ARCADIS Design & Consultancy for natural and built assets

Mr. Jason Pelton
Project Manager
New York State Department of Environmental Conservation
Remedial Bureau D
625 Broadway
Albany, NY 12233-7015

Arcadis of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610
www.arcadis.com

ENVIRONMENT

Subject:
2017 Annual Summary Report for the Bethpage Park Soil Gas Containment System (BPSGCS), Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York, NYSDEC Site #1-30-003A.

Date:
March 30, 2018

Contact:
Christopher Engler

Phone:
315.409.6579

Email:
christopher.engler@arcadis.com

Our ref:
NY001496.33TM.RPTI4

Dear Jason:

Enclosed is one electronic PDF copy of the 2017 Annual Summary Report for the BPSGCS, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. Additionally, the enclosed summarizes the operation, maintenance and monitoring activities performed during the 2017 reporting period (i.e., January 1 through December 31, 2017). As we have transitioned to electronic submittals (via PDF) in line with NYSDEC's paper reduction program, 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.

Christopher Engler, PE
New York PE-069748

Vice President

Enclosure

Copies:
Edward Hannon, Northrop Grumman Corporation
Donald Hesler, NYSDEC
Steven Karpinski, NYS Dept. of Health
John Lovejoy, Nassau County Dept. of Health
Lorenzo Thantu, USEPA
Carlo San Giovanni, Arcadis
File

ARCADIS Design & Consultancy for natural and built assets

Northrop Grumman Systems Corporation

2017 ANNUAL SUMMARY REPORT

Operation, Maintenance, and Monitoring Report for the Bethpage Park Soil Gas Containment System

Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID # 1-30-003A

March 30, 2018

Matthew Bell
Task Manager

Paul Martorano, PE
Senior Engineer | New York PE-088403

Christopher Engler, PE
Engineer of Record | New York PE-069748

Carlo San Giovanni
Project Manager

2017 ANNUAL SUMMARY REPORT

Operation, Maintenance, and Monitoring Report for the Bethpage Park Soil Gas Containment System

Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York
NYSDEC ID # 1-30-003A

Prepared for:

Northrop Grumman Systems Corporation

Prepared by:

Arcadis of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610

Our Ref.:

NY001496.33TM

Date:

March 30, 2018

2017 ANNUAL SUMMARY REPORT
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID # 1-30-003A

CONTENTS

TABLES

FIGURES

2017 ANNUAL SUMMARY REPORT
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID # 1-30-003A

1 INTRODUCTION

Pursuant to the Administrative Order on Consent (AOC) Index #W1-0018-04-01 (New York State Department of Environmental Conservation [NYSDEC] 2005) and the Operable Unit 3 (OU3) Record of Decision (NYSDEC 2013), Arcadis of New York, Inc. (Arcadis), on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), has prepared this OU3 Bethpage Park Soil Gas Containment System (BPSGCS) Annual Summary Report for submittal to the NYSDEC. The present-day Bethpage Community Park property (Park), the McKay Field, and Plant 24 Access Road, which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3, are referred to herein as the Site Area. Figure 1 provides a Site Area location map.

The BPSGCS (previously referred to as the Soil Gas Interim Remedial Measure [IRM]) has operated since February 18, 2008. The operation, maintenance, and monitoring (OM&M) activities performed during 2017 (i.e., January 1 through December 31, 2017 [the "annual reporting period"]) are summarized in this Annual Summary Report. Data summaries for the previous three 2017 operational quarterly periods are available in the following letter reports:

- Results of First Quarter 2017 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, May 2017 (Arcadis 2017a)
- Results of Second Quarter 2017 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, August 2017 (Arcadis 2017b)
- Results of Third Quarter 2017 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, November 2017 (Arcadis 2017c)

During 2017, the BPSGCS system OM&M was conducted 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 2014).

As discussed in the Remedial Investigation Report (RI Report), [Arcadis 2011], Northrop Grumman does not take responsibility for certain compounds (e.g., Freon 12 and Freon 22) present in the Site Area. Throughout this report, a distinction is made between the "Project" and "Non-project" volatile organic compounds (VOCs), which are defined as follows:

- Project VOCs: VOCs that may be related to former Northrop Grumman historical activities. For this report, Project VOCs include 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.
- Non-project VOCs: VOCs, such as Freon 12 and Freon 22, which are understood to be unrelated to former Northrop Grumman activities but have been detected in the Site Area. As noted in the RI Report, a groundwater sub-plume of Freon 22 has been identified originating from the area of the Town of Oyster Bay's (Town's) former ice rink. Based on Town information (Zervos 2007), Freon 22 was used by the Town and released to the environment.

2 BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM OBJECTIVES

The remedial action objectives (RAOs) of the BPSGCS are as follows:

- To mitigate the off-site migration of Project VOCs in the on-site soil gas through the implementation of a soil gas containment system installed along the Plant 24 Access Road and McKay Field Access Road, south and west of the Park, respectively, and;
- To comply with applicable NYSDEC Standards, Criteria, and Guidelines (SCGs)

The compliance objectives of the BPSGCS are as follows:

- To mitigate the off-site migration of soil gas, the system was designed to maintain -0.1 inch of water column (iwc) within a negative pressure curtain established within the vadose zone along the Plant 24 Access Road and along the McKay Field Access Road, from the boundary of the Plant 24 Access Road to approximately 400 feet north along the MacKay Field Access Road, based on a 12-month rolling average.
- To treat extracted vapors until it is demonstrated that all VOCs in the influent (untreated) vapor stream are present at concentrations lower than the NYSDEC Division of Air Resources Guide-1 (DAR-1) Annual Guidance Concentrations (AGCs) on a 12-month rolling average and Short-term Guidance Concentrations (SGCs) for any given grab sample (NYSDEC 2016). On December 29, 2008, NYSDEC approved removal of vapor phase treatment (NYSDEC 2008).
- To manage condensate via one of the following two methods: (1) collect and convey condensate to the Town of Oyster Bay's Cedar Creek treatment facility via the Nassau County Department of Public Works (NCDPW) sanitary sewer, in accordance with the requirements set forth by the NCDPW (NCDPW 2007, 2008), or (2) collect and convey to the Bethpage Park Groundwater Containment System (BPGWCS) treatment system that discharges treated groundwater to the NCDPW recharge basins west of the site.

3 BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM DESCRIPTION

Following review and approval of the Soil Gas IRM 95% Design Report and Design Drawings by the NYSDEC (Arcadis 2007b), the design package was finalized and the BPSGCS constructed. A general site plan (Figure 2) shows the treatment building, which houses the major process equipment, including two 20-horsepower (hp) and one 30 hp regenerative-type depressurization blowers, and three 52-gallon moisture separators and associated transfer pumps. Remaining system components are located outside the treatment building and include one 33-foot tall by 16-inch diameter effluent stack, the heat exchanger, the 18 depressurization wells, and the 47 induced vacuum monitoring wells, also shown on Figure 2. Monitoring well vacuum measurements collected during 2017 are also provided on Figure 2. A process

flow diagram that shows sampling and monitoring locations is provided as Figure 3. A detailed description of the system and a complete set of record drawings are provided in the OM&M Manual (Arcadis 2016).

4 OPERATION AND MAINTENANCE ACTIVITIES

The following sections summarize the routine and non-routine operation and maintenance (O&M) activities completed during the annual reporting period (Section 4.1); the performance evaluation of the BPSGCS (Section 4.2); and the conclusions and recommendations regarding O&M for the BPSGCS (Section 4.3).

4.1 Summary of O&M Completed During the Annual Reporting Period

The O&M of the BPSGCS was conducted in accordance with the OM&M Manual (Arcadis 2016a), and consisted of the following routine maintenance/activities:

- Continuous monitoring of system performance parameters by the Supervisory Control and Data Acquisition (SCADA) system.
- Weekly site checks to monitor and record key process parameters to evaluate system operation, to assess whether a process parameter has changed or is out of range, and to provide information that may be helpful to identify and/or troubleshoot an operational concern.
- Quarterly monitoring events to monitor and record key process parameters (including induced vacuums), to confirm proper system operation, make adjustments as needed, and to collect vapor samples to demonstrate operational compliance. A summary of the quarterly monitoring data collected for the BPSGCS is provided in Tables 1, 2, 3 and 4.
- Routine maintenance of equipment was generally performed in accordance with the manufacturers' specifications as needed.
- Maintenance of equipment and system components in response to alarm conditions or system parameters operating outside of their normal operating ranges. These conditions did not have a significant impact on system performance and have been proactively addressed to minimize system downtime.

