1.0 INTRODUCTION

Environmental Information Logistics, LLC (EIL) was retained by Glen's Landfill to perform Tier 2 landfill gas sampling and analysis at the site, which is located in Maple City, Michigan. The sampling was performed to determine non-methane organic compound (NMOC) concentrations and compare them to the Federal Plan (40 CFR Part 62 Subpart OOO) emission threshold of 34 megagrams per year (Mg/year) and the revised Landfill NESHAP (40 CFR 63 Subpart AAAA) threshold of 50 Mg/year. The testing was conducted in accordance with the revised Landfill NESHAP, the Federal Plan and Method 25C of 40 CFR 60 Appendix A. The test was performed on September 29, 2021. EGLE was present to observe portions of the test events.

A Tier 2 testing workplan was submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on August 30, 2021.

2.0 REGULATORY BACKGROUND

Glen's Landfill, a municipal solid waste landfill operated by Waste Management of Michigan, Inc., began accepting waste in 1973. The facility is subject to the National Emission Standards for Hazzardous Air Pollutants (NESHAP), 40 CFR 63 Subpart AAAA and the Federal Plan, 40 CFR 62 OOO. To comply with the Federal Plan, the facility submitted an Initial Design Capacity Report and a Tier 1 calculation report on September 15, 2021 as required by the regulations. The Glen's Landfill decided to improve the accuracy of the emission calculation by performing Tier 2 landfill gas sampling and analysis to demonstrate that actual facility NMOC emissions are less than the 34 Mg/year Federal Plan emission threshold and the 50 Mg/year NESHAP emission threshold.

Based on the sampling results provided in this report, gas collection and control requirements are not applicable to the facility, since NMOC emissions using the new Tier 2 value do not exceed 34 Mg/year (Federal Plan thresholds) or 50 Mg/yr (NESHAP thresholds). The measured site-specific NMOC concentration was determined to be 235.6 ppm NMOC as hexane. This value was used in to recalculate NMOC emissions of 16.97 Mg/year in 2021.

NMOC emissions are not estimated to exceed 34 Mg/yr and are therefore additionally not expected to exceed 50 Mg/yr for the next five years, using an assumed waste intake rate of 275,000 tons/year. The five year projection is provided in Appendix A of this report. Pursuant to 40 CFR 63.1981(c)(1)(ii)(A) and 40 CFR 62.16724(c)(3), the landfill owner or operator may submit a five year report in lieu of annual reports, as long as the actual waste volumes received in subsequent years are less than the estimated projections.

The Tier 2 testing results are valid for five years according to 40 CFR 63.1959 and 40 CFR 62.16718. A new site-specific NMOC concentration will have to be obtained in 2026.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 Sample Locations

The NESHAP and Federal Plan requires collection of two samples per hectare of landfill surface area in which waste has been in-place for a minimum of two years. At the Glen's Landfill approximately 65 acres, or 26.3 hectares, met the two-year age criteria.

As shown in Figure 1, the existing gas collection system (GCS), consists of vertical gas wells, horizontal collection trenches, multiple connections to the leachate system via cleanout risers, and a utility flare. This GCS covers the majority of the waste mass eligible for Tier 2 sampling. Three (3) samples from the main header to the gas plant were collected for Tier 2 sampling. One additional sample was collected from the flare as a spare, in case one of the three samples was unusable.

A small, pre-subtitle D area exists on the southeast side of the site. This area is approximately 13.2 acres (5.34 hectares) in size. A total of 11 Tier 2 sample probes were required for installation as shown in Figure 1. However, three additional probes were installed as spares. As indicated on the drawing, a small undisturbed area with no refuse separates the capped area on the west edge from the eastern edge of Cell 2 Phase II South.

In order to minimize disturbance to the geosynthetic cap and sand overlay, probes were planned for installation on the southern and eastern edges of this area, as shown on Figure 1.

Therefore, for the 65 acres subject to Tier 2 testing at Glen's Landfill, a total of 10 samples were to be collected: Three from the main header, and 7 composite samples from 13 of the 14 installed probes. One spare probe was left unsampled due to no gas present at the probe.

