

Grafton Regional Landfill

Location: 704 Armidale Road, Elland NSW 2460 Environment Protection Licence Number: 7186 Activities: Waste disposal to land

The internet link to Licence No. 7186 is <https://apps.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=142454&SYSUID=1&LICID=7186>

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

Clarence Valley Council, Locked Bag 23, Grafton NSW 2460

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 figure below, sampling locations are given historical names and colour coded according to the type of monitoring:

M = Monitoring well; SW = Surface water;
SP = Sedimentation Pond; LP = Leachate
pond; Gas = Gas flare.

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. 1	LP1 (leachate pond overflow)
EPA No. 2	SP1 (sedimentation pond overflow)
EPA No. 3	LP1 (leachate pond quality)
EPA No. 4	Surface methane
EPA No. 5	Building methane
EPA No. 6	M1 (groundwater monitoring well)
EPA No. 7	M2 (groundwater monitoring well)
EPA No. 8	M3 (groundwater monitoring well)
EPA No. 11	SWA (surface water monitoring)
EPA No. 12	SWB (surface water monitoring)
EPA No. 16	M7 (groundwater monitoring well)
EPA No. 17	M8 (groundwater monitoring well)
EPA No. 18	Gas1 (landfill gas flare)



Base map: Google 2017

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 the 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 Clarence Valley Council website.

Abbreviations in the tables are provided here in alphabetical order:

Alk = Alkalinity measured as mg/L CaCO₃ equivalent; As = Arsenic; B = Boron; BOD = Biochemical Oxygen Demand; Br = Bromide; Ca = Calcium; Cd = Cadmium; Cl = Chloride; Cr = Chromium; D = Depth to water from top of internal well PVC casing or depth of water in surface water column; DO = Dissolved Oxygen; EC = Electrical Conductivity also called conductivity; Eh = Redox Potential; Fe = Iron; K = Potassium; Mg = Magnesium; Mn = Manganese; Na = Sodium; NH₃ = Ammonia as a measure of ammonium ions; Ni = Nickel; NO_x = Nitrite + Nitrate; NTU = Nephelometric Turbidity Unit; Pb = Lead; S = Sulphur; SO₄ = Sulphate; SS = Total suspended solids; Temp = Temperature; TKN = Total Kjeldahl Nitrogen (organic nitrogen + ammonia); TN = Total Nitrogen; TOC = Total Organic Carbon; TP = Total Phosphorus; VOC = Volatile Organic Compounds; WL RL = water level converted to Reduced Level relative to mean sea level.

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, groundwater has particular characteristics that need to be taken into account so that false conclusions are not made. For example, groundwater may have naturally high salt levels due to the clay strata in which it resides. EC is an indicator of salt levels. The EC of the Grafton Regional Landfill groundwater is a case in point. The high EC levels (Table 1) in wells M2, M3, M7 and M8 are not due to landfill leachate. They were drilled through clay, and no other analytes indicate there is leachate contamination.

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_x) 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 VOC compounds are most likely to definitely indicate landfill leachate intrusion, 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 judicially 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: Through review of historical results from Year 1995 onwards, it can be said that Grafton Landfill leachate is not affecting groundwater or surface water.

