

Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Standard Landfill Site

Flintshire County Council Waste Management Services

Quarterly Monitoring Review July - September 2019

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1.0 INTRODUCTION

1.1 Background

- 1.1.1 This report reviews environmental monitoring data collected during the third quarter of 2019 at Standard Landfill Site, Buckley, as required by Natural Resources Wales (NRW). Samples for quarterly analysis of leachate and surface water were not collected until 31st of October 2019. No Groundwater samples were collected during Quarter 3. All remaining data reviewed by this report was collected between the 1st of July and the 30th of September 2019 in accordance with the Environmental Permit (EPR), ref. EPR/BP3390VA and the Standard Landfill Closure Plan 3031-CAU-XX-XX-RP-V-0304.A0-C3.
- 1.1.2 This report records and discusses the monitoring data collected for landfill gas, groundwater, leachate, and surface water. For details regarding the site location, surrounding land-use, site history and development and environmental context please refer to the Standard Landfill Site Annual Monitoring Review 2019, document reference 3898-CAU-XX-XX-RP-V-0312.A0-C1, submitted to Natural Resources Wales by Caulmert Ltd, on behalf of Flintshire County Council Waste Management Services alongside this report, in March 2020.

2.0 LANDFILL GAS

2.1 Introduction

- 2.1.1 Routine landfill gas (LFG) monitoring was carried out on a weekly basis at 28 perimeter boreholes during the review period. Methane, carbon dioxide, oxygen, relative pressure and atmospheric pressure were recorded at each borehole.
- 2.1.2 Borehole locations are shown on the drawing 'Environmental Monitoring Locations' 0987/1/002, enclosed. A summary table displaying methane and carbon dioxide concentrations can be found in Appendix 1.
- 2.1.3 Site improvements to replace the now redundant oversized 1MW CAT gas engine for a smaller, more efficient 235 KW unit were completed in July. The new unit will utilise the lower gas yield for longer periods before the gas depletes. This will lower the requirement for flaring over long periods. This process will not significantly impact or effect the site's ability to flare if necessary.

2.2 Methane

- 2.2.1 As in the previous review periods, methane was only detected in BH22, where the maximum concentration was 0.1 % and the average concentration was 0.1 %. A decrease from the previous reviews 0.2 % (Quarter 2 2019).
- 2.2.2 A methane compliance of 1.0 % was proposed for BH22 in EPR Compliance Assessment Report (CAR) ID 37073/0202764 issued by Natural Resources Wales (NRW) on the 27th of February 2014. The proposed compliance limit was not exceeded at BH22 during this review period.

2.3 Carbon Dioxide

- 2.3.1 Carbon dioxide compliance limits were agreed with the Environment Agency (now NRW) during Q3 of 2011 and can be found in Appendix 1 along with the monitoring data. The carbon dioxide compliance limit for boreholes BH16 and BH22, 3.0 % and 3.1 % respectively, were approved in EPR Compliance Assessment Report (CAR) ID 37073/0202764.
- 2.3.2 Average carbon dioxide concentrations ranged between 1.27 % in BH5.7 to 2.04 % in BH5.2 during the third quarter.
- 2.3.3 Carbon dioxide concentrations were below the compliance limits in all locations throughout the review period.

2.4 Carbon Monoxide and Hydrogen Sulphide

- 2.4.1 No carbon monoxide or hydrogen sulphide was detected at any of the monitoring locations throughout the review period.

3.0 LEACHATE

3.1 Introduction

3.1.1 Leachate levels were recorded monthly at nine leachate monitoring locations, LC2 (LC2.1/LC), LC3, LC4, LC7, S1, S2, S3, SSR5 (LS5) and SSR6 (LS6). As in the previous quarter, the nearest well to LC2 was sampled (LC) as there was no access to LC2.

3.1.2 Well locations are shown on the enclosed Environmental Monitoring Location drawing.

3.2 Leachate Levels

3.2.1 Leachate levels were recorded monthly. A table of leachate levels, in metres below ground level (mBGL) and metres above Ordnance Datum (mAOD), can be found in Appendix 2.

3.2.2 Table 1 below displays minimum, maximum and average leachate head levels in metres above well base. Leachate levels remained below the compliance limit throughout the review period at all locations. Average leachate head levels ranged from 1.22 m in LS6 to 1.66 m in S2. The base levels are, however, unconfirmed and the accuracy of these leachate ‘head’ figures cannot be verified.