3.2 Probe Installation

At each location, a 21-inch long, 3/8 inch diameter perforated pvc sample probe attached to a segment of poly tubing was utilized. Waste depth was verified at each point by visually verifying waste matter in the sample probe, and by the geoprobe contractor noting the change in density as the probes were being

installed. After waste depth was verified the probe was pushed an additional four feet into the waste layer. After depth was reached, the sample probe rods were extracted and a new set of rods with a disposable tip were used to probe back down to depth of 4 feet into the underlying waste material. Once the appropriate depth was reached the disposable tip was removed and the pvc tube sampling apparatus was installed through the probes to depth. After the sampling apparatus was installed, the probe rods were removed. Next, the sampling apparatus was filled around with a well pack material in order to keep the screen mesh from clogging with debris down hole. Once adequate well pack material was installed to cover the screen mesh, bentonite was installed to provide a seal up to the ground surface and hydrated to ensure a good seal between the landfill cover and the sample probe. After the sample probes were sealed in place, the poly tube was connected to the field monitoring instrument and was purged. A gas quality reading was taken with an Elkins Earthworks Envision meter and the field data was recorded. If the measurement was within the sampling criteria (i.e. less than 20% nitrogen and less than 5% oxygen) then an actual laboratory sample was collected. Three additional probes were installed as spares, and a composite sample was collected from two of these spares and the required 11 other probes for a total of 7 canisters from 13 test probes (one spare probe generated no gas).

The attached Table 2 contains the information for each sample probe including collection times, beginning and ending cylinder vacuums, barometric pressure and ambient temperatures as required by Method 25C.

3.3 Active Gas Collection System

As shown in Figure 1, the existing gas collection system (GCS), consisting of vertical gas wells, horizontal collection trenches, multiple connections to the leachate system via cleanout risers, and a utility flare, provides coverage for the majority of the area eligible for Tier 2 sampling. Three samples from the main header to the utility flare were therefore collected for Tier 2 sampling during the September 29, 2021 sampling event. A fourth canister was collected as a spare, but did not need to be analyzed since the first three samples met the Tier 2 gas quality criteria.

Actual sampling locations at the header pipe leading to the flare station are shown on the map on Figure 1. The attached Table 1 contains the information for each sample point including collection times, beginning and ending cylinder vacuums, barometric pressure and ambient temperatures as required by Method 25C.

3.4 Composite Sampling and Analysis

The Method 25C procedures allow for composite sampling to occur in the field as long as equal volumes of sample are collected from each gas probe/sample location. Composite sampling was conducted from two sample points for each composite sample. Samples were collected from the various sample probes installed on the landfill. Each sample was collected as show in Figure 2.

Each six (6) liter sample canister was pre-filled with less than half its volume of helium. The remaining liters were collected in equal volumes based on pre-determined pressure that resulted in a sample volume of at least 1 liter for each sample for a composite sample.

Composite sampling was performed by taking an initial vacuum reading from the sample tank. To assure the cylinder did not reach ambient pressure and maintain a vacuum in the sample canister, four (4) inches Hg was subtracted from the initial tank pressure that was recorded prior to sampling. The initial vacuum was subtracted by four (4) inches Hg and divided by 2 (allowing 2 samples to be composited into one canister). The subsequent samples for this tank would use the set amount of vacuum calculated above during the compositing process. Upon completion of the last sample for each tank containing 2 samples, the vacuum remaining in the tank was per the calculation shown above. The attached Table 2 contains the composite information for each probe sample point including collection times, beginning and ending cylinder vacuums, barometric pressure and ambient temperatures as required by Method 25C. The sample flow rate was set between 100 - 200 cc/min (100 - 200 ml/min) and was adjusted as necessary during the composite sample to maintain a constant sample flow rate.

The three samples collected from the main header line were <u>not</u> composited. The samples were collected from the header at a flow rate of less than 500 ml/min. A six liter summa canister was utilized for each of the main header samples.

Analyses were performed at AtmAA, Inc., of Calabasas, California. Samples were analyzed at the laboratory with gas chromatography equipped with a flame ionization detector (GC/FID) for 25C and gas chromatography equipped with a thermal conductivity detector (GC/TCD) for 3C. All ten samples were analyzed for oxygen and nitrogen (following Method 3C). All samples showed concentrations of either oxygen below 5%, or nitrogen concentrations below 20%; thus they were all suitable for 25C analysis and were all included in the final averages for the site. Each sample was also analyzed for methane, carbon dioxide and NMOC (following Method 25C). NMOC results are reported as carbon, and must be divided by six to obtain NMOC values as hexane for use in the emissions equation. A schematic of the Method 25C sampling train is found in Figure 2.

