COMHAIRLE CHONDAE AN CABHÁIN

Cavan County Council

Annual Environmental Report 2017

Ballyjamesduff Landfill WL0093-1

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Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to prepare the following Annual Environmental Report.

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1 INTRODUCTION

Ballyjamesduff Landfill has been operated as waste disposal facility by Cavan County Council since the late 1960s. It is located off the Derrylurgan road, approximately 600m north of Ballyjamesduff town on the eastern side of the Derrylurgan road. The site is predominantly bog and comprises 1.62 hectares. The site was operated as a traditional landfill constructed on peat and relies on the properties of the peat bog for attenuation, dilution and dispersal.

A Waste Licence for the facility was issued by the EPA on 7th March 2002, Ref WL 93-1. Condition 11.4 of Waste Licence Ref. 93-1 requires the submission of an Annual Environmental Report (AER) for Ballyjamesduff Landfill facility. This document is produced in order to comply with requirements of Condition 11.4. The reporting period for the purposes of this AER is 1st January 2017 to 31st December 2017.

The site at Ballyjamesduff was closed in early March 2002. Prior to closing the site a temporary cap was placed on site.

The requirements for reporting of Annual Environmental Information arise under individual EPA licences issued under the EPA Acts 1992 – 2008, the Waste Management Acts 1996 – 2008 and other legislation.

This AER will provide information as outlined in Schedule F of the Licence "Content of the Annual Environmental Report".

2 REPORTING PERIOD

The reporting period for the purposes of this AER is 1st January 2017 to 31st December 2017.

3 WASTE ACTIVITIES CARRIED OUT AT THE FACILITY

There were no waste activities carried out at the facility.

4 QUANTITY AND COMPOSITION OF THE WASTE

There is no longer any waste being accepted at the site. The quantity of waste accepted is zero tonnes.

5 SUMMARY REPORT ON EMISSIONS

The PRTR Regulations are the European Communities (European Pollutant Release and Transfer Register) Regulation 2007, S.I. No. 123 of 2007), which signed into Irish Law on 22 March 2007 the E-PRTR Regulation, (EC) No 166/2006, concerning the establishment of a European Pollutant Release and Transfer Register. The summary of emissions is detailed in the (PRTR) Report which appears in Appendix

A of this report. The PRTR has been uploaded onto the EPA website in accordance with our responsibility as Licensee.

A register of Environmental Monitoring is now established and shall be maintained. Cavan County Council now carries out the full scope of sampling as required by the Licence.

5.1 Surface Water

Surface water monitoring is undertaken at 3 locations on a bi-annual basis. SW1 is located upstream of the landfill, SW2 is located downstream while the Discharge Cap from the landfill is also sampled. All monitoring locations are detailed in the site map which is presented in Appendix B.

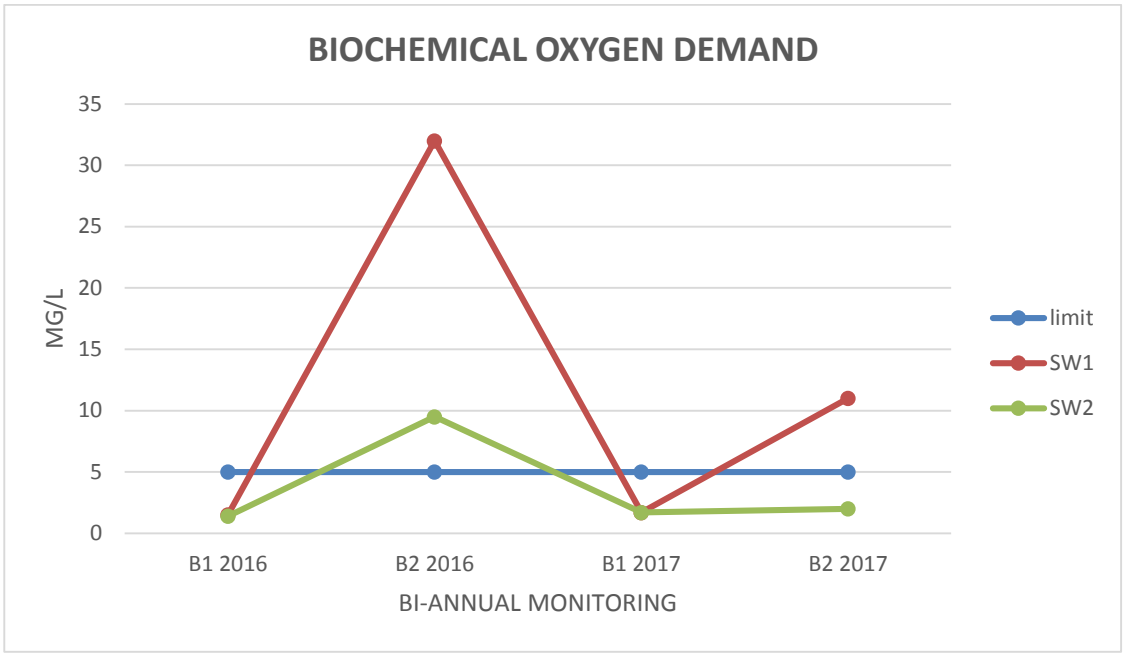
All parameters have been assessed against water limits as outlined in the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989. Results in Bold Italics indicate where the assessment criteria has been exceeded.

As detailed in Table 5.1 below, there were slight exceedances in the surface water analysis for parameters COD, Ammonia and BOD.

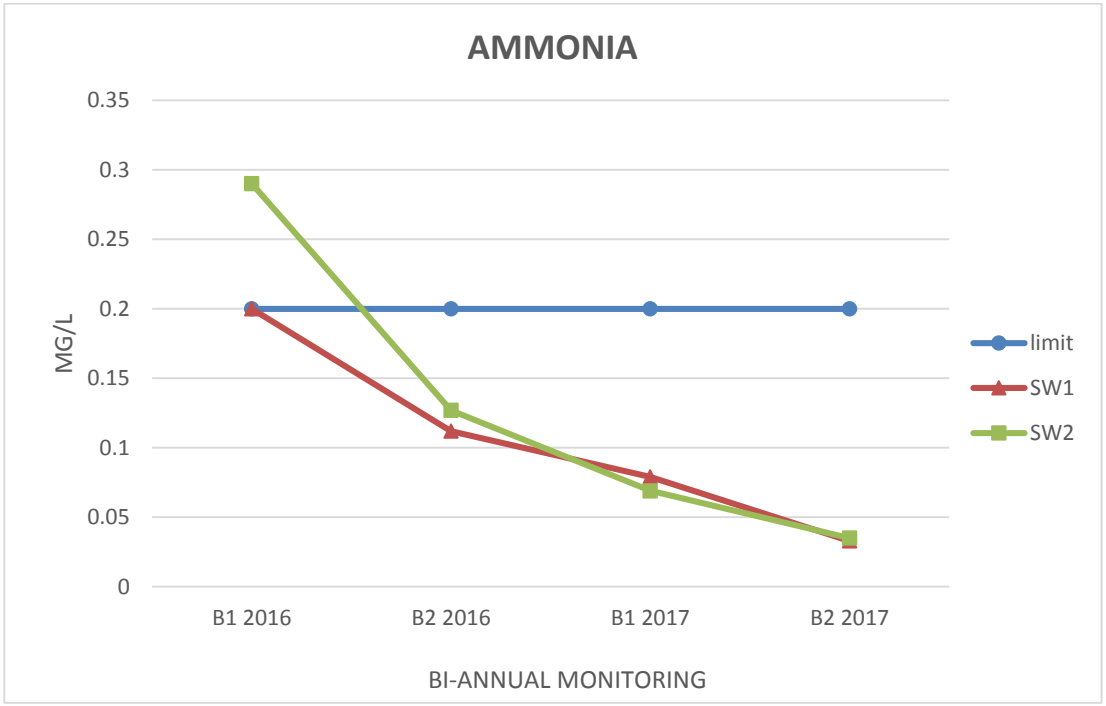
Table 5.1 Surface water summary results

	Surface Water Results 2017								
	Parameter	Ammonia	pH	Cond	BOD	COD	Total Suspended Solids	Cl	DO
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l
SW1	Second biannual 2017	0.033	7.2	205	***11***	68	***109***	16	6
	First biannual 2017	0.079	7.3	284	1.7	21	<5	17	7
	Second biannual 2016	0.112	7	239	***32***	61	***138***	12	<1
	First biannual 2016	0.2	7.5	191	1.5	19	9	12	10
SW2	Second biannual 2017	0.035	7.1	205	<2.0	35	<5	16	5
	First biannual 2017	0.069	7.2	286	1.7	23	<5	17	6
	Second biannual 2016	0.127	7.1	244	***9.5***	52	26	13	<1
	First biannual 2016	**0.29**	7.6	198	1.4	21	13	12	10
Discharge Cap	Second biannual 2017	***1.047***	7	438	<2.0	46	13	17	5
	First biannual 2017	***0.538***	7.8	318	1.7	14	<5	6.8	9
	Second biannual 2016	***0.353***	7.1	540	<2	19	11	3.5	7
	First biannual 2016	***1.2***	7.5	191	<1	19	<5	7.6	6
S.I No. 294/1989 A1		0.2	≥5.5 and ≤8.5	1000	5	40 (A3)	50	250	>60%

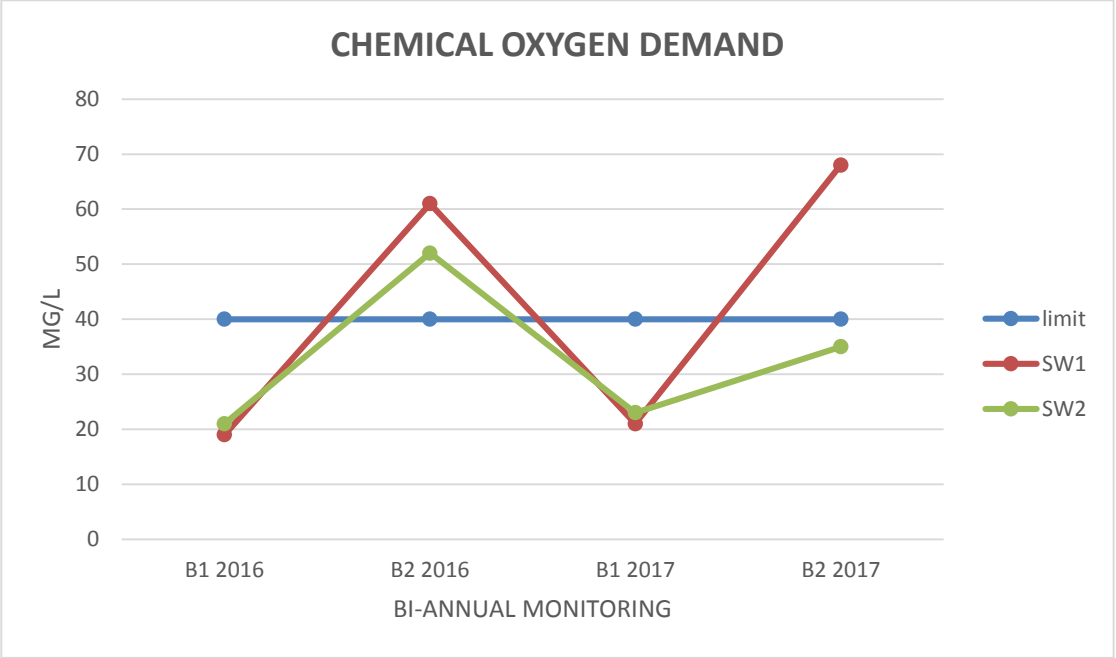
Graph 5.1 Surface Water – Biochemical Oxygen Demand (BOD)



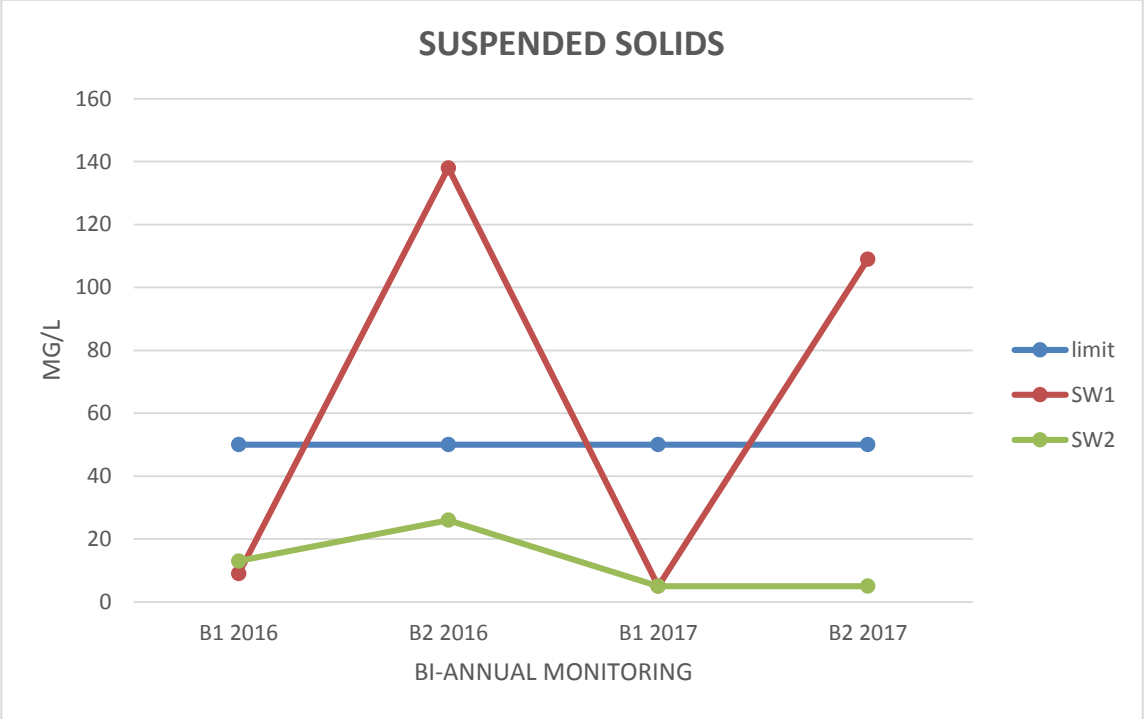
Graph 5.2 Surface Water – Ammonia



Graph 5.3 Surface Water – Chemical Oxygen Demand (COD)



Graph 5.4 Surface Water – Suspended Solids



All surface water locations were found to be within limits specified in the above regulations with the exception of BOD, COD, ammonia and suspended solids. Elevations from these parameters cannot be definitively associated to the landfill due to the presence of increased decaying organic matter in the form of decaying vegetation due to the winter season.

