

Construction Monitoring Report - Landfill Leachate Gas and Odour

December 2021

Project: Sydney Gateway Road Project

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DOCUMENT APPROVAL




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1.0 Introduction

The purpose of this report is to summarise the findings of the monthly construction monitoring program detailed within the Landfill Leachate, Gas, and Odour Management Plan (LLGOMP).

Note – this report has been developed specifically for monitoring conducted within NSW State owned land under approval SSI 9737, which is administered by the NSW Department of Planning, Industry and Environment (DPIE).

The monitoring period of this report is 1st December 2021 to 31st December 2021.

2.0 Leachate Monitoring

Results from monitoring have been compared against the criteria stipulated within the LLGOMP. There are two elements to landfill leachate monitoring:

- Leachate seep sampling
- Leachate monitoring well program

2.1 Leachate Seep Sampling

Where a leachate seep or discharge is identified with the potential to leave the site, and there is sufficient volume being generated that has the potential to migrate off site and the location is safe to access (and there is not an immediate risk to human health or the environment), it is to be sampled by an appropriately qualified person and that sample submitted under chain of custody documentation to a NATA accredited laboratory.

During the reporting period, regular site inspections were undertaken in accordance with the Landfill Leachate Monitoring Program. There were no instances where leachate was noted as seeping from the walls or pooling at the base of excavations onsite. Therefore, no samples could be obtained under the leachate seep sampling protocol.

2.2 Leachate Monitoring Well Program

The leachate monitoring wells were sampled in accordance with the leachate analyte criteria detailed in Appendix A of the LLGOMP. The Location of monitoring wells are shown in Figure 1. The adopted analyte suite is listed in Table 1. Data captured during monitoring was assessed against the baseline groundwater quality maxima as detailed in Table 2.

All results were recorded below the trigger level during the December 2021 sampling round.

Wells GW7 and GW8 were not sampled during the reporting period as they were either lost or destroyed as part on earthworks within Tempe tip, both wells are located within the new road alignment. JHSW is currently working through any necessary action regarding the sampling of alternative wells or the installation of new wells.



Figure 1, Leachate monitoring well sampling locations.

Table 1 Adopted Analyte Suites from LLGOMP

Analysis	Background Level (Outside bentonite wall) (mg/L)	Trigger Level (Outside Bentonite Wall) (mg/L)
Ammonia	85.5	95
Phosphorus as P	2.88	3.2
Nitrate	4.86	5.4
Nitrite	0.27	0.3
Total recoverable hydrocarbons (TRH) ¹	2.16	2.4
Benzene, toluene, ethylbenzene and xylenes (BTEX) ²	-	Not detected – defer to ANZG, 2018 ⁴ (0.91)
Polycyclic aromatic hydrocarbons (PAH)	0.01386	0.0154
Per and poly fluoro alkyl substances (PFAS) (PFOS, PFOA, PFHxS and FTSA only) ³	0.00144	0.00160
Dissolved methane.	12.87	14.3

¹ Combined total of each individual TRH fraction (C₆-C₁₀, C₁₀-C₁₆, C₁₆-C₃₄, and C₃₄-C₄₀)

² Combined total of each individual BTEX parameter (Benzene, toluene, ethylbenzene and xylenes)

³ Combined total of PFAS, PFOS, PFHxS, and FTSA⁴ Based on 90% species protection in freshwater environments

Table 2 Leachate Monitoring Results

Analyte	Units	LLGOMP Background Level	Trigger	MPE_2	MPE_4	MPE_5	MPI_10	MPE_5A	MPE_7	MPI_14	MPI_11	MPE_21	MPI_13
Ammonia	mg/L	85.5	95	7.09	11.3	74.7	70.1	0.06	66.2	90.8	51.2	38.2	91.2
Nitrate	mg/L	4.86	5.4	0.02	0.01	3.60	0.08	0.47	0.35	0.03	0.06	0.03	0.14
Nitrite	mg/L	0.27	0.3	<0.01	0.12	0.01	<0.01	<0.01	0.21	<0.01	0.02	0.12	<0.01
Total Phosphorus as P	mg/L	2.88	3.2	2.11	2.02	0.76	1.67	0.09	0.61	1.87	2.36	2.79	1.48
TRH	mg/L	2.16	2.4	<0.1	<0.1	<0.1		<0.1	<0.1		1.08	<0.1	
BTEX	mg/L	-	0.91	<0.001	<0.001	<0.001		<0.001	<0.001		<0.001	<0.001	
Polycyclic aromatic hydrocarbons (PAH). total	mg/L	0.01386	0.0154	<0.5	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	
Per and poly fluoro alkyl substances (PFAS) (PFOS, PFOA, PFHxS and FTSA only)	mg/L	1.44	1.60	0.0001	0.0004	0.00006		0.00011	0.00011		0.00012	0.00013	
Dissolved methane.	mg/L	12.87	14.3	0.27	0.22	2.0		<0.01	0.67		9.14	0.58	

