January
Monthly Compliance Report

Solid Waste Permit #221
Bristol Integrated Solid Waste Management Facility
2655 Valley Drive
Bristol, VA 24201
(276) 645-7233

SCS ENGINEERS

02218208.05-18 | February 10, 2023

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INTRODUCTION

On behalf of the City of Bristol, Virginia (City), SCS Engineers (SCS) has prepared this report to the Virginia Department of Environmental Quality (VDEQ) This report covers the Solid Waste Permit (SWP) #221 Landfill during the month of January.

The following sections outline actions completed towards the applicable items in Appendix B of the Consent Decree. The sections have been numbered to align with the numbering in Appendix B.

2.0 COVER INTEGRITY AND EXPOSED WASTES

As outlined in Appendix B of the Consent Decree, cover integrity of the SWP #221 Landfill will be managed primarily through ongoing surface emissions monitoring in accordance with Federal and State regulations.

2.3 SURFACE EMISSIONS MONITORING

On October 12, 2022, SCS performed surface emissions monitoring on the landfill. During the monitoring event no exceedances were detected on the serpentine route or at pipe penetrations. Details of the surface emissions monitoring were included in the October Monthly Compliance Report for the SWP #221 Landfill and in a letter outlining the results submitted to VDEQ on October 28, 2022.

On January 26, 2023, SCS performed a "Target Zone" Surface Emissions Monitoring event, where points were collected at locations that showed visual characteristics of a potential exceedance location (erosion rills, bare spots where vegetation was lacking, etc.). Pipe penetration data was also collected at the 15 pre-existing LFG well locations during the Target Zone SEM event. A total of 54 points were monitored (39 "Target Zone" and 15 Pipe Penetrations) during the event. No exceedances were detected.

SCS will notify the city of Bristol prior to performing the 2023 Annual SEM Event.

3.0 GAS COLLECTION

The City has taken steps to optimize gas collection and minimize air intrusion as outlined in the sections below.

3.1 SYSTEM OPTIMIZATION

In conjunction with monthly wellhead monitoring performed during the month of January, adjustments were made to optimize gas quality and applied vacuum. SCS-FS also performed an evaluation of the wellheads and performed regular maintenance on the wellhead components. Results of this evaluation will be used to guide repairs and upgrades to the wellheads.

3.2 OPTIMIZATION PLAN AND REPORTING

3.2.1 Optimization Plan

On December 1, 2022, on behalf of the City, SCS submitted a plan that provides for means and methods for optimizing the performance of the existing gas extraction system in the Solid Waste Permit #221 landfill. Additional details about that plan were included along with a copy of the plan in the November Monthly Compliance Report for the SWP #221 Landfill.

3.2.2 Optimization Actions

During the month of January actions were taken to implement the submitted Optimization Plan. The following actions were taken at the SWP #221 Landfill in accordance with the plan:

- A dedicated wellfield balancing and tuning event was performed.
- A liquid level measurement and down-well camera event was performed.
- A voluntary surface emissions monitoring event was performed.
- A zone of influence map of the landfill gas collection and control system was developed.
- A landfill gas collection system expansion was considered.

SCS prepared a report that detailed the results of each of these activities and recommendations for further optimization of the well field. The report was submitted to VDEQ on February 1, 2023 and a copy is included in Appendix B.

3.2.3 Monthly Wellhead Monitoring

On January 5, 2023 SCS Field Services (SCS-FS) visited the landfill and performed monitoring of the landfill gas wells. The results of the monthly monitoring were submitted to VDEQ on February 1, 2023 and are included in Appendix A.

Appendix A

January Monthly Wellhead Monitoring Data

February 1, 2023
File No. 07220028.00 Task 6

MEMORANDUM

TO: Jonathan Chapman, VDEQ – SWRO

FROM: Mike Gibbons, SCS Field Services

SUBJECT: Monthly Landfill Gas System Wellhead Monitoring Data
for January, 2023 Landfill Permit Areas 221 and 498
Bristol Integrated Solid Waste Management Facility, Bristol, Virginia

SCS Field Services (SCS) is submitting this data on behalf of the City of Bristol per DEQ request for monthly landfill gas (LFG) wellhead monitoring data for Solid Waste Permit Areas #221 and #498 for the month of January, 2023.

Area 221

There are currently 15 vertical extraction wells in the SWP #221 Landfill Area (Well Nos. 1 – 15). In waste disposal units where the age of the buried wastes is greater than 40 years, as is the case at SWP #221 landfill, the rate and quantity of decomposition gas production declines significantly compared to the rate and quantity of LFG generated in more recently buried wastes. There is no historical evidence of elevated temperatures in SWP #221. Also, the #221 Landfill Area is not believed to be a significant source of fugitive LFG emissions or odors.

