

## Armidale Solid Waste Landfill Facility

Location: 108 Long Swamp Road, Armidale NSW 2350 Environment Protection Licence Number: 5860 Activities: Waste disposal to land and waste processing

The internet link to Licence No. 5860 is <https://apps.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=137211&SYSUID=1&LICID=5860>

Licensee under Protection of Environment Operations Act 1997 (POEO Act):

Armidale Regional Council, PO Box 75A, Armidale NSW 2350

Council is required to monitor methane, groundwater, surface water and leachate at various sampling points. This document details recent results. To meet its obligation under Section 66 (6) of the POEO Act, a link to the current version of this document is available on Council's website.

On the adjacent figure, sampling locations are given historical names and colour coded according to the type of monitoring: L = Long Swamp; S = Surface water; O = Overflow; W = Well; LL = Leachate; GW = Groundwater; and EX = Extension. Corresponding Environment Protection Authority (EPA) Identification Numbers detailed on the Licence are provided below.

A few EPA ID numbers are missing due to changes since initial licensing of the landfill.

EPA No. 2	LSO1 (surface water + leachate overflow)
EPA No. 4	LSO2 (surface water + leachate overflow)
EPA No. 5	Annual leachate volume discharge to utilisation area (Pump 1)
EPA No. 6	LSO3 (surface water + leachate overflow)
EPA No. 7	LSO4 (surface water + leachate overflow)
EPA No. 8	LW1 (groundwater monitoring well)
EPA No. 9	LW2 (groundwater monitoring well)
EPA No. 10	LW3 (groundwater monitoring well)
EPA No. 12	LS2 (surface water + leachate)
EPA No. 13	LS3 (surface water + leachate)
EPA No. 14	LS4 (surface water + leachate)
EPA No. 15	LS5 (farmer's dam)
EPA No. 16	LL1 (leachate)
EPA No. 17	Surface methane
EPA No. 18	Building methane
EPA No. 19	LL2 (leachate)
EPA No. 20	LSO5 (surface water + leachate overflow)
EPA No. 21	SWEX-01 (surface water)
EPA No. 22	Annual leachate volume transfer from landfill extension ponds
EPA No. 23	GWEX-01 (groundwater monitoring well)
EPA No. 24	GWEX-02 (groundwater monitoring well)
EPA No. 25	GWEX-03 (groundwater monitoring well)



Monitoring results for the last four years are presented on following pages – as required in the EPA publishing requirements.

**Water quality analytes** are organised in tables on following pages according to chemical grouping to assist chemical review. [Analytes are listed on the licence in alphabetical order.] They include analytes for groundwater, surface water and landfill leachate.

The left hand table provides the field test results. The field tests are conducted on the same date that a sample is collected.

The right hand table provides analytical results from the NATA registered laboratory. The date the laboratory issued the results is first, followed by the date by which results were placed on the Armidale Dumaresq Council website.

Abbreviations in the tables are provided here in alphabetical order:

Alk = Alkalinity measured as mg/L CaCO<sub>3</sub> equivalent; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; Ca = Calcium; Cl = Chloride; D = Depth to water from top of internal well PVC casing; DO = Dissolved Oxygen; EC = Electrical Conductivity also called conductivity; Eh = Redox Potential; Fe = Iron; Hg = Mercury; K = Potassium; Mg = Magnesium; Mn = Manganese; Na = Sodium; ND = Nil detected; NH<sub>3</sub> = Ammonia as a measure of ammonium ions; NO<sub>x</sub> = Nitrite + Nitrate; NR = not required by licence; OC&OP = Organochlorine & Organophosphorus; WL RL = water level converted to Reduced Level relative to mean sea level; PAH = Polynuclear aromatic hydrocarbons; SO<sub>4</sub> = Sulphate; SS = Total suspended solids; Temp = Temperature; TKN = Total Kjeldahl Nitrogen (organic nitrogen + ammonia); TN = Total Nitrogen; TOC = Total Organic Carbon; VFR = Volumetric Flow Rate; Zn = Zinc.

Measures:

mg/L = milligram per litre (equivalent to ppm); µS/cm = micro Siemens per centimetre; mV = millivolts; °C= degrees Celsius; kL = kilolitres; ppm = parts per million.

Choice of water quality analytes:

Some analytes are tested because they give a general understanding of groundwater, surface water and leachate quality. Often the concentrations are greater in leachate than in groundwater and surface water. A simple comparison can tell us if landfill leachate may have escaped into groundwater or surface water. However, care is needed when reviewing these general results so that false conclusions are not made. The salt levels in groundwater are a case in point. EC is an indicator of salt levels. If the EC has previously been low, and then becomes at least three to four times higher, one would assume it is due to landfill leachate ingress into groundwater. The Long Swamp Road Landfill groundwater has relatively low EC (Table 1) except for well LW1. So landfill leachate intrusion may be indicated if the EC in other wells becomes a lot higher. (LW1 is an upgradient well contaminated with nitrogen compounds. Historical photos have revealed that it is not due to landfill leachate, but due to old night soil trenches that are close by.)

Other analytes give us more specific information about the possible presence of landfill leachate in groundwater and surface water. Even with these we must carefully consider if their increased concentrations are definitely due to landfill leachate and are not from some other source.

- Nitrogen compounds indicate biodegradation of the plant and animal waste in our solid waste. They may also be due to fertilizer use on nearby properties or old night soil trenches. A general rule of thumb is that total nitrogen (TKN + NO<sub>x</sub>) should be <5 mg/L.
- Iron and manganese above 10 mg/L is an indicator that landfill leachate may be present in groundwater. However, these groundwater analytes may increase due to leaching of iron and manganese from the soil after excessive rainfall or flood water infiltration.
- Organic analytes such as BTEX compounds are most likely to indicate landfill leachate, especially if they haven't been detected before.

So it is important to monitor on a regular basis to note any changes in water quality analyte concentrations and to judiciously review the results. Increases in groundwater and surface water analyte concentrations due to landfill leachate intrusion are often at least three to four times the previous concentrations.