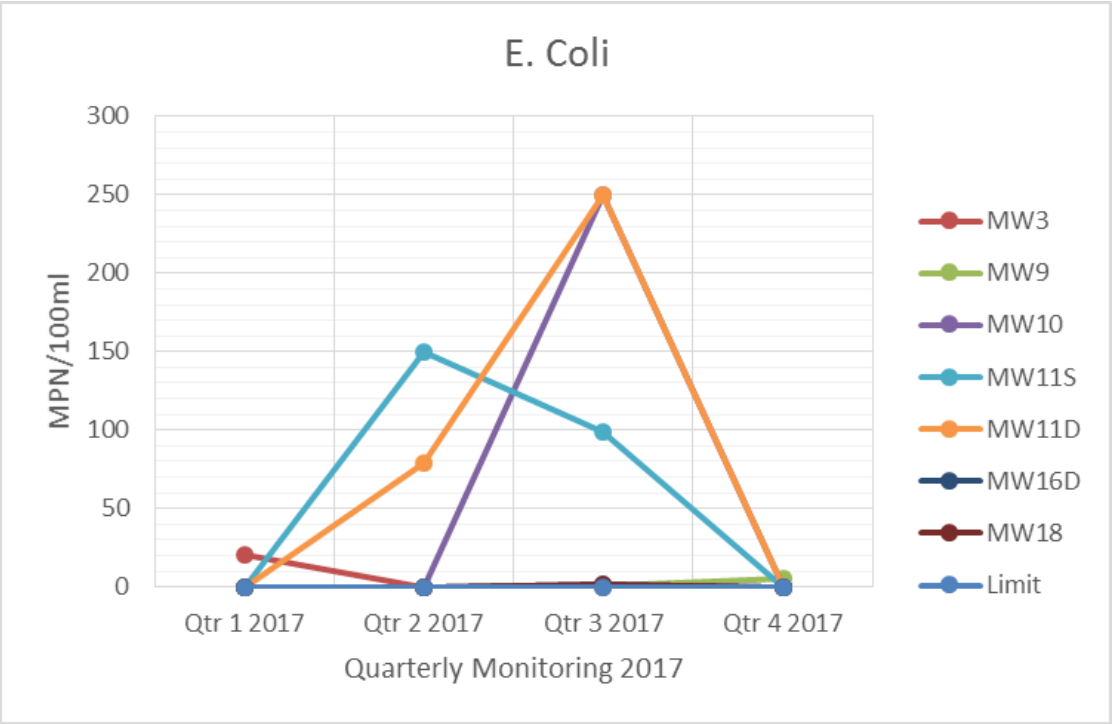
5.2 Groundwater

Table 5.2 summaries the groundwater monitoring results from 2017. The results where the Interim Guideline Values (IGVs) has been exceeded are identified in italic bold. The exceedances are illustrated in Graphs 5.5 – 5.11. It should be noted that MW4 was not accessible for sampling during 2017.

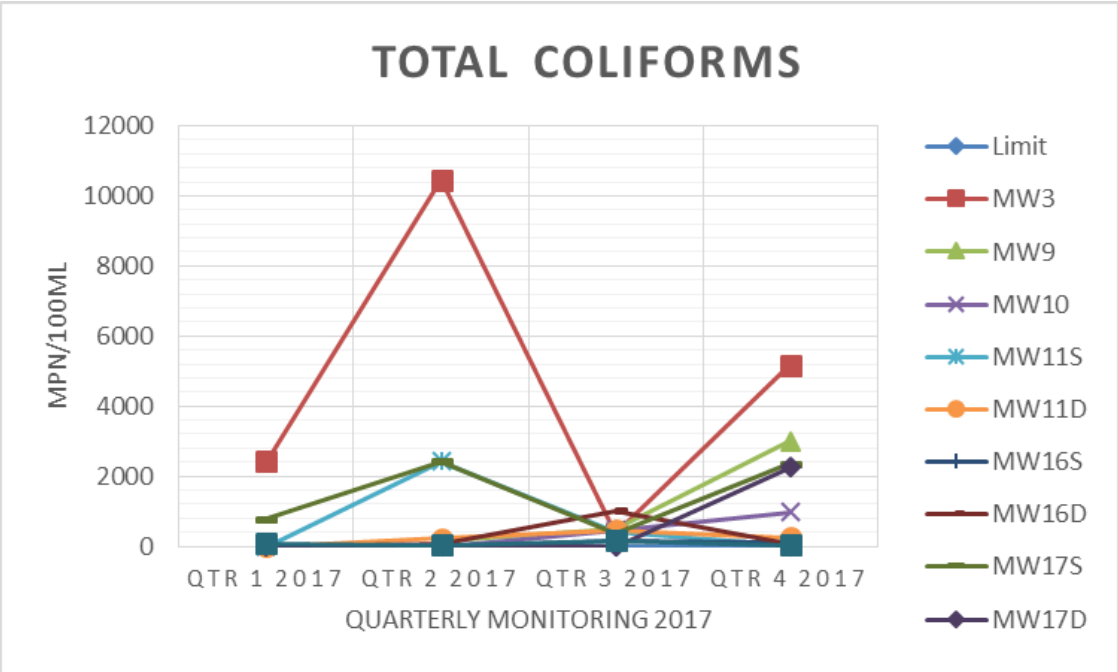
Table 5.2 Groundwater Summary Results

	Parameter	TOC	E.Coli	Ammonia	TON	Tot Coliform	pH	Cond	Cl	DO	Total Phenols	Fe	K	Na
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW3	Qtr 4 2017	17.51	0	***1.078***	0.28	***5172***	7.2	801	28	2	<0.10	***25000***	***8.8***	32.9
	Qtr 3 2017	24.94	0	***1.421***	<0.15	***372***	7.1	819	25	3	<.10	***18000***	***8.6***	27
	Qtr 2 2017	25.24	0	***14.147***	0.69	***10460***	7	733	22	<1	<0.10	***13000***	***7.6***	21.5
	Qtr 1 2017	65.87	**20**	0.089	<0.138	***2420***	7.1	641	18	<1	<0.1	***16000***	***5.2***	20.7
MW9	Qtr 4 2017	8.47	***5***	***15.109***	<0.15	***2987***	7	***1047***	16	9	<0.10	***30000***	***13.9***	19.5
	Qtr 3 2017	29.29	***1***	***57.005***	<0.15	***479***	6.9	***1585***	***95***	<1	<0.10	***26000***	***34.6***	65.8
	Qtr 2 2017	33.75	0	***17.288***	<0.15	***160***	7.5	***1035***	20	7	<0.10	***13000***	***14.3***	17.8
	Qtr 1 2017	-	-	-	-	-	-	-	-	-	-	-	-	-
MW10	Qtr 4 2017	44	0	***53.86***	<0.15	***970***	6.9	***1522***	***97***	2	<0.10	***47000***	***40.2***	78.1
	Qtr 3 2017	8.56	***250***	<0.005	<0.15	***454***	7.5	417	13	7	<0.10	34	1.5	16.6
	Qtr 2 2017	31.72	0	***34.561***	<0.15	0	6.8	***1271***	***64***	4	<0.10	***2800***	***22.6***	34.9
	Qtr 1 2017	39.3	0	***32.676***	<0.138	***20***	6.8	***1271***	***69***	5	<0.1	**21000**	**15.5**	33.2
MW11S	Qtr 4 2017	11.95	0	0.01	0.41	***6***	6.8	535	***61***	9	<0.10	<20	1.6	27.5
	Qtr 3 2017	3.55	***99***	<0.005	0.76	***400***	7.2	***1250***	***260***	5	<0.10	<20	1.6	19.3
	Qtr 2 2017	7.94	***150***	<0.005	0.85	***2420***	7.2	***1302***	***260***	4	<0.10	<20	1.4	40.7
	Qtr 1 2017	2.71	0	0.032	0.963	0	7.2	***1256***	***270***	7	<0.1	71	1.4	41.8
MW11D	Qtr 4 2017	46.16	0	0.01	<0.15	***251***	7.6	429	14	5	<0.10	<20	1.3	22.7
	Qtr 3 2017	8.56	***250***	<0.005	<0.15	***454***	7.5	417	13	7	<0.10	35	1.5	43.5
	Qtr 2 2017	18.14	***79***	0.013	<0.15	***236***	7.5	409	11	3	<0.10	<20	1.2	18.1
	Qtr 1 2017	2.71	0	***0.581***	<0.138	0	7.4	427	8.5	7	<0.1	32	1.2	17.7
MW16S	Qtr 4 2017	24.75	0	0.007	0.19	***91***	7.6	483	21	10	<0.10	<20	1.7	24.4
	Qtr 3 2017	6.59	0	0.124	<0.15	***167***	7.7	511	***32***	7	<0.10	81	1.8	15.9
	Qtr 2 2017	23.09	0	0.015	<0.15	0	7.5	462	20	2	<0.10	<20	1.6	17.3
	Qtr 1 2017	4.58	0	0.073	0.252	***30***	7.5	503	18	5	<0.1	<20	1.4	19.4
MW16D	Qtr 4 2017	10.91	0	0.052	<0.15	***78***	7.6	505	24	5	<0.10	90	1.5	21.9
	Qtr 3 2017	5.74	***2***	0.052	<0.15	***1011***	7.7	489	23	5	<0.10	***830***	2.6	29.1
	Qtr 2 2017	38.45	0	0.05	<0.15	***56***	7.5	493	23	3	<0.10	60	1.2	16.8
	Qtr 1 2017	9.05	0	0.078	<0.138	0	7.5	501	20	5	<0.1	110	1.2	16.2
MW17S	Qtr 4 2017	19.7	0	***1.552***	2.3	***2359***	7.1	419	17	4	<0.10	***1200***	***5.5***	22.4
	Qtr 3 2017	10.13	0	***0.672***	<0.15	***358***	7.1	490	18	1	<0.10	180	2.1	27.8
	Qtr 2 2017	6.53	0	***6.065***	<0.15	***2420***	6.9	492	17	2	<0.10	***5700***	2	18.5
	Qtr 1 2017	4.67	0	***6.737***	<0.138	***790***	6.9	518	15	4	<0.1	***11000***	1.7	18.5
MW17D	Qtr 4 2017	32.7	0	0.007	0.25	***2247***	7.4	431	16	6	<0.10	<20	2.3	29.5
	Qtr 3 2017	2.19	0	***0.24***	<0.15	***1***	7.7	490	17	4	<0.10	<20	2.3	29.5
	Qtr 2 2017	18.32	0	***0.261***	<0.15	***29***	7.5	475	17	4	<0.10	210	1.6	23.7
	Qtr 1 2017	5.49	0	***0.319***	<0.138	0	7.4	509	15	6	<0.1	***460***	1.8	23
MW18	Qtr 4 2017	7.85	0	0.022	<0.15	***41***	7.4	489	18	7	<0.10	***300***	2.4	30.8
	Qtr 3 2017	7.68	***2***	0.02	<0.15	***159***	7.5	482	16	6	<0.10	150	2.1	27.3
	Qtr 2 2017	3.74	0	0.026	0.27	***40***	7.4	484	17	2	<0.10	190	1.5	22.6
	Qtr 1 2017	3.53	0	0.044	<0.138	***74***	7.3	489	14	6	<0.1	***300***	1.7	22.6
MW19	Qtr 4 2017	7.93	***30***	0.035	<0.15	***500***	7.5	711	30	7	<0.10	<20	2.5	32.4
MW20	Qtr 4 2017	21.17	0	0.011	<0.15	0	7.6	408	16	6	<0.10	<20	2	20.7
IGV		**NAC**	**0**	**0.15**	**NAC**	**0**	**≥6.5 &≤9.5**	**1000**	**30**	**NAC**	**0.0005**	**200**	**5**	**150**