  During the annual reporting period, condensate removal was conducted during routine BPSGCS maintenance. Collected condensate was treated at the BPGWCS and discharged along with the treated groundwater to the NCDPW recharge basins east of the site. As of 2015, condensate removal is conducted, as needed, by manipulating manifold vacuums and flow rates for brief periods of time. This process does not entirely vacate the below grade lines of condensate, though it enables the system to maintain adequate flow and vacuum at the manifolds without requiring a vacuum truck and a full day shutdown event.

The following non-routine activities occurred during the annual reporting period:

- Non-routine system shutdown required between July 25 and July 28, 2017 to accommodate vapor intrusion sampling at the former Plant 24 building.
- Non-routine system shutdown required between December 26, and December 29, 2017 to accommodate additional vapor intrusion sampling at the former Plant 24 building.

4.2 Performance Evaluation

The OU3 BPSGCS operated continuously during the annual reporting period with the exception of brief shutdown events for routine and non-routine system maintenance. An operational summary of the depressurization wells, monitoring wells, flow rates and vacuums for the annual reporting period are provided in Tables 1 and 2. In summary:

- The system operated during the annual reporting period for approximately 357 days out of a total 365 days (97.8% uptime).
- An annual rolling average vacuum of -0.1 iwc or greater was maintained at all induced vacuum monitoring points throughout the annual reporting period. Data recorded at several wells indicated that vacuum induced at the well heads was slightly less than the targeted -0.1 iwc, during September and December 2017. Northrop Grumman will continue to proactively manage this issue through condensate removal and system rebalancing of the manifold flow.

4.3 Conclusions and Recommendations for O&M

The O&M activities conducted during the annual reporting period met the requirements of the O&M Manual.

5 MONITORING

The following sections summarize the monitoring completed during the annual reporting period (Section 5.1); the 2017 monitoring data, comparisons of the results with applicable AGCs and SGCs, and additional data evaluations describing the performance effectiveness of the OU3 BPSGCS (Section 5.2); and the conclusions and recommendations regarding monitoring for the Site (Section 5.3).

5.1 Summary of Monitoring Completed

In general, the monitoring of the OU3 BPSGCS was completed in accordance with the OU3 BPSGCS OM&M Manual (Arcadis 2016). A summary of the monitoring completed during this annual reporting period is provided below:

- Quarterly system performance monitoring:
    - Instantaneous vacuum measurements at compliance measurement points and system operating measurements at influent manifolds, blower inlet and outlet, and system effluent were collected to assess the system performance. Summaries of the measurements are provided in Tables 1 and 2.

- Quarterly system compliance monitoring:
  - Containment system air quality monitoring was completed to monitor the performance of the containment system and to compare the levels to applicable AGCs and SGCs. Summaries of the results are provided in Tables 3, 4, and 5.

5.2 Summary of Monitoring Results

5.2.1 Containment System Performance Monitoring

5.2.1.1 Annual Reporting Period System Operating Parameters

System operating parameters measured during the annual reporting period are summarized in Tables 1 and 2. The system components generally operated within their recommended ranges during the annual reporting period.

5.2.1.2 Vapor Screening

The total effluent screening level vapor samples (i.e., photoionization detector [PID] reading) measured during the annual reporting period are provided in Table 1. The screening results throughout the annual reporting period ranged from 0.0 parts per million by volume (ppmv) (March and June 2017) to 0.1 ppmv (September and December 2017), which is consistent with historic data.

5.2.2 Containment System Compliance Monitoring

5.2.2.1 System Operating Parameters

Instantaneous vacuum measurements in compliance monitoring wells from the annual reporting period and annual time-weighted rolling averages are summarized in Table 2. Quarterly vacuum measurement data from the annual reporting period are also shown on Figure 2.

As shown on Table 2, during the annual reporting period, the instantaneous induced vacuum at all compliance-related monitoring points met or exceeded the minimum performance standard (greater than or equal to -0.1 iwc), with the exceptions of VMWC-12D, VMWC-16B, VMWC-18A, and VMWC-18B. Although instantaneous induced vacuum measurements were slightly lower than -0.1 iwc at VMWC-18A in September 2017, and at VMWC-12D, VMWC-16B, VMWC-18A, and VMWC-18B in December 2017, the annual time-weighted rolling average of induced vacuum readings at all compliance-related monitoring points were maintained at greater than or equal to -0.1 iwc. Therefore, the BPSGCS is meeting the operational compliance objectives.

5.2.2.2 Vapor Sample

Effluent vapor samples were collected on a quarterly basis throughout the annual reporting period. The total volatile organic compound (TVOC) concentrations ranged from 226 micrograms per cubic meter

(µg/m^3) in March 2017 to 1,113 µg/m^3 in June 2017, as shown in Table 3. The Project TVOC concentrations ranged from 198 µg/m^3 in March 2017 to 876 µg/m^3 in June 2017. The Non-project TVOC concentrations ranged from 28 µg/m^3 in March 2017 to 280 µg/m^3 in September 2017.

The TVOC concentration in effluent vapor has generally declined since system startup. Figure 4 provides an overview of the concentration trend over the report period. During the reporting period the containment system has removed 20.8 pounds of TVOCs, with 16.6 pounds of Project TVOCs (79.8%) and 4.2 pounds of Non-project TVOCs (20.2%). The containment system has removed a total of 346 pounds of TVOCs, with 275 pounds of Project TVOCs (79.5%) and 71 pounds of Non-project TVOCs (20.5%) since startup in February 18, 2008, as shown on Figure 5. Figure 6 presents the mass removal rate, which has declined since system startup.

Carbon tetrachloride, trichloroethene (tricholoroethylene) and vinyl chloride, environmentally “A”-rated compounds, as defined in DAR-1 AGC/SGC tables, revised August 10, 2016 (NYSDEC 2016), were detected in the effluent vapor sample during the annual reporting period; the concentrations were consistent with historical data. These are three of the four environmentally “A”-rated compounds historically detected in the effluent vapor samples. Benzene was not detected during the annual reporting period.

The concentrations of the tentatively identified compounds (TICs) were consistent with data collected throughout previous annual reporting periods. A total of 2 TICs were identified during the annual reporting period. The most common TIC identified over the annual reporting period was carbon dioxide.

5.2.2.3 Condensate Sample

Collection of a compliance monitoring condensate sample was not required during the annual reporting period, as all condensate was transferred to the BPGWCS system for treatment.

5.2.3 Air Emissions Model

Vapor concentrations for the annual period were compared with the degree of cleaning required pursuant to 6NYCRR III A Part 212-2.3(b) (Rule 212), Table 4 - Degree of Air Cleaning Required for Non-Criteria Air Contaminants. Concentrations of all compounds detected during the Fourth Quarter were less than 40,970 µg/m^3 (concentration equivalent to 0.1 pounds per hour at a flow rate of 653 cubic feet per minute), as shown in Table 5 of this report. Therefore, in accordance with the requirements of Table 4 of the NYSDEC regulations, air dispersion modeling was performed to demonstrate that the maximum off-site air concentration is less than the NYSDEC DAR-1 AGC/SGC values issued August 10, 2016.

The U.S. Environmental Protection Agency (USEPA) air quality dispersion model AERMOD was executed to estimate the highest ambient air concentration of the compounds detected during the Fourth Quarter. AERMOD is the USEPA’s recommended best state-of-the-art practice Gaussian plume dispersion model. Gaussian models are the most widely used techniques for estimating the impact of non-reactive pollutants, per Appendix W of Title 40 Code of Federal Regulations (CFR) 51 – Guideline of Air Quality Models.

The following parameters were used for the AERMOD model analysis:

- Urban dispersion coefficients
- AERMAP base and terrain elevations, processed using National Elevation Dataset (NED) digitized terrain data
- Surface and upper air observations measured at the Nation Weather Service stations located at Farmingdale and Brookhaven airports for calendar years 2011-2015, in accordance with NYSDEC's DAR-10 Air Dispersion Modeling Guidance Document. This longer period of time was reviewed for the model run, to provide a conservative estimate of atmospheric impacts on the off-site concentrations.
- Discrete receptor grids, per the following methodology:
  - Receptors were located along the property boundary at distances not exceeding 25 meters;
  - A 1.5 km x 1.5 km Cartesian grid receptors with distances of 50 meters between the receptors; and
  - A 3.0 km x 3.0 km Cartesian grid receptors with distances of 100 meters between the receptors.
- Emission rate: 1 gram per second (g/s)

Based on the AERMOD model analysis, the maximum one-hour ambient air impact from all years of operations is 462.83 [µg/m^3]/[g/s] and the maximum annual ambient air impact is 20.02 [µg/m^3]/[g/s]. The compound specific scaled hourly ambient air impact and the scaled annual ambient air impact for the Fourth Quarter detections are presented in Table 5. The results demonstrate that the scaled ambient air impacts for the BPSGCS are below the corresponding SGCs and AGCs.