Table 1: Groundwater quality & depth

Frequency required by licence		DO	EC	pH	Eh	Temp	Alk	D	WL	RL
Measure		mg/L	µS/cm	1-14	mV	°C	mg/L	m		m
M1	6 monthly									
13/02/15								15.65		71.35
15/06/15		0.15	446	7.12	-266	19.5	110	13.60		73.40
16/09/15								14.18		72.82
12/01/16		0.21	1656	7.32	-86	24.9	450	16.55		70.45
11/04/16								17.26		69.74
25/06/16		0.45	2940	7.25	-118	19.1	930	14.82		72.18
19/09/16								16.99		70.01
05/01/17		0.49	3065	7.40	-139	20.9	800	17.23		69.77
13/04/17								17.37		69.63
28/06/17		0.40	3193	7.27	-136	18.7	873	17.12		69.88
07/09/17								17.43		69.57
15/01/18		4.55	3215	7.06	-194	23.4	900	17.39		69.61
18/04/18								17.45		69.55
26/06/18		3.28	3440	7.32	-126	20.3	1100	17.20		69.80
03/09/18								17.60		69.40
12/01/19		0.54	3660	7.28	-96	22.6	1130	17.20		69.80
11/03/19								17.68		69.32
10/06/19		0.39	4055	7.48	-113	20.4	1138	17.49		69.51
M2	6 monthly									
13/02/15								10.15		63.49
15/06/15		0.94	6145	7.32	+113	19.6	1227	9.83		63.81
16/09/15								9.20		64.44
13/01/16		1.56	6510	7.01	+93	22.0	1200	9.12		64.52
11/04/16								9.52		64.12
25/06/16		1.16	6435	6.89	+69	19.7	1240	9.67		63.97
19/09/16								9.55		64.09
06/01/17		0.74	6220	7.04	+56	21.4	1210	9.73		63.91
13/04/17								9.90		63.74
27/06/17		4.41	4721	6.80	-11	20.0	583	8.80		64.84
07/09/17								10.01		63.63
16/01/18		0.26	5038	7.10	-101	22.2	595	10.15		63.49
18/04/18								10.29		63.35
26/06/18		0.43	5563	6.97	-110	20.1	913	10.39		63.25
03/09/18								10.44		63.20
11/01/19		2.97	5838	6.98	+50	22.9	867	10.50		63.14
11/03/19								10.69		62.95
10/06/19		0.49	5843	7.04	+43	20.5	1040	10.74		62.90

Received from laboratory	Accessible on Council website by	Mn	Fe	Pb	NH ₃	NO _x	TKN	TN	TOC
		mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L
M1									
24/06/15	17/07/15	0.106	2.11	<0.001	4.83	0.01	8.2	8.2	36
22/01/16	02/03/16	0.131	0.80	<0.001	1.17	0.02	2.8	2.8	34
11/07/16	29/07/16	0.244	1.76	<0.001	0.52	<0.01	1.4	1.4	12
25/01/17	07/02/17	0.237	0.93	<0.001	1.88	<0.01	3.2	3.2	<1
06/07/17	26/07/17	0.245	0.74	<0.001	0.88	0.01	2.0	2.0	25
24/01/18	14/02/18	0.267	0.58	<0.001	0.87	0.04	1.8	1.8	30
05/07/18	25/07/18	0.272	0.52	<0.001	0.58	<0.01	1.6	1.6	27
23/01/19	22/02/19	0.266	1.44	<0.001	0.60	<0.01	1.8	1.8	12
25/06/19	15/07/19	0.254	1.62	<0.001	0.62	<0.01	1.4	1.4	25
M2									
24/06/15	17/07/15	0.777	<0.05	0.005	0.09	0.04	0.1	0.1	14
22/01/16	02/03/16	0.842	<0.05	0.002	0.07	0.03	0.2	0.2	16
11/07/16	29/07/16	0.750	<0.05	<0.001	0.09	<0.01	<0.1	<0.1	<5
17/01/17	07/02/17	1.120	0.39	0.002	0.08	<0.01	0.2	0.2	19
06/07/17	26/07/17	0.651	0.36	<0.001	0.07	0.07	0.6	0.7	14
24/01/18	14/02/18	0.269	0.09	<0.001	0.06	0.18	0.7	0.9	18
05/07/18	25/07/18	0.702	0.25	0.002	0.09	0.02	0.4	0.4	15
23/01/19	22/02/19	0.463	0.09	<0.001	0.09	0.13	0.5	0.6	<1
25/06/19	15/07/19	0.399	0.06	0.001	0.05	0.09	0.3	0.4	17