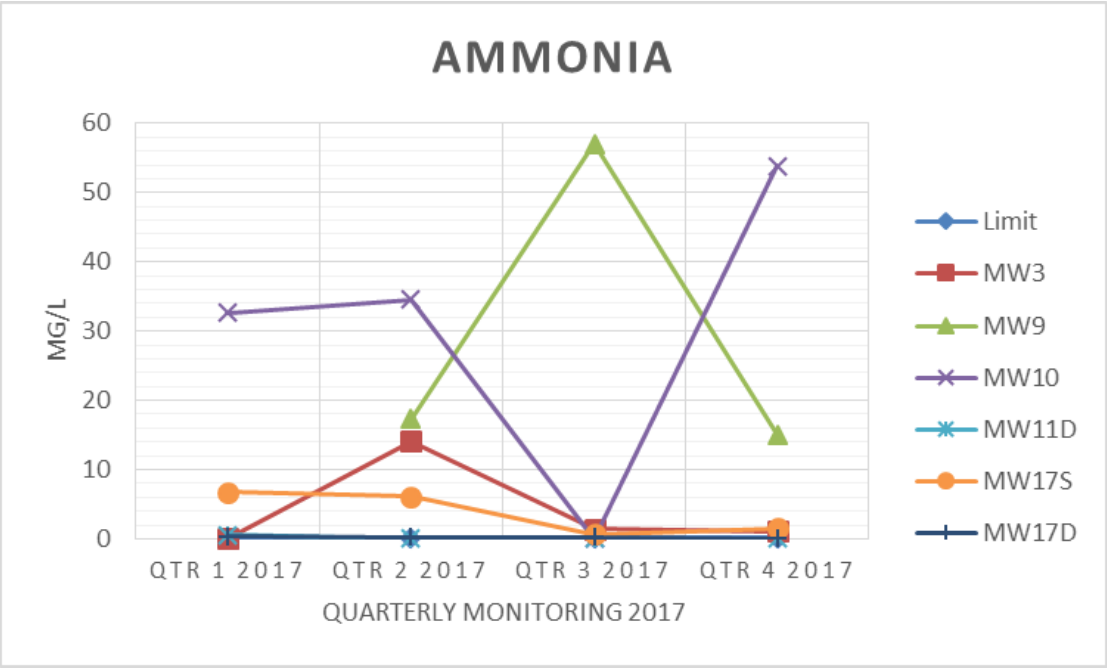
Graph 5.5 Groundwater - E Coli



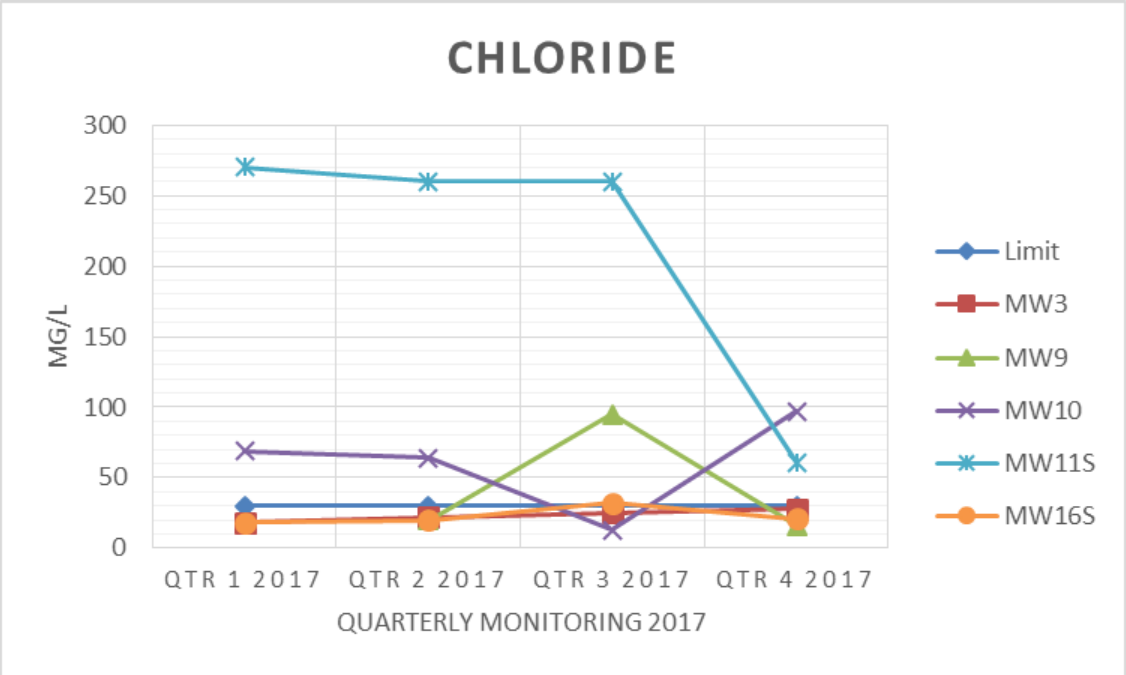
Graph 5.6 Groundwater – Total Coliforms



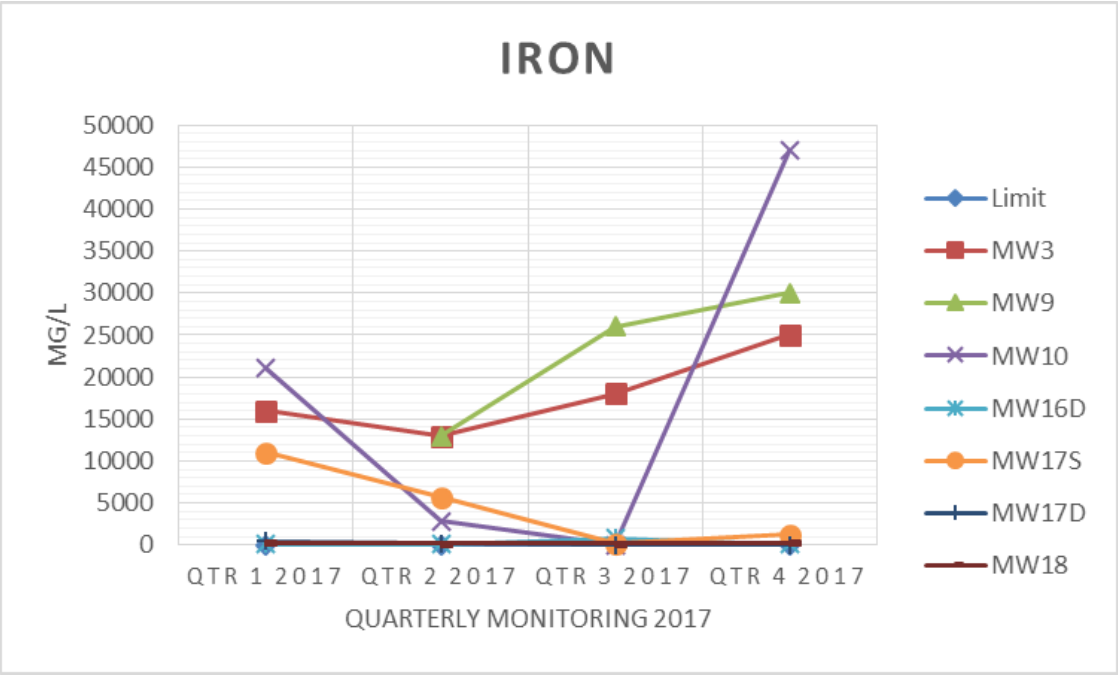
Graph 5.7 Groundwater - Ammonia



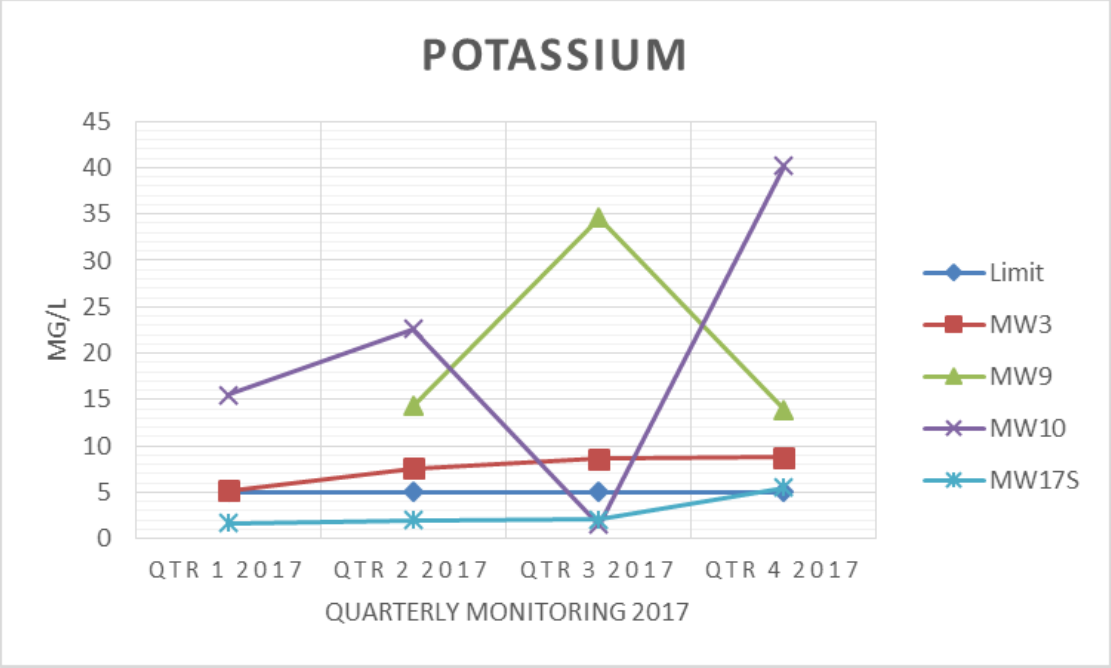
Graph 5.8 Groundwater - Chloride



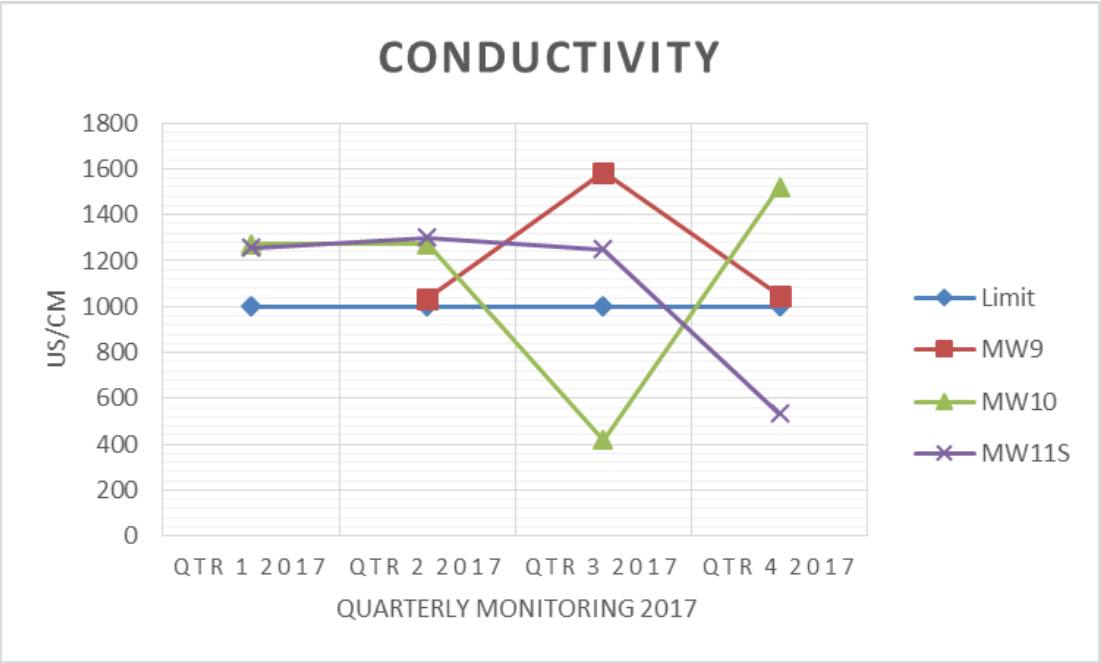
Graph 5.9 Groundwater – Iron



Graph 5.10 Groundwater – Potassium



Graph 5.11 Groundwater – Conductivity



As detailed in the above graphs, there were numerous groundwater exceedances at this landfill during 2017.

Exceedances occurred in the following parameters:

- **E. Coli (*Escherichia coli*):** Elevated levels of this parameter were found in samples MW3, MW9, MW10, MW11S, 11D, MW16D and MW18. It is not uncommon for wells in the vicinity of a landfill to be contaminated with *E. coli.* It is also attributed to influx of contamination from other sources such as septic tanks, slurry spreading and animal fecal contaminations. It should be noted that there were numerous horses present on the landfill for the most part of 2017 and as such the E.Coli contamination cannot be solely attributed to the landfill itself.

- **Ammonia:** Elevated levels of this parameter were prevalent during 2017. Elevated levels of ammonia are strongly associated with pollution from waste water treatment systems and agricultural practices (e.g. farmyard runoff, landspreading etc.) and therefore contamination of these wells by the landfill cannot be definitively concluded.

- **Total Coliforms:** Elevated levels of this parameter was detected at numerous locations during 2017. Exceedances can be attributed to contamination from organic matter and from agricultural practices (e.g. farmyard runoff, landspreading etc.) and therefore exceedances in this parameter may not be directly linked to the landfill.

- **Iron:** Although increased iron levels can be attributed to contamination from landfills, it is also strongly associated with the native soils of the Cavan area and therefore cannot be directly linked to the landfill.

- **Chloride:** Results from the 2017 monitoring returned elevated concentrations for chloride at MW3, MW9 MW11S and MW16S when compared to the IGV for groundwater. It should be noted that contamination of MW11S cannot be attributed to the landfill due to MW11S being located up gradient of the landfill and therefore an alternative source of chloride contamination should be investigated in this instance.

- **Potassium:** Elevated levels of potassium can be associated with landfill contamination but it can also be associated with contamination from agricultural sources such as fertilizers. Therefore direct contamination from the landfill cannot be concluded.

- **Conductivity:** Electrical conductivity measures the number of dissolved ions in the sample and can be used as a general measure to assess the presence of contamination.

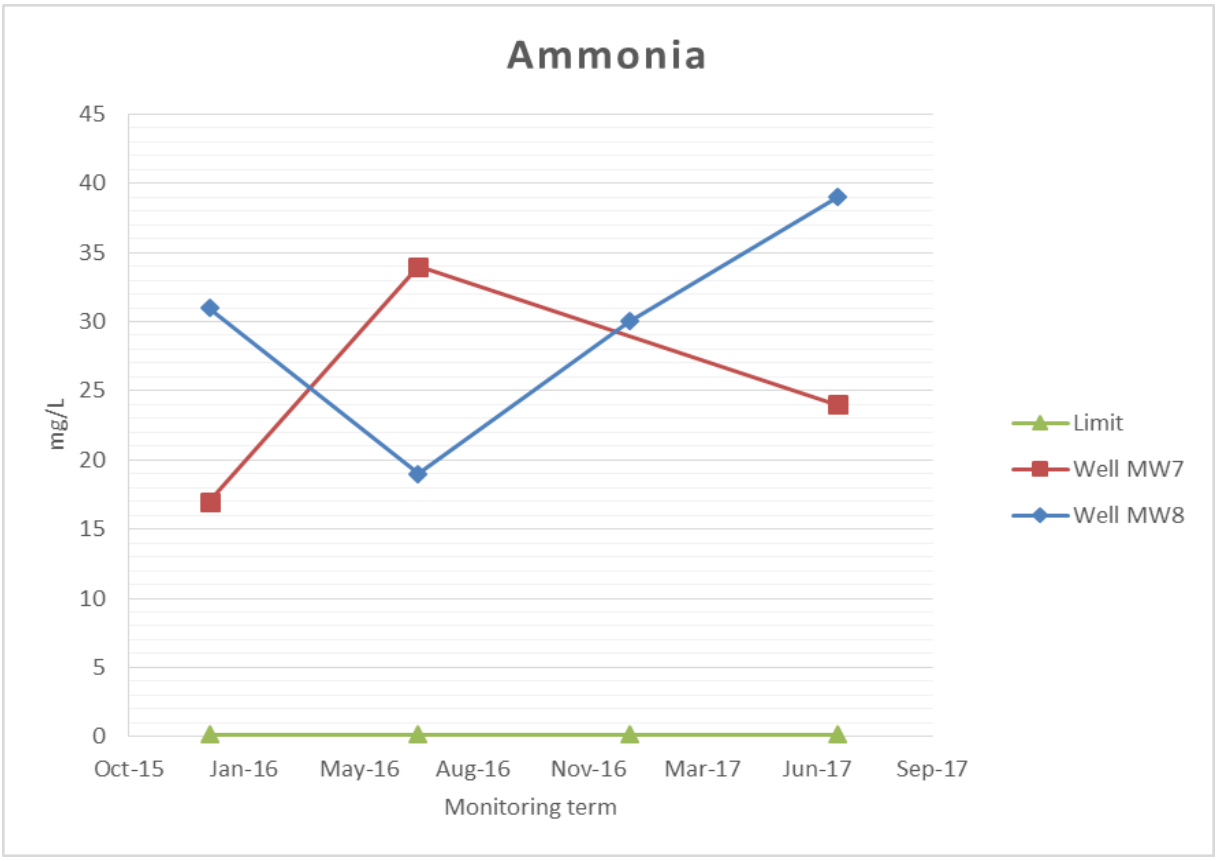
5.3 Leachate Monitoring

Leachate monitoring is carried out biannually in accordance with the licence. Re-occurring exceedances are displayed in Table 5.3 below. Results in bold italic indicate where the EPA's Interim Guideline Value (IGV) have been exceeded, while the elevated concentrations are presented in Graph 5.12 – 5.13.

