%

Notes and abbreviations on last page.

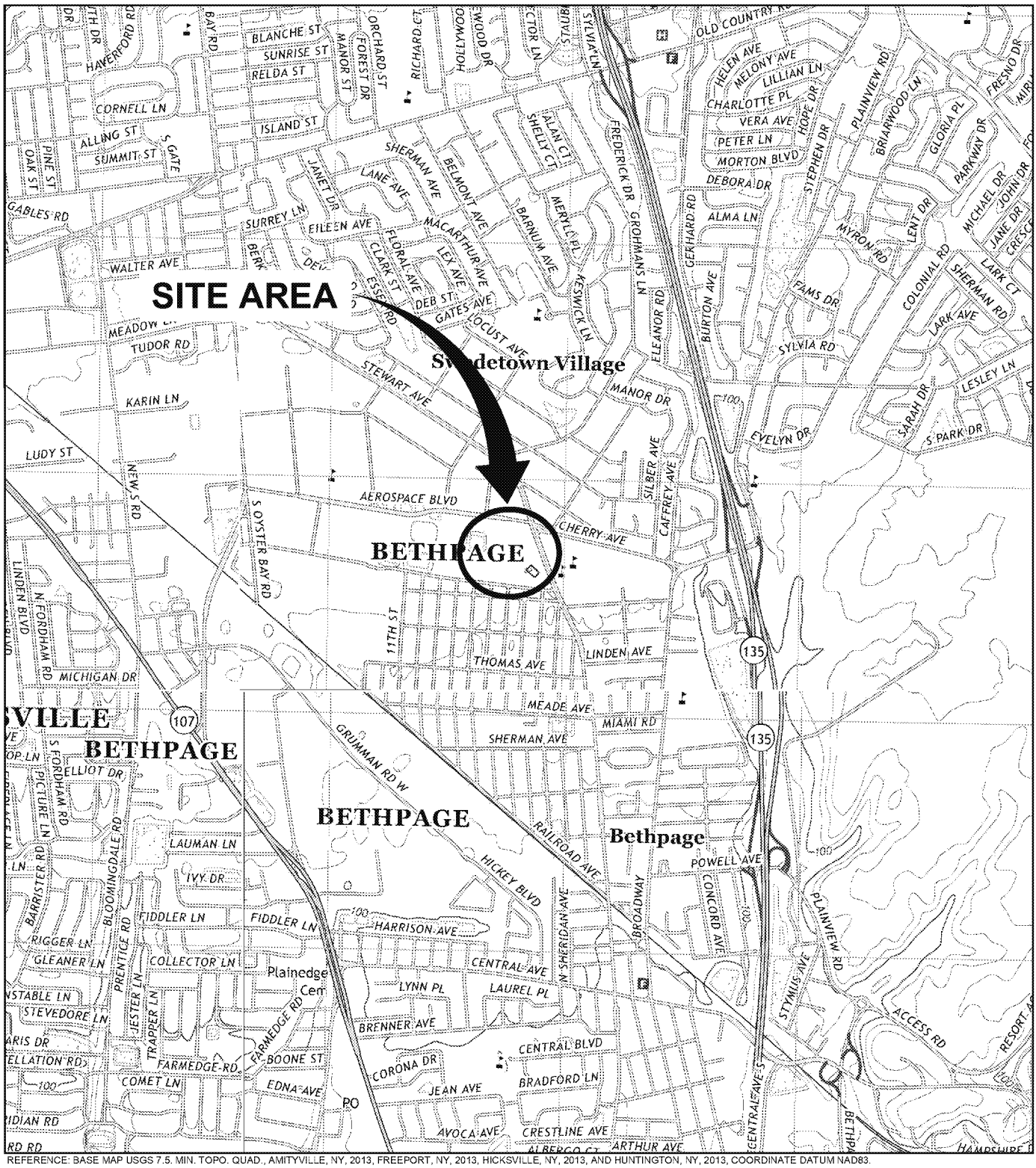
ARCADIS Design & Consultancy for natural and built assets

Notes and Abbreviations:

AGC	Allowable Annual Guideline Concentration
DAR-1	Division of Air Resources Air Guide-1
MASC	Maximum Allowable Stack Concentration
$\mu g/m^3$	micrograms per cubic meter
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
NYSDEC	New York State Department of Environmental Conservation
SGC	Short-term Guideline Concentration
%	percent