Table 1 continued: Groundwater quality & depth

Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	D	WL	RL
Measure	mg/L	µS/cm	1-14	mV	°C	mg/L	m	m	
M3	6 monthly								
13/02/15							7.93	61.40	
15/06/15	0.66	7415	7.07	-201	21.1	1213	7.79	61.54	
16/09/15							7.65	61.68	
13/01/16	0.32	7495	6.84	-131	23.5	1120	7.56	61.77	
11/04/16							7.58	61.75	
26/06/16	0.41	6700	6.80	-53	20.4	1300	7.72	61.61	
19/09/16							7.71	61.62	
06/01/17	0.74	7398	6.93	-90	22.5	1170	7.93	61.40	
13/04/17							7.81	61.52	
27/06/17	0.35	7263	6.75	-95	20.9	1160	7.95	61.38	
07/09/17							7.94	61.39	
16/01/18	0.33	7315	6.76	-134	22.8	1190	8.09	61.24	
18/04/18							8.08	61.25	
26/06/18	3.32	6903	6.89	-41	21.2	1040	8.16	61.17	
03/09/18							8.23	61.10	
11/01/19	0.47	7468	6.84	-65	22.9	1210	8.29	61.04	
11/03/19							8.28	61.05	
11/06/19	0.49	7328	6.76	-6	21.4	1150	8.38	60.95	

Received from laboratory	Accessible on Council website by	Mn	Fe	Pb	NH ₃	NO _x	TKN	TN	TOC
		mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L
M3									
24/06/15	17/07/15	0.255	0.31	<0.001	0.05	0.04	0.1	0.1	15
22/01/16	02/03/16	0.223	0.30	<0.001	0.03	0.02	0.2	0.2	24
11/07/16	29/07/16	0.178	0.27	<0.001	0.05	<0.01	<0.1	<0.1	<5
17/01/17	07/02/17	0.221	0.42	<0.001	0.02	<0.01	0.1	0.1	12
06/07/17	26/07/17	0.175	0.32	<0.001	0.04	<0.01	<0.5	<0.5	17
24/01/18	14/02/18	0.189	0.41	<0.001	<0.01	<0.01	<0.1	<0.1	6
05/07/18	25/07/18	0.209	0.71	0.002	<0.01	0.25	0.2	0.4	13
23/01/19	22/02/19	0.160	0.62	0.002	0.08	<0.01	<0.1	<0.1	12
25/06/19	15/07/19	0.172	0.56	0.002	0.03	<0.01	0.1	0.1	15

Table 1 continued: Groundwater quality & depth

Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	D	WL	RL
Measure	mg/L	µS/cm	1-14	mV	°C	mg/L	m	m	m
M7 6 monthly									
13/02/15							11.10	57.28	
16/06/15	0.62	13793	7.01	-168	20.0	517	11.10	57.28	
16/09/15							11.20	57.18	
12/01/16	1.34	13170	6.85	-25	27.8	510	11.41	56.97	
11/04/16							11.60	56.78	
26/06/16	0.76	13850	6.86	-65	18.1	540	11.69	56.69	
19/09/16							11.59	56.79	
05/01/17	0.84	13550	6.98	-82	22.4	512	11.98	56.40	
13/04/17							11.70	56.68	
28/06/17	0.47	13763	6.78	-115	20.9	524	11.70	56.68	
07/09/17							11.78	56.60	
15/01/18	0.47	13650	6.48	-179	22.3	526	11.92	56.46	
18/04/18							11.86	56.52	
26/06/18	0.39	13115	6.52	-129	20.8	560	12.05	56.33	
03/09/18							12.15	56.23	
12/01/19	0.48	14118	6.88	-86	25.0	560	11.94	56.44	
11/03/19							12.20	56.18	
10/06/19	0.66	14190	7.05	-55	21.7	520	11.86	56.52	
M8 6 monthly									
13/02/15							5.50	55.12	
16/06/15	0.51	13875	6.72	+7	20.9	880	5.36	55.26	
16/09/15							5.50	55.12	
13/01/16	2.39	14088	6.80	+19	22.4	740	4.71	55.91	
11/04/16							6.02	54.60	
26/06/16	0.72	14093	6.68	-23	20.3	804	6.04	54.58	
19/09/16							5.75	54.87	
06/01/17	0.64	15020	6.78	+1	22.3	824	6.41	54.21	
13/04/17							6.20	54.42	
27/06/17	2.86	13948	6.66	-127	21.0	810	5.92	54.70	
07/09/17							6.30	54.32	
16/01/18	0.58	13833	6.60	-80	22.8	850	6.19	54.43	
18/04/18							6.10	17.45	
26/06/18	0.54	12825	6.61	-80	21.4	830	6.32	54.30	
03/09/18							6.54	54.08	
12/01/19	0.38	14133	6.72	-17	23.5	840	6.09	54.53	
11/03/19							6.54	54.08	
11/06/19	0.25	13683	7.49	-18	21.9	840	6.86	53.76	

