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.
105 Maxess Road,
Suite N108
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610
www.arcadis.com

Subject:
2023 Annual Summary Report for the Northrop Grumman Bethpage Park Soil Gas Containment System (BPSGCS), Operable Unit 3 (OU3; Former Grumman Settling Ponds), Bethpage, New York, NYSDEC Site #1-30-003A

Date:
July 1, 2024

Contact:
Christopher Engler

Phone:
315.409.6579

Email:
christopher.engler@arcadis.com

Our ref:
30227171

Dear Jason:

Enclosed is one electronic PDF copy of the 2023 Annual Summary Report for the 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) 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 me.

Sincerely,

Arcadis of New York, Inc.

Christopher Engler PE

Vice President

Enclosure

Copies:
Edward Hannon, Northrop Grumman
Sarah Johnston, NYSDEC
Jim Sullivan, NYS Dept. of Health
Angela Pettinelli, Nassau County Dept. of Health
Robin Putnam, Nassau County Dept. of Health
Richard Castle, Nassau County Dept. of Health
Carlo San Giovanni, Arcadis
Nidal Azzam, USEPA
Alexis Stabulas, USEPA
Public Repository
File

Northrop Grumman

2023 Annual Operation, Maintenance, and Monitoring Report

Operable Unit 3 – Soil Gas Containment System (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID # 1-30-003a

July 1, 2024

2023 Annual Operation, Maintenance and Monitoring Report

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

July 1, 2024

Prepared By:
Arcadis of New York, Inc.
105 Maxess Road, Suite N108
Melville
New York 11747
Phone: 631 249 7600
Fax: 631 249 7610

Prepared For:
Northrop Grumman

Our Ref:
30227171.RPTI4

Arnas Nemickas
Project Manager

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

Michael F. Wolfert
Technical Expert

Carlo San Giovanni
Program Manager

Contents

Tables

Figures

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 (ROD) (NYSDEC 2013), Arcadis of New York, Inc. (Arcadis), on behalf of 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) and former Plant 24 Access Driveway, 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 2023 (i.e., January 1 through December 31, 2023 [the "annual reporting period"]) are summarized in this Annual Summary Report. Data summaries for the previous three 2023 operational quarterly periods are available in the following letter reports:

- Results of 2023 First Quarter Operation and Monitoring for the Bethpage Park Soil Gas Containment System, May 2023 (Arcadis 2021a)
- Results of 2023 Second Quarter Operation and Monitoring for the Bethpage Park Soil Gas Containment System, August 2023 (Arcadis 2021b)
- Results of 2023 Third Quarter Operation and Monitoring for the Bethpage Park Soil Gas Containment System, November 2023 (Arcadis 2021c)

During 2023, 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 2016).

As discussed in the Site Area 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; trichloroethylene; 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) 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:

- 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 former Plant 24 Access Driveway and McKay Field Access Road, south and west of the Park, respectively, (Figure 2) and;
- 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 establish and maintain -0.1 inch of water column (iwc) within a negative pressure curtain within the vadose zone along the former Plant 24 Access Driveway and along the McKay Field Access Road, from the boundary of the former Plant 24 Access Driveway to approximately 400 feet north along the MacKay Field Access Road, based on a 12-month rolling average.
- Treat extracted vapors until it is demonstrated that 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).
- 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 the collected condensate to the Bethpage Park Groundwater Containment System (BPGWCS) treatment system for treatment prior to discharge 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 (Arcadis 2007b) by the NYSDEC, the design package was finalized and the BPSGCS was 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. The remaining system components are located outside the treatment building and include one 35.5-foot tall by 16-inch diameter effluent stack, one heat exchanger, 18 depressurization wells, and 50 induced vacuum monitoring wells, also shown on Figure 2. Induced vacuum measurements collected during 2023 are also provided on Figure 2. A process flow diagram showing system configuration and 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 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 2016), and consisted of the following routine activities:

- Continuous monitoring of system performance parameters by the Supervisory Control and Data Acquisition (SCADA) system.
- Weekly site visits 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 and 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 and as needed maintenance of equipment, per manufacturers' specifications.
- Maintenance of equipment and system components in response to alarm conditions or system parameters operating outside of their normal 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 west 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 system shutdown event.

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

- Non-routine 2-hour shutdown in April 2023 due to power shutdown for ISTR area.
- Non-routine 1-hour shutdown in May 2023 to troubleshoot vacuum readings at monitoring wells.
- Non-routine 22.5-hour shutdown in October 2023 due to a heat exchanger fault.
- Non-routine 2.5-hour shutdown in October 2023 due to electrical work.
- Non-routine 28-hour shutdown in December 2023 due to a Programmable Logic Controller (PLC) upgrade.

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 as described above. 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 363 days out of a total 365 days (99.5% uptime).
- An annual rolling average induced vacuum of -0.1 iwc or more negative was maintained at all vacuum monitoring points throughout the annual reporting period.

4.3 Conclusions 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 2023 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).

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 activities 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 allowable emissions. 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 results of photoionization detector [PID] screening level readings of total effluent vapor samples measured during the annual reporting period are provided in Table 1. The screening results were 0.0 ppmv in all four quarters during the annual reporting period.

5.2.2 Containment System Compliance Monitoring

5.2.2.1 System Operating Parameters

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

As shown in Table 2, during the annual reporting period, the instantaneous induced vacuum at all compliance-related monitoring points met or exceeded the minimum performance standard (more negative than or equal to -0.1 iwc), with the exception of VMWC-16B. Although the instantaneous induced vacuum reading at VMWC-16B on 2/9/23 was less than -0.1 iwc of vacuum, the twelve-month rolling average met the compliance goal of -0.1 iwc of vacuum.

5.2.2.2 Vapor Sampling

The total volatile organic compound (TVOC) concentrations attributed to the OU3 Soil Gas System extraction wells ranged from 423 micrograms per cubic meter (µg/m^3) on November 9, 2023 to 650 µg/m^3 on August 31, 2023, as shown in Table 3. The Project TVOC concentrations ranged from 331 µg/m^3 on November 9, 2023 to 508 µg/m^3 on August 31, 2023. The Non-Project TVOC concentrations ranged from 88 µg/m^3 on February 9, 2023 to 142 µg/m^3 on August 31, 2023.

The TVOC concentration in the soil gas system vapor has generally declined since system startup. Figure 4 provides an overview of the concentration trend over the period of record, which has been generally down; however, there were noticeable increases in 2021 and again in 2022. Information on those historical detections was provided in the associated annual reports. During the reporting period the containment system has removed 11.5 pounds of TVOCs, with 9.1 pounds of Project TVOCs (79.1%) and 2.4 pounds of Non-project TVOCs (20.9 %). The containment system removed a total of 492.9 pounds of TVOCs, 404.3 pounds of Project TVOCs (82.0%), and 88.6 pounds of Non-project TVOCs (18.0%) since startup on February 18, 2008, as shown on Figure 5. Increases in the concentration trend mentioned above regarding Figure 4 is also reflected in the

cumulative VOC mass removed in Figure 5 by the noticeable upward deflection in the trend line in 2021 and the more subtle upward deflection in 2022. Figure 6 presents the mass removal rate, which has declined since system startup with the exception of the increases in 2021 and 2022 which are consistent with the increases/upward deflections noted above.