3.2.3 The meters above ordinance datum calculations for all locations, based on recent top of well surveys, show that all levels were comparable to those detected previously.

Table 1: Leachate Head Levels in metres above well base

Location	Leachate Head (m)		
	Min	Max	Average
LC	1.26	1.28	1.27
LC3	1.50	1.55	1.53
LC4	1.43	1.44	1.44
LC7	1.63	1.66	1.64
LS5	1.26	1.27	1.27
LS6	1.22	1.23	1.22
S1	1.27	1.29	1.28
S2	1.64	1.67	1.66
S3	1.35	1.37	1.36

3.3 Leachate Quality

3.3.1 A summary of the leachate quality is shown in Table 2.2 in Appendix 2. The quarterly parameters were sampled once during October 2019.

3.3.2 Concentrations of ammoniacal nitrogen (as NH₄) within the leachate ranged from 685 mg/l in S1 up to a maximum of 1830 mg/l in LC7. Similarly, concentrations of chloride ranged between 852 mg/l at S1 and 1740 mg/l at LC7.

- 3.3.3 COD concentrations were also highest at LC7 with a concentration of 2410 mg/l. A minimum COD concentration of 659 mg/l was recorded at S1.
- 3.3.4 pH concentrations remained relatively neutral with concentrations ranging from 7.67 in SSR6 to 7.99 in LC3.
- 3.3.5 Concentrations have generally remained similar within the site when compared to the last quarterly suite (Q2 2019).

4.0 GROUNDWATER

4.1 Introduction

- 4.1.1 During the review period groundwater levels were recorded on a monthly basis at eight groundwater monitoring boreholes, GW1, GW2, GW2R, GW3, GW4, GW5, GW6 and GW7R. Location GW2R was installed in October 2016 to replace GW2. No groundwater samples were collected during this monitoring period.

4.2 Groundwater Levels

- 4.2.1 Groundwater level data was recorded on a monthly basis in metres below ground level (mBGL). Where borehole cover level to Ordinance Datum was available this was used to calculate the groundwater level in metres above Ordinance Datum (mAOD).
- 4.2.2 Groundwater levels, in mBGL and mAOD are displayed in a summary table included in Appendix 3. Groundwater levels increased throughout the review period with the greatest increase seen in GW 7R at 6.27 m.

5.0 SURFACE WATER

5.1 Introduction

- 5.1.1 Surface water samples were collected at all 3 locations in the quarterly suite, SW4, SW5 and SW6 during October. The results can be found in Appendix 4.
- 5.1.2 Ammoniacal nitrogen as both N and NH₄ was detected at SW4 at a concentration of 1.59 mg/l and 2.04 mg/l respectively. No ammoniacal nitrogen was detected in SW5 and SW6 in this quarter.
- 5.1.3 As in the previous review, chloride concentrations were slightly elevated in SW4 at 44.7 mg/l compared to 24.1 mg/l in Q1. Concentrations within SW5 and SW6 were similar to that in the previous quarter at 17.8 mg/l and 17.4 mg/l respectively.
- 5.1.4 Total oxidised nitrogen was relatively high within SW4 at 5.16 mg/. Concentrations within SW5 and SW6 remained below the limit of detection, similar to that recorded in the previous quarter.
- 5.1.5 pH concentrations were slightly alkaline at 8.03 at SW4. Concentrations within SW5 and SW6 were near neutral at 7.42 and 7.46 respectively.
- 5.1.6 Iron concentrations increased during quarter three at SW4 from below the detection limit to 0.0199 mg/l. Concentrations within and SW5 and SW6 were similar at 0.0548 mg/l and 0.0527 mg/l respectively. Concentration were significantly lower than those recorded within Q1 2019 (0.0828 mg/l and 0.135 mg/l for SW4 and SW5 respectively).

6.0 CONCLUSIONS

6.1 Landfill gas

- 6.1.1 None of the permitted trigger levels for methane or carbon dioxide were exceeded during this review period.
- 6.1.2 Methane was only detected in BH22, remaining below the compliance limit of 1.0 % throughout the review period, with an average concentration of 0.1 %.
- 6.1.3 No carbon monoxide or hydrogen sulphide was detected.
- 6.1.4 Site improvements to replace the oversized 1MW gas engine for a smaller, more efficient unit were completed in July. The new unit will utilise the lower gas yield for longer periods before the gas depletes. This will lower the requirement for flaring over long periods.