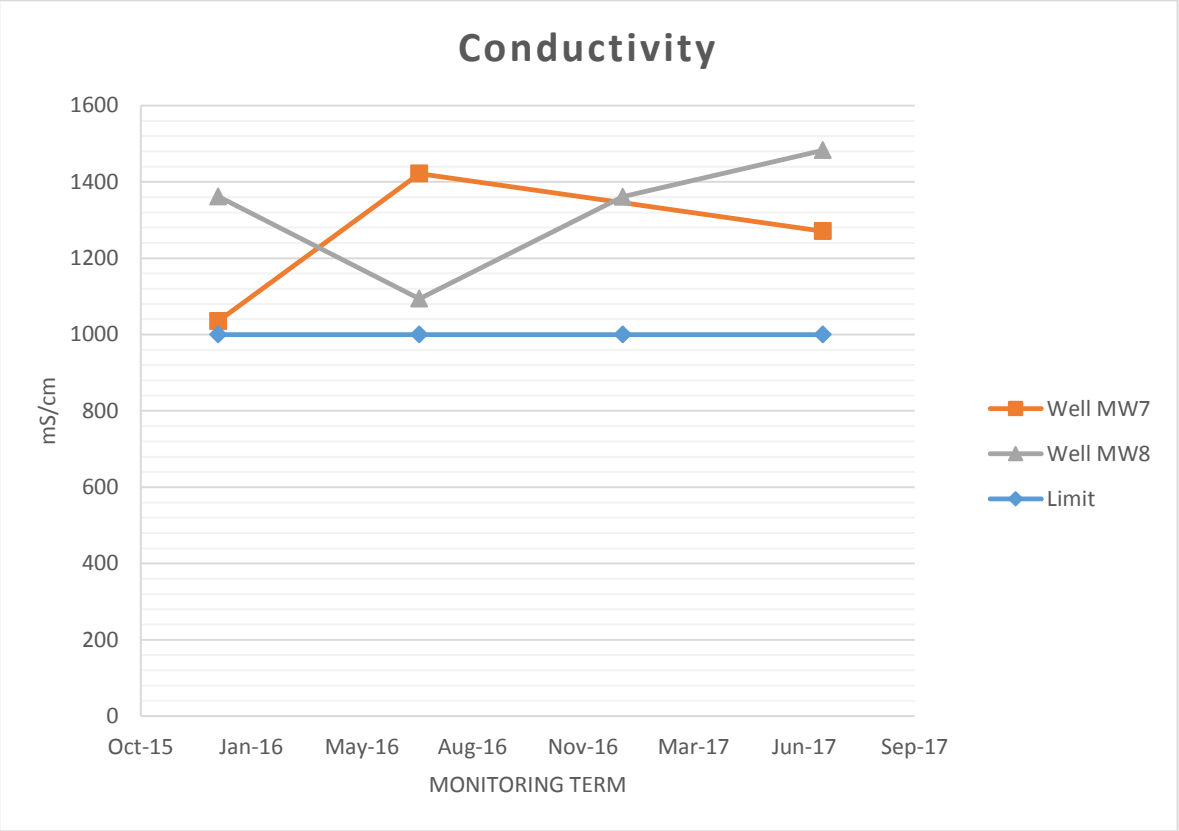
Table 5.3 Leachate Summary Results

Lechate Monitoring Results 2017								
	Parameter	Ammonia	TON	pH	Cond	BOD	COD	Cl
	Units	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l
WELL MW 7	Second biannual 2017	***24***	<0.69	7.1	***1271***	35	347	23
	First Biannual 2017	-	-	-	-	-	-	-
	Second biannual 2016	***34***	0.83	7.3	***1422***	27	30	***43***
	First Biannual 2016	***17***	<0.69	7	***1035***	21.9	65	15
	Second biannual 2015	***16***	<0.69	6.9	***1044***	<10	69	13
WELL MW 8	Second biannual 2016	***39***	<0.69	7.1	***1483***	47	249	***35***
	First Biannual 2017	***30***	<0.69	7.1	***1361***	29	42	***42***
	Second biannual 2016	***19***	<0.69	6.7	***1094***		30	21
	First Biannual 2016	***31***	<0.69	7.5	***1362***	18.9	46	***37***
	Second biannual 2015	***33***	1.1	7.4	***1447***	57	89	***37***
Interim Guideline Values		0.15	NAC	≥6.5&≤9.5	1000			30

Graph 5.12 – Leachate – Ammonia



Graph 5.13 Leachate – Conductivity



5.4 Gas Emissions

Landfill gas was monitored at seven locations both within and outside the landfill mass. Table 5.4 details all results during 2017, while the methane and carbon dioxide concentrations are illustrated in Graphs 5.14 and 5.15.

Table 5.4 Gas Emissions Summary Results

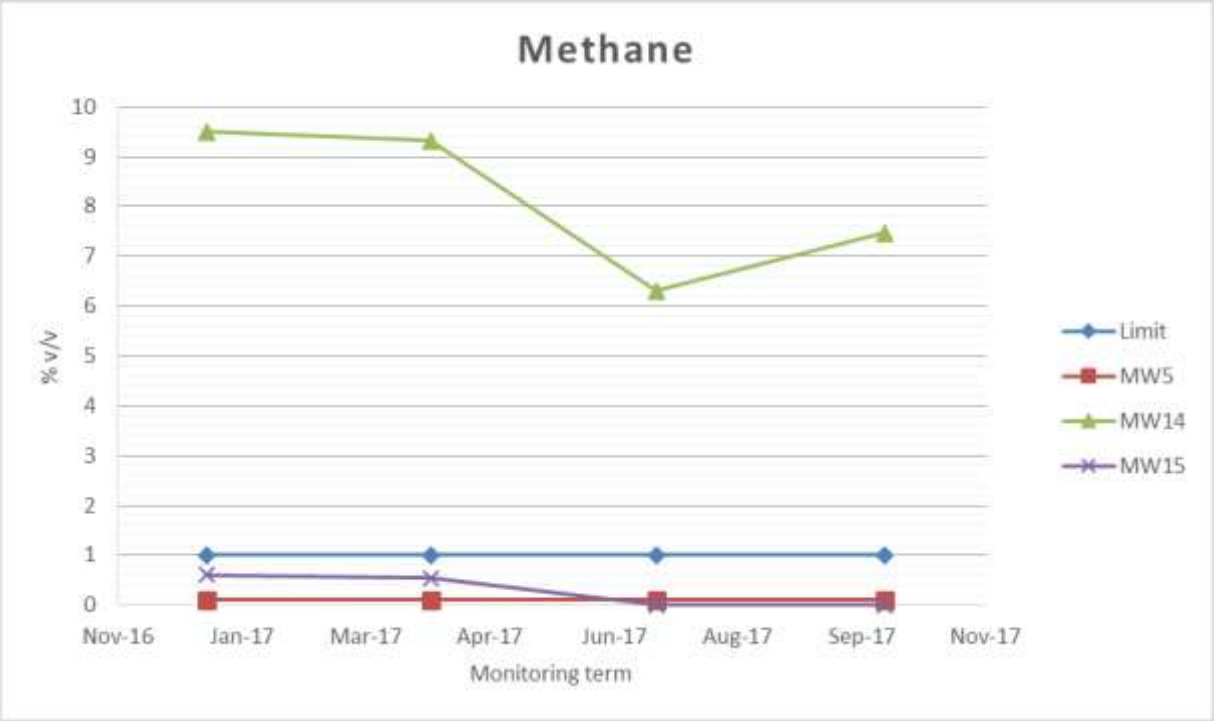
Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		% v/v	% v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2017	0	0.1	19.78	0	29.62
	Qtr 3 2017	0	0.1	20.72	0	29.62
	Qtr 2 2017	0	0.1	19.76	0	996
	Qtr 1 2017	0	0.1	19.7	0	996
MW 2	Qtr 4 2017	0	0.1	20.76	0	29.62
	Qtr 3 2017	0	0.2	20.5	0	29.62
	Qtr 2 2017	0	0.1	19.58	0	996
	Qtr 1 2017	0	0.1	19.54	0	996
MW 5	Qtr 4 2017	0.1	0.1	19.6	0	29.62
	Qtr 3 2017	0.1	0.1	20.7	0	29.62
	Qtr 2 2017	0.1	0.1	20.28	0	999
	Qtr 1 2017	0.1	0.1	20.16	0	999
MW 12	Qtr 4 2017	0.0	0.1	20.7	0	29.6
	Qtr 3 2017	0.0	0.1	20.7	0	29.6
	Qtr 2 2017	0.0	0.1	20.9	0	994.0
	Qtr 1 2017	0.0	0.1	20.8	0	994.0
MW 13	Qtr 4 2017	0	0.1	20.3	0	29.62
	Qtr 3 2017	0	0.1	20.32	0	29.62
	Qtr 2 2017	0	0.1	21.5	0	996
	Qtr 1 2017	0	0.1	21.28	0	996
MW 14	Qtr 4 2017	7.46	10.18	38.16	0	29.62
	Qtr 3 2017	6.3	10.2	13.3	0	29.62
	Qtr 2 2017	9.32	10.4	13.24	0	995
	Qtr 1 2017	9.5	10.36	13.06	0	995
MW 15	Qtr 4 2017	0	0.32	20.42	0	29.62
	Qtr 3 2017	0	0.3	20.38	0	29.62
	Qtr 2 2017	0.54	0	18.14	0	994
	Qtr 1 2017	0.6	0	17.56	0	994
	Limit	**1**	**2**			
Exceedance of waste licence						

NOTES

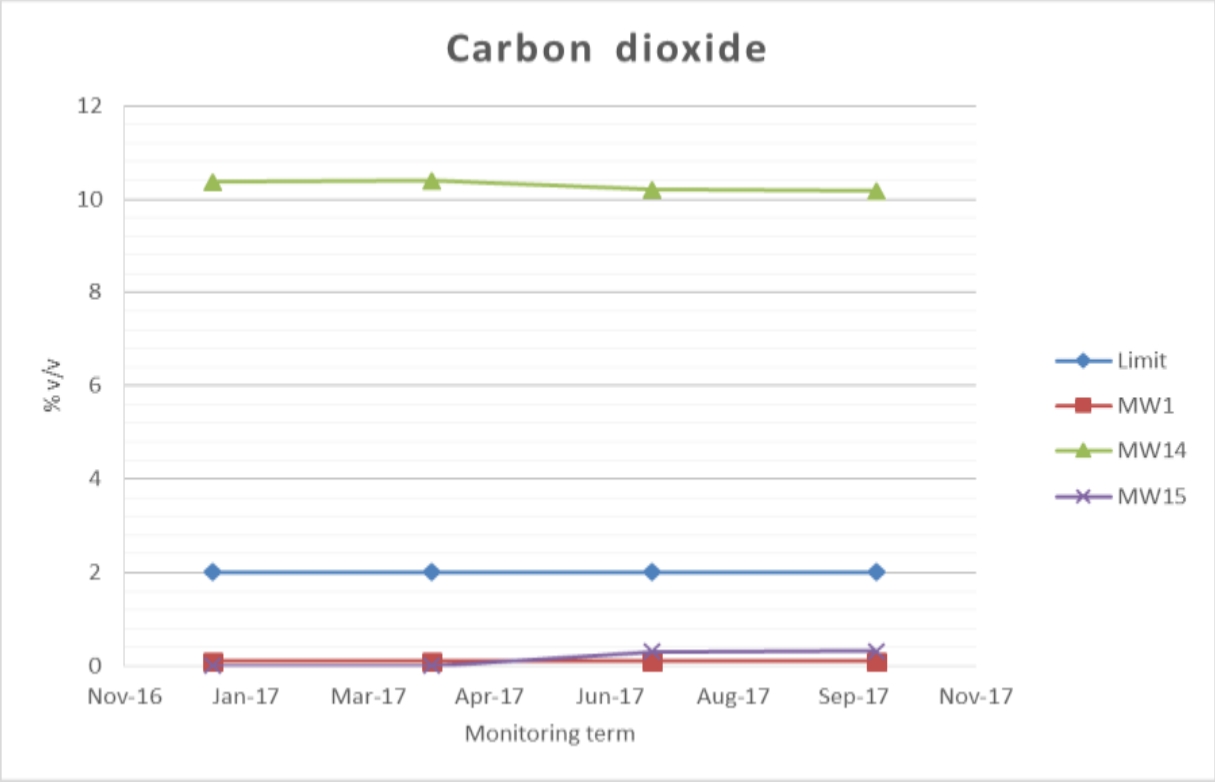
1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence

Graph 5.14 Gas – Methane



Graph 5.15 Gas – Carbon Dioxide



Gas monitoring on the site generally revealed typical low levels of methane and carbon dioxide and higher levels of Oxygen. MW14 returned elevated concentrations for methane and carbon dioxide, however, given that this location is located within the waste mass these results would be expected.

There were no exceedances in licence limits for wells located outside the waste mass. These results are typical of a closed landfill.

6 SUMMARY OF RESULTS AND INTERPRETATION OF ENVIRONMENTAL MONITORING

As reported in Section 4 there were a number of elevations recorded in 2017. It should also be noted that there are no limits specified by the waste licence and so results are compared only to indicator limits from sources such as the Interim Guideline Values (IGVs) for groundwater and the Environmental Quality Standards (EQS) for surface waters.

Included in Appendix C is a copy of the Quarter 4 monitoring results as reported by Boylan Engineering who were commissioned by Cavan County Council to undertaken the environmental monitoring for the landfill. We are satisfied that we are carrying out the environmental monitoring as specified in the Waste Licence. We are also satisfied that there are no major environmental impacts associated with this facility. We will continue to monitor and report as per the licence requirement.

7 RESOURCES AND ENERGY CONSUMPTION SUMMARY

As there is in-sufficient gas produced to run a gas flare or engine there is no use for the gas resource on site. There is no energy consumed on site.

8 REPORT ON RESTORATION OF FACILITY

The site is fully restored and the cap intact. There were horses grazing on the site during 2017.

9 ESTIMATED ANNUAL AND CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY

This information is reported in the PRTR Report attached in Appendix A. The estimated quantity of Methane released is 28,100kgs/yr. Page one from the Annual Gas Survey is also presented in Appendix A.

10 FULL TITLE AND WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR WHICH RELATES TO THE FACILITY OPERATION

There was no change to or development of any procedures undertaken by the licensee or monitoring contractor in 2017.

11 REPORTED INCIDENTS AND COMPLAINTS SUMMARY

There were no incidences in the reporting period 2017. There were no complaints received by the EPA or the Local Authority regarding this facility in the reporting period 2017.

12 REVIEW OF NUISANCE CONTROLS

As there are no known nuisances associated with this site there are no nuisance controls in place for parameters such as noise or vermin. There is no odour detectable from the site and as these are the main nuisances associated with landfills the licensee has not reviewed the controls. This is backed up by the absence of any complaints regarding the facility. However if any nuisances arise at the facility the licensee will deal with them using appropriate measures and procedures.

13 REPORT ON TRAINING OF STAFF

Executive Engineer Brona Keating from Cavan County Council deals with in full with any issues identified by the Agency Inspectors or any other party. Brona is a Chartered Waste Manager with many years' experience managing the compliance of landfill and waste sites. Brona carries a Safe Pass and has been trained in Landfill Gas Management.

Table 13.1 Management Structure 2017

Position	Name	Duties
Director of Services, Environment	Paddy Connaughton	Oversee and assign responsibilities to staff regarding landfill
Acting Senior Engineer	Colm O'Callaghan	Oversee general supervision, monitoring and reporting of the site.
Executive Engineer / Landfill Operations Manager	Brona Keating	Responsible for general supervision, monitoring and reporting of the site.

Contact Person for Sanitary Authority for 2017 / 2018:

Brona Keating

Executive Engineer

Waste Management Section

Cavan County Council

Farnham Street, Cavan

14 ANY OTHER ITEMS SPECIFIED BY THE AGENCY

As per the licence we have included in Appendix B a copy of the most recent Map of the site showing all Monitoring locations. New boreholes were installed in 2017 on-site as per risk assessments carried out on site. It is proposed that they will be included in the monitoring schedule going forward.