1. Actual effluent concentrations are analytical results from air samples collected on the dates shown. Data in this table corresponds to the past year of system operation. Table summarizes detected compounds only.
2. AGC refers to the compound-specific AGC per the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
3. Annual MASC was calculated by dividing the product of the AGC of a compound and the ratio of the SCREEN3 gas emission rate and the SCREEN 3 average annual concentration at receptor height by the air flow rate at the stack temperature and multiplying by the appropriate conversion factors.
4. Percent of MASC was calculated by dividing the actual effluent concentration by the MASC for the past four quarters of operation.
5. Cumulative percent of the MASC was calculated using a time-weighted average of the percent MASC per event. Values shown have been rounded to include two significant figures.

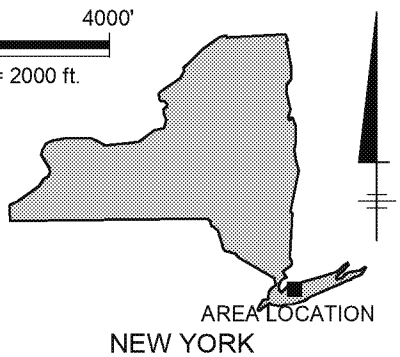
FIGURES



REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., AMITYVILLE, NY, 2013, FREEPORT, NY, 2013, HICKSVILLE, NY, 2013, AND HUNTINGTON, NY, 2013, COORDINATE DATUM NAD83.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.



NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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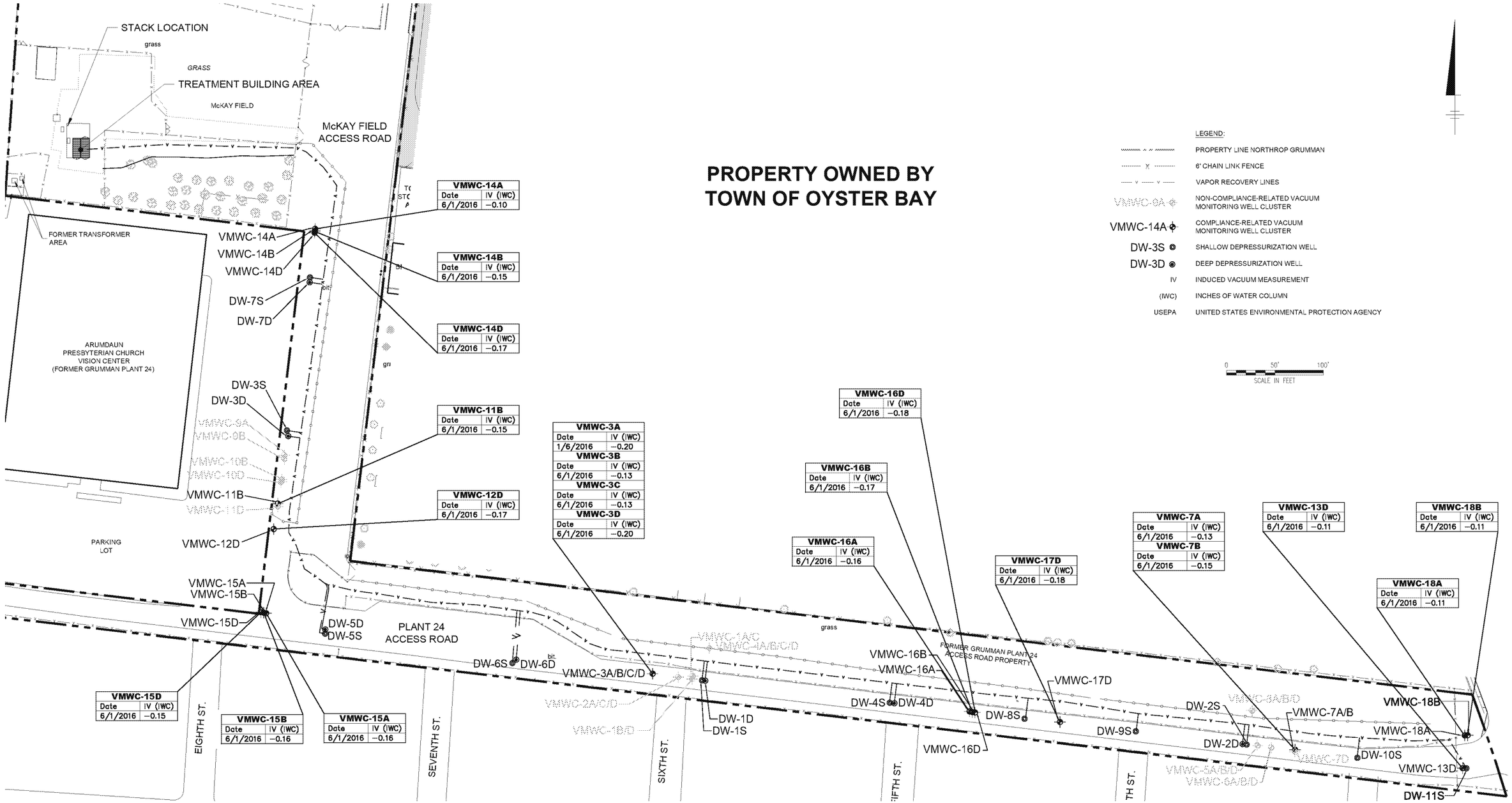
2013Freeport.jpg
2013Hicksville.jpg
2013Huntington.jpg