6.2 Leachate

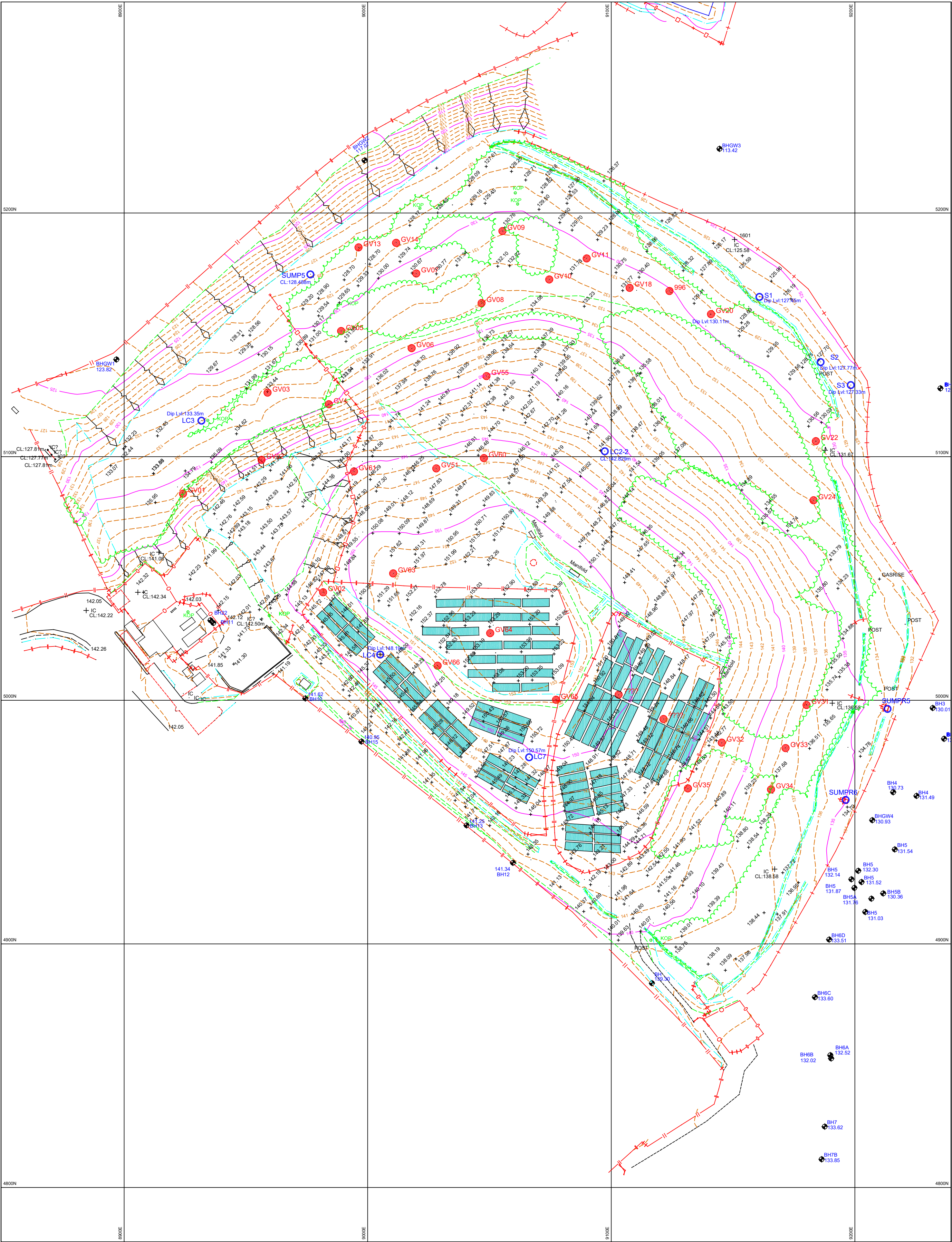
- 6.2.1 Leachate levels remained compliant for the duration of the review period. These levels, when converted to meters above ordinance datum were comparable to those detected during the previous quarter (Q2 2019)
- 6.2.2 Concentrations have generally remained similar within the site when compared to the last quarterly suite (Q2 2019).