*Well located landfill side of bentonite wall. Included for comparison purposes

3.0 Landfill Gas Monitoring

Two forms of landfill gas monitoring are undertaken during the works on site to review potential impacts from landfill gas generation on surrounding receivers and onsite workers. These include the following:

- Daily/regular monitoring of pits, excavations and boring/piling operations.
- Monthly sub-surface, structure/enclosed space monitoring.

3.1 Daily/regular monitoring of pits, excavations, and boring/piling operations

This monitoring takes place while ground-breaking, excavation, boring or piling works are taking place across the works area within the former Tempe Landfill. Results of gas monitoring are displayed in Table 3. All results were recorded below the adopted trigger levels. No reportable concentrations of methane were identified. It should be noted that the site was shut down between 23/12/2021 and beyond the 31/12/2021 therefore no readings were obtained during this period.

Table 3 Monitoring of site excavations, pits and piling

Date	Time (24 hour)	Wind Direction & Speed (km/h)	Location	CH ₄ /Flammable Gases ppm)	OXY Vol %	PID (ppm)	CO ₂ (%v/v)	CO (ppm)	H ₂ S (ppm)	Comments
Trigger values				10,000	<19.5	10	0.5	30	10	-
01/12/2021	15:12	NE 17	Cut 3 - CMC Pile	1800	20.9	0	0.06	0	0	Compliant
01/12/2021	15:20	NE 17	Waste Stockpile	0	20.9	0	0	0	0	Compliant
01/12/2021	15:35	NE 17	Cut 1	30	20.9	0	0	0	0	Compliant
01/12/2021	15:40	NE 17	Stockpile near office	15	20.9	0	0	0	0	Compliant
02/12/2021	8:30	N 11	CMC Piling - Cut 3	1000-3800	20.9	0	0	0	0	Compliant
02/12/2021	8:42	N 11	Cut 2B	20	20.9	0	0	0	0	Compliant
02/12/2021	8:45	N 11	Cut 1	10	20.9	0	0	0	0	Compliant
02/12/2021	8:47	N 11	Cut 1	0	20.9	0	0	0	0	Compliant
03/12/2021	9:00	NW 13	CMC Pile near golf range	3000-7500	20.9	0	0	0	0	Compliant
03/12/2021	9:05	NW 13	Cut 3	35	20.9	0	0	0	0	Compliant
03/12/2021	9:35	NW 13	Cut 1	75-130	20.9	0	0	0	0	Compliant
03/12/2021	9:39	NW 13	Cut 1	20	20.9	0	0	0	0	Compliant
03/12/2021	9:45	NW 13	Cut 2B	35	20.9	0	0	0	0	Compliant
06/12/2021	9:16	SW 7	CMC Pile - GR	35 - 280	20.9	0	0	0	0	Compliant
06/12/2021	9:21	SW 7	Cut 3	0	20.9	0	0	0	0	Compliant
06/12/2021	9:40	SW 7	Cut 2B	0	20.9	0	0	0	0	Compliant
06/12/2021	9:45	SW 7	Cut 2B	5	20.9	0	0	0	0	Compliant
06/12/2021	9:48	SW 7	Cut 1	15	20.9	0	0	0	0	Compliant
06/12/2021	9:51	SW 7	Cut 1	0	20.9	0	0	0	0	Compliant
07/12/2021	9:33	N 13	CMC Pile - GR	800-4000	20.9	0	0	0	0	Compliant