Adjustments are made during wellhead monitoring to optimize gas quality and applied vacuum on the Area 221 wells. All Area 221 are under vacuum. During the January monitoring event, slight valve adjustments were made at wells GW-03 and -08, wellhead. The average gas composition in the Area 221 wells is shown in Table 1. Methane and carbon dioxide concentrations decreased over the previous month while oxygen concentration increased since the previous month, this is likely attributed to the corresponding increase in applied vacuum. SCS preformed an evaluation of the wellheads in Area 221 by disassembling the wellheads and inspecting the components SCS cleaned the Pitot tubes as needed prior to reassembly. The PVC wellheads are weathered and brittle and prone to small air leaks. Pitot tubes on GW-03, -06, and -09, needed for flow rate measurements, have fallen off. SCS recommends replacing some of these wellheads with QED Precision wellheads. Details of the inspection results and recommendations are summarized in Table 2. SCS is developing a repair parts list and working with the City to make improvements to the wellheads.

Table 1. Monthly Average Wellhead LFG Composition – Area 221 Wells

Month	Average CH_4 (% Vol)	Average CO_2 (% Vol)	Average O_2 (% Vol)	Average Pressure (inches w.c.)
October '22	40.0	29.2	6.4	-14.9
November '22	47.4	33.7	3.3	-11.9
December '22	58.7	39.6	0.3	-2.7
January '23	39.8	27.0	6.0	-20.6

Table 2. Bristol Landfill Area 221 Wellhead Assessment 1/18/2023

Well#	Fernco Condition	Flex Hose Condition	Valve Condition	Pitot Tube Condition	Comments	Recommendtions
GW-1	OK	Good	OK	OK	clogged, flushed out; temp port broken	Replace port
GW-2	OK	OK	Poor	OK	Valve is bad and will not close	Replace wellhead
GW-3	OK	Poor	OK	Missing		Replace wellhead
GW-4	OK	Poor	OK	OK	flushed out debris	Replace flex hose
GW-5	OK	OK	OK	Poor	flushed out and tube is warped	Replace wellhead
GW-6	OK	OK	Poor	Missing	Valve is broken, No pitot tube	Replace wellhead
GW-7	OK	OK	OK	OK	flushed out debris	
GW-8	OK	Poor	OK	N/A	Unable to open; screws are stripped	Replace wellhead
GW-9	OK	OK	Poor	Missing		Replace wellhead
GW-10	OK	OK	OK	OK	flushed out debris	
GW-11	OK	OK	OK	OK	flushed out debris	
GW-12	Poor	Poor	OK	OK	flushed out debris	Replace 6" lateral fernco and flex hose
GW-13	OK	Poor	Poor	OK	flushed out debris, Valve broken	Replace wellhead
GW-14	OK	Poor	OK	OK	flushed out debris	Replace flex hose
GW-15	OK	Poor	Poor	OK	flushed out debris, Valve broken	Replace wellhead
GW-16	OK	Poor	OK	Good		Replace flex hose
GW-17	OK	OK	OK	OK	flushed out debris	
GW-18	OK	OK	OK	Good		

KEY:

Good	Good conition
OK	Not leaking, not new
Poor	Bad, Broken, Leaking need to be replaced
Missing	Part is missing
N/A	Unable to check

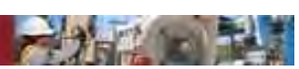
Area 498

The SWP #498 Landfill is approximately 12.0 acres and is located south of the SWP #221 Landfill and east of the SWP #588 Landfill. As of September 2022, mining in Permit #498 has concluded. The majority of the SWP #498 Landfill does not have an active LFG collection system, due to mining operations which have occurred since waste placement was completed. The current system includes four vertical wells (GW-19, GW-20, GW-21, and GW-22) and a condensate trap (CT-1) at the low point. Field reconnaissance efforts in September/October 2022 identified that the header pipe serving the four wells had been severed, blocked, or otherwise compromised. Vacuum was restored to GW-19 in November 2022. As of January 18, 2023, the blocked header piping was replaced, restoring vacuum to wells GW-20 and -21. These wells were monitored and adjusted on January 25, 2023. The buried wastes in SWP #498 Landfill Area is greater than 25 years old, thus, the rate and quantity of decomposition gas production has declined significantly compared to the rate and quantity of LFG generated in more recently buried wastes. Accordingly, the methane concentration tends to be substantially lower, the oxygen and nitrogen concentrations tend to be substantially greater, and the quantity of LFG collected declines substantially compared to the years immediately after waste placement. Furthermore, much of the organic wastes in the upper layer have likely decomposed aerobically (i.e., were composted) because of the mining operations. There is no historical evidence of elevated temperatures in SWP #498; however, the methane-to-carbon dioxide ratio measured in the wellheads can sometimes be less than 1 due to the fact that the wastes are becoming biochemically stabilized (meaning organic wastes have been more fully decomposed) and the rate of methanogenesis has declined. Also, the #498 Landfill Area is not believed to be a significant source of odors.

To better control flow rate from GW-19, SCS replaced the 1.25-inch orifice plate in the wellhead with a 1.0-inch orifice. Extraction wells GW-16, -17, -18, and -23 are perimeter migration control wells affiliated with Permit #498. These wells were monitored and adjusted as needed to control migration.