6.3 Groundwater

- 6.3.1 Groundwater levels increased throughout the review period with the greatest increase seen in GW 7R at 6.27 m. No groundwater samples were collected during this review period.

6.4 Surface Water

- 6.4.1 The leachate indicators ammoniacal nitrogen and chloride were detected within SW4 during this quarter. Trends will be monitored closely to ensure there is no leachate outbreak.
- 6.4.2 Total oxidised nitrogen concentrations increased significantly within SW4.
- 6.4.3 Iron concentrations within both SW4 and SW5 were similar to those detected within quarter two, however, remained significantly lower compared to those in quarter one (2019)



	SITE	SCALE	NOTES		 www.stafsurv.com Vernon Courtyard, Main Road, Sudbury, Derbyshire, DE6 5HS T 01283 584800 F 01284 584844 E info@stafsurv.com
	Standard Landfill	DATE	Site Grid Shown Levels Relate to Site Datum		
	PROJECT	22/05/2019	 Leachate Well  Gas Vent Switched On		
	Site Survey	DRAWING No.	 Solar Panel		
		10439a			

APPENDIX 1

Table 1 – Summary of Landfill Gas Concentrations

ID	Methane					Carbon Dioxide				
	Min	Max	Average	Count	Trigger	Min	Max	Average	Count	Trigger
BH 1	0	0	0	13	1.00	1.2	1.9	1.46	13	5.40
BH 1.1	0	0	0	13	1.00	1.2	2	1.64	13	5.40
BH 2.0	0	0	0	13	1.00	1.4	2.3	1.88	13	7.00
BH 2.1	0	0	0	13	1.00	1.1	1.9	1.44	13	7.60
BH 2.2	0	0	0	13	1.00	1.2	1.7	1.38	13	5.80
BH 3.0	0	0	0	13	1.00	1.4	2	1.67	13	6.70
BH 3.1	0	0	0	13	1.00	1.2	1.9	1.52	13	7.80
BH 4.0	0	0	0	13	10.00	1.6	2.3	1.95	13	10.60
BH 4.1	0	0	0	13	1.00	1.2	1.7	1.48	13	7.10
BH 4.2	0	0	0	13	1.00	1.4	1.9	1.65	13	8.60
BH 5.0	0	0	0	13	15.00	1.2	2.1	1.48	13	19.40
BH 5.1	0	0	0	13	1.00	1.5	1.9	1.68	13	5.80
BH 5.2	0	0	0	13	1.00	1.8	2.4	2.04	13	9.60
BH 5.3	0	0	0	13	1.00	1.4	2	1.76	13	6.00
BH 5.4	0	0	0	13	1.00	1.3	2.3	1.72	13	16.00
BH 5.5	0	0	0	13	1.00	1.2	1.6	1.41	13	17.10
BH 5.7	0	0	0	13	1.00	1.1	1.5	1.27	13	7.10
BH 6.0	0	0	0	13	1.00	1.1	2	1.52	13	5.40
BH 6.1	0	0	0	13	1.00	1.4	2	1.65	13	5.40
BH 6.2	0	0	0	13	1.00	1.4	1.9	1.72	13	5.40
BH 6.3	0	0	0	13	1.00	1.2	2.3	1.62	13	8.20
BH 7.0	0	0	0	13	1.00	1.4	1.9	1.58	13	6.20
BH 7.1	0	0	0	13	1.00	1.6	2.2	1.82	13	5.50
BH 12	0	0	0	13	10.00	1.3	1.9	1.58	13	6.50
BH 13	0	0	0	13	10.00	1.2	1.8	1.45	13	5.20
BH 15	0	0	0	13	1.00	1.2	1.8	1.48	13	8.30
BH 16	0	0	0	13	1.00	1.2	2.1	1.58	13	3.00
BH 22	0.1	0.1	0.1	13	1.60	1.4	1.8	1.57	13	3.10