Based on the ambient modeling analysis conducted in the annual reporting period, the BPSGCS continues to meet all of the requirements for DAR-1 and is below the Rule 212 requirements without add on controls (i.e. vapor phase GAC treatment).

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following conclusions are provided regarding the performance and ability of the OU3 BPSGCS to comply with the remedial action and compliance objectives:

- OM&M requirements of the OU3 BPSGCS OM&M Manual were met during the annual reporting period.
- The BPSGCS generally operated as designed during the annual reporting period to mitigate the off-site migration of soil gas.
  - The BPSGCS operated continuously with the exception of brief shutdown periods for routine and non-routine maintenance (97.8% uptime).
  - A total of 21 pounds of VOCs were removed from the subsurface during the annual reporting period, and a total of 346 pounds of VOCs were removed since system startup in 2008.

- An annual rolling average vacuum of -0.1 iwc or greater was maintained at all induced vacuum monitoring points throughout the annual reporting period. Data recorded at several wells indicated that vacuum induced at the well heads was slightly less than the targeted -0.1 iwc, during September and December 2017. Northrop Grumman will continue to proactively manage this issue through condensate removal and system rebalancing of the manifold flow.
- The operation of the BPSGCS complied with applicable NYSDEC SCGs during the annual reporting period.
- Effluent vapor emissions met applicable AGC and SGC air discharge criteria during the annual reporting period. Based on the ambient modeling analysis conducted in the annual reporting period, the BPSGCS continues to meet all of the requirements for DAR-1 and is below the Rule 212 requirements without add on controls (i.e. vapor phase GAC treatment).

6.2 Recommendations

Based on the information provided herein, Arcadis recommends to continue operation of the BPSGCS, to maintain compliance with the RAOs. No modifications or upgrades are needed at this time.

7 CERTIFICATION

Statement of Certification

On behalf of Northrop Grumman Systems Corporation, I hereby certify and attest that the Operable Unit 3 Bethpage Park Soil Gas Containment System is operated in compliance with the remedial action objectives provided within the NYSDEC approved Soil Gas Interim Remedial Measure Work Plan (Arcadis 2007a), which was prepared pursuant to NYSDEC Administrative Order on Consent Index # W1-0018-04-01 (NYSDEC 2005) referencing the Former Grumman Settling Ponds Site and dated July 4, 2005.

Christopher Engler, P.E.
Engineer of Record
License # 069748

8 REFERENCES

Arcadis of New York, Inc. 2007a. Operable Unit 3 – Soil Gas Interim Remedial Measure Work Plan, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A. February 16, 2007.

Arcadis of New York, Inc. 2007b. 95% Design Report, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A. September 7, 2007.

Arcadis of New York, Inc. 2016 Operable Unit 3, Operation, Maintenance, and Monitoring Manual, Bethpage Park Soil Gas Containment System (Formerly Soil Gas Interim Remedial Measure), Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A. Revision 3: March 17, 2016.

Arcadis of New York, Inc. 2011.Remedial Investigation Report (Site Area), Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York, Site #1-30-003A. Revised: February 8, 2011.

Arcadis of New York, Inc. 2017a. Results of First Quarter 2017 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York, Site #1-30-003A. May 19, 2017.

Arcadis of New York, Inc. 2017b. Results of Second Quarter 2017 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York, Site #1-30-003A. August 31, 2017.

Arcadis of New York, Inc. 2017c. Results of Third Quarter 2017 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York, Site #1-30-003A. November 24, 2017.

County of Nassau Department of Public Works (NCDPW). 2007. Letter Regarding Discharge of IRM Condensate Water, Northrop Grumman, OU3 Site, Bethpage, New York. October 16, 2007.

NCDPW. 2008. Letter Regarding Discharge of IRM Condensate Water Northrop, Grumman, OU3 Site, Bethpage, New York. September 17, 2008.

New York State Department of Environmental Conservation (NYSDEC). 2005. Order on Consent Index #WI-0018-04-01, Site # 1-30-003A. July 4, 2005.

NYSDEC. 2008. Letter of Approval For Proposed Modifications. December 12, 2008.

NYSDEC. 2013. Record of Decision. Northrup Grumman – Bethpage Facility, Operable Unit Number: 03, State Superfund Project, Bethpage, Nassau County, Site #1-30-003A. March, 2013.

NYSDEC. 2016. DAR-1 AGC/SGC Tables. Revised August 10, 2016.

Zervos, Theodore. 2007. Deposition of Theodore Zervos in the matter Town of Oyster Bay v. Northrop Grumman Systems Corporation et al. Case No. 05-CV-1945 (TCP)(AKT). January 22, 2007.

TABLES

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

	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
3/24/17	102	-19	-1.8	12	-12	-0.55	6.5	-5.0	-0.30	14	-5.0	-0.44	86	-14	-1.7	14	-14	-2.8	65	-16	-1.6	7.0	-5.0	-1.3
6/14/17	120	-21	-1.6	4.5	-11	-0.50	12	-6.0	-0.33	10	-6.2	-0.42	62	-24	-1.1	13	-13	-2.2	85	-16	-1.7	4.0	-4.3	-1.8
9/21/17	100	-18	-1.8	5.0	-20	-0.56	5.0	-7.5	-0.26	11	-6.0	-0.36	86	-13	-1.3	14	-13	-2.5	80	-15	-1.6	6.2	-5.0	-1.2
12/11/17	103	-23	-1.7	8.0	-7.5	-0.49	8.0	-7.0	-0.25	13	-6.5	-0.42	99	-16	-1.6	14	-12	-2.5	95	-19	-1.9	7.0	-5.2	-1.4

Notes and abbreviations on last page.

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

	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
3/24/17	96	-23	-2.3	6.3	-3.0	-1.7	70	-15	-1.6	7.0	-6.5	-0.84	61	-17	-1.9	36	-13	-1.7	33	-28	-1.5	34	-19	-1.4
6/14/17	90	-22	-1.9	4.6	-2.5	-1.3	69	-14	-1.3	5.0	-6.0	-0.56	65	-17	-1.8	43	-14	-1.7	22	-21	-1.4	39	-23	-2.2
9/21/17	85	-22	-2.0	5.1	-2.5	-1.5	75	-14	-1.5	7.0	-7.0	-0.76	73	-19	-2.1	35	-13	-1.4	33	-26	-2.0	36	-21	-2.2
12/11/17	100	-22	-2.4	5.5	-2.5	-1.6	95	-17	-2.1	9.0	-7.0	-0.87	75	-25	-2.2	42	-13	-1.7	23	-23	-1.6	43	-25	-2.6

Notes and abbreviations on last page.

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

	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
3/24/17	29	-13	-1.6	32	-20	-2.3	NA	-38	NA	200	NA	NA	NA	-40	3.0	60.00	NA	NA	NA	641	0.0	100	1.0	84
6/14/17	35	-14	-1.9	34	-23	-2.0	NA	-32	NA	150	NA	NA	NA	-37	2.5	60.00	NA	NA	NA	664	0.0	111	0.0	100
9/21/17	34	-15	-1.9	24	-19	-1.6	NA	-36	NA	30	NA	NA	NA	-37	2.0	60.00	NA	NA	NA	670	0.1	120	2.9	106
12/11/17	40	-19	-2.2	30	-24	-2.1	NA	NA	-30	0	NA	NA	NA	NA	NA	NA	-35	3.0	60.00	653	0.1	104	3.0	85

Notes and abbreviations on last page.

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

Abbreviations, Notes, and Units:

DW	Depressurization Well
NA	Not Applicable
PID	Photoionization Detector

1. Total gallons of water accumulated at storage tank ST-510 per quarter. Values for First and Second Quarter 2017 are estimated based on average volume collected during condensate removal events. Values for Third and Fourth Quarter 2017 are taken from site operator condensate event logs.

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.