Appendix A

PRTR Emissions Report and Gas Survey

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2017

1. FACILITY IDENTIFICATION

Parent Company Name	Cavan County Council
Facility Name	Ballyjamesduff Landfill
PRTR Identification Number	W0093
Licence Number	W0093-01

Classes of Activity

No.	**class_name**
-	Refer to PRTR class activities below

Address 1	Derrylurgan
Address 2	Ballyjamesduff
Address 3	
Address 4	
	Cavan
Country	Ireland
Coordinates of Location	-7.20884 53.8687
River Basin District	IEGBNISH
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Gareth O'Brien
AER Returns Contact Email Address	g.obrien@boylanengineering.ie
AER Returns Contact Position	Senior Environmental Consultant
AER Returns Contact Telephone Number	046-9286000
AER Returns Contact Mobile Phone Number	087-1045333
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	0
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	1
User Feedback/Comments	No comment
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	**Activity Name**
5(c)	Installations for the disposal of non-hazardous waste
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	No
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	NA
Is the reduction scheme compliance route being used ?	NA

4. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0093 | Facility Name : Ballyjamesduff Landfill | Filename : W0093_2017.xls | Return Year : 2017 | 10/04/2018 17:36

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
03	Carbon dioxide (CO2)	C	OTH	GASSIM	0.0	73100.0	0.0	73100.0
01	**Methane (CH4)**	C	OTH	GASSIM	0.0	28100.0	0.0	28100.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Ballyjamesduff Landfill

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used**		**Facility Total Capacity m3 per hour**	
			Method Code	**Designation or Description**		
Total estimated methane generation (as per site model)	28100.0	C	OTH		N/A	
Methane flared	0.0				0.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	0.0				N/A	

Environmental Protection Agency

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2017

Please choose from the drop down menu the license number for your site	W0093
Please choose from the drop down menu the name of the landfill site	Ballyjamesduff Landfill
Please enter the number of flares operational at your site in 2017	0
Please enter the number of engines operational at your site in 2017	0
Total methane flared	0 kg/year
Total methane utilised in engines	0 kg/year

Please note that the closing date for reciept of completed surveys is 31/03/2018

Introduction

The Office of Environmental Sustainability (OES) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's emission reduction targets under the Effort Sharing Decision (No. 406/2009/EC). The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most uptodate information on methane flaring and recovery in utilisation plants at landfills sites is used in calculating the contribution of the landfill sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:
LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2017) to:
LFGProject@epa.ie

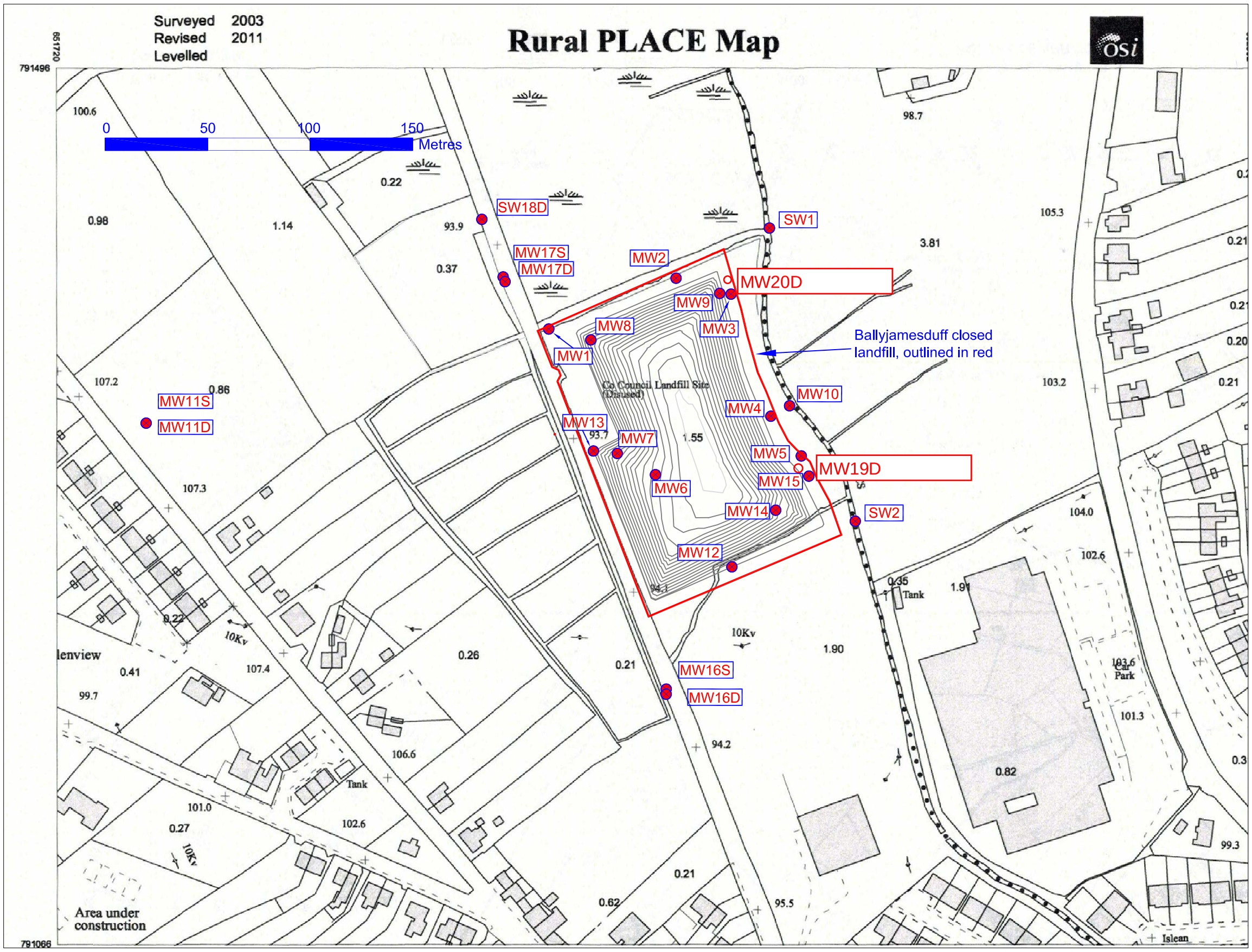
Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	No

Appendix B

Monitoring Location Plan

Rural PLACE Map

Surveyed 2003
Revised 2011
Levelled



Please Note
Do not scale from drawing.
All dimensions should be verified on site before construction and any discrepancies found brought to the attention of the Engineer.

NOTES / LEGEND

Client: Cavan County Council

Project:
Ballyjamesduff Landfill (WL93-01)

Boylan engineering
Main St., Mullagh, Kells, Co. Meath.
Phone: 046 - 928 6000
Email: info@boylanengineering.ie
Website: www.boylanengineering.ie

Drawn By	Approved by
A. Clarke	B. Keating

Drawing No.	Drawing Name
001	Monitoring Well Locations

Date	Scale	Rev.
11.06.2012	1:2000	000

Appendix C

Quarter 4 Monitoring Report

GROUNDWATER MONITORING REPORT BALLYJAMESDUFF LANDFILL W0093-01 Quarter 3 and 4 2017

Document No.: CCC-03-01-07-03-Rev 1

Project No.: CCC-03-01

Client: Cavan County Council

Project Name: Ballyjamesduff Landfill
Derrylurgan
Ballyjamesduff
Co. Cavan

Summary of Document Revisions		
Rev No.	**Date Revised**	**Revision Description**

Prepared by	Terry Keating	23/01/18
Approved by	Gareth O'Brien	24/01/18

CONTENTS

LIST OF TABLES

1 SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out environmental monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan for Quarter 3 and Quarter 4 2017. This report documents the finding from the groundwater monitoring and sampling undertaken at Ballyjamesduff Landfill on 17th August (Q3) 2017 and 01st / 28th November (Q4) 2017.

2 INTRODUCTION

Ballyjamesduff Landfill is situated approximately 600 m north of Ballyjamesduff town centre in the townland of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 2002. A waste licence (W0093-01) was issued by the Environmental Protection Agency (EPA) after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the groundwater, sampling programme conducted on site and also summarises findings and analytical results for Quarter 3 and Quarter 4 of 2017. The Monitoring undertaken during Q4 also included the annual suite of analysis for new monitoring wells, 19D and 20D at the landfill.

- The purpose of environmental monitoring at closed landfills is to:
- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behaviour with expected/modelled behaviour
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Ballyjamesduff landfill is situated in the R21 Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R21 Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste license - (EPA, Groundwater Protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

The generation of Leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

3 METHODOLOGY

3.1 Environmental Monitoring and Sampling

The following procedures were conducted by Boylan Engineering to ensure accurate groundwater monitoring:

- ISO 5667: Guidance on sampling of groundwaters was adhered to.

- Prior to sampling, the depth of water in groundwater wells was measured by dipping. Dipping the wells before sampling allows for calculation of the volume of water in the well. This data was recorded on the field sheet for volume calculation which is presented in Appendix 3.
- Once the volume was calculated the boreholes were purged three times their volume before sampling.
- Sampling was conducted using a Waterra inertial lift pump and associated tubing, pumping water directly from the borehole to the appropriate sampling bottles.
- Designated tubing was used at each location.
- Having obtained a representative sample the following parameters were also measured on-site using a Hanna HI 98129 combination waterproof high accuracy probe.
    - Conductivity
    - Temperature
    - pH

3.2 Laboratory Analysis

- Samples were sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes ensure that samples are maintained at a consistent temperature between 0 oC and 4oC on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0^{o} C and 4^{o} C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 2.

3.3 Weather Report

The weather report from Q3 and Q4 of 2017 are presented in Table 1 - 3 below.

Table 1 - Weather Report Q3

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Maximum Gust	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
17/08/2017	2.7	19.9	11.6	10.4	8.2		

Table 2 - Weather Report Q4

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Maximum Gust	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
01/11/2017	0.3	13.9	9.2	6.4	5.3		

Table 3 - Weather Report Q4

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Maximum Gust	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
28/11/2017	0.1	6.3	1.8	-1.7	6.4		

3.4 Monitoring Locations

The groundwater monitoring locations from Q3 and Q4 of 2017 are presented in Tables 4 below, with the monitoring plan presented in Appendix 1.

Table 4 – Q3 and Q4 Groundwater monitoring locations

Q4 2017					
Monitoring Well	**Sample Type**	**Cover Level M (OD Malin Head)**	**Water Level M (OD Malin Head)**	**Water Depth M (Top of Casing)**	**National Grid Co-Ordinates**
MW1	Gas	94.92	94.92		N291352.31 E252020.68
MW2	Gas	92.92	92.92		N291377.38 E252082.84
MW3	GW	94.39	93.79	0.6	N291369.28 E252109.44
MW4	GW	93.65	93.7		N291309.78 E252129.14
MW5	Gas	92.84	-	n/a	TBC
MW6	Leachate	100.71	-	n/a	TBC
MW 7	Leachate	97.54	-	n/a	TBC
MW8	Leachate	96.56	-	4.15	N291346.99 E252041.22
MW9	GW	95.69	94.79	0.9	N291369.67 E252103.93
MW10	GW	93.95	92.55	1.4	N291314.86 E252138.12
MW11S	GW	TBC	-	2.6	TBC
MW11D	GW	TBC	-	12.9	TBC
MW12	Gas	94.38	-	n/a	N291236.30 E252110.10
MW13	Gas	94.69	-	n/a	TBC
MW14	Gas	98.77	-	n/a	N291263.92 E252131.54
MW15	Gas	93.11	-	n/a	TBC
MW16S	GW	94.02	93.22	0.80	N252076.89 E291174.65
MW16D	GW	94.16	93.46	0.70	N252077.36 E291173.27
MW17S	GW	93.59	92.28	1.31	N251997.04 E291377.19
MW17D	GW	93.63	92.03	1.60	N251997.80 E291376.00
MW18	GW	93.5	93.5	0.0	N251986.57 E291425.39
SW1	SW	n/a	-	n/a	TBC
SW2	SW	n/a	-	n/a	TBC
Cap	SW	n/a	-	-	TBC
MW19	GW	n/a	TBC	0	TBC
MW20	GW	n/a	TBC	0	TBC

4 SUMMARY OF RESULTS

A summary of the groundwater monitoring results from Q3 and Q4 2017 are presented in Table 5 and Table 6 below, with the laboratory certificates presented in Appendix 4. As noted, monitoring was undertaken on two occasions in Q4 to incorporate the additional groundwater wells MW19 and MW20.

Table 5 - Q3 Summary of Groundwater Monitoring Analytical Results

Report Number		115717															
Monitoring Date:		17/08/2017															
Method		Site Tests	Site Tests	(TOC)	Coliforms	AQ2		Coliforms	Titralab		AQ2-UP2	Dissolved Oxygen	Total Cyanide High	PhenolsTotal -Index (Sub1)	Metals-Dissolved		
Method Number		Site Tests	Site Tests	EW123	MIC133	EW003	EW051	MIC133	EW138	EW139	EW015	EW043	ug/L	Sub-Con	EM130		
Parameter		Sample temperature (onsite)	Cond	TOC	E.Coli	Ammonia	TON	Total Coliforms	pH	Cond	Cl	DO	Total Cyanide High (Sub)	Total Phenols	Fe	K	Na
Units		Deg C	us/cm	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l		mg/l	ug/l	mg/l	mg/l
Limit of Detection		-	-	0.250	0.000	0.007	0.138	0.000	0.300	25.000	2.600	1.000		0.15	5.0	0.2	0.5
Date Testing Initiated		17.8.17								18.8.17							
ELS Ref	Client Ref																
115717	MW3	14.4	885	24.94	0	***1.421***	<0.15	***372***	7.1	819	25	3	<9	<.10	***18000***	**8.6**	27
115717	MW10	13.7	1265	29.29	***1***	***57.005***	<0.15	***479***	6.9	***1585***	***95***	<1	<9	<0.10	**26000**	***34.6***	65.8
115717	11S	13.8	905	8.56	***250***	<0.005	<0.15	***454***	7.5	417	13	7	<9	<0.10	34	1.5	16.6
115717	11D	14.2	420	3.55	***99***	<0.005	0.76	***400***	7.2	***1250***	***260***	5	<9	<0.10	35	1.5	43.5
115717	MW 16S	13	481	6.59	0	0.124	<0.15	***167***	7.7	511	***32***	7	<9	<0.10	<20	1.6	19.3
115717	MW 16D	10.7	488	5.74	***2***	0.052	<0.15	***1011***	7.7	489	23	5	<9	<0.10	81	1.8	15.9
115717	MW 17S	13.8	514	10.13	0	***0.672***	<0.15	***358***	7.1	490	18	1	<9	<0.10	***830***	2.6	29.1
115717	MW 17D	11.5	471	2.19	0	***0.24***	<0.15	***1***	7.7	490	17	4	<9	<0.10	180	2.1	27.8
115717	MW18	11.9	482	7.68	***2***	0.02	<0.15	***159***	7.5	482	16	6	<9	<0.10	150	2.1	27.3
IGV				NAC	0	0.15	NAC	0	≥6.5 &≤9.5	1000	30	NAC		0.0005	200	5	150

Exceedance

NOTES

1 Sub-contract analysis denoted by *

2 ND - Concentration was below the limit of detection

3 NAC- No Abnormal Change

4 IGV - Interim Guide Value

As there are no limits set in the waste licence for groundwater, results are compared to the Interim Guide Values (IGVs) for the protection of Groundwater.