APPENDIX 2

Table 2.1 - Leachate Levels

Monitoring Point	Date	Dip to liquid	Dip to Base	Leachate depth (meters above base)	Leachate Level mAOD
LC2.1	02/07/2019	29.72	31	1.28	111.33
	05/08/2019	29.73	31	1.27	111.32
	02/09/2019	29.74	31	1.26	111.31
LC3	02/07/2019	3.29	4.84	1.55	130.67
	05/08/2019	3.31	4.84	1.53	130.65
	02/09/2019	3.34	4.84	1.5	130.62
LC4	02/07/2019	17.56	19	1.44	131.09
	05/08/2019	17.57	19	1.43	131.08
	02/09/2019	17.56	19	1.44	131.09
LC7	02/07/2019	18.67	20.31	1.64	132.62
	05/08/2019	18.68	20.31	1.63	132.61
	02/09/2019	18.65	20.31	1.66	132.64
LS5	02/07/2019	28.81	32	1.27	104.50
	05/08/2019	28.83	32	1.26	104.48
	02/09/2019	28.84	32	1.26	104.47
LS6	02/07/2019	29.95	33	1.22	104.91
	05/08/2019	29.92	33	1.23	104.94
	02/09/2019	29.94	33	1.22	104.92
S1	02/07/2019	3.16	4.43	1.27	124.82
	05/08/2019	3.15	4.43	1.28	124.83
	02/09/2019	3.14	4.43	1.29	124.84
S2	02/07/2019	1.71	3.35	1.64	127.15
	05/08/2019	1.69	3.35	1.66	127.17
	02/09/2019	1.68	3.35	1.67	127.18
S3	02/07/2019	3.74	5.09	1.35	124.76
	05/08/2019	3.72	5.09	1.37	124.78
	02/09/2019	3.73	5.09	1.36	124.77

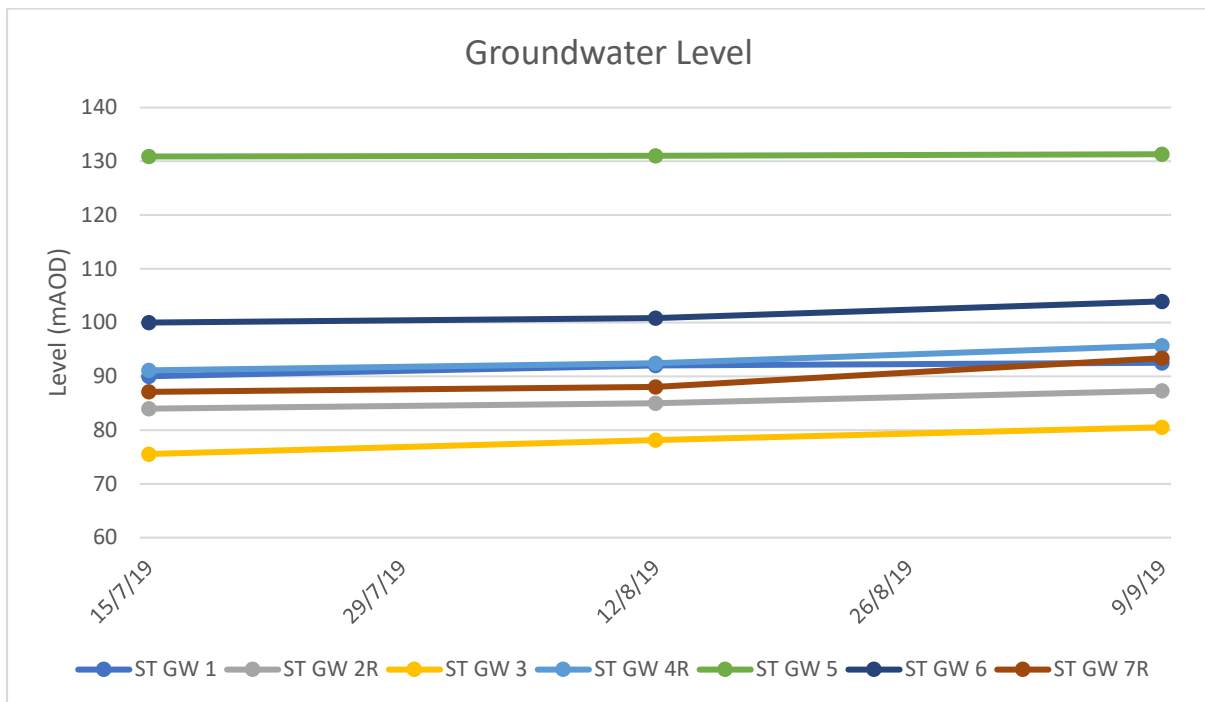
Table 2.2 - Leachate Quality Data Summary