Received from laboratory	Accessible on Council website by	Mn	Fe	Pb	NH ₃	NO _x	TKN	TN	TOC
		mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L
M7									
24/06/15	17/07/15	0.126	2.79	0.003	1.44	0.01	1.6	1.6	6
22/01/16	02/03/16	0.137	4.85	0.005	1.31	<0.01	1.9	1.9	3
11/07/16	29/07/16	0.117	3.34	0.002	1.36	<0.01	1.4	1.4	<5
25/01/17	07/02/17	0.112	2.35	<0.001	1.62	<0.01	1.5	1.5	<1
06/07/17	26/07/17	0.117	2.71	<0.001	1.22	<0.01	1.4	1.4	8
24/01/18	14/02/18	0.130	3.41	0.001	1.50	0.02	1.5	1.5	5
05/07/18	25/07/18	0.151	3.25	0.002	1.59	<0.01	1.4	1.4	10
23/01/19	22/02/19	0.121	3.10	0.001	1.38	<0.01	1.3	1.3	2
25/06/19	15/07/19	0.115	2.70	0.002	1.39	<0.01	1.7	1.7	6
M8									
24/06/15	17/07/15	0.444	2.45	0.002	0.19	<0.01	0.2	0.2	5
22/01/16	02/03/16	0.402	2.64	0.001	0.16	0.06	0.3	0.4	5
11/07/16	29/07/16	0.433	3.28	<0.001	0.19	<0.01	0.2	0.2	<5
17/01/17	07/02/17	0.779	2.49	0.002	0.20	<0.01	0.3	0.3	9
06/07/17	26/07/17	0.491	2.78	<0.001	0.32	<0.01	<0.5	<0.5	4
24/01/18	14/02/18	0.477	3.22	0.001	0.25	<0.01	0.3	0.3	12
05/07/18	25/07/18	0.526	3.58	0.002	0.28	<0.01	0.4	0.4	26
23/01/19	22/02/19	0.441	2.85	0.001	0.26	<0.01	<0.5	<0.5	6
25/06/19	15/07/19	0.508	3.02	0.001	0.24	0.01	0.3	0.3	14

Table 2: Surface water quality

Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website by	SS	Turbidity	Mn	NH ₃	NO _x	TKN	TN	TOC	BOD			
Measure	mg/L	µS/cm	1-14	mV	°C	mg/L			mg/L	NTU	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L			
SWA	6 monthly							SWA											NR	
16/06/15	1.96	89	5.74	+207	14.2	13	24/06/15	17/07/15	66		0.083	0.04	0.08	2.4	2.5	16				
13/01/16	1.23	192	5.97	+58	30.0	27	22/01/16	02/03/16	534		0.360	0.19	<0.01	12.8	12.8	42				
26/06/16	1.96	299	5.85	-11	9.3	14	11/07/16	29/07/16	12	22	0.263	0.05	<0.01	1.9	1.9	35				
05/01/17	2.05	310	6.65	+102	23.0	33	25/01/17	07/02/17	58	112	0.360	0.43	0.02	5.0	5.0	39				
28/06/17	6.12	79	8.21	+145	16.2	12	06/07/17	26/07/17	9	51	0.029	0.02	<0.01	1.5	1.5	23				
16/01/18	5.40	113	5.94	+173	25.7	15	24/01/18	14/02/18	23	22.9	0.118	0.09	<0.01	1.9	1.9	26				
26/06/18	3.76	147	8.97	+84	13.1	10	05/07/18	25/07/18	20	18.8	0.106	0.04	<0.01	1.7	1.7	14				
12/01/19	2.66	116	5.90	+200	26.7	11	23/01/19	22/02/19	10	13.6	0.108	0.03	<0.01	1.7	1.7	6				
11/06/19	Insufficient water																			
SWB	6 monthly							SWB												NR
16/06/15	7.59	399	7.47	+118	17.1	80	24/06/15	17/07/15	20		0.028	0.04	0.01	1.5	1.5	11				
13/01/16	6.19	523	6.85	+55	31.0	67	22/01/16	02/03/16	9		0.238	0.01	<0.01	1.9	1.9	18				
26/06/16	6.34	293	6.13	+123	12.5	19	11/07/16	29/07/16	14	35	0.010	0.05	<0.01	1.0	1.0	18				
05/01/17	3.35	602	6.76	+139	24.4	103	25/01/17	07/02/17	16	41	0.298	<0.01	<0.01	2.2	2.2	24				
16/01/18	2.52	431	5.76	+70	24.8	87	24/01/18	14/02/18	20	35.1	0.297	<0.01	<0.01	2.0	2.0	25				
26/06/18	4.67	573	7.76	+117	9.5	56	05/07/18	25/07/18	<5	8.7	0.009	0.05	<0.01	0.8	0.8	14				
12/01/19	7.18	448	6.90	+177	31.1	70	23/01/19	22/02/19	15	26.2	0.028	0.04	<0.01	1.8	1.8	15				
11/06/19	5.06	599	6.83	+175	17.7	120	26/06/19	15/07/19	12	26.2	0.054	<0.01	<0.01	1.3	1.3	16				