VMWC-14A	
Date	IV (IWC)
6/1/2016	−0.10

VMWC-14B	
Date	IV (IWC)
6/1/2016	−0.15

VMWC-14D	
Date	IV (IWC)
6/1/2016	−0.17

VMWC-11B	
Date	IV (IWC)
6/1/2016	−0.15

VMWC-12D	
Date	IV (IWC)
6/1/2016	−0.17

VMWC-3A	
Date	IV (IWC)
1/6/2016	−0.20
VMWC-3B	
Date	IV (IWC)
6/1/2016	−0.13
VMWC-3C	
Date	IV (IWC)
6/1/2016	−0.13
VMWC-3D	
Date	IV (IWC)
6/1/2016	−0.20

VMWC-16D	
Date	IV (IWC)
6/1/2016	−0.18

VMWC-16B	
Date	IV (IWC)
6/1/2016	−0.17

VMWC-16A	
Date	IV (IWC)
6/1/2016	−0.16

VMWC-17D	
Date	IV (IWC)
6/1/2016	−0.18

VMWC-7A	
Date	IV (IWC)
6/1/2016	−0.13
VMWC-7B	
Date	IV (IWC)
6/1/2016	−0.15

VMWC-13D	
Date	IV (IWC)
6/1/2016	−0.11

VMWC-18B	
Date	IV (IWC)
6/1/2016	−0.11

VMWC-18A	
Date	IV (IWC)
6/1/2016	−0.11

VMWC-15D	
Date	IV (IWC)
6/1/2016	−0.15

VMWC-15B	
Date	IV (IWC)
6/1/2016	−0.16

VMWC-15A	
Date	IV (IWC)
6/1/2016	−0.16

NOTES:

1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE-RELATED VACUUM MONITORING WELLS ON A 12-MONTH ROLLING AVERAGE (ARCADIS 2007).
3. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE-RELATED VACUUM MONITORING WELLS ONLY.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM, SECOND QUARTER 2016