Date	Time (24 hour)	Wind Direction & Speed (km/h)	Location	CH4/Flammable Gases ppm)	OXY Vol %	PID (ppm)	CO2 (%v/v)	CO (ppm)	H2S (ppm)	Comments
07/12/2021	9:37	N 13	Cut 1	10	20.9	0	0	0	0	Compliant
07/12/2021	9:41	N 13	Cut 1	35	20.9	0	0	0	0	Compliant
07/12/2021	9:44	N 13	Cut 1	190-290	20.9	0	0	0	0	Compliant
08/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
09/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
10/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
13/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
14/12/2021	8:10	W 7	Cut 1	89	20.8	0	0	0	0	Compliant
14/12/2021	8:12	W 7	Cut 1	76	20.8	0	0	0	0	Compliant
14/12/2021	8:14	W 7	Cut 1	74	20.8	0	0	0	0	Compliant
15/12/2021	15:17	NE 32	Cut 1	95	20.8	0	0	0	0	Compliant
15/12/2021	15:20	NE 32	Cut 1	75	20.8	0	0	0	0	Compliant
15/12/2021	15:22	NE 32	Cut 1	80	20.8	0	0	0	0	Compliant
16/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
16/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
16/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
17/12/2021	9:30	SW 9	Cut 1	35	20.9	0	0	0	0	Compliant
17/12/2021	9:47	SW 9	Cut 2B	20	20.9	0	0	0	0	Compliant
20/12/2021	-	-	-	-	-	-	-	-	-	Rainfall
21/12/2021	8:48	S 15	Cut 2B	15	20.7	0	0	0	0	Compliant
21/12/2021	8:51	S 15	Cut 2	5	20.7	0	0	0	0	Compliant
21/12/2021	8:57	S 15	Cut 1	25	20.7	0	0	0	0	Compliant
21/12/2021	9:03	S 15	Cut 1	35	20.7	0	0	0	0	Compliant

Date	Time (24 hour)	Wind Direction & Speed (km/h)	Location	CH4/Flammable Gases ppm)	OXY Vol %	PID (ppm)	CO2 (%v/v)	CO (ppm)	H2S (ppm)	Comments
22/12/2021	8:10	S 24	Cut 2	55	20.9	0	0	0	0	Compliant
22/12/2021	8:13	S 24	Cut 2	60	20.9	0	0	0	0	Compliant
22/12/2021	8:18	S 24	Cut 1	20	20.9	0	0	0	0	Compliant
22/12/2021	8:20	S 24	Cut 1	10	20.9	0	0	0	0	Compliant
23/12/2021	SHUTDOWN									
24/12/2021										
25/12/2021										
26/12/2021										
27/12/2021										
28/12/2021										
29/12/2021										
30/12/2021										
31/12/2021										

3.2 Monthly Landfill gas monitoring

Monthly gas monitoring of the sub-surface wells including gas accumulation monitoring in offsite buildings was undertaken at locations shown in Figure 2. Results of monitoring are detailed in Table 4.

Results indicate notable methane concentrations in wells GW9A and GW14 which are known to be inside the landfill boundary and as such do not have a maximum concentration level. Carbon Dioxide levels were recorded above the trigger level in gas wells GW1A, GW3, GW4A, GW5A, GW11A, GW14, GW16, GW19A, and GW22s, however the results were comparable to historic sampling results.

In accordance with the Landfill Gas Risk Assessment (LFGRA) and LLGOMP, a comparison of the flow, methane, and carbon dioxide ranges and corresponding gas situation between the LFGRA and current datasets was undertaken. Gas readings collected from each well was compared against the gas screening criteria for each representative Monitoring Zones depicted in Figure 3. Results are presented in Table 5. The results demonstrate that the December 2021 data is within the flow and concentrations ranges identified within the historical dataset and therefore considered to present minimal risk to the targeted receptors. Updated Risk Classifications and concentrations are also presented in Table 5, the updated risk classification and concentrations will be used as trigger levels in future monitoring rounds.

Gas accumulation monitoring was also undertaken within onsite buildings and the three nominated offsite assessment locations shown in Figure 2 during the reporting period. All readings were compliant with the adopted assessment criteria.