4.0 RESULTS

Samples cannot contain oxygen and nitrogen above the acceptable thresholds (i.e. greater than 5% oxygen or greater than 20% nitrogen). Although one composite probe (P1 + P2) measured nitrogen above 20%, the oxygen was less than 5% so it was able to be used in the NMOC average for the facility. Three (3) main header samples and the seven composite samples from 13 probes were used in the calculations. Laboratory analytical data is provided in Appendix B. A summary of laboratory results is shown in Table 3.

The average NMOC value for the site was 235.6 parts per million (ppm) as hexane. The EPA's LandGEM model, which utilizes the equation provided in 40 CFR 63.1959(a) and 40 CFR 62.16718(b), was used to calculate Tier 2 emissions (Appendix A).

The NMOC emission rate of 16.97 Mg/yr for the year 2021 is below the 34 Mg/year and therefore below the 50 Mg/year trigger for installation of gas collection and control systems. The Tier 2 sampling results (Appendix B) are valid for five years (until 2026). At that time, a new Tier 2 value will need to be obtained.

Appendix A also contains the calculations for projected yearly uncontrolled NMOC emissions for five years, as permitted by 40 CFR 63.1981(c)(1)(ii)(A) and 40 CFR 62.16724(c)(3). Again, based on the future projected waste intake rate of 275,000 tons/year, emissions of NMOC stay below 34 Mg/year and 50 Mg/year for the next five years.

TABLES

Table 1: Glens Landfill
Tier 2 Sampling Field Data
Maple City, Michigan

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
1	108	29.09	53	P. Cloudy				
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	8:55	51	37.9	2.1	8.7			
Leak Check	Vac.	Time	Vac.	Time				
	-20.5	8:57	-20	9:02				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	9:03	-20.5	9:03	388	-3.5	9:10	628
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
2	111	29.14	72	P. Cloudy				
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	17:32	53.1	38.4	1.4	7.1			
Leak Check	Vac.	Time	Vac.	Time				
	-20	17:26	-20	17:31				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	17:32	-20	17:32	406	-4	17:38	379
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
3	113	29.14	70	P. Cloudy				
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	17:49	52.8	38.5	1.4	7.2			
Leak Check	Vac.	Time	Vac.	Time				
	-20	17:53	-20	17:58				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	17:49	-20	17:49	374	-4	17:55	391
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
4	118	29.12	66	P. Cloudy				P1 & P2
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	11:09	33.1	29.1	4.6	32.7			
Leak Check	Vac.	Time	Vac.	Time				
	-20	11:03	-20	11:08				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	11:18	-20	11:18	N/A	-4	11:46	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
5	132	29.15	70	P. Cloudy				P3 & P4
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	12:35	57.4	40.8	1.5	0.1			
Leak Check	Vac.	Time	Vac.	Time				
	-21	12:30	-21	12:35				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	12:37	-21	12:37	N/A	-4	12:50	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
6	145	29.15	71	P. Cloudy				P5 & P6
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	13:28	58.8	40.6	0.6	0			
Leak Check	Vac.	Time	Vac.	Time				
	-20.5	13:23	-20	13:28				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	13:29	-20	13:29	N/A	-4	14:04	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
7	154	29.15	72	P. Cloudy				P7 & P8
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	14:24	55.2	44.5	0.3	0			
Leak Check	Vac.	Time	Vac.	Time				
	-20	14:18	-20	14:23				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	14:26	-20	14:26	N/A	-4	14:41	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
8	180	29.13	72	P. Cloudy				P9 & P10
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	15:11	51.6	48.1	0.3	0			
Leak Check	Vac.	Time	Vac.	Time				
	-20	15:05	-20	15:10				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	15:12	-20	15:12	N/A	-4	15:24	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
9	288	29.13	72	P. Cloudy				P11 & P12
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	15:43	50.9	48.8	0.3	0			
Leak Check	Vac.	Time	Vac.	Time				
	-20	15:37	-19.7	15:42				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	15:44	-20	15:44	N/A	-4	16:12	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
10	245	29.14	72	P. Cloudy				P13
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	16:44	48.5	51.2	0.3	0			
Leak Check	Vac.	Time	Vac.	Time				
	-20	16:38	-20	16:43				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	9/29/2021	16:46	-20	16:46	N/A	-12	16:48	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				
Sample #	Canister #	Barometric Pressure (inches w.c.)	Temperature (°F)	Weather				Associated Probes
N/A	N/A	29.14	72	P. Cloudy				P14
Gas Quality Check	Time	%CH4	%CO2	%O2	% Bal. Gas			
	17:00	1.4	0.5	21.5	76.6			
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				
Sample	Sample Date	Sample Time	Initial Vac. (inches w.c.)	Time	Flare Flow (cfm)	End Vac (inches w.c.)	Time	Flare Flow (cfm)
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Leak Check	Vac.	Time	Vac.	Time				
	N/A	N/A	N/A	N/A				