0.054

Table 2 continued: Surface water quality

Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website by	SS	Turbidity	Mn	NH ₃	NO _x	TKN	TN	TOC	BOD		
Measure	mg/L	µS/cm	1-14	mV	°C	mg/L			mg/L	NTU	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L		
SP1	6 monthly							SP1											
02/03/15	6.47	428	7.27	+66	29.5	106	09/03/15	27/03/15	8		0.042	0.03	<0.01	2.0	2.0	10	7		
16/06/15	5.25	415	7.57	+77	19.1	103	24/06/15	17/07/15	12	15.5	0.051	0.34	<0.01	2.0	2.0	13	4		
27/09/15	6.48	555	7.21	+181	22.9	124	06/10/15	02/03/16	9	14.4	0.110	0.55	<0.01	2.5	2.5	5	<2		
14/01/16	4.14	755	7.11	+148	26.4	140	22/01/16	02/03/16	12	9.0	0.044	0.01	<0.01	1.8	1.8	22	7		
07/04/16	9.68	1181	7.23	+328	30.2	207	15/04/16	06/05/16	12	17.9	0.020	<0.01	0.02	2.9	2.9	30	10		
27/06/16	8.08	584	6.58	+43	13.5	56	11/07/16	29/07/16	16	45.0	0.095	0.12	0.69	1.4	2.1	12	<2		
16/10/16	13.05	817	8.00	+180	22.8	97	26/10/16	07/02/17	19	18.0	0.033	0.03	<0.01	1.3	1.3	16	4		
05/01/17	7.99	2845	7.12	+94	25.6	87	25/01/17	07/02/17	58	81.0	4.320	0.36	<0.01	3.2	3.2	37	7		
11/05/17	6.28	585	6.46	+249	19.0	47	19/05/17	08/05/17	14	68.2	0.318	1.73	0.54	3.1	3.6	12	<2		
28/06/17	7.04	506	7.15	+155	19.2	50	06/07/17	26/07/17	<5	46.8	0.166	0.72	1.25	2.0	3.2	13	<2		
18/09/17	10.62	961	7.33	+127	26.5	26	26/09/17	17/10/17	40	36.0	0.020	0.05	<0.01	1.4	1.4	13	2		
16/01/18	16.22	957	9.63	-74	30.2	90	24/01/18	14/02/18	7	10.5	0.035	0.01	<0.01	2.4	2.4	27	4		
15/05/18	7.85	1136	7.89	+126	21.5	93	23/05/18	25/07/18	176	287.0	0.273	0.03	<0.01	3.2	3.2	26	6		
26/06/18	10.95	1088	7.53	+84	12.7	113	05/07/18	25/07/18	20	87.4	0.067	0.05	<0.01	2.0	2.0	21	4		
27/09/18	13.20	1515	7.66	+95	27.4	95	08/10/18	26/10/18	100	134.0	0.028	0.07	<0.01	3.2	3.2	25	7		
12/01/19	13.25	668	9.60	-3	34.5	107	23/01/19	22/02/19	44	73.9	0.008	0.02	<0.01	2.6	2.6	4	6		
11/06/19	5.35	3050	6.41	-20	20.6	23	25/06/19	15/07/19	52	58.0	5.830	2.68	<0.01	3.8	3.8	11	3		