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Inorganics										
Alkalinity, Total as CaCO ₃	mg/l	3080	4740	3870	5850	3150	4700	4750	4160	5540
Ammoniacal Nitrogen as N	mg/l	610	891	698	1420	533	860	910	785	1050
Ammoniacal Nitrogen as NH ₄	mg/l	784	1150	897	1830	685	1110	1170	1010	1350
BOD, unfiltered	mg/l	50.6	134	74.6	180	29.5	78.9	118	65.2	116
Chloride	mg/l	836	1260	1280	1740	852	1260	1270	1160	1490
Chlorine, Total (Residual)	mg/l	0.2	0.8	0.2	1	1	0.4	0.8	0.4	0.4
COD, unfiltered	mg/l	690	1340	964	2410	659	1280	1340	1060	1580
Conductivity @ 20 deg.C	mS/cm	7.34	10.7	9.35	13.5	7.4	10.6	10.9	9.71	12.6
pH	pH Units	7.97	7.99	7.72	7.81	7.67	7.77	7.82	7.76	7.71
Total Oxidised Nitrogen as N	mg/l	<0.5	<0.5	<0.5	<0.5	16.1	1.12	<0.5	15	14.5
Total Oxidised Nitrogen as NO ₃	mg/l	<1.5	<1.5	<1.5	<1.5	71.3	4.96	<1.5	66.3	64.2
Filtered (Dissolved) Metals										
Magnesium (diss.filt)	mg/l	70.3	84.7	85.4	96	60	73.6	85.6	84.7	95.4
Potassium (diss.filt)	mg/l	294	468	403	551	235	440	462	377	572
Sodium (diss.filt)	mg/l	653	1050	883	1350	528	962	1030	874	1440

APPENDIX 3

Table 3.1 - Groundwater Levels

Monitoring	Date	Dip-Lev (mBGL)	Dip Level (mAOD)
GW 1	15/07/2019	34.06	90.02
GW 1	12/08/2019	32.06	92.02
GW 1	09/09/2019	31.55	92.53
GW 2R	15/07/2019	33.21	84
GW 2R	12/08/2019	32.19	85.02
GW 2R	09/09/2019	29.89	87.32
GW 3	15/07/2019	37.86	75.56
GW 3	12/08/2019	35.28	78.14
GW 3	09/09/2019	32.88	80.54
GW 4R	15/07/2019	39.88	91.12
GW 4R	12/08/2019	38.55	92.45
GW 4R	09/09/2019	35.28	95.72
GW 5	15/07/2019	3.96	130.9
GW 5	12/08/2019	3.84	131.02
GW 5	09/09/2019	3.54	131.32
GW 6	15/07/2019	23.56	100.01
GW 6	12/08/2019	22.71	100.86
GW 6	09/09/2019	19.62	103.95
GW 7R	15/07/2019	54.88	87.12
GW 7R	12/08/2019	53.99	88.01
GW 7R	09/09/2019	48.61	93.39



APPENDIX 4

Table 4 –Surface Water Quality

Parameter	Units	SW4	SW5	SW6
Inorganics				
Alkalinity, Total as CaCO ₃	mg/l	230	95	75
Ammoniacal Nitrogen as N	mg/l	1.59	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	mg/l	2.04	<0.3	<0.3
BOD, unfiltered	mg/l	<1	4.94	6.64
Chloride	mg/l	44.7	17.8	17.4
Chlorine, Total (Residual)	mg/l	0.01	0.02	0.02
COD, unfiltered	mg/l	25.6	220	249
Conductivity @ 20 deg.C	mS/cm	0.821	0.422	0.388
Nitrate as NO ₃	mg/l	22.7	<0.3	<0.3
pH	pH Units	8.03	7.42	7.46
Sulphate	mg/l	192	110	108
Total Oxidised Nitrogen as N	mg/l	5.16	<0.1	<0.1
Filtered (Dissolved) Metals				
Iron (diss.filt)	mg/l	0.0199	0.0548	0.0527
Magnesium (diss.filt)	mg/l	19.1	13.9	13.3
Potassium (diss.filt)	mg/l	22.6	8.18	8.03
Sodium (diss.filt)	mg/l	34.5	18.7	18.4
Unfiltered (Total) Metals				
Calcium (tot.unfilt)	mg/l	135	63.8	62.4



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