Bristol Virginia Landfill - Permit 221 and 498 Well Data - 01/01/2023 to 01/31/2023

Point Name	Record Date	CH4 (% by vol)	CO2 (% by vol)	O2 (% by vol)	Bal Gas (% by vol)	Init Static Pressure ("H2O)	Adj Static Pressure ("H20)	Temp (F)	System Pressure ("H20)	Comments
01	1/5/2023 12:28	60.3	39.7	0.0	0.0	-24.3	-24.2	67.6	-24.2	
02	1/5/2023 12:24	27.4	17.8	11.5	43.3	-24.2	-24.4	66.3	-24.2	
03	1/5/2023 12:16	13.0	9.0	15.7	62.3	-17.5	-16.9	55.9	-24.1	Closed Valve > 1 Turn
04	1/5/2023 12:11	48.2	35.3	3.1	13.4	-15.1	-15.0	64.8	-24.3	
05	1/5/2023 13:09	58.7	41.3	0.0	0.0	-24.3	-24.3	65.5	-24.2	
06	1/5/2023 13:05	14.4	8.6	16.0	61.0	-23.4	-23.2	69.0	-24.2	
07	1/5/2023 13:02	59.0	39.9	0.0	1.1	-14.0	-14.1	65.9	-24.5	
08	1/5/2023 12:58	1.9	1.6	20.3	76.2	-0.9	-0.5	67.1	-24.2	Closed Valve > 1 Turn
09	1/5/2023 12:50	56.6	38.3	1.1	4.0	-24.2	-24.1	65.4	-24.2	
10	1/5/2023 12:46	58.1	41.9	0.0	0.0	-23.1	-24.8	62.1	-24.2	
11	1/5/2023 12:36	29.5	20.2	10.7	39.6	-24.3	-24.4	60.9	-24.1	
12	1/5/2023 12:32	19.2	13.0	14.6	53.2	-24.1	-24.1	58.0	-24.1	
13	1/5/2023 12:19	59.9	40.1	0.1	0.0	-24.2	-24.2	56.9	-24.2	
14	1/5/2023 12:55	31.7	19.1	11.1	38.1	-20.6	-20.6	65.8	-24.2	
15	1/5/2023 12:41	59.5	39.0	0.0	1.5	-24.2	-24.2	56.9	-24.1	
Average Permit 221		39.8	27.0	6.9	26.2	-20.6				
16	1/5/2023 13:14	32.4	35.0	0.0	32.6	-22.8	-22.8	56.3	-24.2	
17	1/5/2023 13:16	56.3	38.1	0.0	5.6	-24.5	-24.5	63.8	-24.6	
18	1/5/2023 13:26	47.9	38.0	0.0	14.1	-17.2	-17.1	66.7	-24.2	
23	1/5/2023 13:20	0.1	0.6	20.6	78.7	-0.1	-0.1	57.9	-24.4	
Average Perimeter Migration Control Wells		34.2	27.9	5.2	32.8	-16.2				
19	1/6/2023 08:13	3.3	14.1	3.7	78.9	-17.8	-17.8	41.3	-24.1	
20	1/25/2023 11:38	8.6	10.6	6.0	74.8	-0.1	-0.4	68.4		Closed Valve > 1 Turn
21	1/25/2023 11:41	7.0	5.7	15.9	71.4	-1.4	-1.4	63.2		Closed Valve > 1 Turn
Average Permit 498		6.3	10.1	8.5	75.0	-6.4				



Appendix B

Landfill Gas Collection and Control System Optimization Results

Landfill Gas Collection and Control System Optimization Results

Bristol Integrated Solid Waste Management Facility

Solid Waste Permits #221 and 498

2655 Valley Drive
Bristol, VA 24201

SCS ENGINEERS

02218208.05 | February 1, 2023

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Appendices

1.0 INTRODUCTION

Per a request by the Virginia Department of Environmental Quality (VDEQ or Department), SCS prepared a LFG Collection and Control System Optimization Plan (Plan) to assess and improve the LFG collection in the Solid Waste Permit (SWP) #221 and 498 landfills at the Bristol Integrated Solid Waste Management Facility (ISWMF) and mitigate potential for subsurface LFG migration.The report was submitted to VDEQ on behalf of the City of Bristol, Virginia (City) on December 1,2022. The Optimization Plan was divided into the following tasks for Each Landfill:

- Review and Evaluation of Existing LFG System Data
- LFG System Design and Construction Considerations
- LFG System Performance Field Activities

The results of these efforts are presented in the following two sections, with a summary and recommendations in Section 4.