Comments on water quality results: Wells (LW2, LW3, GWEX-02, GWEX-03) are downgradient of the landfill and are at most risk from landfill leachate ingress. There is no indication of contamination in these wells. The LS5 dam is also an environmental value to be protected. Its water quality results show no indication of landfill leachate ingress.

Table 1a: Groundwater quality & depth

Frequency required by licence		DO	EC	pH	Eh	Temp	D	WL	RL	Alk	Received from laboratory	Accessible on Council website by	Cl	Mn	Zn	Fe	Hg	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	TOC	PAH	
Measure		mg/L	µS/cm	1-14	mV	°C	m	m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	
<b>LW1</b> 6 monthly													<b>LW1</b>											NR
07/03/15		0.70	3219	3.38	+209	19.4	2.67	1021.12	<1		18/03/15	09/04/15	440	0.153	0.053	<0.05	0.0001	0.05	268	27.4	295	2		
12/10/15		2.32	3273	4.11	+445	15.6	2.95	1020.84	<1		21/10/15	10/11/15	431	0.171	0.050	<0.05	<0.0001	0.06	276	11.3	287	1		
22/03/16		0.20	3323	4.08	+440	18.9	2.72	1021.07	<1		04/04/16	22/04/16	441	0.158	0.070	<0.05	<0.0001	0.02	264	61.0	325	2		
27/09/16		2.06	3160	3.86	+419	15.4	2.82	1020.97	<1		07/10/16	27/10/16	441	0.253	0.078	<0.05	0.0001	0.34	323	42.0	365	2		
12/05/17		0.18	3315	4.04	+383	17.5	2.67	1021.12	<1		23/05/17	13/06/17	440	0.310	0.174	0.06	<0.0001	0.04	259	<10.0	259	3		
06/10/17		1.42	3365	4.10	+429	17.6	2.53	1021.26	<1		13/10/17	02/11/17	504	0.457	0.141	0.06	0.0003	0.03	294	<10.0	294	3		
08/07/18		0.18	3505	4.10	+325	19.0	2.85	1020.94	<1		19/07/18	09/08/18	474	0.403	0.133	0.08	<0.0001	0.03	279	24.8	304	6		
13/10/18		1.46	3268	4.11	+405	15.9	2.99	1020.80	<1		23/10/18	12/11/18	455	0.383	0.230	0.07	0.0004	<0.01	263	22.9	286	4		
15/03/19		0.13	3290	4.38	+447	19.2	2.78	1021.01	<1		25/03/19	15/04/19	434	0.332	0.121	0.07	0.0005	0.05	210	<0.1	210	2		
09/10/19		0.53	3298	3.98	+343	16.0	3.35	1020.44	<1		21/10/19	08/11/19	468	0.423	0.255	0.07	0.0012	0.02	261	36.5	298	7		
<b>LW2</b> 6 monthly													<b>LW2</b>											NR
05/03/15		0.41	519	6.68	+112	19.3	4.98	1001.23	150		18/03/15	09/04/15	51	0.012	0.031	<0.05		0.02	0.130	<0.1	0.1	<1		
12/10/15		6.55	540	6.81	+181	19.7	5.17	1001.04	161		21/10/15	10/11/15	51	0.036	0.088	<0.05		0.090	0.160	<0.1	0.2	3		
22/03/16		1.64	546	6.71	+182	16.7	5.36	1000.85	156		04/04/16	22/04/16	51	0.010	0.018	<0.05		<0.01	0.100	<0.1	0.1	<1		
29/09/16		0.90	522	6.70	+148	13.6	5.25	1000.96	150		07/10/16	27/10/16	49	0.080	0.011	<0.05		0.09	0.040	0.2	0.2	<1		
12/05/17		1.06	554	6.52	+126	16.9	4.70	1001.51	160		23/05/17	13/06/17	56	0.105	0.145	<0.05		0.12	0.060	0.1	0.2	<1		
06/10/17		0.46	529	6.56	+107	19.2	4.27	1001.94	157		13/10/17	02/11/17	61	0.236	0.079	<0.05		0.11	0.090	0.2	0.3	4		
10/07/18		0.89	838	6.67	+125	14.6	4.55	1001.66	170		19/07/18	09/08/18	128	0.074	0.090	<0.05		0.08	0.090	0.5	0.6	4		
12/10/18		0.89	544	7.85	+68	15.4	5.28	1000.93	171		23/10/18	12/11/18	61	0.020	0.084	<0.05		0.01	0.090	<0.1	<0.1	2		
15/03/19		0.73	533	6.71	+103	22.8	5.58	1000.63	160		25/03/19	15/04/19	55	0.026	0.074	<0.05		0.05	0.150	<0.1	0.2	3		
08/10/19		4.23	562	6.62	+125	22.2	6.51	999.70	167		21/10/19	08/11/19	56	0.339	0.096	<0.05		0.17	0.02	0.4	0.4	2		
<b>LW3</b> 6 monthly													<b>LW3</b>											NR
05/03/15		1.30	292	5.86	+16	19.9	11.95	997.46	200		18/03/15	09/04/15	14	0.541	0.028	4.05		0.35	0.01	0.5	0.5	<1		
12/10/15		0.89	457	6.45	-5	18.1	12.29	997.12	180		21/10/15	10/11/15	13	0.535	0.063	4.50		0.37	0.02	0.4	0.4	5		
22/03/16		0.56	468	6.32	+11	17.8	12.42	996.99	193		04/04/16	22/04/16	13	0.580	0.050	4.91		0.33	<0.01	0.6	0.6	2		
29/09/16		0.57	467	6.16	+60	15.3	12.46	996.95	203		07/10/16	27/10/16	23	0.604	0.015	1.25		0.26	0.04	0.4	0.4	12		
12/05/17		0.55	450	6.19	+11	17.3	12.43	996.98	207		23/05/17	13/06/17	16	0.552	0.012	3.42		0.34	<0.01	0.4	0.4	5		
06/10/17		0.55	482	6.26	+13	17.6	12.18	997.23	200		13/10/17	02/11/17	30	0.656	0.148	2.28		0.28	<0.01	0.4	0.4	7		
09/07/18		9.59	489	6.50	-28	17.0	12.03	997.38	213		19/07/18	09/08/18	15	0.560	0.122	4.17		0.36	<0.01	0.3	0.3	9		
12/10/18		0.64	438	6.09	-4	16.0	12.16	997.25	203		23/10/18	12/11/18	15	0.544	0.172	2.87		0.36	0.02	0.4	0.4	3		
15/03/19		0.57	477	6.40	+8	20.7	17.35	992.06	203		25/03/19	15/04/19	14	0.567	0.144	4.26		0.06	<0.01	<0.1	<0.1	5		
08/10/19		5.97	465	6.33	+39	24.1	12.73	996.68	210		21/10/19	08/11/19	14	0.532	0.041	3.34		0.35	<0.01	0.7	0.7	5		