Table 3: Surface water quality tests at SP1 prior to discharge tests of sedimentation pond water

SP1	Frequency required by licence	pH	Turbidity	Received from laboratory	Accessible on Council website by	SS	SP1	Frequency required by licence	pH	Turbidity	Accessible on Council website by	SS	
Measure	1-14		NTU			mg/L	Measure	1-14		NTU		mg/L	
Daily for discharge							Daily for discharge						
27/01/15		7.10	9.2	30/01/15	17/07/15	16	13/04/17			91.0	08/05/17		
28/01/15		7.10	91.0	30/01/15	17/07/15	67	18/04/17	7.31	88.2		08/05/17		
29/01/15		7.50	180.0	30/01/15	17/07/15	81	19/04/17	7.01	82.9		08/05/17		
02/02/15		7.00	87.0	04/02/15	02/03/16	62	20/04/17	7.02	82.9		08/05/17		
05/02/15		7.50	75.0	09/02/15	02/03/16	35	24/04/17	6.92	75.8		08/05/17		
17/02/15		7.10	15.0	18/02/15	02/03/16	12	14/06/17		69.0		17/10/17		
24/02/15		7.50	15.0	26/02/15	02/03/16	13	15/06/17		66.0		17/10/17		
02/03/15		7.27	10.0	09/03/15	02/03/16	8	19/06/17		61.0		17/10/17		
16/03/15		7.20	7.3	18/03/15	02/03/16	15	20/06/17		60.0		17/10/17		
14/04/15		7.40	4.4	16/04/15	02/03/16	5	21/06/17	7.30	57.9		17/10/17		
24/04/15		7.30	5.9	27/04/15	02/03/16	10	22/06/17	7.25	52.0		17/10/17		
19/05/15		7.20	56.0	20/05/15	02/03/16	26	23/06/17	7.25	48.0		17/10/17		
25/05/15		7.20	49.0	26/05/15	02/03/16	20	27/06/17	7.39	45.1		17/10/17		
27/09/15		7.21	14.4	06/10/15	02/03/16	9	28/06/17	7.15	46.8		17/10/17		
10/11/15		7.70	11.0	12/11/15	02/03/16	15	25/10/17	8.57	25.5		14/02/18		
14/01/16		7.11	9.0	22/01/16	02/03/16	12	21/03/18	8.20	13.0		25/07/18	14	
23/06/16		7.45	12.6		29/07/16		23/10/18	7.68	73.0		15/07/19		
27/06/16		6.58	45.0		29/07/16	18	24/10/18	7.63	62.5		15/07/19		
29/06/16		7.47	8.7		29/07/16		25/10/18	7.35	55.3		15/07/19		
01/07/16		7.95	1.8		29/07/16		26/10/18	7.46	69.5		15/07/19		
16/08/16		8.00	13.0		07/02/17	8	24/12/18	7.62	79.6		15/07/19		
21/03/17		7.00	83.0		08/05/17		27/12/18	8.96	61.9		15/07/19		
22/03/17		6.56	84.4		08/05/17								
23/03/17		6.91	59.2		08/05/17								
24/03/17		6.93	50.1		08/05/17								
27/03/17		7.17	39.4		08/05/17								
28/03/17		7.19	33.3		08/05/17								
29/03/17		7.20	44.4		08/05/17								
30/03/17		7.19	42.8		08/05/17								
10/04/17		7.72	95.0		08/05/17								
11/04/17			92.0		08/05/17								
12/04/17			91.0		08/05/17								

Table 4: Leachate quality – field analytes, and laboratory analytes (a)