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FIGURE
2

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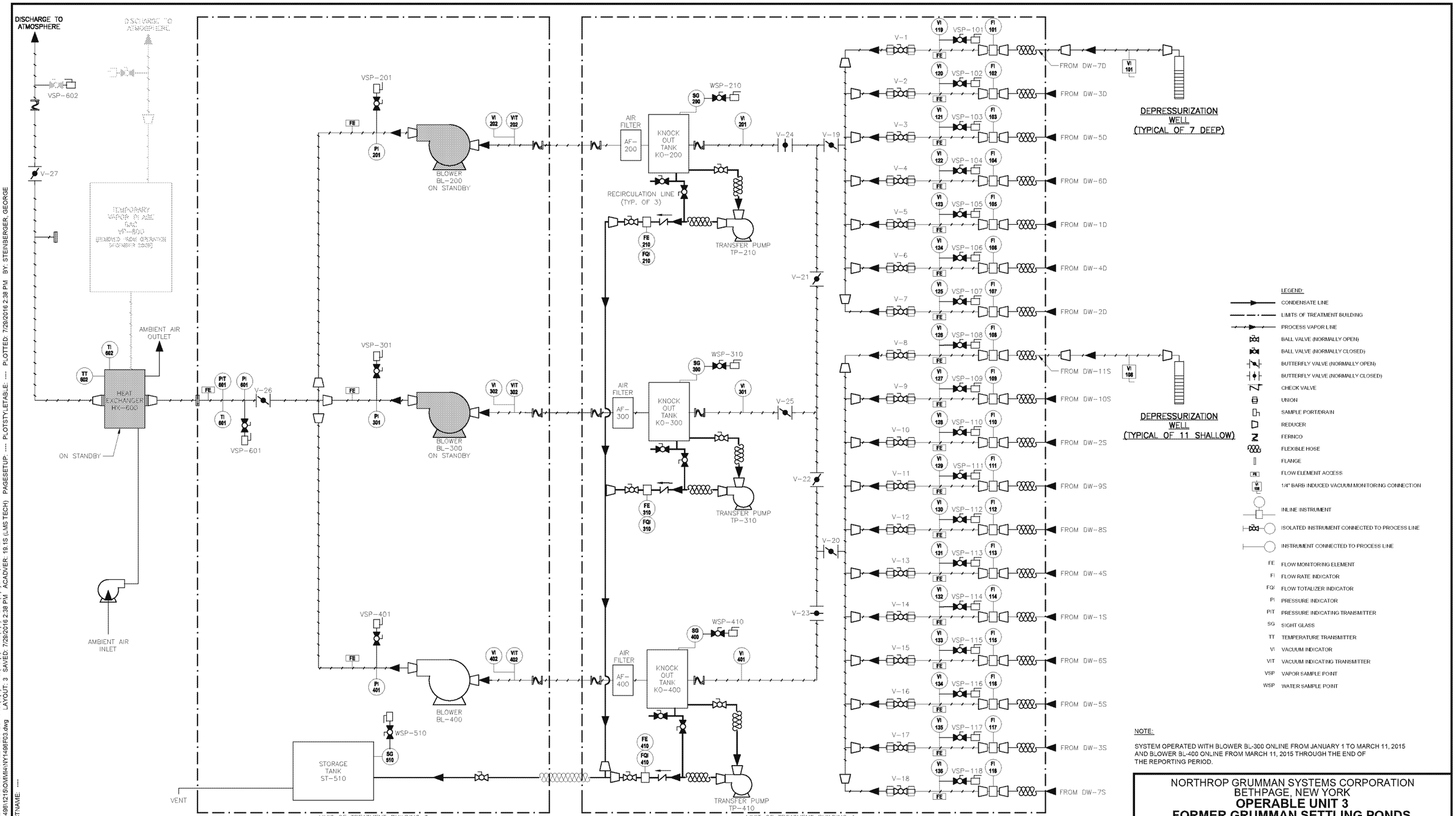

NOTE:

SYSTEM OPERATED WITH BLOWER BL-300 ONLINE FROM JANUARY 1 TO MARCH 11, 2015 AND BLOWER BL-400 ONLINE FROM MARCH 11, 2015 THROUGH THE END OF THE REPORTING PERIOD.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