Table 6 - Q4 Summary of Groundwater Monitoring Analytical Results

Report Number		119264/120286																
Monitoring Date:		01.11.2017/28.11.2017																
Method		Site Tests	Site Tests	(TOC)	Coliforms	AQ2		Coliforms	Titralab		AQ2-UP2	Dissolved Oxygen	Total Cyanide High	PhenolsTotal -Index (Sub1)	Metals-Dissolved		
Method Number		Site Tests	Site Tests	EW123	MIC133	EW003	EW051	MIC133	EW138	EW139	EW015	EW043	ug/L	Sub-Con	EM130		
Parameter		Sample temperature (onsite)	Cond	TOC	E.Coli	Ammonia	TON	Total Coliforms	pH	Cond	Cl	DO	Total Cyanide High (Sub)	Total Phenols	Fe	K	Na
Units		Deg C	us/cm	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l		mg/l	ug/l	mg/l	mg/l
Limit of Detection		-	-	0.250	0.000	0.007	0.138	0.000	0.300	25.000	2.600	1.000		0.15	5.0	0.2	0.5
Date Testing Initiated		1.11.17								2.11.17							
ELS Ref	Client Ref																
119264	MW3	10.1	865	17.51	0	***1.078***	0.28	***5172***	7.2	801	28	2	<9	<0.10	***25000***	**8.8**	32.9
119264	MW9	10.2	986	8.47	***5***	***15.109***	<0.15	***2987***	7	***1047***	16	9	<9	<0.10	***30000***	***13.9***	19.5
119264	MW10	10.4	1201	44	0	***53.86***	<0.15	***970***	6.9	***1522***	***97***	2	<9	<0.10	**47000**	***40.2***	78.1
119264	11S	10.3	889	11.95	0	0.01	0.41	***6***	6.8	535	***61***	9	<9	<0.10	<20	1.6	27.5
119264	11D	10.3	401	46.16	0	0.01	<0.15	***251***	7.6	429	14	5	<9	<0.10	<20	1.3	22.7
119264	MW 16S	10.4	452	24.75	0	0.007	0.19	***91***	7.6	483	21	10	<9	<0.10	<20	1.7	24.4
119264	MW 16D	10.2	472	10.91	0	0.052	<0.15	***78***	7.6	505	24	5	<9	<0.10	90	1.5	21.9
119264	MW 17S	10.5	508	19.7	0	***1.552***	2.3	***2359***	7.1	419	17	4	<9	<0.10	***1200***	***5.5***	22.4
119264	MW 17D	10.4	471	32.7	0	0.007	0.25	***2247***	7.4	431	16	6	<9	<0.10	<20	2.3	29.5
119264	MW18	10.2	479	7.85	0	0.022	<0.15	***41***	7.4	489	18	7	<9	<0.10	***300***	2.4	30.8
120286	MW19	9.8	218	7.93	***30***	0.035	<0.15	***500***	7.5	711	30	7	<9	<0.10	<20	2.5	32.4
120286	MW20	9.9	245	21.17	0	0.011	<0.15	0	7.6	408	16	6	<9	<0.10	<20	2	20.7
IGV				NAC	0	0.15	NAC	0	≥6.5 &≤9.5	1000	30	NAC		0.0005	200	5	150

Exceedance

NOTES

1 Sub-contract analysis denoted by *

2 ND - Concentration was below the limit of detection

3 NAC- No Abnormal Change

4 IGV - Interim Guide Value

As there are no limits set in the waste licence for groundwater, results are compared to the Interim Guide Values (IGVs) for the protection of Groundwater.

5 DISCUSSION OF RESULTS

5.1 Discussion of Results

Monitoring of groundwater is a common and necessary event at landfill sites both during their active life and post closure. The significance of such monitoring is so the facilities can demonstrate that there is no potential for the migration of hazardous contaminants from the unit into the groundwater systems.

Monitoring for Q3 was conducted on the 17th of August 2017, while Q4 monitoring was undertaken on the 01st and 28th of November 2017 respectively. The results from these monitoring rounds are presented in Table 6 and 7 in Section 4 above with any parameters that exceeded the Interim Guideline Values (IGVs) highlighted in bold italic.

5.2 Q3 Analysis

The Results from Q3 2017 returned elevated concentrations at various monitoring locations for Iron, ammonia, total coliforms, e-coli, potassium, chloride, and conductivity. E-coli was recorded at MW10, MW11S and MW11D, MW16D and MW18 during the Q3 monitoring. Significant exceedances for e-coli were noted at MW11D and MW11S, however, these wells are situated up gradient of the landfill and therefore these exceedances cannot be attributed to the landfill. The elevated readings for e-coli was likely to have been a result of agricultural activities such as spreading of manure / slurry. Marginal exceedances for E-coli were noted at MW10, MW16D and MW18 and theses wells are situated below ground level and are susceptible to filtration of slurry during spreading.

Elevated concentrations of chloride were detected at MW10, MW11D and MW16S. As noted, MW11D is situated up gradient of the landfill and the land use is predominately agricultural and therefore this is the most likely source of contamination. MW10 are located in close proximity to a local watercourse, which flows in southern direction through existing farmland prior to the landfill. This elevated concentration of chloride may therefore be attributed to local agricultural practices.

Exceedances were also noted for ammonia in the samples retrieved from MW3, MW10, MW17S and MW17D located to the north and northeast of the landfill. Elevated concentrations of ammonia can also be attributed to the surrounding agricultural land-use and associated activities such as spreading of manure / slurry.

Elevated concentrations of iron were noted at MW3, MW9, MW10, MW17S and MW18. While iron can be an indication of contamination, the hypothesis proposed is that the source of this Iron is not the landfill leachate, but the native soils beneath the landfill. Iron can become mobilised due to changing pH and/or redox conditions in the environment underneath the landfill. Alternatively, the leachate from the non-hazardous waste may produce reducing conditions beneath the landfill, allowing the solution of Iron from the underlying deposits. Elevated Iron may also be attributed to the natural composition of this area.

5.3 Q4 Analysis

As noted, two additional wells, (MW19D and MW20D) were monitored during Q4 2017, while no sample was retrieved from MW4 during Q4 as the well was dry.

The results from Q4 2017 returned elevated concentrations at various monitoring locations for iron, ammonia, total coliforms, e-coli, potassium, chloride, and conductivity. There were exceedances for e-coli at MW9 and MW19D during Q4 2017 monitoring. The location of the two wells are in close proximity to a local water course, which runs along an existing farm. These may be susceptible to land spreading activities such as manure/slurry.

Elevated concentrations of chloride were detected at MW10 and MW11S. MW11S is situated up gradient of the landfill and the land use is predominately agricultural and therefore this is the most likely source of contamination. MW10 is located in close proximity to a local watercourse, which flows in a southern direction through existing farmland prior to the landfill. This elevated concentration of chloride may therefore be attributed to local agricultural practices.

Exceedances were noted for ammonia in the samples retrieved from MW3, MW9, MW10 and MW17S located to the north and northeast of the landfill. Elevated concentrations of ammonia can also be attributed to the surrounding agricultural land-use and associated activities such as spreading of manure / slurry.

When compared to recent historical data, exceedances noted during the Q3 and Q4 2017 revealed similar results to that of previous monitoring events. Information relating to previous results can be seen in the historical data tables in Appendix 5.

6 CONCLUSION

The groundwater results obtained were generally consistent with previous monitoring events and do not show any signs of dramatic exceedances. The next monitoring event will be carried out in Q1 in 2018.

Appendix 2

Laboratory Analysis Methods

2.0 Appendix - Analysis Method

ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW154
Chloride 2.6-250 mg/l EW154
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 mg/l EW094
Nitrate 0.12-50 mg/l N EW154
Nitrite 0.013-1 mg/l N EW154
pH 4 – 10 pH Units EW153
Phosphate 0.009-1 mg/l P EW154
Alkalinity 10-1000mg/l EW153
TOC 0.25-100mg/l EW123
BOD 1-1300mg/l EW001
Total Nitrogen 1-100mg/l N EW140
Total Phosphorous 0.01-40 mg/l P EW143
Suspended Solids 5-1000mg/l EW013
Dissolved Oxygen 1 to 10 mg/l EW043
Conductivity 25-6000 us/cm EW154

Miscellaneous (P,G,S)
Bromate 1 to 50ug/l BRO3 EW137
Colour 2.5-50mg/l PtCCo EW154
Sulphate 1-250mg/l SO4 EW154
Total Dissolved Solids 15-1000mg/l EW046
Total Hardness 3-330mg/l CaCO3 EM099
Total Oxidised Nitrogen 0.138-51mg/l N EW051
Turbidity 0.11-150 NTU EW136
TKN Calculation 1-49 mg/l EW010

Metals EM130 (P,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 – 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 20.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI439 Potable Water VOCs & THM
EO025 (P,G,S,W)
Benzene 0.1-35 µg/l
1.2-Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-150 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S,W)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether 0.5 - 35 µg/l
11 Dichloroethene 0.5 - 35 µg/l
Iodomethane/Mehyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride 0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene 0.5 - 35 µg/l
Trans-1,2 Dichloroethene 0.5 - 35 µg/l
MtBE 0.5 - 35 µg/l
11 Dichloroethane 0.5 - 35 µg/l
Cis-12 Dichloroethene 0.5 - 35 µg/l
Methyl Acrylate 5.0 - 35 µg/l
Bromochloromethane 0.5 - 35 µg/l
Tetrahydrofuran 5.0 - 35 µg/l
111 Trichloroethane 0.5 - 35 µg/l
1-Chlorobutane 0.5 - 35 µg/l
Carbon Tetrachloride 0.5 - 35 µg/l
11 Dichloropropene 0.5 - 35 µg/l
12 Dichloropropane 0.5 - 35 µg/l
Dibromomethane 0.5 - 35 µg/l
Methyl Methacrylate 0.5 - 35 µg/l
13 Dichloropropene, cis 2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene 0.5 - 35 µg/l
13 Dichloropropene,trans 2.0 - 35 µg/l
Ethyl Methacrylate 2.0 - 35 µg/l
112 Trichloroethane 0.5 - 35 µg/l
13 Dichloropropane 0.5 - 35 µg/l
2 Hexanone 1.0 - 35 µg/l
12 Dibromoethane 0.5 - 35 µg/l
Chlorobenzene 0.5 - 35 µg/l
1112 Tetrachloroethane 2.0 - 35 µg/l
Ethyl Benzene 0.5 - 35 µg/l
m & p Xylene 0.5 - 35 µg/l
O Xylene 0.5 - 35 µg/l
Stryene 2.0 - 35 µg/l
Isopropyl Benzene 0.5 - 35 µg/l
Bromobenzene 0.5 - 35 µg/l
1122 Tetrachloroethane 0.5 - 35 µg/l
123 Trichloropropane 2.0 - 35 µg/l
Propyl Benzene 0.5 - 35 µg/l
2-Chlorotoluene 0.5 - 35 µg/l
4 Chlorotoluene 0.5 - 35 µg/l
135 Trimenthylbenzene 0.5 - 35 µg/l
Tert Butyl Benzene 0.5 - 35 µg/l
124 Trimethlbenzene 0.5 - 35 µg/l
Sec Butyl Benzene 0.5 - 35 µg/l
13 Dichlorobenzene 0.5 - 35 µg/l
P Isopropyltoluene 0.5 - 35 µg/l
14 Dichlorobenzene 0.5 - 35 µg/l
12 Dichlorobenzene 0.5 - 35 µg/l
N Butyl Benzene 0.5 - 35 µg/l
Hexachloroethane 5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene 0.5 - 35 µg/l
123 Trichlorobenzene 0.5 - 35 µg/l

Other VOC's EO025 (P,G,S)
22 Dichloropropane 0.5 - 35 µg/l

PAH EO129 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H

Organophosphorus Pesticides(P,G,S)
Range 0.01 - 0.2 µg/l
Famphur OP
Methyl Parathion OP
Parathion OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P'-DDD OC
P,P'-DDT OC

Notes

1.Sample Matrix:P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

Appendix 3

Field Monitoring Sheets

ON SITE SAMPLING FORM

Facility Name: Ballyjamesduff | **Waste Licence No:** W0093-01

Report To:

Sampling Date: 17.08.17

Sample Type (GW, SW, Leachate) All

Personnel: Terry Keating

Weather: Dry

Other Remarks:

GPS:

Sample Ref No	Sample Type	Time	DO Level	Elec Cond (us)	pH pH units	Temp ^{o}C	Visual
3	GW	-	-	885	7.1	14.4	Lacky
4	GW	-	-	-	-		-
9	GW	-	-	-	-	-	-
10	GW	-	-	1265	6.7	13.7	Lacky
11S	GW	-	-	905	7.0	13.8	Brownish
11D	GW	-	-	420	7.4	14.2	Brownish
16S	GW	-	-	481	7.2	13	Straw
16D	GW	-	-	488	7.0	10.7	Straw
17S	GW	-	-	514	6.8	13.8	Straw
17D	GW	-	-	471	6.9	11.5	Straw
18	GW	-	-	482	7.5	11.9	Clear

COMMENTS:

ON SITE SAMPLING FORM

Facility Name: Ballyjamesduff | **Waste Licence No:** W0093-01

Report To:

Sampling Date: 01.11.17

Sample Type (GW, SW, Leachate) All

Personnel: Terry Keating

Weather: wet

Other Remarks:

GPS:

Sample Ref No	Sample Type	Time	DO Level	Elec Cond (us)	pH pH units	Temp ^{o}C	Visual
3	GW	-	-	865	7.1	10.1	Lacky
4	GW	-	-				-
9	GW	-	-	986	7.3	10.2	-
10	GW	-	-	1201	7.4	10.4	Lacky
11S	GW	-	-	889	7.3	10.3	Brownish
11D	GW	-	-	401	7.6	10.3	Brownish
16S	GW	-	-	452	7.5	10.4	Straw
16D	GW	-	-	472	7.6	10.2	Straw
17S	GW	-	-	508	7.3	10.5	Straw
17D	GW	-	-	471	7.1	10.4	Straw
18	GW	-	-	479	7.4	10.2	Clear
19D	GW	-	-	218	7.7	9.8	Clear
20D	GW	-	-	245	7.5	9.9	Clear

COMMENTS: Two additional boreholes (MW19D and MW20D) were monitored in Quarter 4 2017

Cavan County Council Groundwater Sampling ref. 3.14

Site Reference: Ballyjamesduff **Permit No.** W0093 **Date:** 17.08.2017 **Personnel: Terry Keating**

Sample Ref	Depth of Well	Depth of water below Ground Level	Depth of water column	Diameter of well	Radius of well	Radius squared	Volume of water in well	Volume of water in well	Volume of water to purge	Time to purge
	(m)	(m) B	A-B=h	(m)	(m)	(m^2)	(m3) π r2h	litres	(litres x 3)	(mins)
(Shallow/Deep)	A	B		C	(C/2) = r	r^2		(m^3 x 1000)		
MW3	2.9	1	1.90	0.05	0.025	0.00063	0.00373	3.72875	11.1863	2
MW4	2.2	0	2.20	0.05	0.025	0.00063	0.00432	4.3175	12.9525	2
MW9	4.5	0.7	3.80	0.05	0.025	0.00063	0.00746	7.4575	22.3725	4
MW10	3.4	1.2	2.20	0.05	0.025	0.00063	0.00432	4.3175	12.9525	2
MW11S	5	1.25	3.75	0.05	0.025	0.00063	0.00736	7.359375	22.0781	4
MW11D	30	12.7	17.30	0.05	0.025	0.00063	0.03395	33.95125	101.854	17
MW16S	5	1.3	3.70	0.05	0.025	0.00063	0.00726	7.26125	21.7838	4
MW16D	10	2.1	7.90	0.05	0.025	0.00063	0.0155	15.50375	46.5113	8
MW17S	5	2.7	2.30	0.05	0.025	0.00063	0.00451	4.51375	13.5413	2
MW17D	15	1.3	13.70	0.05	0.025	0.00063	0.02689	26.88625	80.6588	13
MW18	21	0	21.00	0.05	0.025	0.00063	0.04121	41.2125	123.638	21