2.0 PERMIT #221 LANDFILL

2.1 DEDICATED WELLFIELD BALANCING AND TUNING EVENT

A dedicated LFG wellfield balancing and tuning event by an experienced field technician to optimize the performance at each individual wellhead for the quality and quantity of LFG removal was performed by SCS staff on January 16, 2023. Methane content, carbon dioxide, oxygen, balance gas (assumed to be nitrogen), pressure, and temperature were measured at each of the wells GW-1 through GW-15. The full results are presented in Appendix A, and summarized as follows:

- All wells appear to be receiving appropriate system vacuum (~24 in. H2O)

- Eight of the 15 wells recorded oxygen concentrations greater than 5 percent, indicating excess air intrusion. Vacuum adjustments have been/will be made at these wells to reduce vacuum with the intension to reduce air intrusion.

- Only one of the 15 wells recorded methane concentrations greater than 58 percent, indicating need for additional gas extraction. Vacuum adjustments have been/will be made at this well to increase vacuum.

In addition to the dedicated tuning event, SCS-FS performed reconnaissance efforts on the wellfield to identify operations and maintenance issues with the existing wellfield infrastructure. SCS-FS flushed out debris and made observations on several broken valves, flex hoses, and other parts. In addition, it is recommended that the Facility consider replacing several wellheads with new 1" wellheads to enable fine tuning adjustments, and enable the landfill operator to measure flow rates to assist with optimization activities. SCS-FS and the City are coordinating on the replacement and repair of the wellheads.

2.2 LIQUID LEVEL MEASUREMENT AND DOWN-WELL CAMERA EVENT

SCS staff inspected and measured total depth and liquid level measurements with a camera on January 24 and 25,2023 to investigate the extent of liquid blockage and/or physical obstructions in

existing wells. Obstructions were encountered in four wells. The full results are presented in Appendix B, and summarized as follows:

- Eleven of the 15 wells had less than 10 feet of liquid in the well casing, indicating a relatively dry wellfield.

- The average depth to bottom or obstruction for the 15 wells was approximately 29 feet. This indicates relatively shallow wells in older waste

- A pump was observed in seven of the 15 wells; however these pumps are no longer active. The Facility should consider if these pumps can be reactivated, if they should be reactivated, and if they could potentially be moved to some of the wells that are experiencing higher levels of liquid blockages

2.3 VOLUNTARY SEM EVENT TO IDENTIFY FUGITIVE EMISSIONS "HOT SPOTS";

A voluntary Surface Emissions Monitoring (SEM) event was conducted on January 26,2023 to identify fugitive emissions "hot spots." SCS staff used a Thermo Scientific TVA-2020 Flame Ionization Detector (FID) to measure methane concentrations at the surface of the landfill. SCS targeted surface cover penetrations and any locations on the landfill that are potential locations of fugitive emissions (lack of vegetation, erosion rills, etc.). Most of the points exhibited methane concentrations less than 5 ppm. Surface penetrations at GW-7 and GW-15 exhibited methane concentrations of 82.4 ppm and 421 ppm, respectively. The Facility will consider general cover improvements to reduce fugitive emissions at these specific points, however these SEM results generally indicate sufficient collection of gas at the SWP 221 landfill. A map of the monitoring route and detailed results of the event are included in Appendix C.

2.4 ZONE OF INFLUENCE MAP OF THE LFGCCS

SCS developed a theoretical zone of influence at each vertical LFG well in the Permit #221 Landfill, using the current depth measured by field personnel, multiplied by a value of 3 to obtain a radius, then translating the radius into a circular area to assess the "horizontal" coverage of the LFGCCS. In order to assess the potential influence of liquids in LFG collection capacity, an adjusted radius and circle were calculated by only accounting for depth that is not structurally impaired or blocked by liquids.

A map of coverage areas based on the theoretical and adjusted zones of influence is included in Appendix D. The results of this exercise indicate that the current wellfield has been designed with appropriate coverage. Many of the zones of influence are overlapping and there are very few gaps in coverage. The adjusted zones of influence show some opportunity to increase coverage through dewatering activities.

2.5 LFGCCS EXPANSION CONCEPT DESIGN

SCS considered a design to incorporate additional wells, mostly in central areas of the landfill. Based on the data collected and reviewed, SCS is not recommending an expansion at this time.

3.0 PERMIT #498 LANDFILL

3.1 REPAIR EXISTING GCCS COMPONENTS

Site personnel have made repairs to the existing main header pipe that connects wells GW-19, GW-20, and GW-21 to the main system header as of January 19, 2022. Beginning in February 2023, these wells will be included in monthly wellfield monitoring events.

3.2 LIQUID LEVEL MEASUREMENT EVENT

Wells GW-19, GW-20, and GW-21 were inspected and total depth and liquid level were measured to determine if they should be utilized in the design of an LFG system expansion within this waste disposal unit. Sounding data indicates partial liquid blockages (less than 50 percent of total depth) in all three wells, with the wells, on average, around 31 feet deep. There were no obstructions observed at these three wells, and therefore these wells are likely suitable to continue to serve as functional extraction components.