PROCESS FLOW DIAGRAM BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM

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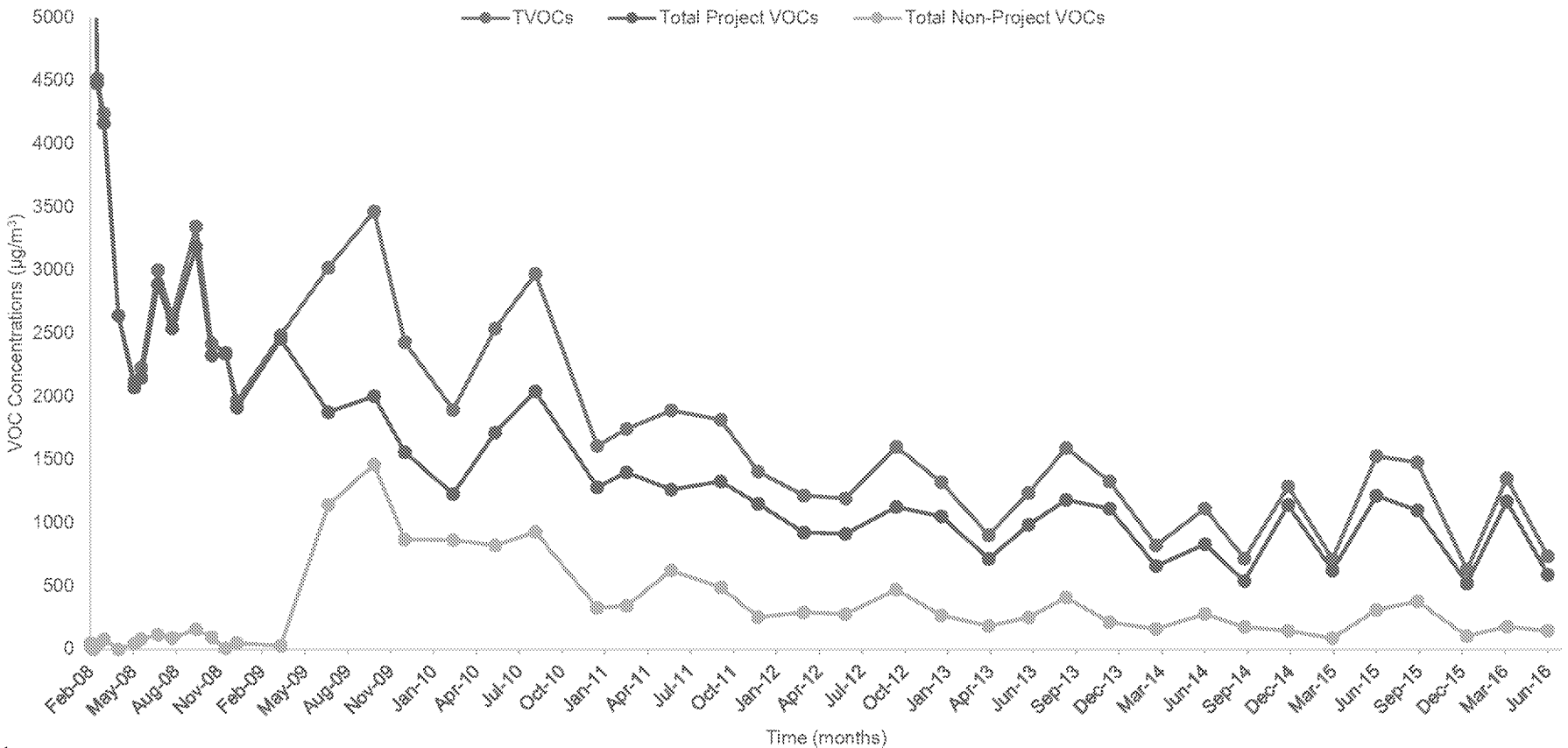
FIGURE
3

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\NY\0014981215\GM\NY1498F03.dwg LAYOUT: 3 SAVED: 7/29/2016 2:38 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/29/2016 2:38 PM BY: STEINBERGER, GEORGE
XREFS: IMAGES: PROJECTNAME: ----
XFBDR-DL



Notes:

µg/m³ = micrograms per cubic meter
TVOCs = total VOCs detected
VOCs = volatile organic compounds
Total Project VOCs = Sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.
Total Non-Project VOCs = Sum of VOCs that are not Project VOCs.