Cavan County Council Groundwater Sampling ref. 3.14

Site Reference: Ballyjamesduff **Permit No.** W0093 Date: 01.11.2017 **Personnel: Terry Keating**

Sample Ref	Depth of Well	Depth of water below Ground Level	Depth of water column	Diameter of well	Radius of well	Radius squared	Volume of water in well	Volume of water in well	Volume of water to purge	Time to purge
	(m)	(m) B	A-B=h	(m)	(m)	(m^2)	(m3) π r2h	litres	(litres x 3)	(mins)
(Shallow/Deep)	A	B		C	(C/2) = r	r^2		(m^3 x 1000)		
MW3	2.9	0.6	2.30	0.05	0.025	0.00063	0.00451	4.51375	13.5413	2
MW4	2.2	0	2.20	0.05	0.025	0.00063	0.00432	4.3175	12.9525	2
MW9	4.5	0.9	3.60	0.05	0.025	0.00063	0.00707	7.065	21.195	4
MW10	3.4	1.4	2.00	0.05	0.025	0.00063	0.00393	3.925	11.775	2
MW11S	5	2.6	2.40	0.05	0.025	0.00063	0.00471	4.71	14.13	2
MW11D	30	12.9	17.10	0.05	0.025	0.00063	0.03356	33.55875	100.676	17
MW16S	5	0.8	4.20	0.05	0.025	0.00063	0.00824	8.2425	24.7275	4
MW16D	10	0.7	9.30	0.05	0.025	0.00063	0.01825	18.25125	54.7538	9
MW17S	5	1.31	3.69	0.05	0.025	0.00063	0.00724	7.241625	21.7249	4
MW17D	15	1.6	13.40	0.05	0.025	0.00063	0.0263	26.2975	78.8925	13
MW18	21	0	21.00	0.05	0.025	0.00063	0.04121	41.2125	123.638	21

Appendix 4

Laboratory Results

ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

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email:info@elsltd.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/001
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW3		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms									
	Total Coliforms		MIC133	0		372	MPN/100ml	INAB	
	E. Coli		MIC133	0		0	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		3	mg/L	INAB	
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		1.421	mg/l N		
	Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
	Chloride mg/L		EW175	1.0		25	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EM130	20		18000	ug/L		
	Potassium-Dissolved		EM130	0.2		8.6	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		27.0	mg/L	INAB	
PhenolsTotal -Index (Sub1)									
	Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		819	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		24.94	mg/L	INAB	

Signed : _____ 30/08/2017

Brendan Murray-Deputy Technical Manager

NOTES
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2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test

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email:info@elsltd.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/002
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW10		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms								
Total Coliforms		MIC133	0		479	MPN/100ml	INAB	
E. Coli		MIC133	0		1	MPN/100ml	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		<1	mg/L	INAB	
Gallery Plus-Suite A								
Ammonia as N		EW175	0.005		57.005	mg/l N		
Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
Chloride mg/L		EW175	1.0		95	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20		26000	ug/L		
Potassium-Dissolved		EM130	0.2		34.6	mg/L		
Sodium-Dissolved		EM130	0.5		65.8	mg/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab								
pH		EW153	0.0		6.9	pH Units	INAB	
Conductivity @20 DegC		EW153	25		1585	uscm-1@20	INAB	
Total Cyanide High (Sub)								
Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		29.29	mg/L	INAB	

Signed : 30/08/2017

Brendan Murray-Deputy Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test

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email:info@elsltd.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/003
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW16D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms								
Total Coliforms		MIC133	0		1011	MPN/100ml	INAB	
E. Coli		MIC133	0		2	MPN/100ml	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		5	mg/L	INAB	
Gallery Plus-Suite A								
Ammonia as N		EW175	0.005		0.052	mg/l N	INAB	
Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
Chloride mg/L		EW175	1.0		23	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20		81	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		1.8	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		15.9	mg/L	INAB	
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab								
pH		EW153	0.0		7.7	pH Units	INAB	
Conductivity @20 DegC		EW153	25		489	uscm-1@20	INAB	
Total Cyanide High (Sub)								
Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		5.74	mg/L	INAB	

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Brendan Murray-Deputy Technical Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/004
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW16S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms								
Total Coliforms		MIC133	0		167	MPN/100ml	INAB	
E. Coli		MIC133	0		0	MPN/100ml	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		7	mg/L	INAB	
Gallery Plus-Suite A								
Ammonia as N		EW175	0.005		0.124	mg/l N	INAB	
Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrite as N		EW175	0.005		0.009	mg/l N	INAB	
Chloride mg/L		EW175	1.0		32	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20		<20	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		1.6	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		19.3	mg/L	INAB	
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab								
pH		EW153	0.0		7.7	pH Units	INAB	
Conductivity @20 DegC		EW153	25		511	uscm-1@20	INAB	
Total Cyanide High (Sub)								
Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		6.59	mg/L	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/005
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW17D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms								
Total Coliforms		MIC133	0		1	MPN/100ml	INAB	
E. Coli		MIC133	0		0	MPN/100ml	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		4	mg/L	INAB	
Gallery Plus-Suite A								
Ammonia as N		EW175	0.005		0.240	mg/l N	INAB	
Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
Chloride mg/L		EW175	1.0		17	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20		180	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		2.1	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		27.8	mg/L	INAB	
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab								
pH		EW153	0.0		7.7	pH Units	INAB	
Conductivity @20 DegC		EW153	25		490	uscm-1@20	INAB	
Total Cyanide High (Sub)								
Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		2.19	mg/L	INAB	

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Brendan Murray-Deputy Technical Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/006
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW17S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms								
Total Coliforms		MIC133	0		358	MPN/100ml	INAB	
E. Coli		MIC133	0		0	MPN/100ml	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		1	mg/L	INAB	
Gallery Plus-Suite A								
Ammonia as N		EW175	0.005		0.672	mg/l N		
Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrite as N		EW175	0.005		0.012	mg/l N	INAB	
Chloride mg/L		EW175	1.0		18	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20		830	ug/L		
Potassium-Dissolved		EM130	0.2		2.6	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		29.1	mg/L	INAB	
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab								
pH		EW153	0.0		7.1	pH Units	INAB	
Conductivity @20 DegC		EW153	25		490	uscm-1@20	INAB	
Total Cyanide High (Sub)								
Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		10.13	mg/L	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	**115532 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115532/007
		Date of Receipt	18/08/2017
		Date Started	18/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	30/08/2017
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	MW18		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms								
Total Coliforms		MIC133	0		159	MPN/100ml	INAB	
E. Coli		MIC133	0		2	MPN/100ml	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		6	mg/L	INAB	
Gallery Plus-Suite A								
Ammonia as N		EW175	0.005		0.020	mg/l N	INAB	
Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
Chloride mg/L		EW175	1.0		16	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20		150	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		2.1	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		27.3	mg/L	INAB	
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab								
pH		EW153	0.0		7.5	pH Units	INAB	
Conductivity @20 DegC		EW153	25		482	uscm-1@20	INAB	
Total Cyanide High (Sub)								
Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		7.68	mg/L	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**115717 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115717/002
		Date of Receipt	23/08/2017
		Date Started	23/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	21/02/2018
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	11S		

LRN		**Category** 2017-08-22		**Entity**	
Station		**Template**			
Laboratory	**Analyst**	**SampleDate**		**SampleTime**	**SampleMethod**
SampleReason		**SampleNotes**			

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms									
	Total Coliforms		MIC133	0		400	MPN/100ml	INAB	
	E. Coli		MIC133	0		99	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		5	mg/L	INAB	
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		<0.005	mg/l N	INAB	
	Total Oxidised Nitrogen (TON) as N		EW175	0.15		0.76	mg/l N	INAB	
	Nitrate as N		EW175	0.15		0.76	mg/l N	INAB	
	Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
	Chloride mg/L		EW175	1.0		260	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EM130	20		35	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		1.5	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		43.5	mg/L	INAB	
PhenolsTotal -Index (Sub1)									
	Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.2	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		1250	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		3.55	mg/L	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**115717 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	115717/001
		Date of Receipt	23/08/2017
		Date Started	23/08/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	21/02/2018
Quotation No	QN006417	**Sample Type**	Ground Waters
Customer Ref	11D		

LRN		**Category**	2017-08-22	**Entity**	
Station		**Template**			
Laboratory	**Analyst**	**SampleDate**		**SampleTime**	**SampleMethod**
SampleReason		**SampleNotes**			

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Coliforms									
	Total Coliforms		MIC133	0		454	MPN/100ml	INAB	
	Analyst Micro Comment: The start date for this micro test is 23/08/17								
	E. Coli		MIC133	0		250	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		7	mg/L	INAB	
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		<0.005	mg/l N	INAB	
	Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
	Chloride mg/L		EW175	1.0		13	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EM130	20		34	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		1.5	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		16.6	mg/L	INAB	
PhenolsTotal -Index (Sub1)									
	Phenols-Total	*	Default	0.10		<0.10	mg/L	YES	
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.5	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		417	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<9	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		8.56	mg/L	INAB	

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Appendix 5

Historical Results

	Parameter	TOC	E.Coli	Ammonia	TON	Tot Coliforms	pH	Cond	Cl	DO	Total Phenols	Fe	K	Na
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW3	Qtr 4 2017	17.51	0	***1.078***	0.28	***5172***	7.2	801	28	2	<0.10	***25000***	***8.8***	32.9
	Qtr 3 2017	24.94	0	***1.421***	<0.15	***372***	7.1	819	25	3	<.10	***18000***	***8.6***	27
	Qtr 2 2017	25.24	0	***14.147***	0.69	***10460***	7	733	22	<1	<0.10	***13000***	***7.6***	21.5
	Qtr 1 2017	65.87	**20**	0.089	<0.138	***2420***	7.1	641	18	<1	<0.1	***16000***	***5.2***	20.7
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW4	Qtr 4 2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 3 2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 1 2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW9	Qtr 4 2017	8.47	***5***	***15.109***	<0.15	***2987***	7	***1047***	16	9	<0.10	***30000***	***13.9***	19.5
	Qtr 3 2017	29.29	***1***	***57.005***	<0.15	***479***	6.9	***1585***	***95***	<1	<0.10	***26000***	***34.6***	65.8
	Qtr 2 2017	33.75	0	***17.288***	<0.15	***160***	7.5	***1035***	20	7	<0.10	***13000***	***14.3***	17.8
	Qtr 1 2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW10	Qtr 4 2017	44	0	***53.86***	<0.15	***970***	6.9	***1522***	***97***	2	<0.10	***47000***	***40.2***	78.1
	Qtr 3 2017	8.56	***250***	<0.005	<0.15	***454***	7.5	417	13	7	<0.10	34	1.5	16.6
	Qtr 2 2017	31.72	0	***34.561***	<0.15	0	6.8	***1271***	***64***	4	<0.10	***2800***	***22.6***	34.9
	Qtr 1 2017	39.3	0	***32.676***	<0.138	***20***	6.8	***1271***	***69***	5	<0.1	**21000**	**15.5**	33.2
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW11S	Qtr 4 2017	11.95	0	0.01	0.41	***6***	6.8	535	***61***	9	<0.10	<20	1.6	27.5
	Qtr 3 2017	3.55	***99***	<0.005	0.76	***400***	7.2	***1250***	***260***	5	<0.10	<20	1.6	19.3
	Qtr 2 2017	7.94	***150***	<0.005	0.85	***2420***	7.2	***1302***	***260***	4	<0.10	<20	1.4	40.7
	Qtr 1 2017	2.71	0	0.032	0.963	0	7.2	***1256***	***270***	7	<0.1	71	1.4	41.8
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW11D	Qtr 4 2017	46.16	0	0.01	<0.15	***251***	7.6	429	14	5	<0.10	<20	1.3	22.7
	Qtr 3 2017	8.56	***250***	<0.005	<0.15	***454***	7.5	417	13	7	<0.10	35	1.5	43.5
	Qtr 2 2017	18.14	***79***	0.013	<0.15	***236***	7.5	409	11	3	<0.10	<20	1.2	18.1
	Qtr 1 2017	2.71	0	***0.581***	<0.138	0	7.4	427	8.5	7	<0.1	32	1.2	17.7
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW16S	Qtr 4 2017	24.75	0	0.007	0.19	***91***	7.6	483	21	10	<0.10	<20	1.7	24.4
	Qtr 3 2017	6.59	0	0.124	<0.15	***167***	7.7	511	***32***	7	<0.10	81	1.8	15.9
	Qtr 2 2017	23.09	0	0.015	<0.15	0	7.5	462	20	2	<0.10	<20	1.6	17.3
	Qtr 1 2017	4.58	0	0.073	0.252	***30***	7.5	503	18	5	<0.1	<20	1.4	19.4
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW16D	Qtr 4 2017	10.91	0	0.052	<0.15	***78***	7.6	505	24	5	<0.10	90	1.5	21.9
	Qtr 3 2017	5.74	***2***	0.052	<0.15	***1011***	7.7	489	23	5	<0.10	***830***	2.6	29.1
	Qtr 2 2017	38.45	0	0.05	<0.15	***56***	7.5	493	23	3	<0.10	60	1.2	16.8
	Qtr 1 2017	9.05	0	0.078	<0.138	0	7.5	501	20	5	<0.1	110	1.2	16.2
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW17S	Qtr 4 2017	19.7	0	***1.552***	2.3	***2359***	7.1	419	17	4	<0.10	***1200***	***5.5***	22.4
	Qtr 3 2017	10.13	0	***0.672***	<0.15	***358***	7.1	490	18	1	<0.10	180	2.1	27.8
	Qtr 2 2017	6.53	0	***6.065***	<0.15	***2420***	6.9	492	17	2	<0.10	***5700***	2	18.5
	Qtr 1 2017	4.67	0	***6.737***	<0.138	***790***	6.9	518	15	4	<0.1	***11000***	1.7	18.5
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW17D	Qtr 4 2017	32.7	0	0.007	0.25	***2247***	7.4	431	16	6	<0.10	<20	2.3	29.5
	Qtr 3 2017	2.19	0	***0.24***	<0.15	***1***	7.7	490	17	4	<0.10	<20	2.3	29.5
	Qtr 2 2017	18.32	0	***0.261***	<0.15	***29***	7.5	475	17	4	<0.10	210	1.6	23.7
	Qtr 1 2017	5.49	0	***0.319***	<0.138	0	7.4	509	15	6	<0.1	***460***	1.8	23
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l
MW18	Qtr 4 2017	7.85	0	0.022	<0.15	***41***	7.4	489	18	7	<0.10	***300***	2.4	30.8
	Qtr 3 2017	7.68	***2***	0.02	<0.15	***159***	7.5	482	16	6	<0.10	150	2.1	27.3
	Qtr 2 2017	3.74	0	0.026	0.27	***40***	7.4	484	17	2	<0.10	190	1.5	22.6
	Qtr 1 2017	3.53	0	0.044	<0.138	***74***	7.3	489	14	6	<0.1	***300***	1.7	22.6
MW19	Qtr 4 2017	7.93	***30***	0.035	<0.15	***500***	7.5	711	30	7	<0.10	<20	2.5	32.4
MW20	Qtr 4 2017	21.17	0	0.011	<0.15	0	7.6	408	16	6	<0.10	<20	2	20.7
IGV		NAC	0	0.15	NAC	0	≥6.5 &≤9.5	1000	30	NAC	0.0005	200.000	5	150

SURFACE WATER MONITORING REPORT
BALLYJAMESDUFF LANDFILL W0093-01
BI-ANNUAL 2 OF 2 2017

Document No.: CCC-03-01-07-03-Rev 1

Project No.: CCC-03-01

Client: Cavan County Council

Project Name: Ballyjamesduff Landfill
Derrylurgan
Ballyjamesduff
Co. Cavan

Summary of Document Revisions		
Rev No.	**Date Revised**	**Revision Description**

Prepared by	Terry Keating	22/01/18
Approved by	Gareth O'Brien	24/01/18

CONTENTS

LIST OF TABLES

1 SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out environmental monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan for Bi-annual 2 of 2 2017. This report documents the finding from the surface water sampling and monitoring undertaken at Ballyjamesduff Landfill on 01st November 2017.