Benzene, carbon tetrachloride, trichloroethene (trichloroethylene) and vinyl chloride, classified as environmentally "A"-rated compounds as defined in DAR-1 AGC/SGC tables (NYSDEC 2016), were detected in the effluent vapor samples during the annual reporting period and the concentrations were consistent with historical data.

5.2.2.3 Condensate Sample

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

5.2.3 Air Discharge and Dispersion Modeling

Facility-wide emissions were evaluated for the reporting period to determine compliance with the DAR-1 Guideline for The Evaluation and Control of Ambient Air Contaminants Under 6 CRR-NY 212 (Rule 212). Two different emission sources, that operated throughout the reporting period, are collectively considered the facility-wide emission sources. These emission sources consist of:

- OU3 Bethpage Park Groundwater Containment System (BPGWCS) which operated for the entire reporting period.
- OU3 Bethpage Park Soil Gas Containment System (BPSGCS) which operated for the entire reporting period.

Pursuant to 6 CRR-NY 212-2.1, for an air contaminant listed in section 212-2.2 table 2 – high toxicity air contaminant (HTAC) list, the facility owner or operator shall either limit the actual annual emissions from all process operations at the facility so as to not exceed the mass emission limit listed for the individual HTAC; or demonstrate compliance with the air cleaning requirements for the HTAC as specified in subdivision 212-2.3(b), table 4 – degree of air cleaning required for non-criteria air contaminants, of this Subpart for the environmental rating assigned to the contaminant by the department. For each non-HTAC air contaminant, dispersion modeling will not be required if the actual annual emission rate is less than 100 pounds per year facility-wide. Actual annual emission rates used for comparison can take control devices into account and must meet the provisions of 212-1.5(g). Emission source specific and facility-wide emission rates were calculated for the detected constituents for the reporting period and are summarized in Table 5. All detected compounds were below the compound specific mass emission limit for the reporting period and therefore, no further analysis was required.

Based on Table 5, the facility-wide effluent air discharge for the annual reporting period meets the requirements of Rule 212.

6 Conclusions and Suggestions

6.1 Conclusions

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

- OM&M requirements as described in the OU3 BPSGCS OM&M Manual were met during the annual reporting period.
- The BPSGCS met design and performance objectives during the annual reporting period:
  - The system maintained 0.1 inch of water column (iwc) within a negative pressure curtain based on a 12-month rolling average.
  - The system operated continuously with the exception of shutdown periods for routine and non-routine maintenance (99.5% uptime).
  - A total of 11.5 pounds of VOCs were removed from the subsurface during the annual reporting period, and a total of 492.9 pounds of VOCs were removed since system startup in 2008.
  - The operation of the BPSGCS complied with applicable NYSDEC SCGs during the annual reporting period.
  - The facility-wide effluent air discharge for the annual reporting period meets the requirements of Rule 212.

6.2 Suggestions

Based on the information provided herein, the operation, maintenance, and monitoring of the BPSGCS should continue in accordance with the consent order and approved plans. No system modifications or upgrades are needed at this time.

7 Certification

Statement of Certification

On behalf of Northrop Grumman, 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. 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. 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. 2021a. Results of First Quarter 2021 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.

Arcadis of New York, Inc. 2021b. Results of Second Quarter 2021 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.

Arcadis of New York, Inc. 2021c. Results of Third Quarter 2021 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.

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. Northrop 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)
Northrop Grumman,
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
2/9/23	90	-22	-1.57	13.0	-11.0	-0.54	7.0	-6.0	-0.19	11.0	-12.0	-0.38	62	-13.0	-0.90	12	-11.0	-2.89	65	-14	-1.27	9	-7	-1.87
6/16/23	110	-19	-1.80	5.0	-6.0	-0.44	6.0	-7.0	-0.21	11.0	-10.0	-0.36	63	-12.0	-1.68	20	-20.0	-0.58	48	-11	-0.88	8.2	-6	-1.55
8/31/23	105	-19	-1.79	5.0	-9.0	-0.43	5.0	-7.0	-0.22	11.0	-10.0	-0.40	65	-11.0	-0.93	18	-15.0	-3.40	45	-10	-0.76	7.8	-6	-1.49
11/9/23	95	-24	-1.77	5.0	-9.0	-0.46	6.0	-6.0	-0.23	11.0	-10.0	-0.46	65	-11.0	-1.56	11	-10.0	-0.86	44	-11	-1.59	7.8	-7	-0.92

Notes, Abbreviations, and Units on last page.

Table 1
General System Operating Parameters
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
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
2/9/23	80	-20	-1.82	4.5	-3	-1.28	47	-12.0	-0.78	8.0	-9	-0.51	65	-27.0	-1.99	30	-12	-1.24	34	-29	-1.47	30	-16	-1.78
6/16/23	95	-22	-1.69	5.7	-4	-1.18	72	-14.0	-1.50	10.0	-6	-0.66	78	-20.0	-2.21	34	-12	-1.43	30	-34	-0.98	34	-21	-2.17
8/31/23	95	-22	-1.97	5.7	-4	-1.73	70	-14.0	-1.41	8.0	-8	-0.61	75	-20.0	-2.37	35	-12	-1.29	40	-25	-2.03	32	-19	-2.04
11/9/23	95	-22	-0.23	5.9	-3.5	-1.78	70	-14.0	-1.54	10.0	-5	-0.19	65	-26.0	-0.21	33	-13	-1.41	34	-27	-1.99	22	-19	-1.91

Notes, Abbreviations, and Units on last page.

Table 1
General System Operating Parameters
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
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
2/9/23	35	-21	-2.31	12	-37	-0.45	NA	-40	-40	0	NA	NA	NA	42	NA	60	40	2	40	781.99	0.0	120	3.0	67
6/16/23	44	-15	-2.43	20	-15	-2.80	NA	-39	-40	70	NA	NA	NA	39	NA	60	39	3	40	628.61	0.0	125	3.0	96
8/31/23	35	-18	-2.15	34	-27	-2.26	-40	-38	0	180	NA	NA	NA	40	NA	60	5	0	40	739.88	0.0	125	3.5	97
11/9/23	35	-24	-2.12	22	-29	-0.11	NA	-38	-40	175	NA	NA	NA	42	NA	60	38	0	40	627.58	0.0	117	3.0	120

Notes, Abbreviations, and Units on last page.

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

Notes, Abbreviations, and Units:

1. Total gallons of water accumulated at storage tank ST-510 per quarter are based on storage tank level and condensate removed as documented in site operator condensate discharge 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.