°F	degrees Fahrenheit
gal	gallons
Hz	Hertz
iwc	inches of water column
ppmv	parts per million by volume
scfm	standard cubic feet per minute

Table 2
Summary of Induced Vacuum Readings at Compliance Monitoring Points
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

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
03/24/17	-0.13	-0.20	-0.20	-0.20	-0.12	-0.15	-0.16	-0.15	-0.19	-0.16	-0.18	-0.20	-0.13	-0.11	-0.13	-0.17	-0.11	-0.23	-0.29	-0.19	-0.18
06/14/17	-0.12	-0.18	-0.19	-0.11	-0.14	-0.11	-0.11	-0.13	-0.13	-0.14	-0.15	-0.17	-0.15	-0.12	-0.15	-0.12	-0.16	-0.12	-0.28	-0.11	-0.11
09/21/17	-0.10	-0.19	-0.19	-0.12	-0.56	-0.16	-0.14	-0.15	-0.14	-0.15	-0.15	-0.20	-0.27	-0.18	-0.17	-0.12	-0.13	-0.19	-0.24	-0.09	-0.10
12/11/17	-0.10	-0.18	-0.20	-0.12	-0.08	-0.10	-0.11	-0.10	-0.13	-0.14	-0.14	-0.11	-0.77	-0.21	0.00	-0.11	-0.13	-0.27	-0.26	-0.08	-0.09
Time Weighted Rolling Average[1]	**-0.11**	**-0.19**	**-0.19**	**-0.14**	**-0.34**	**-0.14**	**-0.14**	**-0.14**	**-0.15**	**-0.15**	**-0.16**	**-0.18**	**-0.34**	**-0.17**	**-0.12**	**-0.13**	**-0.12**	**-0.22**	**-0.26**	**-0.11**	**-0.12**

Gross Average Compliance Points[2]	
12/11/17	-0.17

Abbreviations, Notes, and Units:

DW Depressurization Well
VMWC Vapor Monitoring Well Cluster

1. Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average. 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.
2. Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.

iwc inches of water column

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

ARCADIS Design & Consultancy for natural and built assets

Compound (units in µg/m^3)	Sample ID[1]: Sample Date:	VSP-601 3/24/2017	VSP-601 6/23/2017 [4]	VSP-601 9/22/2017 [5]	VSP-601 12/11/2017
Project VOCs	CAS No.				
1,1,1-Trichloroethane	71-55-6	**2.8**	**12**	**16**	**10**
1,1-Dichloroethane	75-34-3	< 3.2 U	**8.9**	**13**	**9.7**
1,1-Dichloroethene	75-35-4	< 3.2 U	<7.9 U	**0.56 J**	< 3.2 U
1,2-Dichloroethane	107-06-2	< 3.2 U	<8.1 U	< 0.81 U	< 3.2 U
Benzene	71-43-2	< 2.6 U	<6.4 U	< 0.64 U	< 2.6 U
cis-1,2-Dichloroethene	156-59-2	**110**	**400**	**311**	**358**
Tetrachloroethene	127-18-4	< 1.1 U	**14**	**20**	**8.8**
Toluene	108-88-3	< 3.0 U	<7.5 U	**1.7**	< 3.0 U
trans-1,2-Dichloroethene	156-60-5	< 3.2 U	**4.4 J**	**4.0**	**2.6 J**
Trichloroethylene	79-01-6	**85**	**437**	**429**	**378**
Vinyl chloride	75-01-4	< 0.41 U	<1.0 U	**0.95**	< 0.41 U
Xylene-O	95-47-6	< 3.5 U	<8.7 U	**0.43 J**	< 3.5 U
Xylenes - M,P	1330-20-7	< 3.5 U	<8.7 U	**1.2**	< 3.5 U
Subtotal Project VOCs		**198**	**876**	**798**	**767**
Non-Project VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	< 2.7 U	<6.9 U	<0.69 U	< 2.7 U
1,1,2-Trichloroethane	79-00-5	< 2.2 U	<5.5 U	<0.55 U	< 2.2 U
1,2-Dichloropropane	78-87-5	< 3.7 U	<9.2 U	<0.92 U	< 3.7 U
1,3-Butadiene	106-99-0	< 1.8 U	<4.4 U	<0.44 U	< 1.8 U
2-Butanone	78-93-3	< 2.4 U	<5.9 U	**1.3**	< 2.4 U
2-Hexanone	591-78-6	< 3.3 U	<8.2 U	<0.82 U	< 3.3 U
4-Methyl-2-Pentanone	108-10-1	< 3.3 U	<8.2 U	<0.82 U	< 3.3 U
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	ND[3]	**200**	**220**	**69.1**
Acetone	67-64-1	**4.5**	**4.5 J**	**5.5**	**4.3**
Bromodichloromethane	75-27-4	< 2.7 U	<6.7 U	<0.67 U	< 2.7 U
Bromoform	75-25-2	< 1.7 U	<4.1 U	< 0.41 U	< 1.7 U
Bromomethane	74-83-9	< 3.1 U	<7.8 U	<0.78 U	< 3.1 U
Carbon Disulfide	75-15-0	< 2.5 U	<6.2 U	<0.62 U	< 2.5 U
Carbon Tetrachloride	56-23-5	< 1.0 U	<2.5 U	**1.4**	< 1.0 U
Chlorobenzene	108-90-7	< 3.7 U	<9.2 U	<0.92 U	< 3.7 U
Chlorodibromomethane	124-48-1	< 3.4 U	<8.5 U	<0.85 U	< 3.4 U

Notes and abbreviations on last page.

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

Compound (units in µg/m^3) Non-Project VOCs	Sample ID[1]: Sample Date: CAS No.	VSP-601 3/24/2017	VSP-601 6/23/2017 [4]	VSP-601 9/22/2017 [5]	VSP-601 12/11/2017
Chloroethane	75-00-3	< 2.1 U	<5.3 U	<0.53 U	< 2.1 U
Chlorodifluoromethane (Freon 22)	75-45-6	< 2.8 U	**2.3 J**	<0.070 U	< 2.8 U
Chloroform	67-66-3	**2.7 J**	**25**	**45**	**33**
Chloromethane	74-87-3	**1.3 J**	<4.1 U	<0.41 U	< 1.7 U
cis-1,3-Dichloropropene	10061-01-5	< 3.6 U	<9.1 U	<0.91 U	< 3.6 U
Dichlorodifluoromethane (Freon 12)	75-71-8	**2.7 J**	<9.9 U	**3.8**	**3.0 J**
Ethylbenzene	100-41-4	< 3.5 U	<8.7 U	<0.87 U	< 3.5 U
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 3.1 U	<7.7 U	**0.74 J**	< 3.1 U
Methyl Tert-Butyl Ether	1634-04-4	< 2.9 U	<7.2 U	<0.72 U	< 2.9 U
Methylene Chloride	75-09-2	**14**	**4.5 J**	<0.69 U	**3.8**
Styrene	100-42-5	< 3.4 U	<8.5 U	<0.85 U	< 3.4 U
Trans-1,3-Dichloropropene	10061-02-6	< 3.6 U	<9.1 U	<0.91 U	< 3.6 U
Trichlorofluoromethane (Freon 11)	75-69-4	**2.7**	<5.6 U	**2.1**	< 2.2 U
Subtotal Non-Project VOCs		**28**	**236**	**280**	**113**
TVOC[2]		**226**	**1,113**	**1,078**	**880**

Notes and abbreviations on last page.

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

ARCADIS Design & Consultancy for natural and built assets

Abbreviations, Notes, Qualifiers, and Units:

CAS No.	Chemical Abstracts Service list number
ELAP	Environmental Laboratory Approval Program
NA	Not Analyzed
ND	Not Detected
NYSDOH	New York State Department of Health
NYSDEC	New York State Department of Environmental Conservation.
TIC	Tentatively Identifed Compound
TVOC	Total Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1. Vapor samples collected by Arcadis 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. In the 2017 first quarter sampling event (03/24/2017), target compound 1-Chloro-1,1-difluoroethane (Freon 142b) was reported as a Tentatively Indentified Compound (TIC), due to the expiration of the laboratory standard.
4. 6/23/2017 sample taken 7 days after parameter and vacuum readings.
5. 9/22/2017 sample taken 1 day after parameter and vacuum readings.