3.3 LFGCCS EXPANSION CONCEPT DESIGN

SCS reviewed the existing LFG components as well as any available information about the waste depth and planned final cover grading, and determined that the approximately 20 feet of waste in the Permit #498 Landfill lent itself best to horizontal LFG collectors. These will also be helpful under the final cap currently in the design phase, to mitigate LFG bubbling to the surface under the geotextile. The horizontal collectors are arranged in the design drawing (Appendix E), in order to expand coverage from the minimal number of collectors on the southern boundary of the landfill to stretch into the central parts of the landfill where SCS suspects the most waste is located.

As part of the final closure Permit modification application, design drawings for a permanent GCCS were included, expanding coverage throughout the footprint of the 498 landfill with four horizontal collectors and an extension of the 8-inch header pipe to create a redundant loop. These drawings are included in the Permit Modification that was submitted to DEQ on January 31, 2023.

4.0 CONCLUSIONS/RECOMMENDATIONS

Once design plans are completed for the LFG expansion project, these action items can proceed as an extension of this Optimization Plan (***after*** the February 1, 2023 deadline).

- Reconnaissance efforts at the SWP 221 landfill indicated maintenance needs at several wellheads. See Table 2 in the January Monthly LFG System Monitoring Data for SWP 221 and 498, submitted by Mike Gibbons of SCS Engineers on January 31, 2023 for recommendations.

- Install one-inch wellheads on the wells in SWP 221. Plans to do this are already in motion, which will make it more feasible to make fine tuning to lower oxygen and lower methane at select wells. In addition, these adjustments should be performed on the extraction components in SWP 498 once monitoring begins on those components in February.

- The Facility should consider adding additional cover soil at the two locations identified in Section 2.3 (surface cover penetrations at GW-7 and GW-15), which appeared to have slightly elevated surface methane levels.

- In general, it appears that the City is appropriately addressing liquid infiltration in LFG wells via the installation of pumps, but could consider shifting pumps from drier wells to wells with higher liquid levels as measured during the sounding/camera event.

- While the existing extraction components in SWP 498 are functional, additional components are recommended to increase coverage throughout the landfill footprint. However, based on the field observations outlined above, the existing GCCS on the SWP 221 landfill appears sufficient at collecting LFG and no expansion is recommended at this time.

Appendix A

Wellfield Monitoring Data

APPENDIX A

PERMIT 221 WELLFIELD TUNING EVENT - JANUARY 16, 2023

BRISTOL LANDFILL - BRISTOL, VIRGINIA

ID	Date/Time	CH4	CO2	O2	Balance	Init. Static Press.	Sys. Press.	Temp.
		%	%	%	%	in. H2O	in. H2O	DegF
BRTLGW01	1/16/2023 12:37	37	24.7	7.5	30.8	-25.45	-24.3	56.1
BRTLGW02	1/16/2023 12:50	26.1	16.9	11.9	45.1	-25.46	-23.83	65.4
BRTLGW03	1/16/2023 13:58	18.3	12.2	14.9	54.6	-3.28	-24.52	55.9
BRTLGW04	1/16/2023 13:20	46.8	33.6	4.2	15.4	-14.96	-24.51	55.1
BRTLGW05	1/16/2023 13:24	50.8	35.6	3.3	10.3	-24.54	-24.48	60.5
BRTLGW06	1/16/2023 13:38	43.7	25.9	6.5	23.9	-21.99	-24.54	59.2
BRTLGW07	1/16/2023 11:31	56.4	38.3	0.6	4.7	-13.92	-24.53	62.4
BRTLGW08	1/16/2023 11:40	23	15.2	13.1	48.7	-1.24	-24.6	60.6
BRTLGW09	1/16/2023 11:56	51.7	35.4	2.3	10.6	-24.33	-24.05	60.3
BRTLGW10	1/16/2023 12:13	38.8	29.7	6	25.5	-24.79	-24.12	63.3
BRTLGW11	1/16/2023 12:21	17.8	12.2	14.7	55.3	-25.28	-24.33	68.1
BRTLGW12	1/16/2023 12:28	22.1	15.2	13.3	49.4	-24.75	-24.82	58.7
BRTLGW13	1/16/2023 13:49	59.9	39.7	0.3	0.1	-24.54	-24.48	54.4
BRTLGW14	1/16/2023 13:45	26	14.9	13.4	45.7	-20.11	-24.52	48.8
BRTLGW15	1/16/2023 13:53	51.7	34.8	3.1	10.4	-24.56	-24.56	55