Table 1b: Groundwater quality & depth

Frequency required by licence	DO	EC	pH	Eh	Temp	D	WL	RL	Alk
Measure	mg/L	µS/cm	1-14	mV	°C	m	m	mg/L	
<b>GWEX-01</b> 6 monthly									
06/03/15	1.26	595	4.14	+392	18.1	4.56	1019.43	1	
12/10/15	1.15	627	4.78	+590	17.2	4.85	1019.14	<1	
19/03/16	0.74	558	4.66	+547	18.3	4.66	1019.33	1	
27/09/16	0.78	615	4.67	+579	15.3	4.89	1019.10	2	
14/05/17	0.56	649	4.68	+556	16.4	4.79	1019.20	1	
06/10/17	0.50	638	5.06	+569	17.3	4.85	1019.14	1	
10/07/18	0.71	641	5.64	+523	15.3	5.52	1018.47	2	
13/10/18	0.53	606	5.41	+452	15.9	5.69	1018.30	1	
15/03/19	0.35	600	5.07	+597	18.1	5.66	1018.33	1	
09/10/19	0.44	580	4.47	+582	15.5	6.27	1017.72	1	
<b>GWEX-02</b> 3 monthly									
06/03/15	0.40	342	5.65	+88	17.0	14.73	992.72	100	
01/08/15	0.35	355	6.21	+164	16.3	14.93	992.52	103	
12/10/15	0.38	351	6.16	+266	16.9	14.98	992.47	80	
02/12/15	0.93	360	6.17	+239	17.5	15.05	992.40	100	
19/03/16	0.27	354	6.10	+179	17.6	15.13	992.32	103	
03/06/16	0.40	364	6.10	+223	15.7	15.35	992.10	105	
27/09/16	0.39	352	6.09	+239	15.8	14.84	992.61	113	
17/01/17	0.43	351	6.26	+197	17.6	14.75	992.70	103	
14/05/17	0.34	354	5.86	+154	16.7	14.82	992.63	103	
28/07/17	0.30	357	5.90	+156	15.5	14.72	992.73	97	
06/10/17	0.27	350	6.00	+252	16.4	14.68	992.77	100	
22/01/18	0.44	362	6.17	+89	17.7	14.89	992.56	100	
08/07/18	0.23	366	6.77	+120	19.3	15.46	991.99	100	
08/09/18	0.39	348	6.21	+152	16.3	15.55	991.90	107	
13/10/18	0.35	344	6.53	+155	16.6	15.62	991.83	102	
05/01/19	0.31	366	6.05	+228	18.5	15.67	991.78	102	
15/03/19	0.32	356	6.14	+212	17.3	15.84	991.61	93	
13/08/19	0.40	352	6.05	+130	16.3	16.27	991.18	97	
09/10/19	0.24	355	5.80	+340	15.7	16.38	991.07	117	