2.8	Bolding indicates that the analyte was detected at or above its reporting limit
< 1.0 U	Compound not detected above its laboratory quantification limit
D	Concentration is based on diluted sample analysis
J	Compound detected below its reporting limit; value is estimated
µg/m^3	micrograms per cubic meter

Table 4
Total Effluent Vapor Sample Analytical Results
Tentatively Identified Compounds
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

Sample ID: / Sample Date[1]: / Units: / Tentatively Identified Compounds [2]	VSP-601 3/24/2017 ppbv	VSP-601 6/23/2017 [3] ppbv	VSP-601 9/22/2017 [4] ppbv	VSP-601 12/11/2017 ppbv
Carbon Dioxide	**1100 JNB**	ND	**35 JNB**	**690 JNB**
Unknown	ND	ND	**10 J**	ND

Abbreviations, Notes, Qualifiers, and Units:

ND	Not Detected
ELAP	Environmental Laboratory Approval Program
NYSDOH	New York State Department of Health
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. VSP-601 6/23/2017 sample taken 7 days after parameter and vacuum readings.
4. VSP-601 9/22/2017 sample taken 1 day after parameter and vacuum readings.

B	Indicates analyte found in associated method blank
J	Indicates an estimated value
JN	Compound tentatively identified, concentration is estimated
ppbv	parts per billion by volume

Table 5
Air Quality Impact Analysis
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Toxic Air Contaminant	CAS#	VSP-601 Vapor Effluent (µg/m^3) 12/11/2017	Emission Rate[1]			Scaled Impact - Hourly[2] (µg/m^3)	Scaled Impact - Annual[2] (µg/m^3)	SGC[3] (µg/m^3)	AGC[3] (µg/m^3)	% of SGC	% of AGC
			lb/yr	lb/hr	g/s						
Project VOCs											
1,1,1 - Trichloroethane	00071-55-6	10	2.1E-01	2.4E-05	3.1E-06	1.4E-03	6.2E-05	9,000	5,000	0.0%	0.0%
1,1 - Dichloroethane	00075-34-3	9.7	2.1E-01	2.4E-05	3.0E-06	1.4E-03	6.0E-05	NS	0.63	NS	0.0%
Tetrachloroethene	00127-18-4	8.8	1.9E-01	2.1E-05	2.7E-06	1.3E-03	5.4E-05	300	4.0	0.0	0.0%
Trichloroethene	00079-01-6	378	8.1E+00	9.2E-04	1.2E-04	5.4E-02	2.3E-03	20	0.2	0.3%	1.2%
cis 1,2-Dichloroethene	00156-59-2	358	7.7E+00	8.7E-04	1.1E-04	5.1E-02	2.2E-03	NS	63	NS	0.0%
trans 1,2-Dichloroethene	00156-60-5	2.6	5.6E-02	6.3E-06	8.0E-07	3.7E-04	1.6E-05	NS	63	NS	0.0%
Non-Project VOCs											
Acetone	00067-64-1	4.3	9.2E-02	1.0E-05	1.3E-06	6.1E-04	2.6E-05	180,000	30,000	0.0%	0.0%
Chloroform	00067-66-3	33	7.1E-01	8.1E-05	1.0E-05	4.7E-03	2.0E-04	150	14.7	0.0%	0.0%
Dichlorodifluoromethane (Freon 12)	00075-71-8	3.0	6.4E-02	7.3E-06	9.2E-07	4.3E-04	1.8E-05	NS	12,000	NS	0.0%
Methylene Chloride	00075-09-2	3.8	8.1E-02	9.3E-06	1.2E-06	5.4E-04	2.3E-05	14,000	60	0.0%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)	00075-68-3	69.1	1.5E+00	1.7E-04	2.1E-05	9.8E-03	4.3E-04	NS	50,000	NS	0.0%

Notes and abbreviations on last page.

Table 5
Air Quality Impact Analysis
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Abbreviations, Notes, and Units:

AGC	Annual Guideline Concentration
CAS#	Chemical Abstracts Service Registry Number
DAR-1	Division of Air Resources-1
NS	None Specified
NYSDEC	New York State Department of Environmental Conservation
SGC	Short-term Guideline Concentration
VSP	Vapor Sampling Point

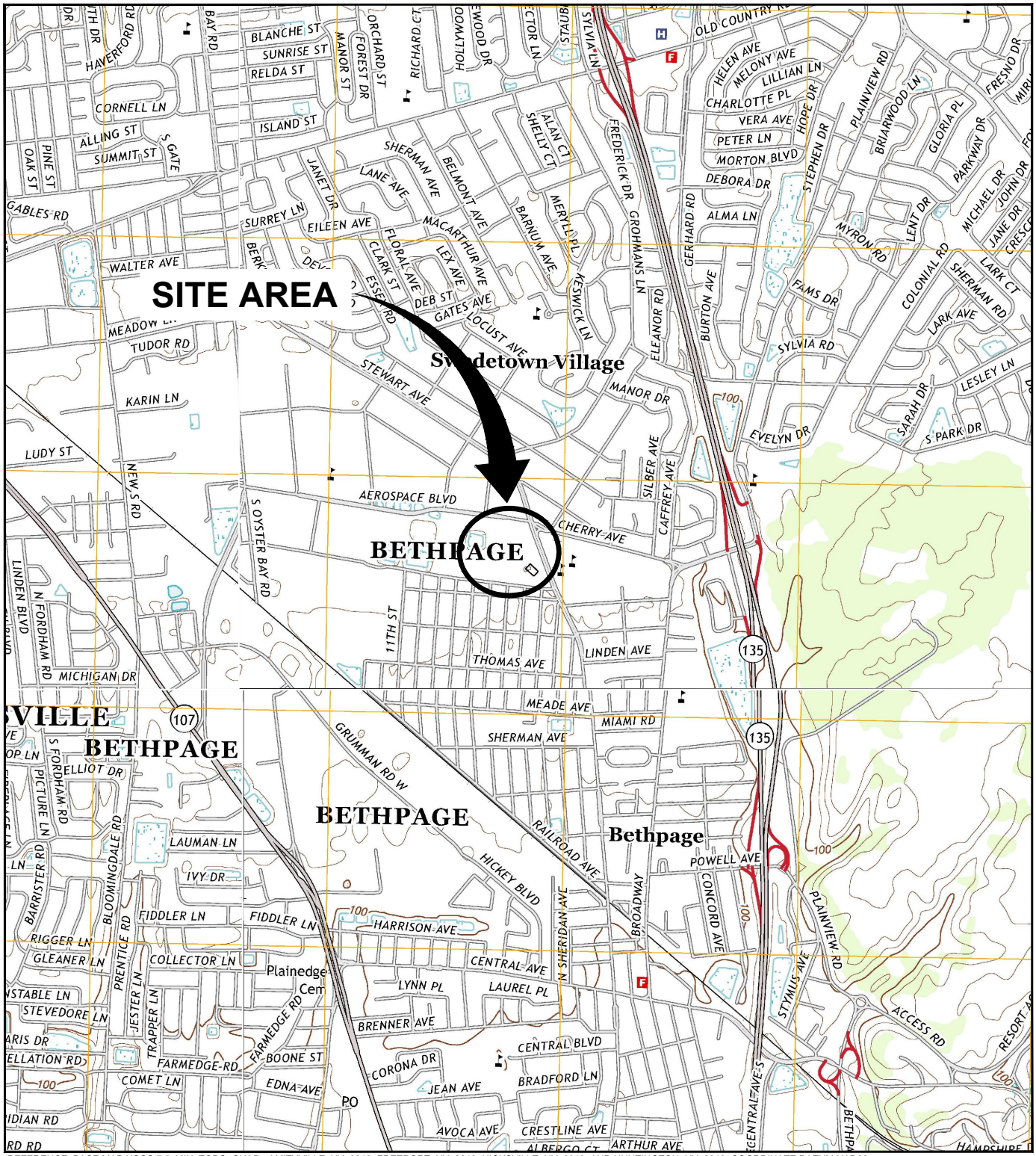
1. Emission rate calculated based on VSP-601 effluent concentration and an exit air flow rate of 653 ft^3/min for 12/11/2017.
   TCE (lb/hr) = TCE [µg/m^3] x Air Flow Rate [ft^3/min] x (1 m^3/35.3147 ft^3) x (60 min/hr) x (0.000001 g/1 ug) x (0.0022 lb/g)
   lb/yr = lb/hr x 8,760 hrs/yr
   g/s = lb/hr x 1 hr/ 3,600 sec x 453.59 g/lb
2. Ambient impact based on AERMOD modeling using normalized rate of 1 g/s is scaled to the actual emission rate of the pollutant. Modeling was performed using the representative meteorological data from the nearest station (Farmingdale) for the years 2011 through 2015. The maximum impact from all the years was used for the calculations.
   Scaled hourly impact (µg/m^3) = AERMOD predicted hourly ambient impact at 1 g/s ([µg/m^3]/[g/s]) x Actual emission rate (g/s)
   Scaled annual impact (µg/m^3) = AERMOD predicted annual ambient impact at 1 g/s ([µg/m^3]/[g/s]) x Actual emission rate (g/s)