Appendix B
Down-well Camera Event Log

APPENDIX B
PERMIT 221 WELL SOUNDING/CAMERA EVENT - JANUARY 24&25, 2023
BRISTOL LANDFILL - BRISTOL, VIRGINIA

Wellhead	Distance to Water (.ft)	Distance to Bottom (.ft)	Distance to obstruction (.ft)	Percent open casing	Pump (Y/N)	Notes:
GW-1	16.33	N/A	19.5	84%	Y	Obstruction preventing total depth measurment believed to be pump lines. Clear
GW-2	18.8	N/A	30.85	61%	Y	Obstruction preventing total depth measurment known to be pump rope. Clear
GW-3	Dry	31.58	N/A	100%	N	No Water, Well Unobstructed
GW-4	25.95	N/A	27.4	95%	Y	Obstruction preventing total depth measurment believed to be well casing
GW-5	18.95	33.68	N/A	56%	N	Well Unobstructed, Corrosion noted on well casing, Silt in water
GW-6	20.76	28.18	N/A	74%	Y	Well Unobstructed, Clear Water
GW-7	41	45.4	N/A	90%	N	Well Unobstructed, Clear water
GW-8	17.7	19.75	N/A	90%	Y	Silt in water, Well unobstructed
GW-9	N/A	N/A	15.65	--	Y	Thick black buildup around pump lines prevented camera ingress. Personnel
GW-10	19.9	29.3	N/A	68%	N	Well Unobstructed, Clear water
GW-11	13.65	29.5	N/A	46%	N	Well Unobstructed, Clear water
GW-12	15.55	27.15	N/A	57%	Y	Well Unobstructed, Clear water
GW-13	26.25	28.3	N/A	93%	N	Well unobstructed, clear water, black muddy substance found on bottom 4 feet of camera
GW-14	23.43	29	N/A	81%	N	Well Unobstructed, Clear water
GW-15	28.7	36.15	N/A	79%	N	Well Unobstructed, Clear water

Appendix C
Voluntary SEM Data

SCS ENGINEERS

SURFACE EMISSIONS MONITORING RESULTS
PERMIT 221 - TARGET ZONES - JANUARY 26, 2023
BRISTOL LANDFILL - BRISTOL, VIRGINIA

Date	Time	ID #	Methane Concentration		Compliance	Comments
1/26/23	10:24	1	1.6	PPM	OK	
1/26/23	10:25	2	1.7	PPM	OK	GW-6
1/26/23	10:27	3	1.2	PPM	OK	
1/26/23	10:27	4	1.1	PPM	OK	
1/26/23	10:28	5	82.4	PPM	OK	GW-7
1/26/23	10:29	6	1.2	PPM	OK	
1/26/23	10:29	7	1.3	PPM	OK	GW-8
1/26/23	10:30	8	1.2	PPM	OK	
1/26/23	10:30	9	1.7	PPM	OK	
1/26/23	10:31	10	2	PPM	OK	GW-9
1/26/23	10:31	11	1.7	PPM	OK	
1/26/23	10:32	12	1.3	PPM	OK	
1/26/23	10:34	13	1.4	PPM	OK	GW-10
1/26/23	10:35	14	1.3	PPM	OK	
1/26/23	10:36	15	1.8	PPM	OK	
1/26/23	10:36	16	1.4	PPM	OK	
1/26/23	10:37	17	1.5	PPM	OK	
1/26/23	10:37	18	1.7	PPM	OK	
1/26/23	10:38	19	1.5	PPM	OK	
1/26/23	10:38	20	2.3	PPM	OK	GW-11
1/26/23	10:39	21	2.6	PPM	OK	GW-12
1/26/23	10:39	22	1.7	PPM	OK	
1/26/23	10:40	23	2.1	PPM	OK	GW-1
1/26/23	10:40	24	2.5	PPM	OK	
1/26/23	10:41	25	2.1	PPM	OK	
1/26/23	10:41	26	1.7	PPM	OK	
1/26/23	10:41	27	1.7	PPM	OK	
1/26/23	10:42	28	1.4	PPM	OK	GW-2
1/26/23	10:42	29	1.4	PPM	OK	
1/26/23	10:43	30	1.5	PPM	OK	
1/26/23	10:43	31	1.6	PPM	OK	
1/26/23	10:44	32	1.5	PPM	OK	GW-3
1/26/23	10:44	33	1.9	PPM	OK	
1/26/23	10:45	34	1.5	PPM	OK	
1/26/23	10:45	35	3.1	PPM	OK	
1/26/23	10:46	36	2.8	PPM	OK	GW-4
1/26/23	10:46	37	3.1	PPM	OK	
1/26/23	10:47	38	2	PPM	OK	
1/26/23	10:47	39	1.9	PPM	OK	
1/26/23	10:47	40	1.4	PPM	OK	GW-13
1/26/23	10:49	41	2.2	PPM	OK	
1/26/23	10:49	42	1.2	PPM	OK	
1/26/23	10:49	43	1.2	PPM	OK	
1/26/23	10:50	44	1.1	PPM	OK	
1/26/23	10:50	45	1.1	PPM	OK	
1/26/23	10:51	46	421	PPM	OK	GW-15
1/26/23	10:52	47	1.1	PPM	OK	
1/26/23	10:53	48	1.1	PPM	OK	
1/26/23	10:53	49	1.2	PPM	OK	
1/26/23	10:54	50	2.2	PPM	OK	GW-14
1/26/23	10:56	51	1.4	PPM	OK	
1/26/23	10:56	52	1.3	PPM	OK	
1/26/23	10:58	53	1.2	PPM	OK	GW-5
1/26/23	11:02	54	1.2	PPM	OK	