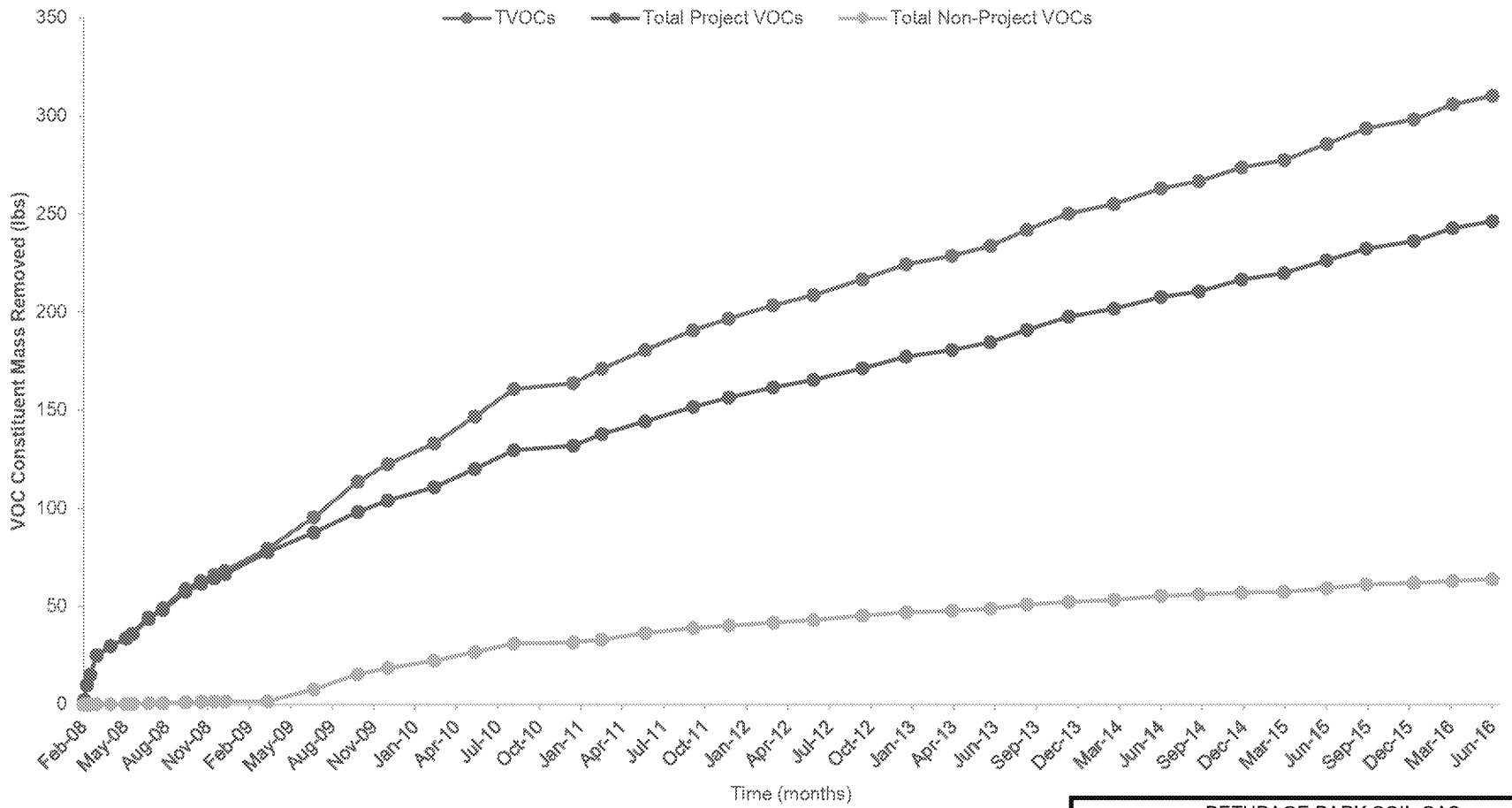
1. Samples were collected at Vapor Sample Port-601 (VSP-601); refer to Figure 3 of this OM&M report for the location of VSP-601.
2.Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 18, 2008 - 20,622 µg/m³, February 19, 2008 - 14,519 µg/m³, and February 25, 2008 - 8,196 µg/m³.
3. The sample results from December 3, 2010 were not consistent with historical data and is not included in this figure. The TVOC concentration for December 3, 2010 was 13 µg/m³.

BETHPAGE PARK SOIL GAS
CONTAINMENT SYSTEM, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

SOIL GAS VOC CONCENTRATIONS THROUGH JUNE 2016

ARCADIS Design & Consultancy for natural and built assets

FIGURE
4



Notes:

TVOCs = total VOCs detected

VOCs = volatile organic compounds

Total Project VOCs = Sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.

Total Non-Project VOCs = Sum of VOCs that are not Project VOCs.