DW	Depressurization Well
NA	Not Applicable
°F	degrees Fahrenheit
Hz	Hertz
iwc	inches of water column
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)
Northrop Grumman,
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-15E[3]	VMWC-3A	VMWC-3B	VMWC-3C	VMWC-3D	VMWC-16D	VMWC-16A	VMWC-16B[4]	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
02/09/23	-0.10	-0.10	-0.13	-0.14	-0.10	-0.10	-0.10	-0.10	-0.50	-0.50	-0.50	-0.50	-0.10	-1.27	0.01	-0.11	-0.10	-0.12	-0.11	-0.24	-0.02
06/16/23	-0.10	-0.20	-0.19	-0.10	-1.30	-0.11	-0.11	-0.10	-0.15	-0.13	-0.12	-0.42	-0.23	-0.23	-0.14	-0.11	-1.32	-0.21	-0.24	-0.11	-0.12
08/31/23	-0.11	-0.17	-0.17	-0.31	-0.12	-0.12	-0.10	-0.10	-0.14	-0.16	-0.15	-0.22	-0.24	-0.18	-1.24	-0.11	-0.47	-0.22	-0.24	-0.11	-0.14
11/09/23	-0.11	-0.22	-0.23	-0.10	-0.10	-0.11	-0.11	-0.11	-0.23	-0.17	-0.22	-0.16	-0.18	-0.16	-0.11	-0.11	-0.27	-0.50	-0.16	-0.11	-0.16
Time Weighted Rolling Average[1]	**-0.10**	**-0.17**	**-0.18**	**-0.15**	**-0.53**	**-0.11**	**-0.11**	**-0.10**	**-0.25**	**-0.23**	**-0.24**	**-0.34**	**-0.19**	**-0.45**	**-0.33**	**-0.11**	**-0.65**	**-0.25**	**-0.19**	**-0.14**	**-0.11**

Gross Average Compliance Points[1,2]	
2023	-0.22

Notes, Abbreviations, and Units:

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 preceding four quarters and dividing by the number of readings.
3. Replacement well VMWC-15E installed on 7/21/20 to replace VMWC-15D.
4. Although the instantaneous induced vacuum reading at VMWC-16B on 2/9/23 was less than -0.1 iwc of vacuum, the twelve-month rolling average met the compliance goal of -0.1 iwc of vacuum.

DW	Depressurization Well
iwc	inches of water column
VMWC	Vapor Monitoring Well Cluster

Table 3
OU3 Soil Gas Containment System
Influent Vapor Sample Analytical Results
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York

Compound (units in µg/m^3)	Sample ID[1, 2]: Sample Date:	VSP-601 2/9/2023	VSP-601 5/16/2023	VSP-601 8/31/2023	VSP-601 11/9/2023
Project VOCs	**CAS No.**				
1,1,1-Trichloroethane	71-55-6	**1.9**	**2.1**	**4.7**	**2.9**
1,1-Dichloroethane	75-34-3	**4.9**	**4.5**	**6.1**	**4.9**
1,1-Dichloroethene	75-35-4	**0.75**	**1.1**	**0.5**	< 0.32
1,2-Dichloroethane	107-06-2	< 0.65	< 0.81	< 0.65	< 1.6
Benzene	71-43-2	**0.54**	< 0.64	**1.0**	< 1.3
cis-1,2-Dichloroethene	156-59-2	**117**	**142**	**157**	**96**
Tetrachloroethene	127-18-4	**3.9**	**5.6**	**8.1**	**6.7**
Toluene	108-88-3	**0.98**	**2.9**	**0.3**	**1.2**
trans-1,2-Dichloroethene	156-60-5	**2.1**	**3.0**	**3.5**	**2.4**
Trichloroethylene	79-01-6	**260**	**274**	**325**	**217**
Vinyl chloride	75-01-4	**1.1**	**0.89**	**0.38**	< 0.20
Xylenes - O	95-47-6	< 0.69	**0.42 J**	< 0.48	< 1.7
Xylenes - M,P	1330-20-7	**0.61 J**	**0.69 J**	**0.96 J**	< 1.7
Subtotal Project VOCs		**394**	**437**	**508**	**331**
Non-Project VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	< 0.55	<0.69	<0.55	<1.1
1,1, 2-Trichloroethane	79-00-5	< 0.44	<0.55	<0.44	<1.1
1,2-Dichloropropane	78-87-5	< 0.74	<0.92	<0.74	<1.8
1,3-Butadiene	106-99-0	< 0.35	<0.44	<0.35	<0.88
1-Chloro-1,1-difluoroethane (Freon 142B)	75-68-3	**47.7**	**90.8**	**77.3**	**43.6**
2-Butanone	78-93-3	**3.2**	**2.8**	**3.5**	**0.9**
2-Hexanone	591-78-6	**0.78**	< 0.82	< 0.65	<1.6
4-Methyl-2-Pentanone	108-10-1	< 0.66	< 0.82	< 0.66	<1.6
Acetone	67-64-1	**5.0**	**4.8**	**15.0**	**6.2**
Bromodichloromethane	75-27-4	< 0.54	<0.67	<0.54	<1.3
Bromoethene	593-60-2	--	<0.78	--	--

Notes, Abbreviations, Qualifiers, and Units on last page.

Table 3
OU3 Soil Gas Containment System
Influent Vapor Sample Analytical Results
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York

Compound (units in µg/m^3)	Sample ID[1, 2]: Sample Date:	VSP-601 2/9/2023	VSP-601 5/16/2023	VSP-601 8/31/2023	VSP-601 11/9/2023
Non-Project VOCs (cont'd)					
Bromoform	75-25-2	< 0.33	<0.41	<0.33	<0.83
Bromomethane	74-83-9	< 0.62	<0.78	<0.62	<1.6
Carbon Disulfide	75-15-0	< 0.50	<0.62	<0.50	<1.2
Carbon Tetrachloride	56-23-5	< 0.20	**0.60**	**0.69**	<0.50
Chlorobenzene	108-90-7	< 0.74	<0.92	<0.74	<1.8
Chlorodibromomethane	124-48-1	<0.68	<0.85	<0.68	<1.7
Chloroethane	75-00-3	<0.42	<0.53	<0.42	<1.1
Chlorodifluoromethane (Freon 22)	75-45-6	**0.88**	<0.70	**1.70**	**1.40**
Chloroform	67-66-3	**21**	**26**	**40**	**25**
Chloromethane	74-87-3	**0.56**	<0.41	<0.33	<0.83
cis-1,3-Dichloropropene	542-75-6	< 0.73	<0.91	<0.73	<1.8
Dichlorodifluoromethane (Freon 12)	75-71-8	**2.2**	<0.99	**1.60**	**2.00**
Ethylbenzene	100-41-4	< 0.69	<0.87	<0.69	<1.7
Methylene Chloride	75-09-2	**5.6**	**1.4**	**1.2**	**13.0**
Methyl Tert-Butyl Ether	1634-04-4	< 0.58	<0.72	<0.58	<1.4
Styrene	100-42-5	< 0.68	**2.0**	< 0.68	<1.7
trans-1,3-Dichloropropene	10061-02-6	< 0.73	<0.91	<0.73	<1.8
Trichlorofluoromethane (Freon 11)	75-69-4	**1.5**	**1.3**	**1.3**	<1.1
Trichlorotrifluoroethane (Freon 113)	76-13-1	<0.61	<0.77	<0.61	<1.5
Subtotal Non-Project VOCs		**88**	**130**	**142**	**92**
TVOC[2]		**482**	**567**	**650**	**423**

Notes, Abbreviations, Qualifiers, and Units on last page.