Sampling date	Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website by	Br	SO ₄	Cl	Ca	Mg	Na	K	As	Cd	Cr	Ni	Pb	Mn	B	Fe
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	mg/L	mg/L	mg/L	mg/L
LP1 (quality)	6 monthly							LP1 (quality)																
16/06/15		16.25	3150	9.15	+3	19.5	710	24/06/15	17/07/15	3.75	38	687	36	60	502	96	0.007	<0.0001	0.007	0.017	<0.001	0.106	0.42	2.11
13/01/16		11.58	3975	9.62	-24	34.1	690	22/01/16	02/03/16	12.3	36	889	12	74	604	113	0.010	<0.0001	0.006	0.022	<0.001	0.150	0.61	0.12
26/06/16		3.15	4225	8.50	-132	12.2	740	11/07/16	29/07/16	5.58	75	866	31	77	646	108	0.010	<0.0001	0.008	0.025	<0.001	0.272	0.63	0.30
05/01/17		10.51	5610	9.39	+31	27.9	980	25/01/17	07/02/17	8.93	50	1170	21	104	974	156	0.018	<0.0001	0.009	0.036	<0.001	0.177	0.82	0.53
28/06/17		17.31	3785	8.60	+54	19.5	720	06/07/17	26/07/17	4.85	70	800	44	69	601	93	0.008	<0.0001	0.010	0.024	<0.001	0.207	0.56	0.16
16/01/18		5.91	5015	8.51	+23	29.4	840	24/01/18	14/02/18	6.56	64	1140	27	103	994	138	0.012	<0.0001	0.009	0.031	<0.001	0.180	0.76	0.21
26/06/18		12.21	4315	7.57	-141	17.7	800	05/07/18	25/07/18	5.14	39	934	34	76	678	97	0.007	<0.0001	0.007	0.002	<0.001	0.146	0.56	0.40
12/01/19		4.39	3740	8.43	+73	30.3	774	23/01/19	22/02/19	3.66	30	728	46	75	567	85	0.008	<0.0001	0.007	0.022	<0.001	0.312	0.52	0.55
10/06/19		11.65	4770	9.45	+40	19.6	900	25/06/19	15/07/19	NR	50	1070	28	88	784	106	0.010	<0.0001	0.008	0.033	<0.001	0.124	0.63	1.26

Table 5: Leachate quality – laboratory analytes (b)

Sampling date	Frequency required by licence	NH ₃	NO _x	TKN	TN	TP	S	TOC	VOC compounds
Measure		mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L
LP1 (quality)	6 monthly								
16/06/15		4.50	0.80	17.4	18.2	0.39	<0.1	10	Chloroform 0.017 mg/L
13/01/16		0.21	0.02	14.6	14.6	0.36	<0.1	111	nil detected
26/06/16		12.9	<0.01	24.4	24.4	0.48	<0.1	115	nil detected
05/01/17		5.24	<0.01	29.3	29.3	1.52	<0.1	160	nil detected
28/06/17		6.26	1.72	21.2	22.9	0.36	<0.1	111	nil detected
16/01/18		6.34	0.01	20.8	20.8	0.34	<0.1	143	nil detected
26/06/18		5.40	0.22	15.7	15.9	0.50	<0.1	119	nil detected
12/01/19		10.30	<0.01	20.5	20.5	0.20	<0.1	89	nil detected
10/06/19		5.04	0.03	22.6	22.6	0.67	NR	119	nil detected

No leachate pond discharges [LP1 (overflow) – Point 1] have occurred.

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.

The Grafton Regional Landfill has been divided into a grid pattern by which to report surface methane detections.

Comments on methane monitoring results:
Methane is occasionally detected. **Hotspots** $\geq 3\%$ LEL and repeat hotspots are remediated with soil cover usually by the next day.

Note: Dark blue area not in use as landfill as yet.