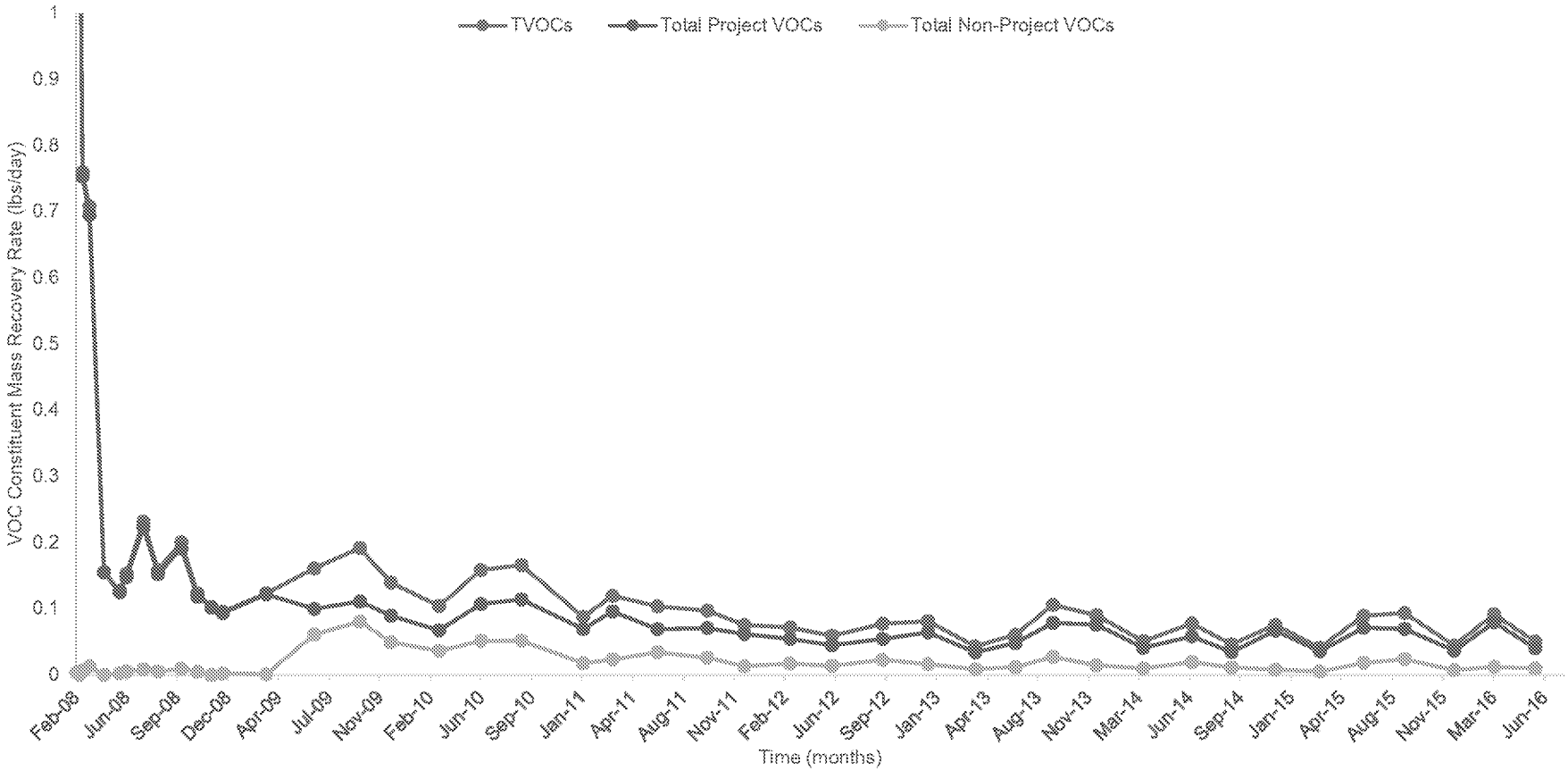
1. The sample results from December 3, 2010 were not consistent with historical data and thus, the recovery rate is not included in this table.

BETHPAGE PARK SOIL GAS
CONTAINMENT SYSTEM, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

CUMULATIVE TOTAL, PROJECT, AND NON-PROJECT VOC MASS REMOVED THROUGH JUNE 2016

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5



Notes:

TVOCs = total VOCs detected.
VOCs = volatile organic compounds
Total Project VOCs = Sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.
Total Non-Project VOCs = Sum of VOCs that are not Project VOCs.

1. Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 19, 2008 - 2.2 lbs/day and February 25, 2008 1.3 lbs/day.
2. The sample results from December 3, 2010 were not consistent with historical data and thus the recovery rate is not included in this figure. The TVOC concentration for December 3, 2010 was 13 µg/L.

BETHPAGE PARK SOIL GAS
CONTAINMENT SYSTEM, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

VOC MASS RECOVERY RATES THROUGH JUNE 2016

ARCADIS Design & Consultancy for natural and built assets

FIGURE
6