P14*: No gas present at probe therefore left unsampled.

TABLE 2

SUMMARY OF METHOD 25C AND METHOD 3C DATA

Glens Landfill
Maple City, Michigan

Sample ID Number	Sample Location	Date Sampled	CH4 (%)	CO2 (%)	O2 (%)	N2 (%)	NMOC (ppm as carbon)	NMOC (ppm as hexane)*
Header 1	Flare header Upstream of Blower	9/29/2021	47.1	32.6	1.31	18.8	1,280.0	213
Header 2		9/29/2021	48.6	32.7	0.95	17.5	1,328.0	221
Header 3		9/29/2021	48.5	32.2	1.04	17.4	1,363.0	227
P1 + P2*	Composite Probe Samples	9/29/2021	36.7	29.0	3.35	30.9	2,023.0	337
P3 + P4		9/29/2021	55.8	32.2	1.00	10.4	1,311.0	218
P5 + P6		9/29/2021	58.5	37.1	0.37	3.7	1,016.0	169
P7 + P8		9/29/2021	61.5	37.2	0.48	0.7	959.0	160
P9 + P10		9/29/2021	57.8	40.4	0.32	0.8	1,402.0	234
P11 + P12		9/29/2021	55.7	40.6	0.27	0.8	1,656.0	276
P13		9/29/2021	56.3	41.8	0.47	0.6	1,808.0	301
		Average	**52.7**	**35.6**	**1.0**	**10.2**	**1414.6**	**235.6**

*Sample for P1+P2 was over 20% N_2 but O_2 was less than 5%. Therefore, lab corrected NMOC value to O_2 as allowed by Method 25C. All other NMOC values were corrected to N_2 as required.

CH_4: methane (From Method 3C results)