Figure 2: Monthly offsite landfill gas monitoring locations

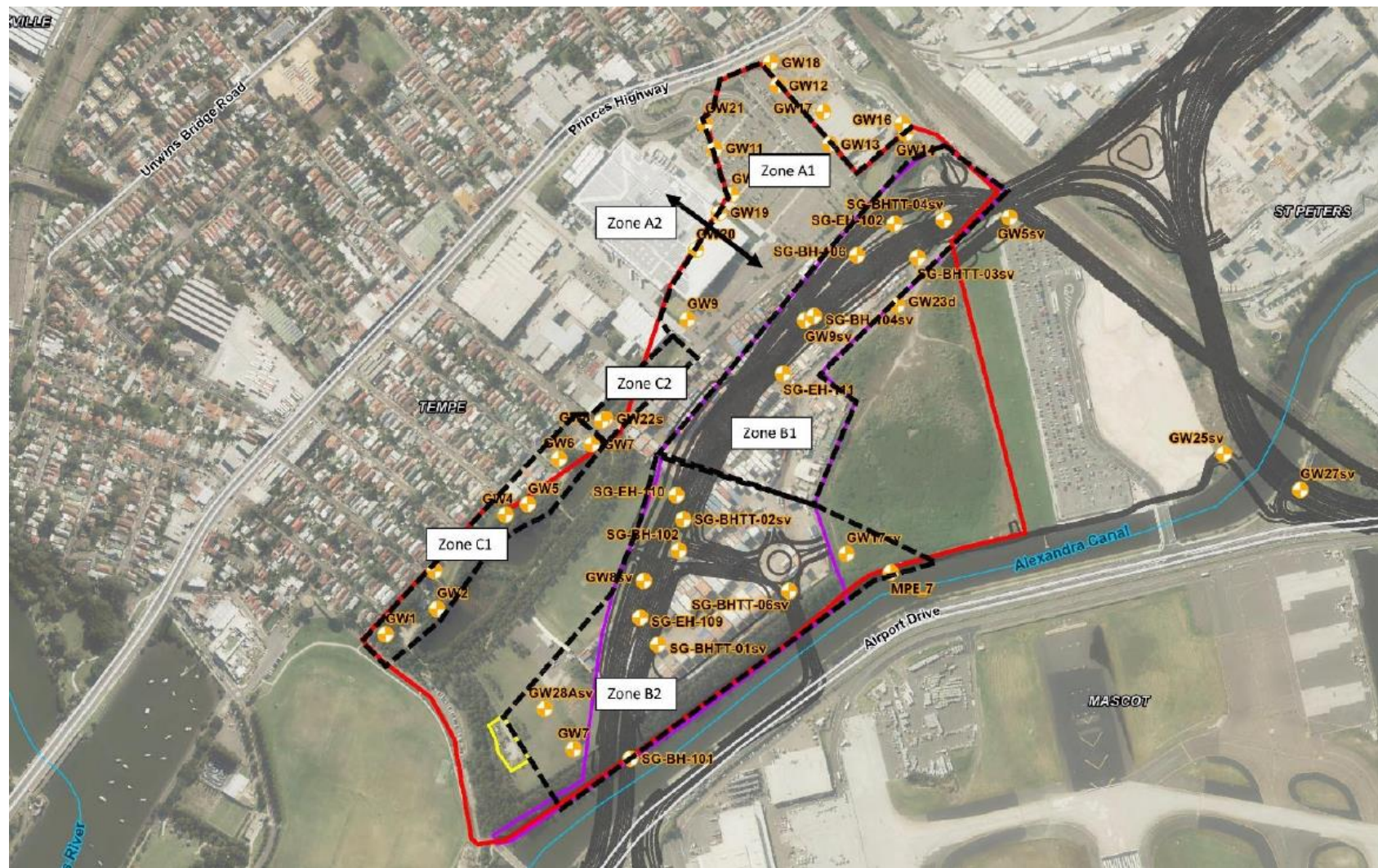


Figure 3 – Gas Monitoring Zones

Table 4 Monthly offsite subsurface gas monitoring results

			Flow (Stabilised)	Relative Pressure (Stabilised)	Methane (Stabilised)	Carbon Dioxide (Stabilised)	Oxygen (Stabilised)	Carbon Monoxide (Stabilised)	Hydrogen Sulfide (Stabilised)	Barometer
			L/hr	mb	%	%	%	ppm	ppm	mb
LLGOMP gas assessment criteria			-	-	1	5.0	-	30	10	-
Sample Location	Date	Zone								
GW1A	16/12/2021	C1	0	0	0	12.2	11.2	0	0	1014
GW2	16/12/2021	C1	0	0	0	3.6	12.5	0	0	1014
GW3	16/12/2021	C1	0	0	0	11.7	7.3	0	0	1014
GW4A	16/12/2021	C1	0	0	0	6.3	13.2	0	0	1014
GW5A	16/12/2021	C1	0	0	0	6.4	13.7	0	0	1014
GW6A	16/12/2021	C1	0	0	0	4.3	15.6	0	0	1012
GW9	16/12/2021	A2	0	0	0	0	20.5	0	0	1014
GW9A	16/12/2021	A1	0	0	27.2	6.6	0.1	0	2	1014
GW11A	16/12/2021	A2	0	0	0	7.3	4.1	0	0	1014
GW14	16/12/2021	A1	0.4	1	6.6	14.5	0.1	0	0	1014
GW16	16/12/2021	A2	0	0	0	16.9	3.2	0	0	1012
GW17	16/12/2021	A2	0	0	0	0.1	20.4	0	0	1014
GW19A	16/12/2021	A2	0	0	0	9.0	9.2	0	0	1014
GW22s	16/12/2021	C2	0	0.14	0	16.9	14.8	0	0	1013