AERMOD Normalized Ambient Impact at 1 g/s	
Hourly ([µg/m^3]/[g/s])	Annual ([µg/m^3]/[g/s])
462.83	20.02

3. Short-term and annual guideline concentrations specified in the NYSDEC DAR-1 AGC/SGC tables revised August 10, 2016.
4. Only contaminants with detected concentrations are included in the table.

ft^3/min	cubic feet per minute
g/s	grams per second
µg/m^3	micrograms per cubic meter
lb/hr	pounds per hour

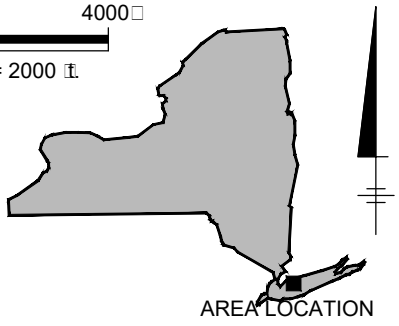
FIGURES



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 PARK SOIL GAS CONTAINMENT SYSTEM
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*
Z:\ENVCAD\SYRACUSE\ACTIVITY\001496\SiteLocMap.dwg LAYOUT: BP SAVED: 3/15/2017 9:38 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/15/2017 9:38 AM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ---
2013A...ville.jpg
2013Freeport.jpg
2013Hic...sville.jpg
2013H...ntington.jpg

PROPERTY OWNED BY TOWN OF OYSTER BAY

STACK LOCATION
grass
GRASS
TREATMENT BUILDING AREA
McKAY FIELD
McKAY FIELD ACCESS ROAD
FORMER TRANSFORMER AREA
ARUMDAUN PRESBYTERIAN CHURCH VISION CENTER (FORMER GRUMMAN PLANT 24)
PARKING LOT
GRASS PENINSULA ISLAND REMOVED. EXTENT OF NEW ASPHALT PAVING
PLANT 24 ACCESS ROAD
FORMER GRUMMAN PLANT 24 ACCESS ROAD PROPERTY
EIGHTH ST.
SEVENTH ST.
SIXTH ST.
FIFTH ST.
TH ST.
bit.
grass

VMWC-14A, VMWC-14B, VMWC-14D, DW-7S, DW-7D

VMWC-14A	
Date	IV (IWC)
12/11/2017	-0.10
9/21/2017	-0.10
6/14/2017	-0.12
3/24/2017	-0.13

VMWC-14B	
Date	IV (IWC)
12/11/2017	-0.18
9/21/2017	-0.19
6/14/2017	-0.18
3/24/2017	-0.20

VMWC-14D	
Date	IV (IWC)
12/11/2017	-0.20
9/21/2017	-0.19
6/14/2017	-0.19
3/24/2017	-0.20

DW-3S, DW-3D, VMWC-9A, VMWC-9B, VMWC-10B, VMWC-10D, VMWC-11B, VMWC-11D, VMWC-12D

VMWC-11B	
Date	IV (IWC)
12/11/2017	-0.12
9/21/2017	-0.12
6/14/2017	-0.11
3/24/2017	-0.20

VMWC-12D	
Date	IV (IWC)
12/11/2017	-0.08
9/21/2017	-0.56
6/14/2017	-0.14
3/24/2017	-0.12

VMWC-15A, VMWC-15B, VMWC-15D, DW-5D, DW-5S

VMWC-15D	
Date	IV (IWC)
12/11/2017	-0.10
9/21/2017	-0.15
6/14/2017	-0.13
3/24/2017	-0.15

VMWC-15B	
Date	IV (IWC)
12/11/2017	-0.11
9/21/2017	-0.14
6/14/2017	-0.11
3/24/2017	-0.16

VMWC-15A	
Date	IV (IWC)
12/11/2017	-0.10
9/21/2017	-0.16
6/14/2017	-0.11
3/24/2017	-0.15

DW-6S, DW-6D, VMWC-3A/B/C/D, VMWC-2A/C/D, VMWC-1B/D, VMWC-1A/C, VMWC-4A/B/C/D, DW-1D, DW-1S

VMWC-3A	
Date	IV (IWC)
12/11/2017	-0.13
9/21/2017	-0.14
6/14/2017	-0.13
3/24/2017	-0.19

VMWC-3B	
Date	IV (IWC)
12/11/2017	-0.14
9/21/2017	-0.15
6/14/2017	-0.14
3/24/2017	-0.16

VMWC-3C	
Date	IV (IWC)
12/11/2017	-0.14
9/21/2017	-0.15
6/14/2017	-0.15
3/24/2017	-0.18

VMWC-3D	
Date	IV (IWC)
12/11/2017	-0.11
9/21/2017	-0.20
6/14/2017	-0.17
3/24/2017	-0.20

VMWC-16A, VMWC-16B, VMWC-16D, DW-4S, DW-4D, VMWC-16D

VMWC-16D	
Date	IV (IWC)
12/11/2017	-0.77
9/21/2017	-0.27
6/14/2017	-0.15
3/24/2017	-0.13

VMWC-16B	
Date	IV (IWC)
12/11/2017	0.00
9/21/2017	-0.17
6/14/2017	-0.15
3/24/2017	-0.13

VMWC-16A	
Date	IV (IWC)
12/11/2017	-0.21
9/21/2017	-0.18
6/14/2017	-0.12
3/24/2017	-0.11

VMWC-17D, DW-8S, DW-9S

VMWC-17D	
Date	IV (IWC)
12/11/2017	-0.26
9/21/2017	-0.24
6/14/2017	-0.28
3/24/2017	-0.29

VMWC-7A, VMWC-7B, VMWC-8A/B/D, DW-2S, DW-2D, VMWC-7A/B, VMWC-7D, DW-10S, VMWC-5A/B/D, VMWC-6A/B/D

VMWC-7A	
Date	IV (IWC)
12/11/2017	-0.11
9/21/2017	-0.12
6/14/2017	-0.12
3/24/2017	-0.17

VMWC-7B	
Date	IV (IWC)
12/11/2017	-0.13
9/21/2017	-0.13
6/14/2017	-0.16
3/24/2017	-0.11

VMWC-13D, DW-11S

VMWC-13D	
Date	IV (IWC)
12/11/2017	-0.27
9/21/2017	-0.19
6/14/2017	-0.12
3/24/2017	-0.23

VMWC-18B, VMWC-18A

VMWC-18B	
Date	IV (IWC)
12/11/2017	-0.09
9/21/2017	-0.10
6/14/2017	-0.11
3/24/2017	-0.18

VMWC-18A	
Date	IV (IWC)
12/11/2017	-0.08
9/21/2017	-0.09
6/14/2017	-0.11
3/24/2017	-0.19

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — NON-COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- VMWC-14A — COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- DW-3S — SHALLOW DEPRESSURIZATION WELL
- DW-3D — DEEP DEPRESSURIZATION WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN
- USEPA — UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

0 50' 100'
APPROXIMATE SCALE IN FEET

NOTES:

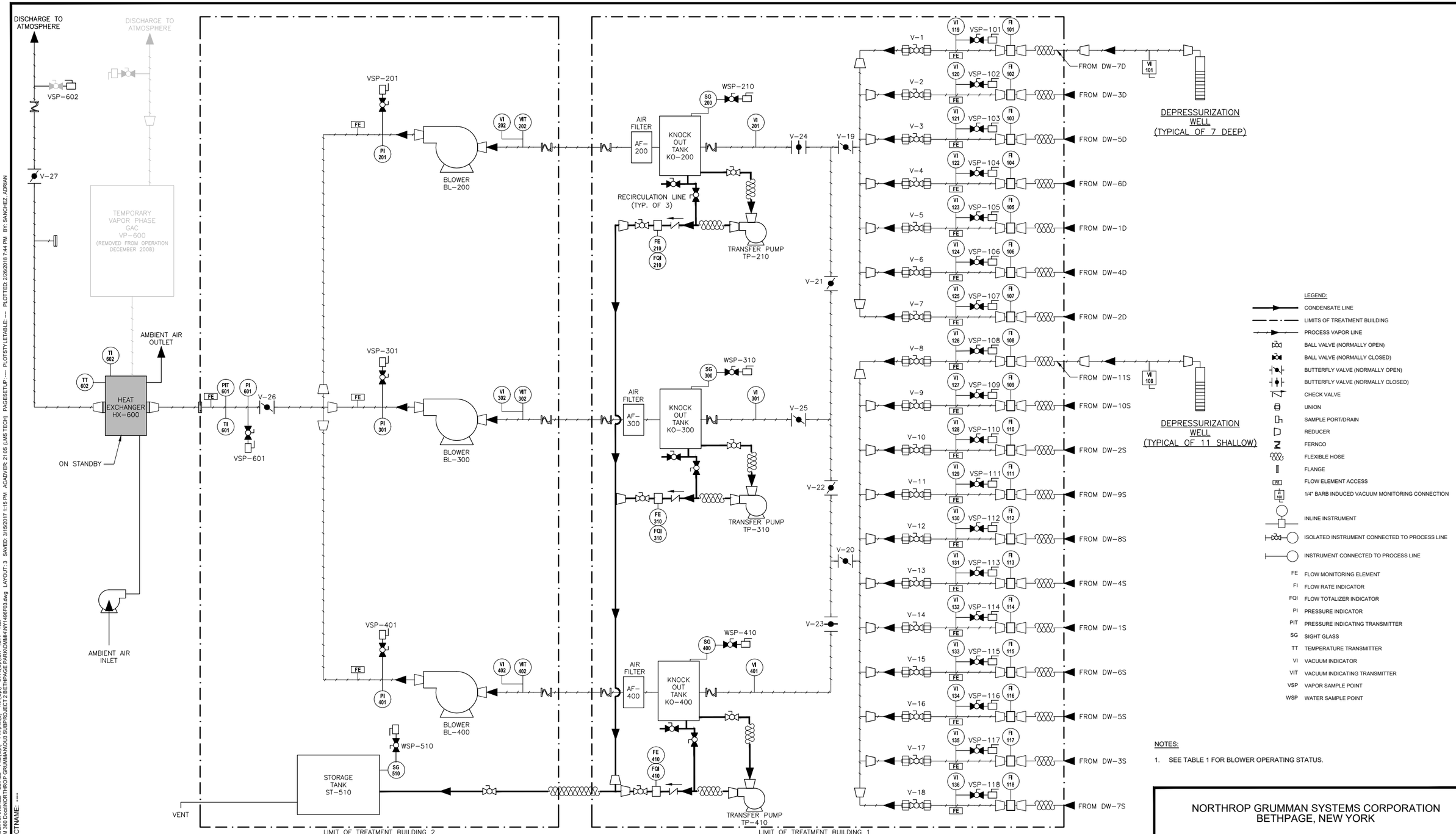
1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE-RELATED VACUUM MONITORING WELLS ON A 12-MONTH ROLLING AVERAGE (ARCADIS 2007).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

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

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2



LEGEND:

- CONDENSATE LINE
- LIMITS OF TREATMENT BUILDING
- PROCESS VAPOR LINE
- BALL VALVE (NORMALLY OPEN)
- BALL VALVE (NORMALLY CLOSED)
- BUTTERFLY VALVE (NORMALLY OPEN)
- BUTTERFLY VALVE (NORMALLY CLOSED)
- CHECK VALVE
- UNION
- SAMPLE PORT/DRAIN
- REDUCER
- FERNCO
- FLEXIBLE HOSE
- FLANGE
- FE — FLOW ELEMENT ACCESS
- VI 108 — 1/4" BARB INDUCED VACUUM MONITORING CONNECTION
- INLINE INSTRUMENT
- ISOLATED INSTRUMENT CONNECTED TO PROCESS LINE
- INSTRUMENT CONNECTED TO PROCESS LINE

FE	FLOW MONITORING ELEMENT
FI	FLOW RATE INDICATOR
FQI	FLOW TOTALIZER INDICATOR
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
SG	SIGHT GLASS
TT	TEMPERATURE TRANSMITTER
VI	VACUUM INDICATOR
VIT	VACUUM INDICATING TRANSMITTER
VSP	VAPOR SAMPLE POINT
WSP	WATER SAMPLE POINT

NOTES:

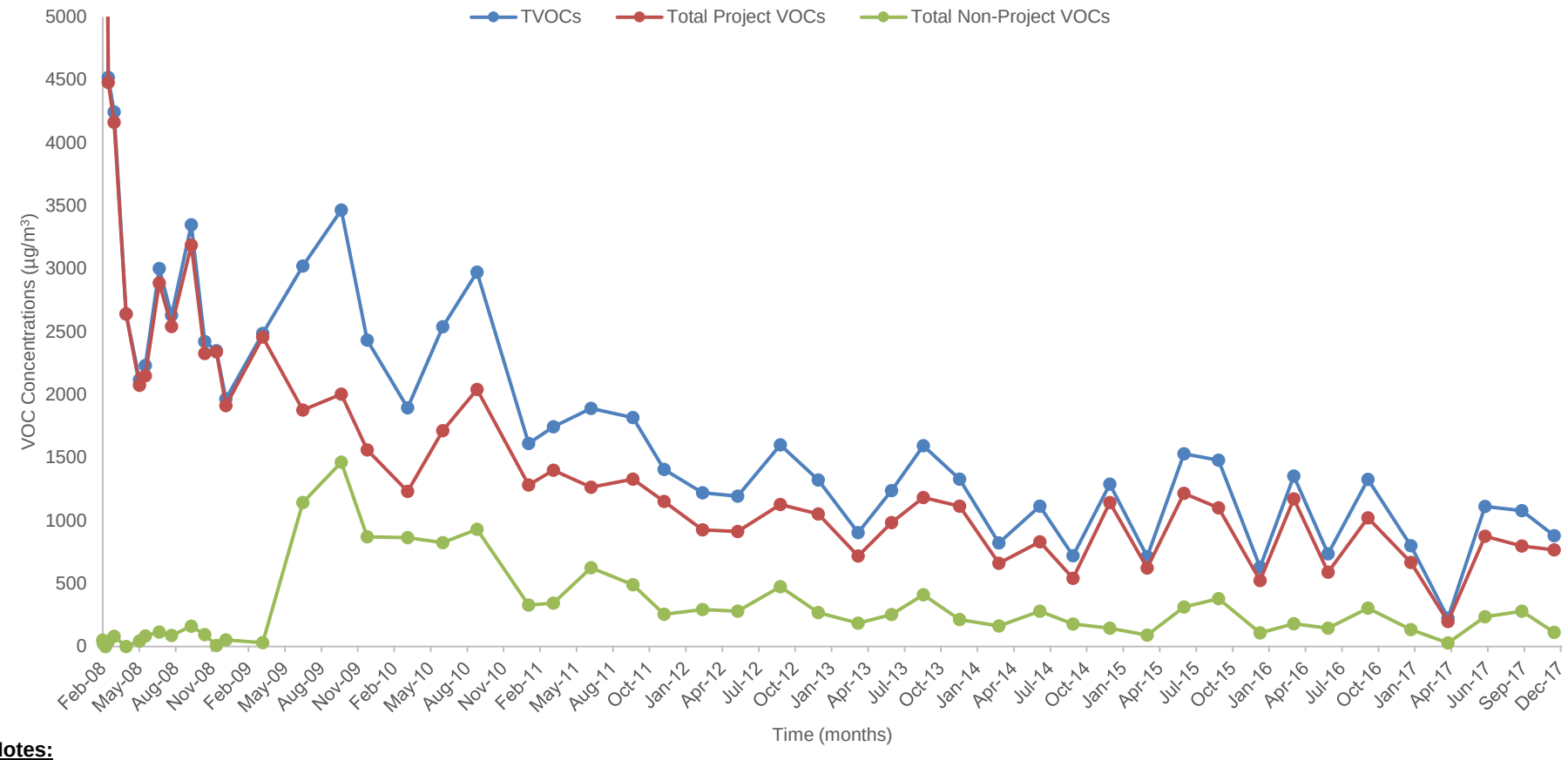
1. SEE TABLE 1 FOR BLOWER OPERATING STATUS.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

PROCESS FLOW DIAGRAM

ARCADIS Design & Consultancy for natural and built assets

FIGURE 3



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.