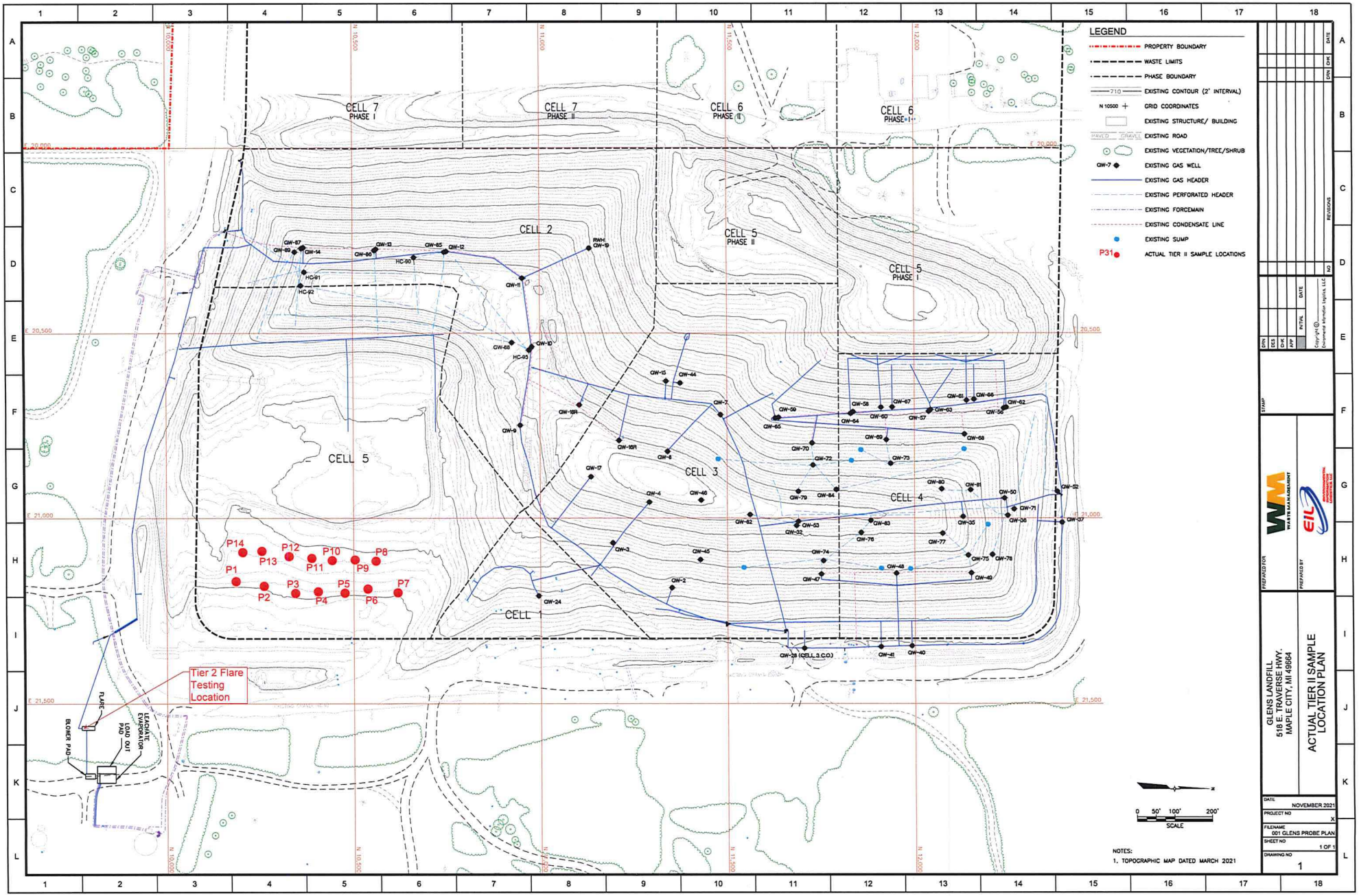
CO_2: carbon dioxide (From Method 3C results)