Table 3
OU3 Soil Gas Containment System
Influent Vapor Sample Analytical Results
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York

Notes, Abbreviations, Qualifiers, and Units:

1. VSP 601: 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.

CAS No.	Chemical Abstracts Service list number
ELAP	Environmental Laboratory Approval Program
NYSDOH	New York State Department of Health
NYSDEC	New York State Department of Environmental Conservation.
TVOC	Total Volatile Organic Compounds
VOC	Volatile Organic Compound

4.7	Bolding indicates that the analyte was detected at or above laboratory reporting limit
<0.65	Compound not detected above its laboratory quantification limit
J	Compound detected below laboratory reporting limit; result is estimated
µg/m^3	micrograms per cubic meter

Table 4
2023 Rule 212 Evaluation
Bethpage Park Soil Gas Containment System and Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York

Project VOCs	CAS#	HTAC?[1]	2023 BPGWCS Maximum Effluent Conc. (ug/m3)[2,8]	2023 BPSGCS Maximum Effluent Conc. (ug/m3)[2,8]	2023 BPGWCS Emissions (lb/yr)[4]	2023 BPSGCS Emissions - combined with ISTR (lb/yr)[4]	Facility Wide Emissions (lb/yr)[5]	Rule 212 Emission Limit (lb/yr)[6]	Further evaluation Required?[7]
1,1,1-Trichloroethane	71-55-6	No		4.7	0.000	0.017	0.238	100	N
1,1 - Dichloroethane	75-34-3	No	15	6.1	0.619	0.090	0.996	100	N
1,1 - Dichloroethene	75-35-4	No	9.1	1.1	0.375	0.027	0.454	100	N
Benzene	71-43-2	Yes	12	1.0	0.495	0.010	0.552	100	N
cis- 1,2-Dichloroethene	156-59-2	No	1990	157	82.101	4.155	93.650	100	N
Tetrachloroethene	127-18-4	Yes	5.8	8.1	0.239	0.011	0.632	1000	N
Toluene	108-88-3	No	1.6	2.9	0.066	0.016	0.219	100	N
trans- 1,2-Dichloroethene	156-60-5	No	17	3.5	0.701	0.141	1.007	100	N
Trichloroethene	79-01-6	Yes	1240	325	51.158	0.009	66.474	500	N
Vinyl Chloride	75-01-4	Yes	107	1.1	4.414	0.186	4.652	100	N
Xylenes[3]	1330-20-7	No	4.6	1.11	0.190	0.043	0.285	100	N
Non-Project VOCs									
1-Chloro-1,1-difluoroethane (Freon 142B)	75-68-3	No		90.8	0.000	0.000	4.276	100	N
2-Butanone	78-93-3	No	2.7	3.5	0.111	0.051	0.328	100	N
2-Hexanone	591-78-6	No		0.78	0.000	0.000	0.037	100	N
Acetone	67-64-1	No	36.3	15.0	1.498	0.323	2.527	100	N
Carbon Tetrachloride	56-23-5	Yes		0.69	0.000	0.000	0.032	100	N
Chlorodifluoromethane (Freon 22)	75-45-6	No	3.4	1.70	0.140	0.000	0.220	100	N
Chloromethane	74-87-3	No	2.5	0.56	0.103	0.013	0.143	100	N
Chloroform	67-66-3	Yes	16	40	0.660	0.307	2.851	100	N
Dichlorodifluoromethane (Freon 12)	75-71-8	No	2.1	2.2	0.087	0.019	0.210	100	N
Ethylbenzene	100-41-4	No	7.4		0.305	0.012	0.317	100	N
Methylene Chloride	75-09-2	No	3.5	13.0	0.144	0.024	0.781	100	N
Styrene (Monomer)	100-42-5	No		2.0	0.000	0.000	0.094	100	N

Footnotes on last page

Table 4
2023 Rule 212 Evaluation
Bethpage Park Soil Gas Containment System and Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York

Project VOCs	CAS#	HTAC?[1]	2023 BPGWCS Maximum Effluent Conc. (ug/m3)[2,8]	2023 BPSGCS Maximum Effluent Conc. (ug/m3)[2,8]	2023 BPGWCS Emissions (lb/yr)[4]	2023 BPSGCS Emissions - combined with ISTR (lb/yr)[4]	Facility Wide Emissions (lb/yr)[5]	Rule 212 Emission Limit (lb/yr)[6]	Further evaluation Required?[7]
Non-Project VOCs (cont'd)									
Trichlorofluoromethane (Freon 11)	75-69-4	No	1.1	1.5	0.045	0.016	0.132	100	N
Trichlorotrifluoroethane (Freon 113)	76-13-1	No	1.6		0.066	0.000	0.066	100	N

Flowrates

Description	Flow (cfm)
BPGWCS	1260
BPSGCS	782

Notes:

1. High toxicity air contaminant (HTAC) based on 6 CRR-NY Rule 212-2.2, Table 2 – high toxicity air contaminant list.

2. Maximum effluent concentrations for soil gas effluent from VSP-601 and GW vapor from VSP-05 based on sampling performed in 2023. Compounds not detected above the laboratory reporting limit are excluded from the air quality impact analysis summary.

3. Total for xylenes m, o, and P.

4. Emission rate calculated based on maximum effluent concentration and maximum air flow rates measured during the sampling events. Emission rate standardized at 70 ^{o}F and 1 atm.

e.g., TCE (lb/yr) = 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 µg) x (0.0022 lb/g) x 8,760 hrs/yr