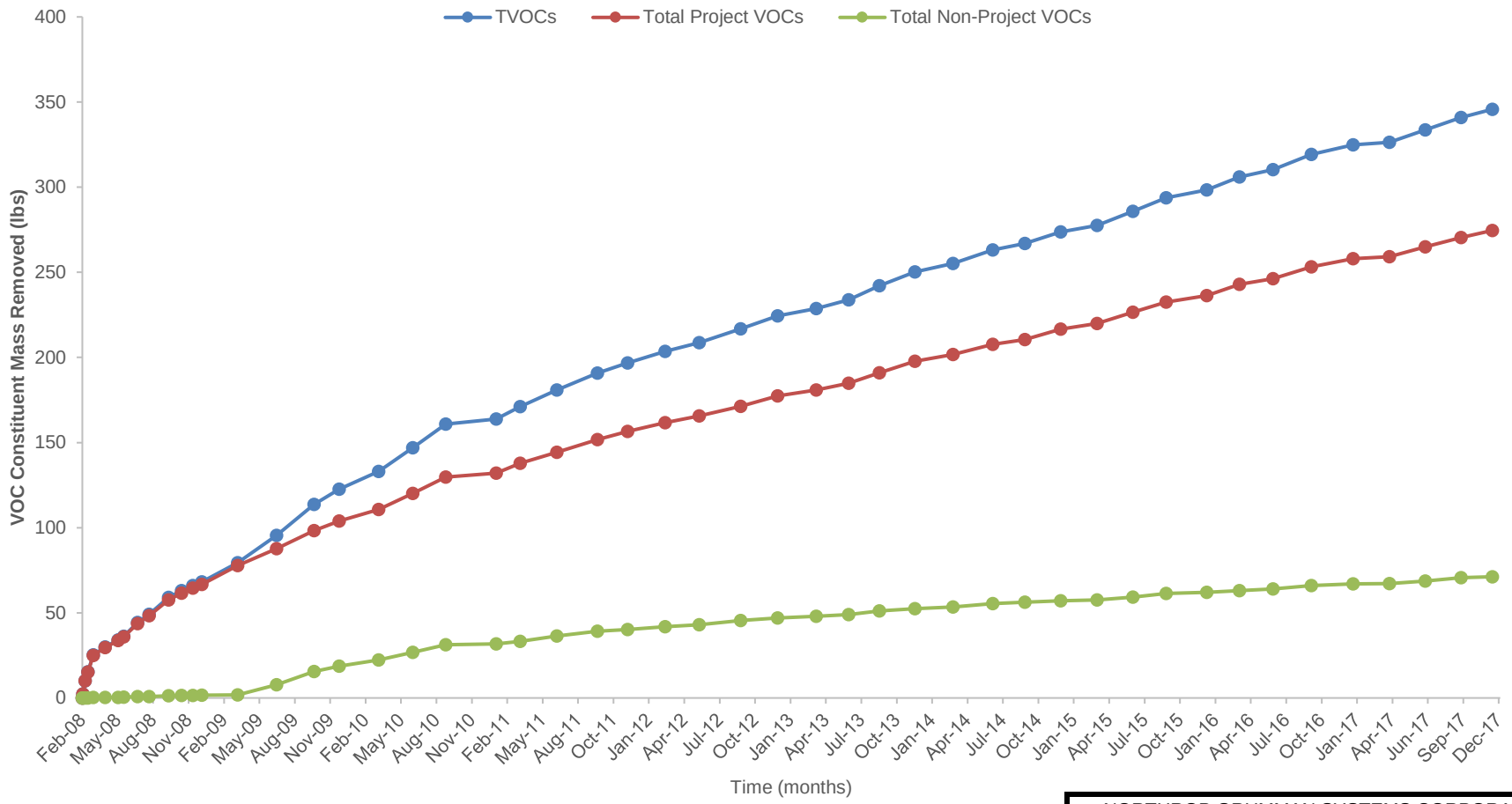
1. Samples were collected at Vapor Sample Port-601 (VSP-601); refer to Figure 3 of this OM&M report for the location of VSP-601.
2.Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 18, 2008 - 20,622 µg/m³, February 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.

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

SOIL GAS VOC CONCENTRATIONS

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.

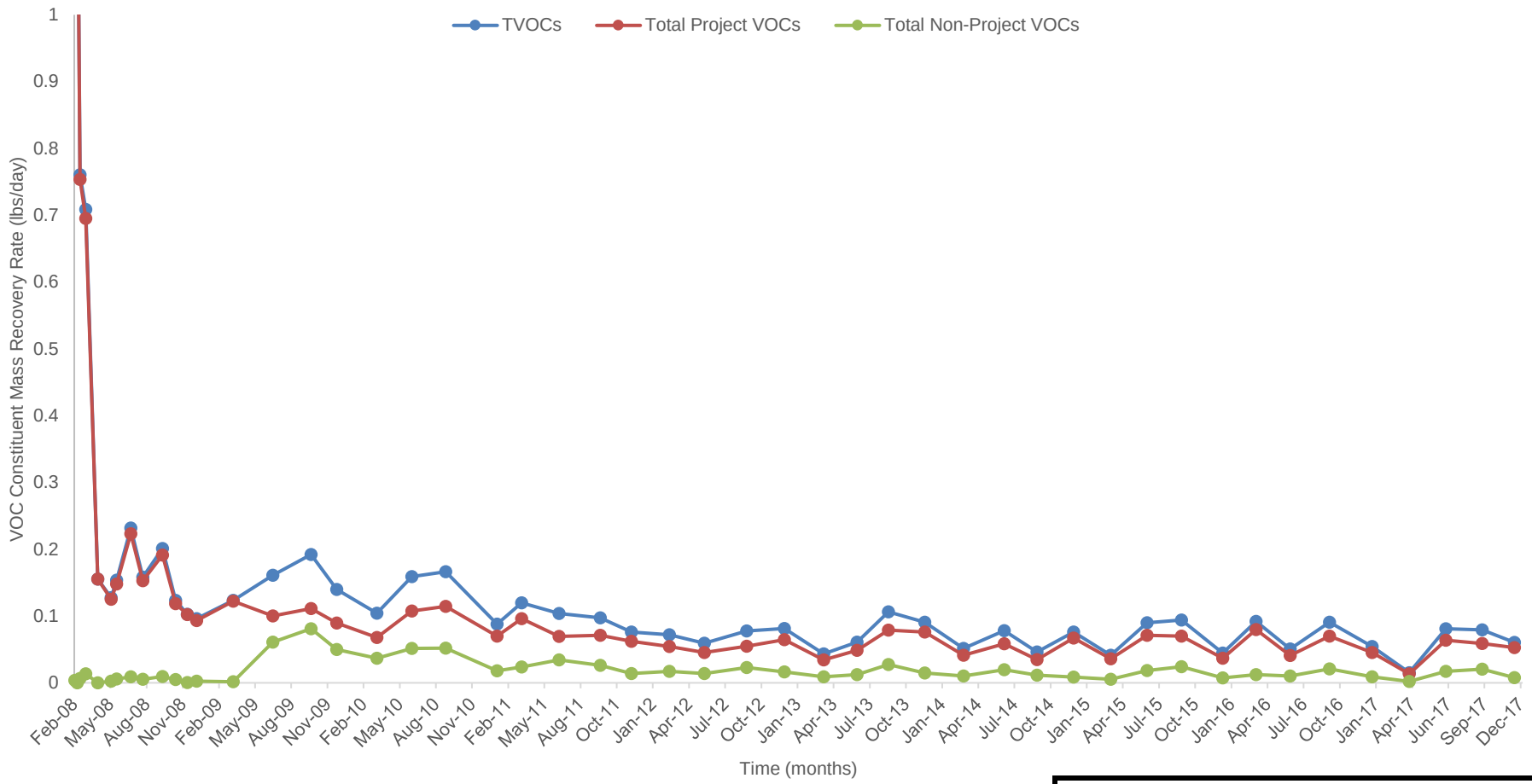
1. The sample results from December 3, 2010 were not consistent with historical data and thus, the recovery rate is not included in this table.

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

CUMULATIVE TOTAL, PROJECT, AND NON-PROJECT VOC MASS REMOVED

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.

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

VOC MASS RECOVERY RATES

ARCADIS Design & Consultancy for natural and built assets

FIGURE
6

Arcadis of New York, Inc.

Two Huntington Quadrangle

Suite 1S10

Melville, New York 11747

Tel 631 249 7600

Fax 631 249 7610

www.arcadis.com