Received from laboratory	Accessible on Council website by	Cl	Mn	Zn	Fe	Hg	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	TOC	PAH
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L
<b>GWEX-01</b>												Annually
18/03/15	09/04/15	184	0.040	0.040	<0.05	0.0043	0.02	0.06	0.1	0.2	2	ND
21/10/15	10/11/15	185	0.045	0.037	<0.05	0.0037	0.06	0.07	<0.1	<0.1	5	NR
04/04/16	22/04/16	197	0.047	0.047	<0.05	0.0028	<0.01	0.04	<0.1	<0.1	<1	ND
07/10/16	27/10/16	181	0.043	0.024	<0.05	0.0029	0.01	0.06	<0.1	<0.1	2	NR
23/05/17	13/06/17	190	0.045	0.073	<0.05	0.0039	0.12	0.05	<0.1	<0.1	4	ND
13/10/17	02/11/17	210	0.045	0.034	<0.05	0.0041	0.02	0.06	<0.1	<0.1	5	NR
19/07/18	09/08/18	184	0.045	0.102	<0.05	0.0034	0.06	0.02	<0.1	<0.1	5	ND
23/10/18	12/11/18	187	0.041	0.117	<0.05	0.0029	0.03	0.01	<0.1	<0.1	2	NR
25/03/19	15/04/19	172	0.041	0.139	0.07	0.0035	0.09	0.10	<0.1	0.1	4	ND
21/10/19	08/11/19	180	0.040	0.031	<0.05	0.0014	<0.01	0.02	<0.1	<0.1	4	NR
<b>GWEX-02</b>												Annually
18/03/15	09/04/15	22	<0.001	0.006	<0.05	<0.0001	0.02	0.14	<0.1	0.1	<1	ND
13/08/15	27/08/15	22	0.006	0.007	<0.05	<0.0001	<0.01	0.13	<0.1	0.1	<1	NR
21/10/15	10/11/15	20	<0.001	<0.005	<0.05	<0.0001	0.06	0.15	<0.1	0.2	4	NR
11/12/15	05/01/16	27	<0.001	<0.005	<0.05	<0.0001	0.03	0.14	<0.1	0.1	<1	NR
04/04/16	22/04/16	23	<0.001	<0.005	<0.05	<0.0001	<0.01	0.14	<0.1	0.1	<1	ND
16/06/16	06/07/16	22	<0.001	<0.005	<0.05	<0.0001	<0.01	0.14	<0.1	0.1	<1	NR
07/10/16	27/10/16	23	<0.001	<0.005	<0.05	<0.0001	<0.01	0.14	<0.1	0.1	7	NR
24/01/17	14/02/17	24	<0.001	0.005	<0.05	<0.0001	0.06	0.15	<0.1	0.2	5	NR
23/05/17	13/06/17	26	<0.001	<0.005	<0.05	<0.0001	0.04	0.14	<0.1	0.1	3	ND
08/08/17	28/08/17	23	<0.001	0.006	<0.05	<0.0001	0.01	0.12	<0.1	0.1	<1	NR
13/10/17	02/11/17	31	<0.001	0.005	<0.05	<0.0001	0.01	0.17	<0.1	0.2	7	NR
30/01/18	19/02/18	27	<0.001	<0.005	<0.05	<0.0001	<0.01	0.14	<0.1	0.1	2	NR
19/07/18	09/08/18	24	<0.001	<0.005	<0.05	<0.0001	0.04	0.15	<0.1	0.2	5	ND
21/09/18	12/10/18	23	<0.001	<0.005	<0.05	<0.0001	0.01	0.14	<0.1	0.1	5	NR
23/10/18	12/11/18	30	<0.001	<0.005	<0.05	<0.0001	<0.01	0.14	<0.1	0.1	9	NR
17/01/19	07/02/19	26	<0.001	<0.005	<0.05	<0.0001	0.05	0.14	0.3	0.4	<1	NR
25/03/19	15/04/19	26	<0.001	<0.005	<0.05	<0.0001	0.08	0.15	<0.1	0.2	1	ND
23/08/19	12/09/19	27	<0.001	<0.005	<0.05	<0.0001	<0.01	0.13	0.1	0.2	<1	NR
21/10/19	08/11/19	26	<0.001	<0.005	<0.05	<0.0001	<0.01	0.14	<0.1	0.1	2	NR

Table 1c: Groundwater quality & depth

Frequency required by licence		DO	EC	pH	Eh	Temp	D	WL	RL	Alk	Received from laboratory	Accessible on Council website by	Cl	Mn	Zn	Fe	Hg	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	TOC	PAH	
Measure		mg/L	µS/cm	1-14	mV	°C	m	m		mg/L			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	
<b>GWEX-03</b>	3 monthly										<b>GWEX-03</b>													Annually
07/03/15		0.23	916	6.47	+110	19.6	11.08	993.10	267		18/03/15	09/04/15	103	<0.001	0.006	<0.05	<0.0001	0.02	0.13	<0.1	0.1	<1		ND
01/08/15		0.12	828	6.60	+130	16.3	11.29	992.89	273		13/08/15	27/08/15	101	<0.001	<0.005	<0.05	<0.0001	<0.01	0.08	<0.1	<0.1	<1		NR
12/10/15		0.20	789	6.56	+300	16.4	11.33	992.85	260		21/10/15	10/11/15	104	<0.001	<0.005	<0.05	<0.0001	0.06	0.10	<0.1	0.1	4		NR
02/12/15		0.28	891	6.51	+244	17.0	11.38	992.80	260		11/12/15	05/01/16	111	<0.001	<0.005	<0.05	<0.0001	0.03	0.09	<0.1	<0.1	<1		NR
22/03/16		0.17	875	6.42	+208	16.4	11.52	992.66	242		04/04/16	22/04/16	109	<0.001	<0.005	<0.05	<0.0001	<0.01	0.20	<0.1	0.2	2		ND
03/06/16		0.30	878	6.57	+197	15.5	11.73	992.45	283		16/06/16	06/07/16	98	0.002	<0.005	<0.05	<0.0001	<0.01	0.09	<0.1	<0.1	<1		NR
29/09/16		0.41	838	6.46	+179	15.6	10.92	993.26	293		07/10/16	27/10/16	102	<0.001	<0.005	<0.05	<0.0001	<0.01	0.09	<0.1	<0.1	<1		NR
17/01/17		0.46	869	6.62	+159	19.0	10.90	993.28	277		24/01/17	14/02/17	99	<0.001	<0.005	<0.05	<0.0001	0.05	0.09	<0.1	<0.1	3		NR
12/05/17		0.17	855	6.36	+168	17.7	10.93	993.25	277		23/05/17	13/06/17	102	<0.001	<0.005	<0.05	<0.0001	0.05	0.08	<0.1	<0.1	7		ND
28/07/17		0.21	864	6.36	+158	15.5	10.77	993.41	273		08/08/17	28/08/17	104	0.002	0.005	<0.05	<0.0001	0.01	0.12	<0.1	0.1	3		NR
06/10/17		0.18	1016	6.42	+122	17.1	10.86	993.32	277		13/10/17	02/11/17	112	<0.001	<0.005	<0.05	<0.0001	0.03	0.16	<0.1	0.2	8		NR
22/01/18		0.20	880	6.49	-28	19.3	11.08	993.10	273		30/01/18	19/02/18	109	<0.001	<0.005	<0.05	<0.0001	<0.01	0.10	<0.1	0.1	1		NR
08/07/18		0.15	880	7.11	+107	19.2	11.80	992.38	279		19/07/18	09/08/18	105	<0.001	<0.005	<0.05	<0.0001	0.04	0.11	<0.1	0.1	6		ND
08/09/18		0.32	805	6.47	+139	16.1	11.92	992.26	260		21/09/18	12/10/18	106	<0.001	<0.005	<0.05	<0.0001	<0.01	0.10	<0.1	0.1	3		NR
12/10/18		0.28	869	7.05	+101	16.0	11.98	992.20	277		23/10/18	12/11/18	108	<0.001	<0.005	<0.05	<0.0001	<0.01	0.09	<0.1	<0.1	4		NR
05/01/19		0.70	867	6.43	+205	18.2	12.03	992.15	280		17/01/19	07/02/19	104	<0.001	<0.005	<0.05	<0.0001	0.04	0.09	0.1	0.2	1		NR
15/03/19		0.21	875	6.71	+146	18.0	12.27	991.91	283		25/03/19	15/04/19	103	<0.001	<0.005	<0.05	<0.0001	0.04	0.10	<0.1	0.1	<1		ND
13/08/19		0.24	865	6.44	+117	16.1	12.79	991.39	273		23/08/19	12/09/19	109	<0.001	0.005	<0.05	<0.0001	0.02	0.09	0.2	0.3	4		NR
08/10/19		0.19	878	6.41	+129	17.6	12.91	991.27	283		21/10/19	08/11/19	109	<0.001	0.007	<0.05	<0.0001	<0.01	0.11	<0.1	0.1	6		NR