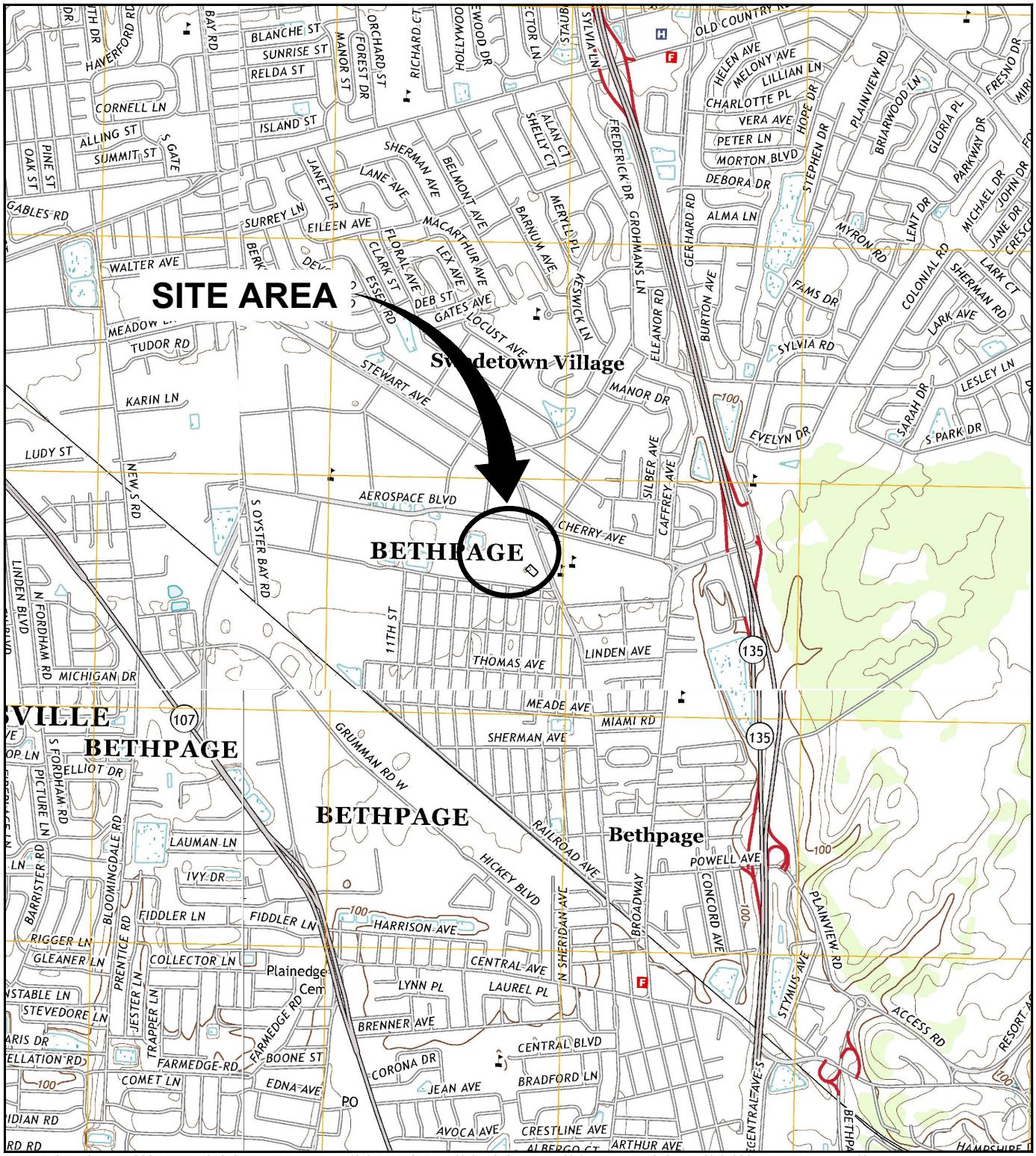
5. Combined 2023 emissions from groundwater, ISTR, and soil gas containment systems.

6. 100 lb/yr for non-HTACs, and mass emission limits based on Rule 212-2.2, Table 2 for HTACs.

7. For HTACs, no further demonstration (i.e., comparison to SGCs, AGCs, or air modeling) is required if the actual facility-wide emissions are less than mass emission limit. For non-HTACs, no further demonstration is required if the actual facility-wide emissions are less than 100 lbs/yr.

8. Blank cell indicates that the compound was not detected above its laboratory quantification limit.

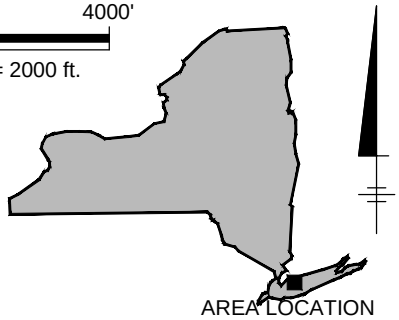
Figures



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.



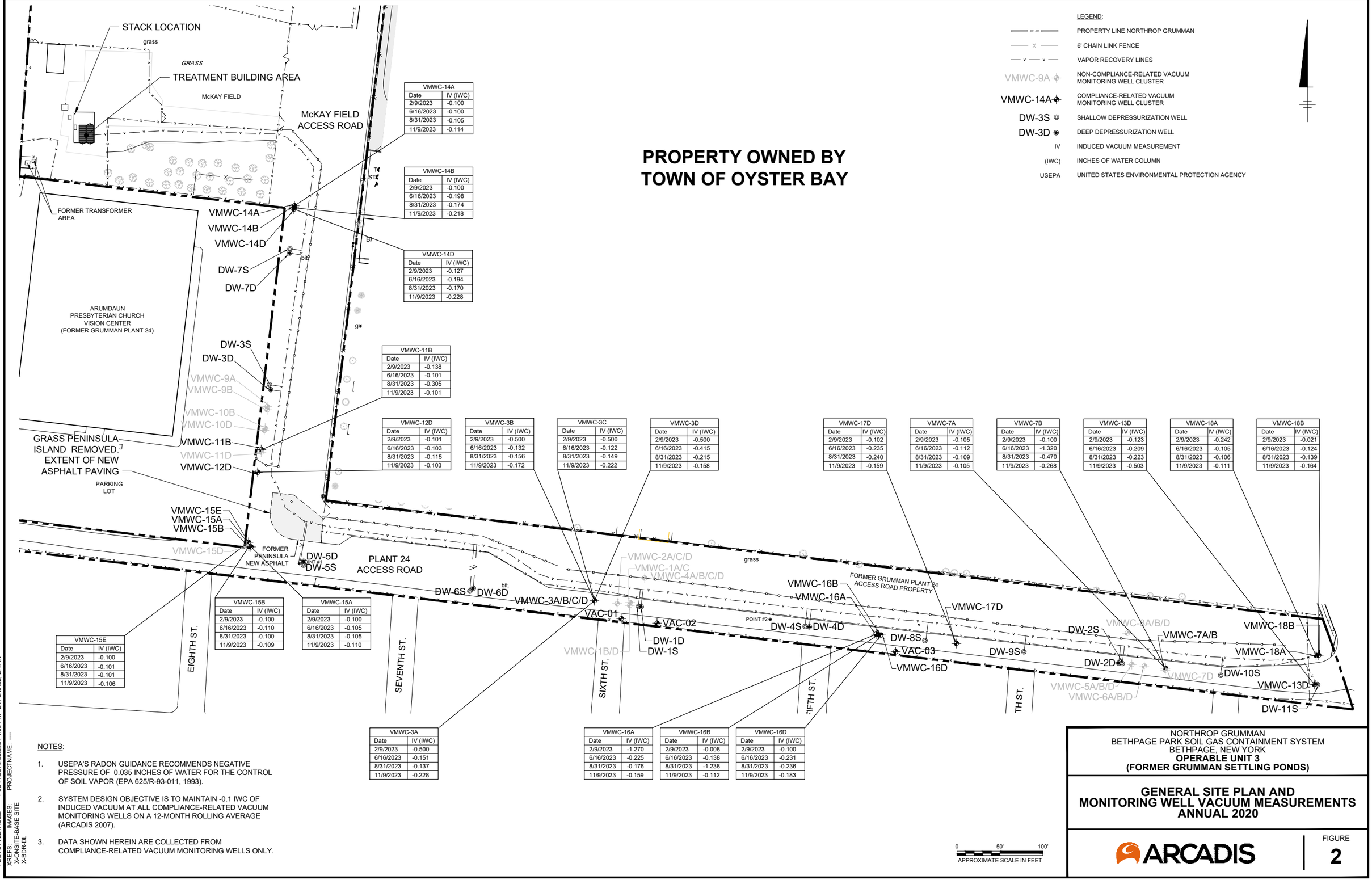
NORTHROP GRUMMAN
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