Table 5 Data comparison between LFGRA and December 2021 sampling results

Zone	Max Flow (L/Hr)	Max CH ₄ (%v/v)	Max CO ₂ (%v/v)	GSV CH ₄	GSV CO ₂	CS	Risk Class (NSW EPA 2020)
A1 LFGRA	5.8	54.7	22.0	3.17	1.28	3	Moderate
A1 Dec 21	0.4	27.2	14.1	0.109	0.056	1	Very Low
A2 LFGRA	1.8	5.6	19.8	0.10	0.36	2	Low
A2 Dec 21	0.1	0.0	16.9	0.00	0.017	1	Very Low
C1 LFGRA	0.1	0.2	17.4	0.0002	0.002	1 (CH ₄) 2 (CO ₂)	Very Low (CH ₄) Low (CO ₂)
C1 Dec 21	0.1	0.0	12.2	0.00	0.012	1	Very Low
C2 LFGRA	0.9	1.9	20.6	0.02	0.19	2	Low
C2 Dec 21	0.1	0.0	16.9	0.00	0.017	1	Very Low

Table 6 Monthly gas accumulation monitoring

Location	Type of Monitoring Point	Methane Limit	Results (Stabilised)
C3 compound office ¹	Gas Accumulation Monitoring	500ppm	<3 (LOR)
C3 lunchroom ¹	Gas Accumulation Monitoring	500ppm	<3 (LOR)
OSA1 ²	Gas Accumulation Monitoring	500ppm	<3 (LOR)
OSA2 ²	Gas Accumulation Monitoring	500ppm	<3 (LOR)
OSA3 ²	Gas Accumulation Monitoring	500ppm	<3 (LOR)

- 1 Monitoring location within project site on the Former Tempe Landfill
- 2 Monitoring location outside the project site

3.3 Odour Monitoring

Odour monitoring was undertaken during the reporting period. All active work areas and stockpiles onsite were inspected twice daily, as well as the site boundary. Where odour was recorded at >2OU at the site boundary, offsite monitoring was undertaken downwind at the most effected receiver depicted in Figure 4. Odour monitoring results are detailed within Table 7.

Generally, no odours >2OU were detected onsite or at the site boundary during monitoring. Mild odour was detected around waste material stockpiles and Cut 1 excavation. However, they were not distinguishable above 2 OU at the source of odour, or at the project boundary using a calibrated nasal ranger and were therefore not recorded as a notable detection.

No community complaints relating to odour were received during the reporting period.