Table 2: Surface water quality

Frequency required by licence		DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website by	SS	SO <sub>4</sub>	Cl	Ca	Mg	Na	K	Mn	Zn	Fe	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	TOC	Phenols
Measure		mg/L	µS/cm	1-14	mV	°C	mg/L			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L
<b>LS5</b>	6 monthly							<b>LS5</b>		NR	NR	NR	NR	NR	NR	NR			NR						NR
04/03/15		9.18	158	9.05	+24	29.5	67	12/03/15	09/04/15	5							0.009	<0.005	0.19	0.01	0.8	0.8	13		
13/10/15		7.66	207	7.19	+310	21.4	23	21/10/15	10/11/15	20							0.108	<0.005	0.18	0.02	1.2	1.2	13		
21/03/16		9.05	191	8.42	+150	18.9	67	04/04/16	22/04/16	10							0.011	<0.005	0.08	0.02	1.2	1.2	12		
19/09/16		12.37	274	8.44	+165	12.2	67	27/09/16	27/10/16	9							0.019	0.008	0.32	0.04	1.4	1.4	20		
14/05/17		12.74	249	8.28	+250	14.7	77	23/05/17	13/06/17	48							0.018	0.051	0.34	<0.01	1.1	1.1	15		
03/10/17		15.73	694	8.72	+172	17.8	77	13/10/17	02/11/17	46							0.028	<0.005	<0.05	<0.01	1.8	1.8	17		
10/07/18		19.27	462	10.09	+109	10.6	40	19/07/18	09/08/18	76							0.004	<0.005	0.26	0.01	3.6	3.6	19		
15/10/18		9.08	235	7.61	+289	15.5	53	23/10/18	12/11/18	34							0.034	0.007	0.26	0.03	1.8	1.8	<1		
16/04/19		4.61	565	6.68	+153	13.6	123	26/04/19	16/05/19	70							0.576	0.006	<0.05	<0.01	4.3	4.3	33		
08/10/19		Insuffi cient water																							
<b>SWEX-01</b>	3 monthly							<b>SWEX-01</b>																	
07/03/15	no flow							12/05/15	26/05/15	8	14	8	14	5	7	8	0.004	<0.005	0.14	0.06	<0.01	0.6	0.6	7	<0.05
04/05/15	flow hint	8.22	181	7.05	+176	18.9	59	13/08/15	27/08/15	<5	20	10	18	6	9	6	0.002	0.006	<0.05	0.02	<0.01	0.6	0.6	5	<0.05
01/08/15	flow hint	8.42	215	7.14	+138	13.1	61																		
13/10/15	no-flow																								
02/12/15	dry																								
19/03/16	dry																								
03/06/16	flow hint	5.81	238	6.51	+193	12.7	23	16/06/16	06/07/16	7	46	19	16	5	12	10	0.044	0.013	0.22	0.03	<0.01	0.8	0.8	9	<0.05
24/08/16	1728 kL/day	7.89	808	7.42	+230	10.7	103	01/09/16	27/10/16	31	93	70	54	14	16	89	0.022	0.023	0.09	0.98	1.42	3.2	4.6	21	<0.05
17/01/17	dry																								
14/05/17	Flow hint	5.44	418	6.54	-109	19.3	150	23/05/17	13/06/17	81	26	16	42	13	18	14	1.81	0.107	3.02	0.05	0.19	1.6	1.8	17	<0.05
28/07/17	2 kL/day	8.88	237	6.40	+175	9.9	70	08/08/17	28/08/17	7	25	12	20	7	11	9	0.004	0.012	<0.05	0.27	<0.01	0.6	0.6	4	<0.05
06/10/17	dry																								
22/01/18	Flow hint	5.15	346	6.13	+98	27.2	147	30/01/18	19/02/18	7	5	10	36	8	11	12	0.470	<0.005	0.32	0.08	<0.01	1.2	1.2	16	<0.05
08/07/18	Flow hint	5.76	235	6.73	+85	15.9	35	19/07/18	09/08/18	11	25	17	16	4	5	12	0.057	0.015	0.53	0.06	0.01	0.8	0.8	14	<0.05
08/09/18	33.23	6.11	242	6.14	+114	14.0	56	21/09/18	12/10/18	12	30	16	19	6	10	12	0.010	0.015	0.07	0.03	<0.01	0.9	0.9	9	<0.05
15/10/18	3.70	5.85	248	6.42	+112	15.2	57	23/10/18	12/11/18	6	23	27	22	6	10	9	0.007	0.006	0.15	0.03	<0.01	0.5	0.5	<1	<0.05
05/01/19	dry																								
15/03/19	dry																								
16/04/19	dry																								
13/08/19	dry																								
09/10/19	dry																								