SITE LOCATION MAP

ARCADIS

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\ACTIVE\00149\6\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



VMWC-14A	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-0.100
8/31/2023	-0.105
11/9/2023	-0.114

VMWC-14B	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-0.198
8/31/2023	-0.174
11/9/2023	-0.218

VMWC-14D	
Date	IV (IWC)
2/9/2023	-0.127
6/16/2023	-0.194
8/31/2023	-0.170
11/9/2023	-0.228

VMWC-11B	
Date	IV (IWC)
2/9/2023	-0.138
6/16/2023	-0.101
8/31/2023	-0.305
11/9/2023	-0.101

VMWC-12D	
Date	IV (IWC)
2/9/2023	-0.101
6/16/2023	-0.103
8/31/2023	-0.115
11/9/2023	-0.103

VMWC-3B	
Date	IV (IWC)
2/9/2023	-0.500
6/16/2023	-0.132
8/31/2023	-0.156
11/9/2023	-0.172

VMWC-3C	
Date	IV (IWC)
2/9/2023	-0.500
6/16/2023	-0.122
8/31/2023	-0.149
11/9/2023	-0.222

VMWC-3D	
Date	IV (IWC)
2/9/2023	-0.500
6/16/2023	-0.415
8/31/2023	-0.215
11/9/2023	-0.158

VMWC-17D	
Date	IV (IWC)
2/9/2023	-0.102
6/16/2023	-0.235
8/31/2023	-0.240
11/9/2023	-0.159

VMWC-7A	
Date	IV (IWC)
2/9/2023	-0.105
6/16/2023	-0.112
8/31/2023	-0.109
11/9/2023	-0.105

VMWC-7B	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-1.320
8/31/2023	-0.470
11/9/2023	-0.268

VMWC-13D	
Date	IV (IWC)
2/9/2023	-0.123
6/16/2023	-0.209
8/31/2023	-0.223
11/9/2023	-0.503

VMWC-18A	
Date	IV (IWC)
2/9/2023	-0.242
6/16/2023	-0.105
8/31/2023	-0.106
11/9/2023	-0.111

VMWC-18B	
Date	IV (IWC)
2/9/2023	-0.021
6/16/2023	-0.124
8/31/2023	-0.139
11/9/2023	-0.164

VMWC-15E	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-0.101
8/31/2023	-0.101
11/9/2023	-0.106

VMWC-15B	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-0.110
8/31/2023	-0.100
11/9/2023	-0.109

VMWC-15A	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-0.105
8/31/2023	-0.105
11/9/2023	-0.110

VMWC-3A	
Date	IV (IWC)
2/9/2023	-0.500
6/16/2023	-0.151
8/31/2023	-0.137
11/9/2023	-0.228

VMWC-16A	
Date	IV (IWC)
2/9/2023	-1.270
6/16/2023	-0.225
8/31/2023	-0.176
11/9/2023	-0.159

VMWC-16B	
Date	IV (IWC)
2/9/2023	-0.008
6/16/2023	-0.138
8/31/2023	-1.238
11/9/2023	-0.112

VMWC-16D	
Date	IV (IWC)
2/9/2023	-0.100
6/16/2023	-0.231
8/31/2023	-0.236
11/9/2023	-0.183

PROPERTY OWNED BY TOWN OF OYSTER BAY

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

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.

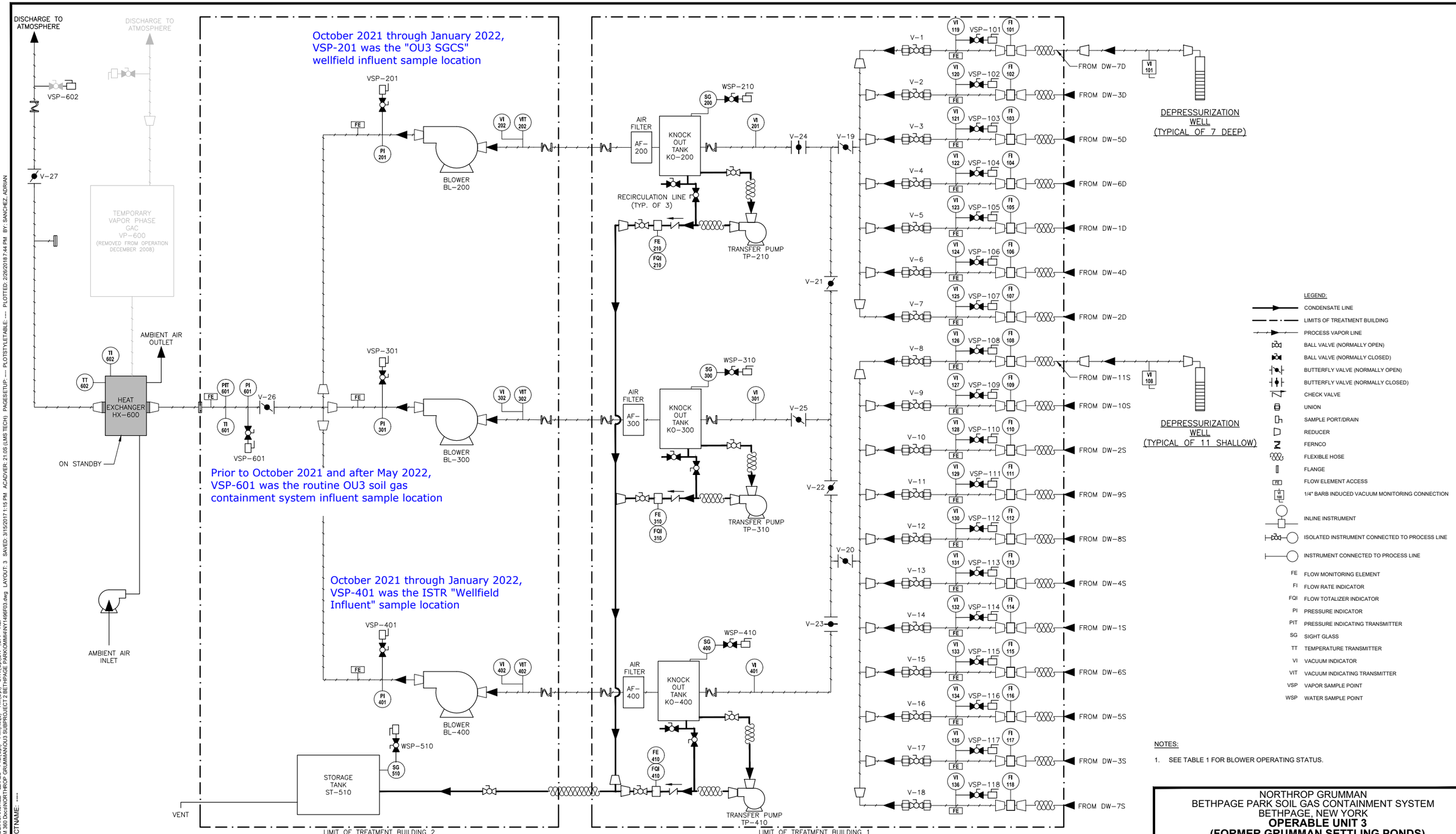
0 50' 100'
APPROXIMATE SCALE IN FEET

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

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS ANNUAL 2020

ARCADIS

FIGURE 2



NOTES:

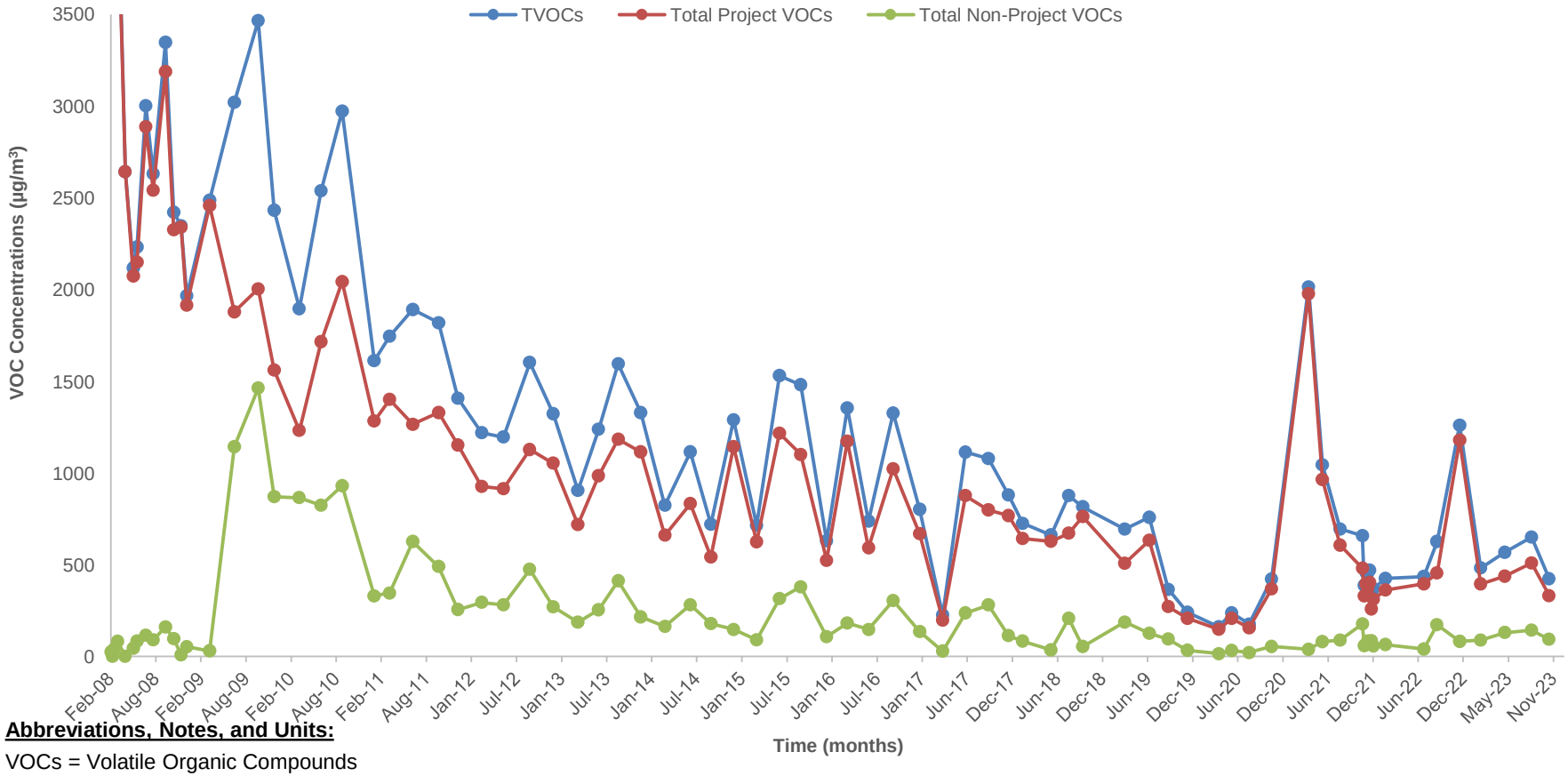
1. SEE TABLE 1 FOR BLOWER OPERATING STATUS.

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

PROCESS FLOW DIAGRAM

ARCADIS

FIGURE
3



Abbreviations, Notes, and Units:

VOCs = Volatile Organic Compounds
TVOCs = Total VOCs detected

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 February 25, 2008 are not shown to improve figure clarity. The TVOC and Total Project VOC concentrations are greater than 3,500 µg/m^3. See previous reports for full data set.
3. The sample results from December 3, 2010 are not consistent with historical data and the results are excluded from this figure. The TVOC concentration for December 3, 2010 was 13 µg/m^3.
4. A notable increase in TVOCs was detected in the March 23rd, 2021 soil gas discharge. This increase is likely due to the ISTR system activities on the Bethpage Community Park property.