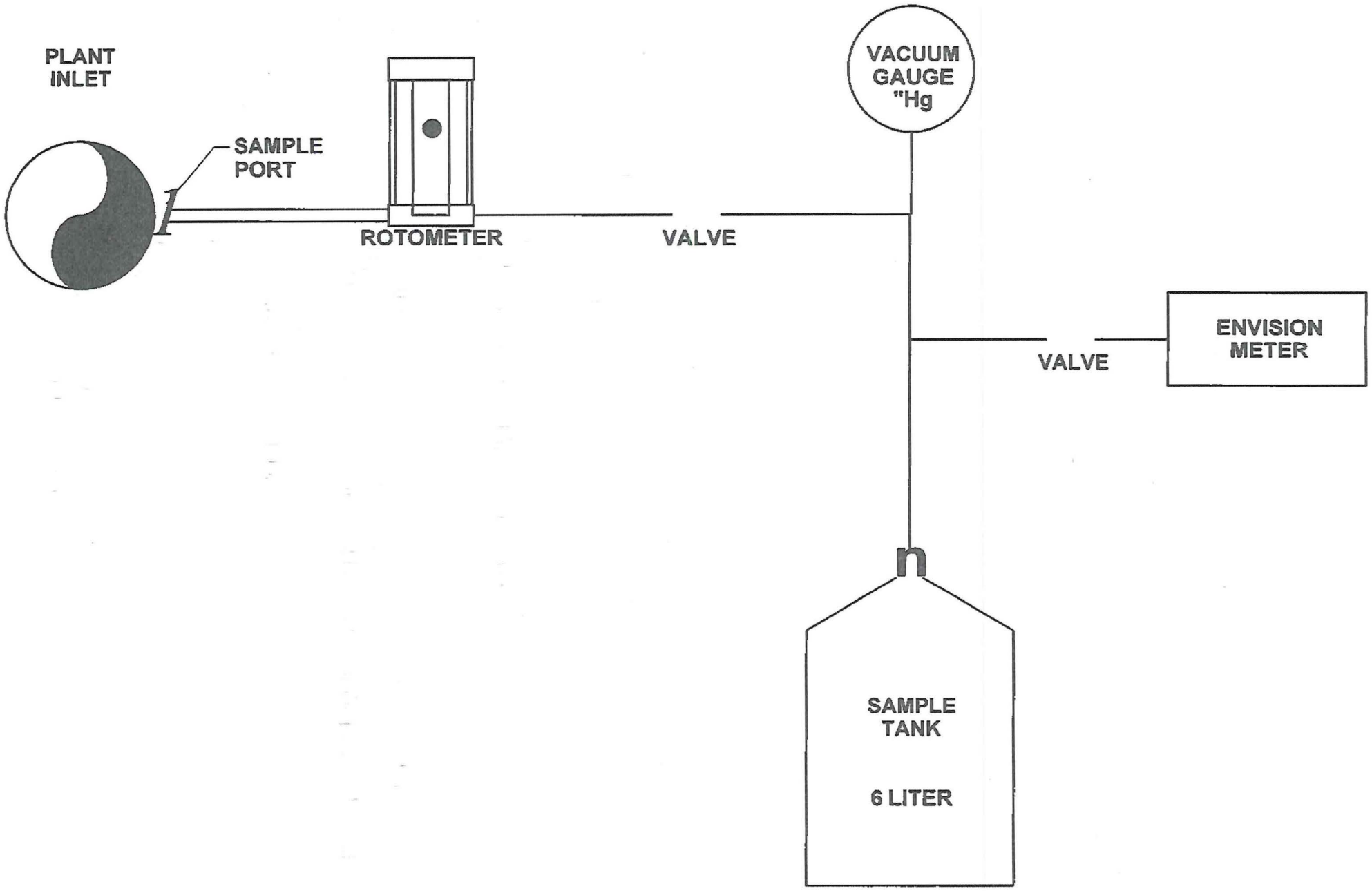
O_2: oxygen

N_2: nitrogen

NMOC as hexane: Non Methane Organic Compounds as hexane (NMOC as carbon divided by six)

FIGURES


LEGEND
PROPERTY BOUNDARY
WASTE LIMITS
PHASE BOUNDARY
EXISTING CONTOUR (2' INTERVAL)
GRID COORDINATES
EXISTING STRUCTURE/ BUILDING
EXISTING ROAD
EXISTING VEGETATION/TREE/SHRUB
EXISTING GAS WELL
EXISTING GAS HEADER
EXISTING PERFORATED HEADER
EXISTING FORCEMAIN
EXISTING CONDENSATE LINE
EXISTING SUMP
ACTUAL TIER II SAMPLE LOCATIONS
CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 5 PHASE I
CELL 5 PHASE II
CELL 6 PHASE I
CELL 6 PHASE II
CELL 7 PHASE I
CELL 7 PHASE II
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
Tier 2 Flare Testing Location
FLARE
BLOWER PAD
LOAD OUT PAD
EVAPORATE EVAPORATOR
0 50' 100' 200'
SCALE
NOTES:
1. TOPOGRAPHIC MAP DATED MARCH 2021
GLENS LANDFILL
518 E. TRAVERSE HWY.
MAPLE CITY, MI 49664
ACTUAL TIER II SAMPLE LOCATION PLAN
DATE: NOVEMBER 2021
PROJECT NO: X
FILENAME: 001 GLENS PROBE PLAN
SHEET NO: 1 OF 1
DRAWING NO: 1



EIL
ENVIRONMENTAL
INFORMATION
LOGISTICS, LLC

060908

FIGURE 2

TOTAL NON-METHANE
ORGANIC COMPOUND SAMPLING TRAIN

WASTE MANAGEMENT, INC. – GLEN'S SANITARY LANDFILL
MAPLE CITY, MICHIGAN AUGUST 2021