SURFACE EMISSIONS MONITORING RESULTS
PERMIT 221 - TARGET ZONES - JANUARY 26, 2023
BRISTOL LANDFILL - BRISTOL, VIRGINIA

Date	Time	ID #	Methane Concentration	Compliance	Comments

Number of locations sampled:	54
Number of exceedance locations:	0

NOTES:
Weather Conditions: Partly Cloudy, 33˚F Wind: NW 14 MPH

Sampling Calibration: Methane - 500 ppm, Zero Air - 0.0 ppm

1/26/23	7:50	ZERO	0.0 PPM
1/26/23	7:57	SPAN	503.0 PPM

Background Reading:

1/26/23	8:00	Downwind	4.2 PPM
1/26/23	8:02	Upwind	2.0 PPM

Appendix D
Zone of Influence Maps

0 80 160 240
SCALE IN FEET

N

LEGEND

PROPOSED LFG WELL	EXISTING MAJOR CONTOUR
EXISTING WELLHEAD	EXISTING MINOR CONTOUR
EXISTING AIR RELEASE VALVE	EXISTING HORIZONTAL COLLECTOR
EXISTING ISOLATION VALVE	EXISTING 2" AIR LINE
EXISTING LEACHATE CLEANOUT	EXISTING 4" FORCE MAIN
EXISTING U-TRAP	EXISTING LFG HEADER
EXISTING CONDENSATE PUMP STATION	EXISTING 4" LFG HEADER
EXISTING HORIZONTAL COLLECTOR SUMP	EXISTING 6" LFG HEADER
EXISTING LFG LIQUIDS CONTAINMENT TANK	EXISTING 8" LFG HEADER
EXISTING GAS PROBE	EXISTING 12" LFG HEADER
EXISTING GROUNDWATER MONITORING WELL	PROPOSED 4" lfg HEADER
EXISTING MANHOLE	PROPOSED 6" HEADER
	PROPOSED 8" HEADER
	PROPOSED 12" HEADER
	BUILDING
	WASTE MANAGEMENT BOUNDARY
	FACILITY PROPERTY BOUNDARY
	APPROXIMATE LOCATION OF SIDEWALL
	EXISTING ROAD OUTLINE
	EXISTING GRAVEL ROAD

TOPOGRAPHY

GRADES SHOWN AS DASHED HALF-TONE CONTOUR LINES REPRESENT THE TOPOGRAPHY DEVELOPED FROM AERIAL PHOTOGRAPHY PROVIDED BY NV5 GEOSPATIAL, DATED OCTOBER 7, 2022.

GENERAL NOTES

1. THE LOCATIONS OF THE EXISTING GAS PROBES AND EXISTING MANHOLES SHOWN ARE APPROXIMATE BASED ON DATA PROVIDED BY DRAPER ADEN ASSOCIATES. THE EXACT LOCATIONS OF THESE EXISTING WELLFIELD COMPONENTS MAY NEED IN-FIELD VERIFICATION.

2. THE LOCATIONS OF WELLS GW-16, GW-17, GW-19, GW-20, AND GW-21 WERE MEASURED USING MAPPING GRADE POSITIONING EQUIPMENT UTILIZING GEOGRAPHIC INFORMATION SYSTEM SOFTWARE.

3. THE LOCATION OF THE EXISTING LFG HEADER WAS MEASURED USING MAPPING GRADE POSITIONING EQUIPMENT UTILIZING GEOGRAPHIC INFORMATION SYSTEM SOFTWARE.

4. THEORETICAL RADII OF INFLUENCE BASED ON MULTIPLYING THE MEASURED WELL DEPTH TIMES A FACTOR OF 3.

5. ADJUSTED RADII OF INFLUENCE BASED ON DEPTH OF WELL CASING FREE OF LIQUIDS, TIMES A FACTOR OF 3.

BM-1
BM-2
BM-3
BM-4
GW-5
GW-6
GW-7
GW-8
GW-9
GW-10
GW-11
GW-12
GW-13
GW-14
GW-15
GW-16
GW-17
GW-19
GW-20
GW-21
GW-22
GW-30R
GW-31R
GW-32
GW-32R
GW-33
GW-34
GW-36
GW-37
GW-38
GW-48
GW-49
GW-50
GW-60
GW-61
GW-62
GW-63
GW-64
GW-65
GW-68
EW-1
EW-29
EW-33
EW-34
EW-37
EW-42
CPS-1
LCT-1
SITE TANK
CT-1
HC-2
THEORETICAL RADIUS OF INFLUENCE
ADJUSTED RADIUS OF INFLUENCE