Figure 4, Indicative offsite odour monitoring locations

Table 7 Odour monitoring undertaken during the December reporting period

Date	Time	Location	Wind Direction	Wind Speed (kph)	Odour (OU) Criteria: >2OU	Works Assessed Onsite
01/12/2021	9:00	All Areas (1-11)	NE	5	<2	Cut 1 earthworks, CMC in Cut 3, stockpiling
01/12/2021	15:00	All Areas (1-11)	NE	21	<2	Cut 1 earthworks, CMC in Cut 3, stockpiling
02/12/2021	9:30	All Areas (1-11)	N	9	<2	Cut 3 CMC Piling, stockpiles, Cut 1 & 2 excavations
02/12/2021	16:30	All Areas (1-11)	NE	32	<2	Cut 3 CMC Piling, stockpiles, Cut 1 & 2 excavations
03/12/2021	9:00	All Areas (1-11)	NW	13	<2	Moxy, excavator, dozer, truck & dog, CMC Piling rig
03/12/2021	12:00	Airport	S	33	<2	Moxy, excavator, dozer, truck & dog, CMC Piling rig
03/12/2021	15:00	All Areas (1-11)	S	46	<2	Moxy, excavator, dozer, truck & dog, CMC Piling rig
06/12/2021	9:00	All Areas (1-11)	SW	7	<2	No activity on site - RDO
06/12/2021	13:30	All Areas (1-11)	NE	20	ND	No activity on site - RDO
07/12/2021	9:33	All Areas (1-11)	N	13	<2	Moxy, excavator, digger, CMC Piling Rig
07/12/2021	15:00	All Areas (1-11)	ENE	32	<2	Moxy, excavator, digger, CMC Piling Rig
08/12/2021	7:00	All Areas (1-11)	SSW	35	<2	Moxy, excavator, digger, CMC Piling Rig
08/12/2021	15:30	All Areas (1-11)	S	32	<2	Moxy, excavator, digger, CMC Piling Rig
09/12/2021	9:00	All Areas (1-11)	S	17	<2	Moxy, excavator, digger, CMC Piling Rig
09/12/2021	15:00	All Areas (1-11)	SSE	26	<2	Moxy, excavator, digger, CMC Piling Rig
10/12/2021	9:00	All Areas (1-11)	WNW	22	<2	Moxy, excavator, digger, CMC Piling Rig
10/12/2021	15:00	All Areas (1-11)	WSW	30	<2	Moxy, excavator, digger, CMC Piling Rig
13/12/2021	8:00	All Areas (1-11)	S	32	<2	Moxy, excavator, digger, CMC Piling Rig
13/12/2021	14:30	All Areas (1-11)	S	32	<2	Moxy, excavator, digger, CMC Piling Rig
14/12/2021	9:00	All Areas (1-11)	SW	9	ND	Moxy, excavator, digger, CMC Piling Rig
14/12/2021	16:30	All Areas (1-11)	ESE	20	ND	Moxy, excavator, digger, CMC Piling Rig
15/12/2021	7:00	All Areas (1-11)	S	32	<2	Moxy, excavator, digger, CMC Piling Rig
15/12/2021	14:00	All Areas (1-11)	S	32	<2	Moxy, excavator, digger, CMC Piling Rig
16/12/2021	10:00	All Areas (1-11)	S	32	<2	Moxy, excavator, digger, CMC Piling Rig
16/12/2021	16:00	All Areas (1-11)	SSE	30	<2	Moxy, excavator, digger, CMC Piling Rig
17/12/2021	9:30	All Areas (1-11)	SW	9	ND	Moxy, excavator, digger, CMC Piling Rig

Date	Time	Location	Wind Direction	Wind Speed (kph)	Odour (OU) Criteria: >2OU	Works Assessed Onsite
17/12/2021	15:45	All Areas (1-11)	ENE	30	ND	Moxy, excavator, digger, CMC Piling Rig
20/12/2021	9:00	All Areas (1-11)	S	20	ND	Cut 2B & 1 excavation
20/12/2021	15:30	All Areas (1-11)	NE	30	ND	Cut 2B & 1 excavation
21/12/2021	8:30	All Areas (1-11)	SSW	35	ND	Cut 2B & 1 excavation
21/12/2021	15:00	All Areas (1-11)	SE	20	ND	Cut 2B & 1 excavation
22/12/2021	8:00	All Areas (1-11)	S	24	ND	Cut 2B & 1 excavation
22/12/2021	15:00	All Areas (1-11)	SE	26	ND	Cut 2B & 1 excavation
23/12/2021	7:00	All Areas (1-11)	SSE	13	ND	Site Shutdown works
23/12/2021	15:00	All Areas (1-11)	SE	26	ND	Site Shutdown works
24/12/2021	End of year Shutdown period. No readings taken.					
25/12/2021						
26/12/2021						
27/12/2021						
28/12/2021						
29/12/2021						
30/12/2021						
31/12/2021						

4.0 Conclusions

Monitoring was conducted during the 1st and 31st December 2021 reporting period in accordance with the LLGOMP. In general, results have been found to be compliant with historic sampling events.

All monitoring wells tested recorded leachate concentrations below the adopted trigger levels indicating that concentrations are consistent with pre-construction concentrations. No leachate seeps were identified during the reporting period.

Landfill gas monitoring conducted during the December 2021 reporting period indicated that there was no offsite gas detected and the calculated risk level was lower, or consistent with historic levels.

Odour monitoring was undertaken during the monitoring period with no to very low levels of odour detected onsite. Odour was not detected at levels greater than 2OU onsite or at the project downwind boundary and are therefore considered compliant with the trigger levels presented in the LLGOMP.