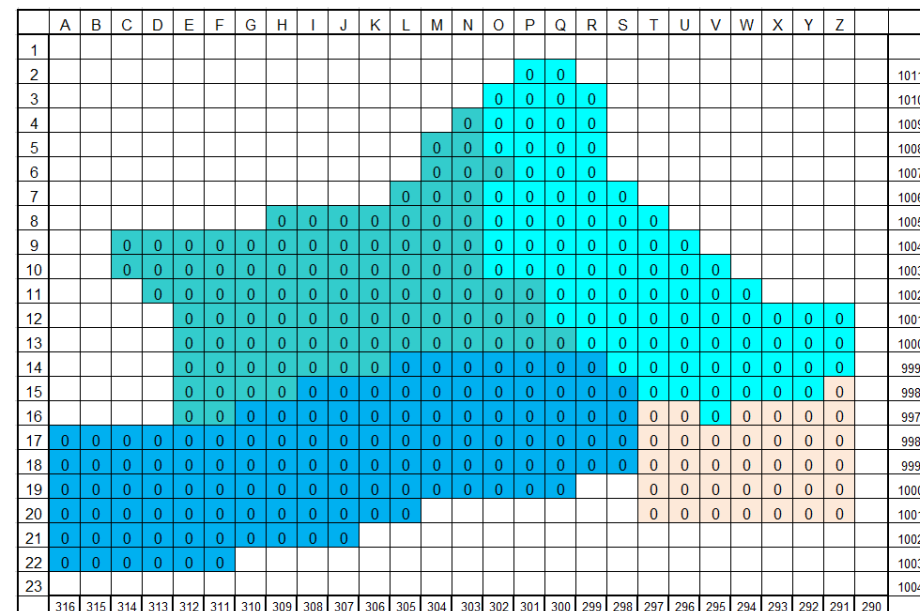


Table 6: Methane detections (surface and building)

Frequency required by licence	Detection locations	Methane (CH ₄) by volume in air	Methane (CH ₄) by volume in air	Methane (CH ₄) as % LEL (Lower Explosive Limit)	Accessible on Council website by	Remediation
3 monthly		ppm CH ₄ in air	% CH ₄ in air	% LEL		
25/03/15	O4 S14 U15	500	0.05	1	27/03/15	
16/06/15	019 S14 W13	500	0.05	1	17/07/15	
07/10/15		nil detects			12/02/16	
31/12/15		nil detects			12/02/16	
22/03/16		nil detects			06/05/16	
01/06/16		nil detects			29/07/16	
29/09/16		nil detects			07/02/17	
30/12/16		nil detects			07/02/17	
09/03/17		nil detects			08/05/17	
21/06/17		nil detects			26/07/17	
21/09/17		No readings above threshold			17/10/17	
10/01/18		No readings above threshold			14/02/18	
28/03/18		No readings above threshold			25/07/18	
20/06/18		No readings above threshold			25/07/18	
20/09/18		No readings above threshold			26/10/18	
04/01/19		No readings above threshold			22/02/19	
27/03/19		No readings above threshold			15/07/19	
26/06/19		No readings above threshold			15/07/19	

Note: 500 ppm CH₄ by volume in air = 0.05% CH₄ by volume in air = 1% LEL

Table 7: Monthly rainfall (from Grafton Regional Landfill weather station 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	315.2	27/03/15	115.4	06/05/16	179.8	26/07/17	132.6	14/02/18	4.8	15/07/19
February	190.2	27/03/15	17.0	06/05/16	94.5	26/07/17	101.1	25/07/18	35.6	15/07/19
March	92.8	17/07/15	65.0	06/05/16	614.7	26/07/17	160.8	25/07/18	106.3	15/07/19
April	125.5	17/07/15	36.0	29/07/16	32.8	26/07/17	51.6	25/07/18	54.9	15/07/19
May	214.3	17/07/15	14.8	29/07/16	73.4	26/07/17	7.4	25/07/18	47.2	15/07/19
June	23.4	17/07/15	247.6	29/07/16	151.9	26/07/17	97.3	25/07/18	65.5	15/07/19
July	25.5	12/02/16	20.8	07/02/17	9.1	17/10/17	16.0	26/10/18		
August	33.6	12/02/16	123.2	07/02/17	0.8	17/10/17	37.8	26/10/18		
September	62.4	12/02/16	39.0	07/02/17	0.3	17/10/17	73.9	26/10/18		
October	24.3	12/02/16	15.6	07/02/17	185.7	14/02/18	200.4	22/02/19		
November	132.8	12/02/16	39.9	07/02/17	78.0	14/02/18	50.3	22/02/19		
December	100.8	12/02/16	38.0	07/02/17	203.5	14/02/18	322.8	22/02/19		