Table 3a: Concentrated leachate quality – LL1 & LL2

Frequency required by licence		DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website by	Cl	Mn	Zn	Fe	Hg	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	TOC	PAH	OC&OP Pesticides	BTEX compounds	
Measure		mg/L	µS/cm	1-14	mV	°C	mg/L			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as n	mg/L	mg/L	mg/L	mg/L	mg/L	
<b>LL1</b> Annually																							
12/10/15		6.86	3580	7.78	+236	14.3	577	21/10/15	10/11/15	652	0.068	0.010	1.84	<0.0001	0.13	20.6	6.4	27.0	49		NR	ND	ND
19/09/16		2.91	3000	7.78	+88	13.8	1040	27/09/16	27/10/16	345	0.921	0.017	0.21	<0.0001	45.6	12.2	39.5	51.7	71			ND	ND
03/10/17		3.27	3690	7.63	+202	16.7	333	13/10/17	02/11/17	580	1.57	0.034	9.02	<0.0001	32.9	33.3	55.4	88.7	95			ND	ND
15/10/18		7.42	3375	7.97	+38	16.8	920	23/10/18	12/11/18	530	0.432	0.013	0.49	<0.0001	5.27	22.7	13.0	35.7	72			ND	ND
08/10/19		6.36	3970	7.60	+193	22.7	550	21/10/19	08/11/19	628	0.202	0.030	4.57	<0.0001	0.22	101.0	8.6	110	47			ND	ND
<b>LL2</b> 6 monthly																					Annually	Annually	Annually
01/08/15		15.59	4535	8.68	+76	13.7	1420	13/08/15	27/08/15	662	0.218	0.011	1.99	<0.0001	65.60	0.09	82.3	82.4	123	ND	ND	ND	ND
02/12/15		5.58	4805	8.42	+278	21.0	1220	11/12/15	05/01/16	766	0.128	<0.005	0.90	<0.0001	38.5	1.53	43.9	45.4	95	NR	NR	NR	NR
03/06/16		7.52	4990	8.82	+188	10.9	1460	16/06/16	06/07/16	884	0.152	<0.005	0.62	<0.0001	24.0	0.06	42.0	42.1	136	ND	ND	ND	ND
17/01/17		17.02	4985	8.55	+90	25.9	1590	24/01/17	14/02/17	755	0.227	<0.005	0.93	<0.0001	90.5	0.30	94.5	94.8	128	NR	NR	NR	NR
28/07/17		15.55	4295	7.46	+85	11.1	1480	08/08/17	28/08/17	572	0.241	0.011	1.93	<0.0001	96.6	1.43	135.0	136.0	107	ND 3/10/17	ND 3/10/17	ND	ND
22/01/18		28.91	4530	8.54	+9	31.4	1160	30/01/18	19/02/18	826	0.127	0.010	0.92	<0.0001	126.0	1.95	28.3	30.2	130	NR	NR	NR	NR
08/09/18		30.49	4110	6.97	+59	17.8	867	21/09/18	12/10/18	869	0.043	0.017	1.64	<0.0001	1.48	0.22	39.8	40.0	170	ND	ND	ND	ND
05/01/19		29.43	4980	10.07	+142	32.3	1087	17/01/19	07/02/19	1020	0.148	<0.005	0.69	<0.0001	0.60	0.04	19.7	19.7	142	NR	NR	NR	NR
13/08/19		31.72	7315	9.57	+110	14.1	1233	23/08/19	12/09/19	1710	0.058	0.019	5.37	<0.0001	1.21	0.01	55.5	55.5	255	ND	ND	ND	ND