NO.	REVISION	DATE

SHEET TITLE
RADIUS OF INFLUENCE MAP

PROJECT TITLE

CLIENT
CITY OF BRISTOL INTEGRATED SOLID WASTE MANAGEMENT FACILITY
2655 VALLEY DRIVE
BRISTOL, VA 24201

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
15521 MIDLOTHIAN TPKE. MIDLOTHIAN, VA 23113
PH: (804) 379-7440 FAX: (804) 379-7453

PROJ. NO.	
DSN. BY: HGW	DWG. BY: HGW
	CHK. BY:
	Q/A RVW BY:
	APP. BY:

CADD FILE:

DATE: Jan 2023

SCALE: AS SHOWN

DRAWING NO.
1

Appendix E
Proposed Conceptual LFG Expansion Plan

N

0 40 80 120
SCALE IN FEET

LEGEND

- PROPOSED HORIZONTAL COLLECTOR
- EXISTING WELLHEAD
- EXISTING AIR RELEASE VALVE
- EXISTING ISOLATION VALVE
- EXISTING LEACHATE CLEANOUT
- EXISTING U-TRAP
- EXISTING CONDENSATE PUMP STATION
- EXISTING HORIZONTAL COLLECTOR SUMP
- EXISTING LFG LIQUIDS CONTAINMENT TANK
- EXISTING GAS PROBE
- EXISTING GROUNDWATER MONITORING WELL
- EXISTING MANHOLE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING HORIZONTAL COLLECTOR
- EXISTING 2" AIR LINE
- EXISTING 4" FORCE MAIN
- EXISTING LFG HEADER
- EXISTING 4" LFG HEADER
- EXISTING 6" LFG HEADER
- EXISTING 8" LFG HEADER
- EXISTING 12" LFG HEADER
- PROPOSED 4" lfg HEADER
- PROPOSED 6" HEADER
- PROPOSED 8" HEADER
- PROPOSED 12" HEADER
- BUILDING
- WASTE MANAGEMENT BOUNDARY
- FACILITY PROPERTY BOUNDARY
- APPROXIMATE LOCATION OF SIDEWALL
- EXISTING ROAD OUTLINE
- EXISTING GRAVEL ROAD

TOPOGRAPHY

GRADES SHOWN AS DASHED HALF-TONE CONTOUR LINES REPRESENT THE TOPOGRAPHY DEVELOPED FROM AERIAL PHOTOGRAPHY PROVIDED BY NVS GEOSPATIAL, DATED OCTOBER 7, 2022.

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1. THE LOCATIONS OF THE EXISTING GAS PROBES AND EXISTING MANHOLES SHOWN ARE APPROXIMATE BASED ON DATA PROVIDED BY DRAPER ADEN ASSOCIATES. THE EXACT LOCATIONS OF THESE EXISTING WELLFIELD COMPONENTS MAY NEED IN-FIELD VERIFICATION.

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3. THE LOCATION OF THE EXISTING LFG HEADER WAS MEASURED USING MAPPING GRADE POSITIONING EQUIPMENT UTILIZING GEOGRAPHIC INFORMATION SYSTEM SOFTWARE.

PROPOSED HORIZONTAL GAS WELL

PROPOSED VERTICAL GAS WELL COLOCATED WITH HORIZONTAL COLLECTOR WELLHEAD (TYP. OF 4)

GW-72
GW-71
GW-70
GW-22
GW-19
GW-20
GW-21
GW-61
GP-2
GP-3
GP-8
GP-7
MW-108
MW-106A
MW-106B
GAS WELL GW-16
BW-2
SITE TANK
CPS-1
LCT-1
CT-1
TP-6
ROAD CROSSING
EXISTING CITY OF BRISTOL LANDFILL (PERMIT No. 498)
CITY OF BRISTOL PARCEL 425-- A-4 DB 333 PG 430
2" PNEUMATIC SUPPLY LINE / CONDENSATE DRAIN IN COMMON TRENCH
EXISTING LFG GAS COLLECTION HEADER
FIRE POND
POND OVER
PAVED AREA
6" FORCE (APPROXIMATE LOCA
SEWER LINE FROM THE BLOWER FLARE STATION AND THE INGENCO F
VALVE BOX
JUNCTION BOX
EXISTING SLOPE DRAIN
CONTACT WATER INLET
30" RCP
6" FM
6" PVC
D.I.

NO.	REVISION	DATE

SHEET TITLE
CONCEPT LFG EXPANSION

PROJECT TITLE

CLIENT
CITY OF BRISTOL INTEGRATED SOLID WASTE MANAGEMENT FACILITY
2655 VALLEY DRIVE
BRISTOL, VA 24201

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
5522 MIDLOTHIAN TURNPIKE, MIDLOTHIAN, VA 23113
PH: (804) 378-7440 FAX: (804) 378-7483

PROJ. NO.
DWN. BY: HGW
D/A RVW BY:
CHK. BY:
APP. BY:
ESIK. BY: HGW

CADD FILE:

DATE: Jan 2023

SCALE: AS SHOWN

DRAWING NO.
1