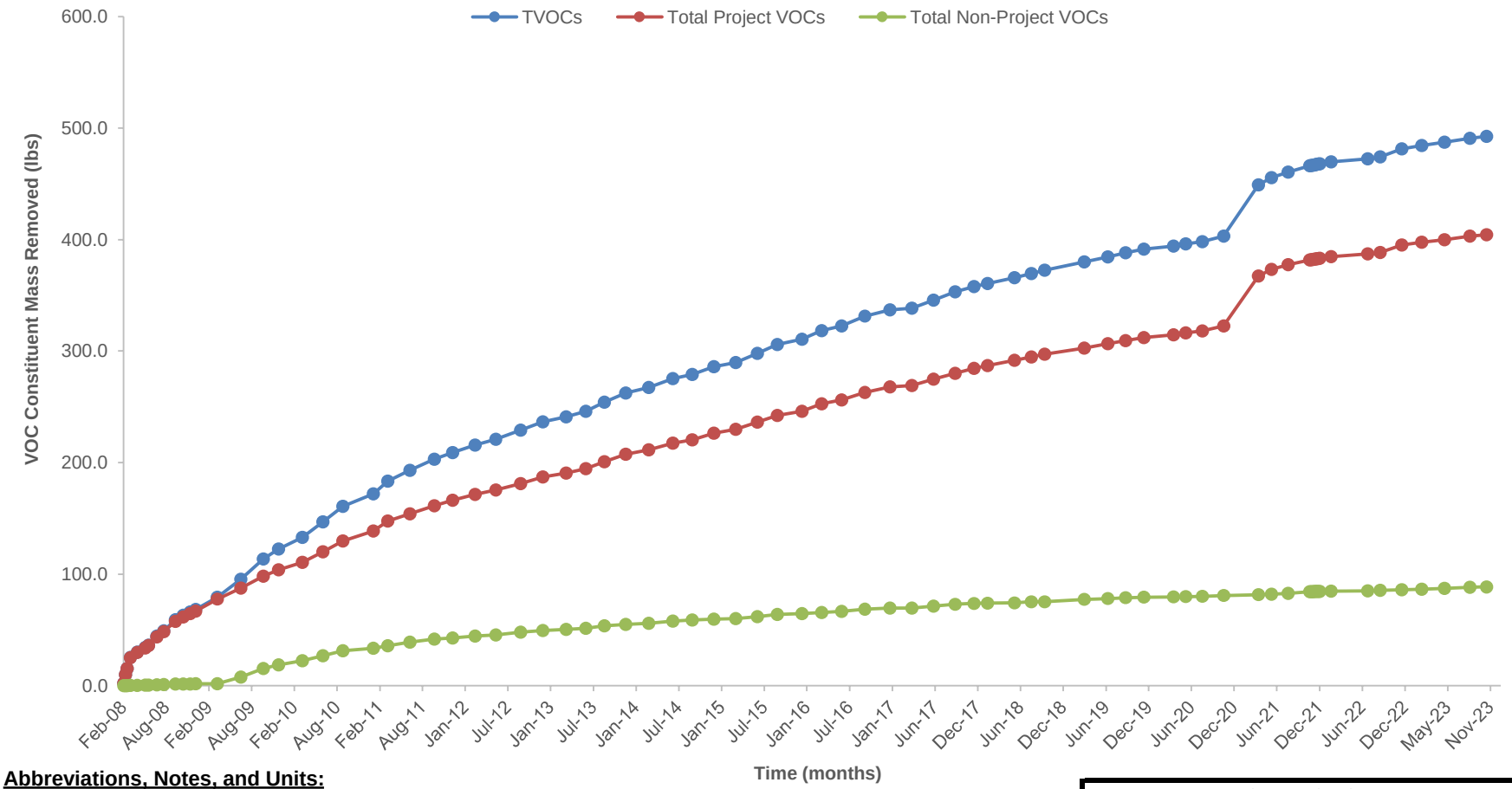
µg/m^3 = micrograms per cubic meter

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

SOIL GAS VOC CONCENTRATIONS

ARCADIS

FIGURE
4



Abbreviations, Notes, and Units:

VOCs = Volatile Organic Compounds

TVOCs = Total VOCs detected

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 are not consistent with historical data and the results are excluded from this figure.
2. A notable increase in VOC mass removal was observed between Q4 2020 and Q1 2021 due to the increase in TVOCs detected (Figure 4).

lbs = pounds

NORTHROP GRUMMAN

BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM

BETHPAGE, NEW YORK, OPERABLE UNIT 3

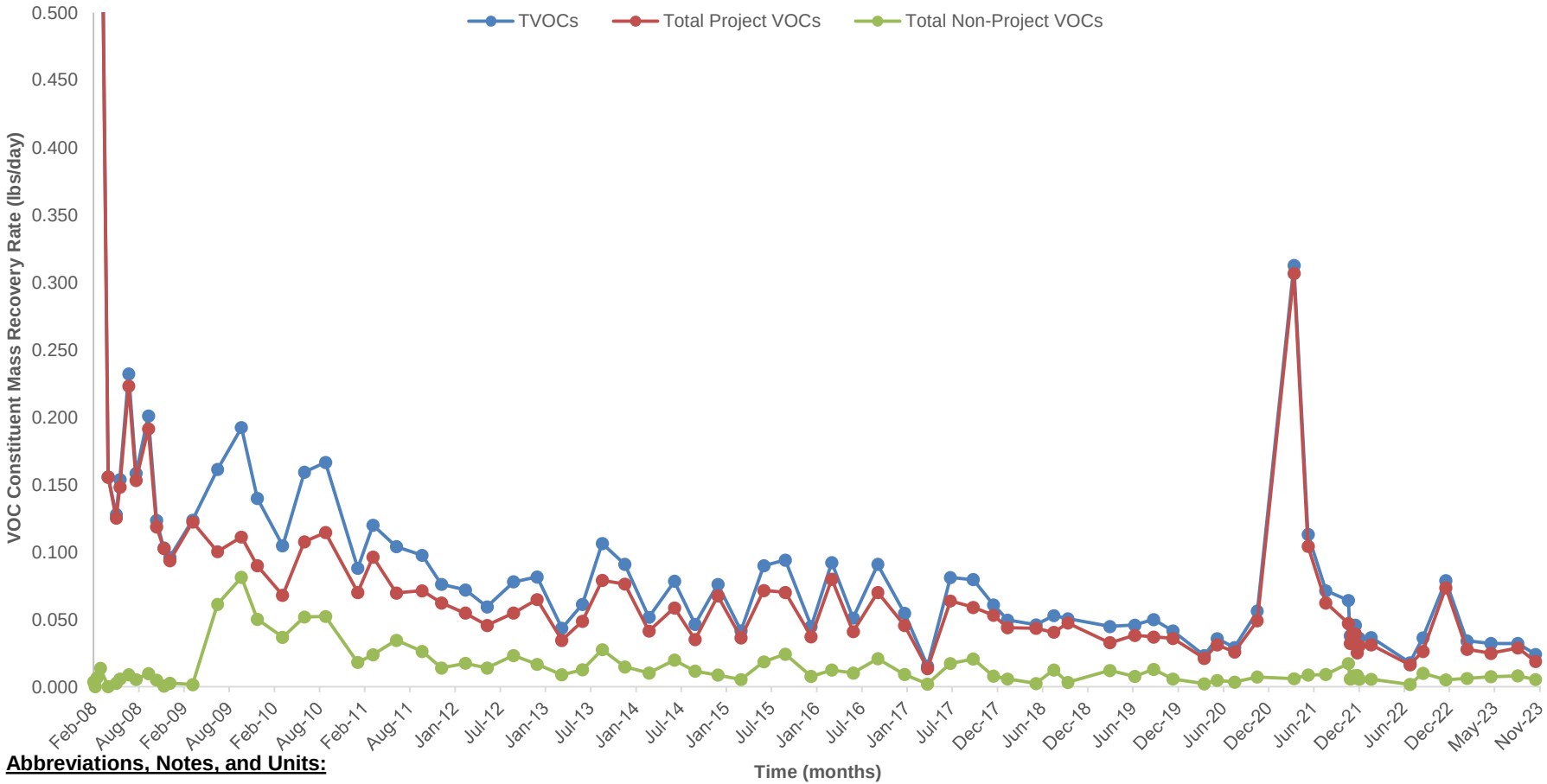
(FORMER GRUMMAN SETTLING PONDS)

CUMULATIVE VOC MASS REMOVED

ARCADIS

FIGURE

5



Abbreviations, Notes, and Units:

VOCs = Volatile Organic Compounds
TVOCs = Total VOCs detected

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 February 25, 2008 are not shown to improve figure clarity. The TVOC and Total Project VOC concentrations are greater than 0.3 lbs/day. See previous reports for full data set.
2. The sample results from December 3, 2010 are not consistent with historical data and the results are excluded from this figure. The TVOC concentration for December 3, 2010 was 13 µg/L.
3. A notabe increase in the VOC mass removal rate was observd on March 23rd 2021 due to the increase in TVOCs detected (Figure 4).

lbs/day = pounds per day

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

VOC MASS RECOVERY RATES

ARCADIS

FIGURE
6

Arcadis of New York, Inc.
105 Maxess Road, Suite N108
Melville
New York 11747
Phone: 631 249 7600
Fax: 631 249 7610
www.arcadis.com