Table 3b: Weaker leachate quality – LS2, LS3, LS4 – previously surface water

Frequency required by licence								Received Accessible															
DO	EC	pH	Eh	Temp	Alk	from laboratory	on Council website by	VFR	SS	Cl	Mn	Zn	Fe	Hg	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	TOC	PAH	OC&OP Pesticides	BTEX compounds	
<b>LS2 6 monthly</b>								<b>LS2</b>															
04/03/15	9.35	4261	9.26	-7	26.0	767	12/03/15	09/04/15	NR	NR					NR	NR					NR	NR	NR
13/10/15	12.29	4185	9.32	+278	18.3	747	21/10/15	10/11/15		48	0.039	<0.005	0.16			<0.01	13.6	13.6	128				
21/03/16	9.72	4570	9.07	+160	19.6	907	04/04/16	22/04/16		179	0.030	0.006	0.61			<0.01	18.4	18.4	134				
19/09/16	10.35	1873	8.93	+105	13.5	333	27/09/16	27/10/16		27	0.054	<0.005	0.56			0.02	15.7	15.7	114				
14/05/17	11.72	2354	7.29	+329	16.3	513	23/05/17	13/06/17		39	0.057	0.011	0.18			1.20	6.6	7.8	46				
03/10/17	9.01	2459	8.27	+189	17.7	152	13/10/17	02/11/17		26	0.028	<0.005	0.12			0.25	5.8	6.0	54				
09/07/18	19.24	3715	8.32	+64	10.1	667	19/07/18	09/08/18		8	0.035	<0.005	0.22			0.21	5.8	6.0	57				
15/10/18	10.94	3780	7.95	-11	17.5	667	23/10/18	12/11/18		80	0.025	0.008	0.32			<0.01	7.6	7.6	80				
16/04/19	13.52	14730	9.86	+105	13.7	553	26/04/19	16/05/19		58	0.067	<0.005	0.80			0.01	9.4	9.4	74				
08/10/19	No	water								213	0.022	0.016	0.41			<0.01	30.6	30.6	307				
<b>LS3 6 monthly</b>								<b>LS3</b>															
04/03/15	11.42	1814	9.18	-6	26.5	300	12/03/15	09/04/15	NR	NR					NR						NR	NR	NR
13/10/15	9.44	1693	9.09	+176	18.2	267	21/10/15	10/11/15		50	0.039	<0.005	0.17		0.08	<0.01	4.9	4.9	53				
21/03/16	8.13	1845	9.00	+155	18.4	380	04/04/16	22/04/16		80	0.038	<0.005	0.29		0.07	0.05	7.2	7.2	43				
19/09/16	17.86	1670	8.66	+96	13.9	347	27/09/16	27/10/16		49	0.047	<0.005	0.35		0.01	0.01	4.9	4.9	40				
14/05/17	9.17	1754	7.83	+281	14.7	357	23/05/17	13/06/17		28	0.051	0.014	0.22		1.59	5.65	7.0	12.6	40				
03/10/17	4.71	2024	8.15	+191	16.6	103	13/10/17	02/11/17		32	0.097	<0.005	0.42		1.13	0.11	4.6	4.7	42				
09/07/18	16.38	3820	7.86	+107	10.6	533	19/07/18	09/08/18		16	0.084	0.005	0.38		2.19	0.12	4.9	5.0	34				
15/10/18	12.34	3730	7.54	-9	16.4	533	23/10/18	12/11/18		25	0.020	<0.005	0.21		0.08	0.01	6.2	6.2	79				
16/04/19	9.67	1214	8.30	+167	14.1	17	26/04/19	16/05/19		42	0.030	<0.005	0.33		0.08	<0.01	8.7	8.7	72				
08/10/19	No	water								<5	0.002	<0.005	<0.05		0.14	3.62	1.2	4.8	9				
<b>LS4 6 monthly</b>								<b>LS4</b>															
04/03/15	7.35	1498	8.31	+10	27.4	233	12/03/15	09/04/15	NR	NR					NR						NR	NR	NR
13/10/15	11.31	1835	9.57	+181	19.1	153	21/10/15	10/11/15		<5	0.053	<0.005	0.11		0.060	0.03	3.4	3.4	40				
21/03/16	12.58	1799	8.77	+179	20.3	313	04/04/16	22/04/16		19	0.179	<0.005	0.76		0.02	0.02	4.4	4.4	40				
19/09/16	12.63	1728	8.26	+84	19.0	353	27/09/16	27/10/16		11	0.070	0.036	0.77		0.92	8.66	5.2	13.9	33				
14/05/17	6.77	2111	7.69	+257	15.3	470	23/05/17	13/06/17		34	0.373	<0.005	0.55		0.38	0.24	4.1	4.3	44				
03/10/17	7.09	2059	8.36	+156	18.6	109	13/10/17	02/11/17		24	0.919	<0.005	0.47		0.75	0.24	4.2	4.4	40				
10/07/18	27.50	2477	8.89	+43	11.7	220	19/07/18	09/08/18		36	0.143	0.007	0.56		0.08	2.87	5.8	8.7	46				
15/10/18	9.91	2167	7.42	+14	14.9	237	23/10/18	12/11/18		57	0.134	0.030	1.41		0.14	3.34	7.0	10.3	50				
16/04/19	4.62	2780	8.73	+142	15.2	193	26/04/19	16/05/19		85	0.114	0.008	0.60		0.57	<0.01	9.7	9.7	104				
08/10/19	No	water																					



**Table 3c: Leachate quality – overflows (LSO1, LSO2, LSO3, LSO4, LSO5)**

Frequency required by licence		pH	EC	Received from laboratory	Accessible on Council website by	VFR	SS	Alk	TOC	Cl	Mn	Zn	Fe	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	BTEX compounds	
Measure		1-14	µS/cm			kL/day	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as n	mg/L	mg/L	
<b>LSO1 overflow</b>																			
No overflow																			
<b>LSO2 overflow</b>																			
	05/08/16	7.99	1460			648	68	248	35	209	0.043	0.031	1.32	1.00	8.74	5.5	14.2	ND	
	01/09/16	8.30	2030			5	100	560	55	299	0.09	0.011	1.17	0.09	<0.01	3.4	3.4	ND	
	19/09/16	8.45	1660			108	38	354	96	231	0.06	0.019	0.25	1.93	5.78	5.7	11.5	ND	
	31/03/17	7.26	1678			173	32	296	41	216	0.05	0.016	0.72	0.55	3.16	4.3	7.5	ND	
<b>LSO3(downstream) If LSO1,2or5</b>																			
	05/08/16	7.77	1510				54	214	40	244	0.011	0.020	0.33	0.14	8.91	4.2	13.1	ND	
	01/09/16	7.43	164				14	54	18	13	0.20	0.009	3.21	0.04	0.02	1.3	1.3	ND	
	19/09/16	8.00	430				18	111	25	42	0.04	<0.005	1.80	0.08	0.22	1.6	1.8	ND	
	31/03/17	6.71	181				34	54	15	9	0.10	0.009	3.86	0.01	<0.01	1.4	1.4	ND	
<b>LSO4 (upstream) If LSO1,2or5</b>																			
	05/08/16	7.44	164				<5	49	14	13	0.009	0.012	1.56	0.01	<0.01	0.9	0.9	ND	
	01/09/16	7.67	253				<5	97	18	21	0.03	0.007	0.45	0.02	0.01	1.1	1.1	ND	
	19/09/16	7.92	213				16	73	22	18	0.04	<0.005	1.92	0.18	0.06	1.4	1.5	ND	
	31/03/17	6.67	247				7	69	20	14	0.05	0.007	2.08	0.06	<0.01	1.4	1.4	ND	
<b>LSO5 overflow</b>																			
No overflow																			

**Table 4: Leachate volume**

Discharge	Year 2015	Accessible on Council website by	Discharge	Year 2016	Accessible on Council website by	Discharge	Year 2017	Accessible on Council website by	Discharge	Year 2018	Accessible on Council website by	Discharge	Year 2019	Accessible on Council website by
Jan 2015	50	09/04/15	Jan 2016	65	22/04/16	Jan 2017	72	13/06/17	Jan 2018	122	19/02/18	Jan 2019	0.0	16/05/19
Feb 2015	86	09/04/15	Feb 2016	79	22/04/16	Feb 2017	122	13/06/17	Feb 2018	149	09/08/18	Feb 2019	43.2	16/05/19
Mar 2015	94	27/08/15	Mar 2016	86	22/04/16	Mar 2017	540	13/06/17	Mar 2018	156	09/08/18	Mar 2019	0.0	16/05/19
Apr 2015	50	27/08/15	Apr 2016	65	06/07/16	Apr 2017	371	13/06/17	Apr 2018	46	09/08/18	Apr 2019	0.0	12/09/19
May 2015	65	27/08/15	May 2016	72	06/07/16	May 2017	515	28/08/17	May 2018	84	09/08/18	May 2019	0.0	12/09/19
June 2015	50	27/08/15	June 2016	22	27/10/16	June 2017	371	28/08/17	June 2018	127	09/08/18	June 2019	0.0	12/09/19
July 2015	29	10/11/15	July 2016	58	27/10/16	July 2017	986	28/08/17	July 2018	107	09/08/18	July 2019	0.0	12/09/19
Aug 2015	79	10/11/15	Aug 2016	1829	27/10/16	Aug 2017	216	02/11/17	Aug 2018	0	12/11/18	Aug 2019	0.0	12/09/19
Sept 2015	72	10/11/15	Sept 2016	137	27/10/16	Sept 2017	94	02/11/17	Sept 2018	84	12/11/18	Sept 2019	0.0	08/11/19
Oct 2015	79	05/01/16	Oct 2016	72	14/02/17	Oct 2017	187	19/02/18	Oct 2018	82	12/11/18	Oct 2019		
Nov 2015	50	05/01/16	Nov 2016	108	14/02/17	Nov 2017	216	19/02/18	Nov 2018	130	07/02/19	Nov 2019		
Dec 2015	72	22/04/16	Dec 2016	108	14/02/17	Dec 2017	180	19/02/18	Dec 2018	101	07/02/19	Dec 2019		

**Methane** is a colourless, odourless gas that is flammable and explosive. It is generated approximately three months after the deposition of putrescible solid waste and once oxygen is depleted. Testing is conducted above ground surfaces to assure that none is escaping to air, and in buildings to assure against asphyxiation and explosion.

Comments on methane monitoring results: Methane is occasionally detected but remediated with soil cover usually by the next day.

**Table 5: Methane detections (surface or building)**

Frequency required by licence	Detection locations	Methane (CH <sub>4</sub> ) by volume in air	Methane (CH <sub>4</sub> ) by volume in air	Methane (CH <sub>4</sub> ) as % LEL (Lower Explosive Limit)	Accessible on Council website by	Remediation
Measure		ppm CH <sub>4</sub> in air	% CH <sub>4</sub> in air	% LEL		
3 monthly						
07/03/15	On ground outside Vent 4, Fig 1	9,950	0.995	19.9	09/04/15	YES
31/07/15	Nil methane detected.				27/08/15	
12/10/15	Nil methane detected.				10/11/15	
02/12/15	On ground outside Vent 4, Fig 1	10,000	1.00	20.0	05/01/16	YES
22/03/16	On ground outside Vent 4, Fig 1	1,450	0.145	2.9	22/04/16	YES
03/06/16	On ground outside Vent 4, Fig 1	3,850	0.385	7.7	06/07/16	YES
27/09/16	On ground outside Vent 4, Fig 1	2,250	0.225	4.5	27/10/16	
18/01/17	Nil methane detected.				14/02/17	
15/05/17	On ground outside Vent 4, Fig 1	6,550	0.655	13.1	13/06/17	
29/07/17	On ground outside Vent 4, Fig 1	4,700	0.470	9.4	28/08/17	
06/10/17	On ground outside Vent 4, Fig 1	7,760	0.776	15.52	02/11/17	
22/01/18	On ground outside Vent 4, Fig 1	9,000	0.999	19.98	19/02/18	YES
14/07/18	On ground outside Vent 4, Fig 1	155	0.015	0.310	09/08/18	
10/09/18	Nil methane detected				12/10/18	
15/10/18	On ground outside Vent 4, Fig 1	510	0.051	1.020	12/11/18	
07/01/19	Nil methane detected				07/02/19	
11/03/19	Nil methane detected				15/04/19	
15/08/19	Nil methane detected				12/09/19	
09/10/19	Nil methane detected				08/11/19	

Note: 500 ppm CH<sub>4</sub> by volume in air = 0.05% CH<sub>4</sub> by volume in air = 1% LEL

**Table 6: Monthly rainfall** (from daily rainfall)

Landfill rain gauge Daily rainfall summarised here as monthly rainfall	Year 2015 (mm)	Accessible on Council website	Year 2016 (mm)	Accessible on Council website	Year 2017 (mm)	Accessible on Council website	Year 2018 (mm)	Accessible on Council website	Year 2019 (mm)	Accessible on Council website
January	103.0	09/04/15	117.0	22/04/16	43.0	13/06/17	59.0	19/02/18	84.0	16/05/19
February	43.5	09/04/15	21.0	22/04/16	59.0	13/06/17	33.0	09/08/18	12.0	16/05/19
March	11.7	09/04/15	28.0	22/04/16	193.0	13/06/17	33.0	09/08/18	53.0	16/05/19
April	87.0	27/08/15	23.0	06/07/16	9.0	13/06/17	28.0	09/08/18	11.0	12/09/19
May	54.0	27/08/15	37.0	06/07/16	40.0	28/08/17	7.0	09/08/18	0.0	12/09/19
June	18.0	27/08/15	75.0	27/10/16	88.0	28/08/17	18.0	09/08/18	13.0	12/09/19
July	29.0	27/08/15	29.0	27/10/16	14.0	28/08/17	32.0	09/08/18	6.5	12/09/19
August	37.0	10/11/15	156.0	27/10/16	12.0	02/11/17	11.0	12/11/18	3.0	12/09/19
September	16.0	10/11/15	55.0	27/10/16	4.0	02/11/17	52.0	12/11/18	1.0	08/11/19
October	65.0	05/01/16	22.0	14/02/17	99.5	19/02/18	96.0	12/11/18		
November	65.5	05/01/16	19.5	14/02/17	64.0	19/02/18	70.0	07/02/19		
December	37.5	22/04/16	153.0	14/02/17	49.0	19/02/18	45.0	07/02/19		