2 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600 m north of Ballyjamesduff town centre in the townland of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 2002. A waste licence (W0093-01) was issued by the Environmental Protection Agency (EPA) after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the surface water, sampling programme conducted on site and also summarises findings and analytical results for Bi-annual 2 of 2 2017. The purpose of environmental monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behaviour with expected/modelled behaviour
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Ballyjamesduff landfill is situated in the R21 Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R21 Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste license - (EPA, Groundwater Protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

The generation of Leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

3 METHODOLOGY

3.1 Environmental Monitoring and Sampling

The following procedure was conducted by Boylan Engineering to ensure accurate surface water monitoring:

- Surface water samples was taken by grab sample using a Telescoup and Pendulum beaker.
- Having obtained a representative sample the following parameters were measured on-site using a Hanna HI 98129 combination waterproof high accuracy.
    - Conductivity

- Temperature
- pH

- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times.

3.2 Laboratory Analysis

- Samples were sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes ensure that samples are maintained at a consistent temperature between 0° C and 4° C on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0° C and 4° C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 2.

3.3 Weather Report

The weather report for Bi-annual 2 of 2 2017 is presented in Table 1 below.

Table 1 Weather Report Bi -annual 2 of 2 2017

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Maximum Gust	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
01/11/2017	0.3	13.9	9.2	6.4	5.3		

3.4 Monitoring Locations

The surface water monitoring locations for Bi-annual 2 of 2 2017 are presented in Table 2 below and illustrated in the monitoring plan in Appendix 1.

Table 2 Monitoring Locations Surface water Bi-annual 2 of 2 2017

Monitoring Location	Sample Type	Cover Level M (OD Malin Head)	Water Level M (OD Malin Head)	Locaiton
SW1	SW	n/a	-	Monitoring at south-flowing stream to northeast of landfill
SW2	SW	n/a	-	Monitoring at south-flowing stream to southeast of landfill
Cap	SW	n/a	-	Surface water disharge point to southeast of site

4 SUMMARY OF RESULTS

A summary of the Surface water monitoring results for Bi annual 2 of 2 2017 is presented in Table 3 below with the laboratory data presented in Appendix 1.

Table 3 Bi -annual 2 of 2 2017 Surface water Monitoring Analytical Results

Report Number	119265
Monitoring Date	01/11/2017

Method		Site Tests	Site Tests	Site Tests	Site Tests	Ammonia	Titralab	Titralab	BOD	COD	Suspended Solids	AQ2-UP2	Dissolved Oxygen	Total Phosphorus-TP	AQ2-UP1
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**EW003**	**EW138**	**EW139**	**EW001**	**EW094**	**EW013**	**EW015**	**EW043**	**EW146**	**EW154M**
Parameter		Sample temperature (to be done onsite)	Cond	pH	Visual Inspection	Ammonia	pH	Cond	BOD	COD	Suspended Solids	Cl	DO	Total Phosphorus-TP	TON (as N)(Calc)
Units		Deg C	us/cm	pH units	-	mg/l N	pH Units	uscm-1@20	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l P	mg/l N
Limit of Detection		-	-	-	-	0.007	0.3	25	1	8	5	2.6	1.0	0.01	0.138
Date Testing Initiated		1.11.17				02.11.17									
ELS Ref	**Client Ref**														
119265	BJD SW 1	10.4	335	7.5	Straw	0.033	7.2	205	***11***	***68***	**109**	16	6	0.45	0.36
119265	BJD SW 2	10.1	321	7.6	Clear	0.035	7.1	205	<2.0	35	<5	16	5	0.1	0.38
119265	BJD Discharge Cap	9.8	687	7.6	Straw	***1.047***	7	438	<2.0	***46***	13	17	5	0.11	<0.15
S.I No. 294/2009						0.2	≥5.5 and ≤8.5	1000	5	40	50	250			NAC

Method		Titralab	AQ2-UP2	Total Metals	Metals-Dissolved										
Method Number		**EW153**	**EW154M-1**	**EM130**											
Parameter		Alkalinity Total (R2 pH4.5)	Sulphate	Chromium-Total	Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved
Units		mg/L CaCO3	mg/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L
Limit of Detection		10	1	1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1
Date Testing Initiated		02.11.17													
ELS Ref	**Client Ref**														
119265	BJD SW 1	74	11	4.1	950	270	4.9	9.2	<0.1	26.5	<0.003	<0.3	5	<0.02	0.36
119265	BJD SW 2	75	10	<3.0	850	240	4.9	9.5	<0.1	26.9	<0.003	<0.3	5.2	<0.02	2.5
119265	BJD Discharge Cap	201	13	<3.0	***5200***	***2600***	5.2	11.2	0.1	72	0.004	0.6	8.6	0.05	7.1
S.I No. 294/2009		NAC	200	30	1000	300		150	5		0.03	10		1	100

Exceedance

NOTES

1 Sub-contract analysis denoted by *

2 ND - Concentration was below the limit of detection

3 NAC- No Abnormal Change

As there are no limits set in the waste licence for surface water, results are compared to S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989.

5 DISCUSSION OF RESULTS

5.1 Discussion of Results

Surface water samples were taken at SW1 and at SW2 located along the south-flowing Pound River and at the discharge cap during the 2 of 2 bi-annual monitoring.

As there are no limits set in the waste license for surface water, results are compared to the S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 where available.

Several exceedances were detected in the sample retrieved from the discharge cap with particular reference to ammonia, COD, iron and manganese. These exceedances can be attributed to stagnation as a result of low flows in the cap discharge chamber at the time of monitoring.

There were also marginal exceedances for BOD and COD in the sample retrieved from SW1. As noted, SW1 is located to the northeast of the landfill along the south-flowing Pound River. This watercourse flows through existing farmland prior to passing the landfill and these elevated concentrations may be attributed to local agricultural practices. Furthermore, given that there were no exceedances for BOD or COD in the sample retrieved from SW2, which is located downstream of SW1 and the landfill, it is likely that the marginal exceedances at SW1 is due to agricultural influences and not the landfill.

An exceedances for suspended solids was also noted in the sample retrieved from SW1 returning a concentration of 109 mg/l and is likely due to heavy rainfall during this time of year which can increase the level of total suspended solids through runoff. Similar suspended solids concentrations were noted at SW1 in the results from bi-annual 2 of 2 2016.

All remaining results were within the limits specified by S.I No. 294/1989.

6 CONCLUSION

The surface water results obtained were generally consistent with previous monitoring events and do not show any signs of dramatic exceedances. The next monitoring event will be carried out in Bi-annual 1 in 2018. Information relating to previous results can be seen in the historical data tables in Appendix 1.

2.0 Appendix - Analysis Method

ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW154
Chloride 2.6-250 mg/l EW154
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 mg/l EW094
Nitrate 0.12-50 mg/l N EW154
Nitrite 0.013-1 mg/l N EW154
pH 4 – 10 pH Units EW153
Phosphate 0.009-1 mg/l P EW154
Alkalinity 10-1000mg/l EW153
TOC 0.25-100mg/l EW123
BOD 1-1300mg/l EW001
Total Nitrogen 1-100mg/l N EW140
Total Phosphorous 0.01-40 mg/l P EW143
Suspended Solids 5-1000mg/l EW013
Dissolved Oxygen 1 to 10 mg/l EW043
Conductivity 25-6000 us/cm EW154

Miscellaneous (P,G,S)
Bromate 1 to 50ug/l BRO3 EW137
Colour 2.5-50mg/l PtCCo EW154
Sulphate 1-250mg/l SO4 EW154
Total Dissolved Solids 15-1000mg/l EW046
Total Hardness 3-330mg/l CaCO3 EM099
Total Oxidised Nitrogen 0.138-51mg/l N EW051
Turbidity 0.11-150 NTU EW136
TKN Calculation 1-49 mg/l EW010

Metals EM130 (P,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 – 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 20.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI439 Potable Water VOCs & THM
EO025 (P,G,S,W)
Benzene 0.1-35 µg/l
1.2-Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-150 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S,W)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether 0.5 - 35 µg/l
11 Dichloroethene 0.5 - 35 µg/l
Iodomethane/Mehyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride 0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene 0.5 - 35 µg/l
Trans-1,2 Dichloroethene 0.5 - 35 µg/l
MtBE 0.5 - 35 µg/l
11 Dichloroethane 0.5 - 35 µg/l
Cis-12 Dichloroethene 0.5 - 35 µg/l
Methyl Acrylate 5.0 - 35 µg/l
Bromochloromethane 0.5 - 35 µg/l
Tetrahydrofuran 5.0 - 35 µg/l
111 Trichloroethane 0.5 - 35 µg/l
1-Chlorobutane 0.5 - 35 µg/l
Carbon Tetrachloride 0.5 - 35 µg/l
11 Dichloropropene 0.5 - 35 µg/l
12 Dichloropropane 0.5 - 35 µg/l
Dibromomethane 0.5 - 35 µg/l
Methyl Methacrylate 0.5 - 35 µg/l
13 Dichloropropene, cis 2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene 0.5 - 35 µg/l
13 Dichloropropene,trans 2.0 - 35 µg/l
Ethyl Methacrylate 2.0 - 35 µg/l
112 Trichloroethane 0.5 - 35 µg/l
13 Dichloropropane 0.5 - 35 µg/l
2 Hexanone 1.0 - 35 µg/l
12 Dibromoethane 0.5 - 35 µg/l
Chlorobenzene 0.5 - 35 µg/l
1112 Tetrachloroethane 2.0 - 35 µg/l
Ethyl Benzene 0.5 - 35 µg/l
m & p Xylene 0.5 - 35 µg/l
O Xylene 0.5 - 35 µg/l
Stryene 2.0 - 35 µg/l
Isopropyl Benzene 0.5 - 35 µg/l
Bromobenzene 0.5 - 35 µg/l
1122 Tetrachloroethane 0.5 - 35 µg/l
123 Trichloropropane 2.0 - 35 µg/l
Propyl Benzene 0.5 - 35 µg/l
2-Chlorotoluene 0.5 - 35 µg/l
4 Chlorotoluene 0.5 - 35 µg/l
135 Trimenthylbenzene 0.5 - 35 µg/l
Tert Butyl Benzene 0.5 - 35 µg/l
124 Trimethlbenzene 0.5 - 35 µg/l
Sec Butyl Benzene 0.5 - 35 µg/l
13 Dichlorobenzene 0.5 - 35 µg/l
P Isopropyltoluene 0.5 - 35 µg/l
14 Dichlorobenzene 0.5 - 35 µg/l
12 Dichlorobenzene 0.5 - 35 µg/l
N Butyl Benzene 0.5 - 35 µg/l
Hexachloroethane 5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene 0.5 - 35 µg/l
123 Trichlorobenzene 0.5 - 35 µg/l

Other VOC's EO025 (P,G,S)
22 Dichloropropane 0.5 - 35 µg/l

PAH EO129 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H

Organophosphorus Pesticides(P,G,S)
Range 0.01 - 0.2 µg/l
Famphur OP
Methyl Parathion OP
Parathion OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P'-DDD OC
P,P'-DDT OC

Notes

1.Sample Matrix:P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

ON SITE SAMPLING FORM

Facility Name: Ballyjamesduff | **Waste Licence No:** W0093-01

Report To:

Sampling Date: 01.11.17

Sample Type (GW, SW, Leachate) All

Personnel: Terry Keating

Weather: wet

Other Remarks:

GPS:

Sample Ref No	Sample Type	Time	DO Level	Elec Cond (us)	pH pH units	Temp ^{o}C	Visual
SW1	sw			335	7.50	10.4	Straw
SW2	sw			321	7.6	10.1	Clear
Discharge cap	sw			687	7.60	9.8	Straw

COMMENTS:

ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**119265 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119265/001
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	13/11/2017
Quotation No	QN006417	**Sample Type**	Surface Waters
Customer Ref	BJD Discharge Cap		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		<2.0	mg/L	INAB	
COD									
	COD		EW094	8		46	mg/L	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		5	mg/L	INAB	
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		1.047	mg/l N		
	Total Oxidised Nitrogen (TON) as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
	Chloride mg/L		EW175	1.0		17	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		13	mg/L	INAB	
Metals-Dissolved									
	Cadmium-Dissolved		EW188	0.1		0.1	ug/L	INAB	
	Calcium-Dissolved		EW188	1.0		72.0	mg/L	INAB	
	Copper-Dissolved		EW188	0.003		0.004	mg/L	INAB	
	Iron-Dissolved		EW188	20		5200	ug/L		
	Lead-Dissolved		EW188	0.3		0.6	ug/L	INAB	
	Magnesium-Dissolved		EW188	0.3		8.6	mg/L	INAB	
	Manganese-Dissolved		EW188	1.0		2600	ug/L		
	Mercury-Dissolved		EW188	0.02		0.05	ug/L	INAB	
	Potassium-Dissolved		EW188	0.2		5.2	mg/L	INAB	
	Sodium-Dissolved		EW188	0.5		11.2	mg/L	INAB	
	Zinc-Dissolved		EW188	1.0		7.1	ug/L	INAB	
Metals-Total									
	Chromium-Total		EW187	3.0		<3.0	ug/L	INAB	
Suspended Solids									
	Suspended Solids		EW013	5		13	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.0	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		438	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		201	mg/L CaCO3	INAB	

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email:info@elsltd.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**119265 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119265/001
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	13/11/2017
Quotation No	QN006417	**Sample Type**	Surface Waters
Customer Ref	BJD Discharge Cap		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.11	mg/l P	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**119265 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119265/002
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	13/11/2017
Quotation No	QN006417	**Sample Type**	Surface Waters
Customer Ref	BJD SW 2		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		<2.0	mg/L	INAB	
COD									
	COD		EW094	8		35	mg/L	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		5	mg/L	INAB	
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		0.035	mg/l N	INAB	
	Total Oxidised Nitrogen (TON) as N		EW175	0.15		0.38	mg/l N	INAB	
	Nitrate as N		EW175	0.15		0.38	mg/l N	INAB	
	Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
	Chloride mg/L		EW175	1.0		16	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		10	mg/L	INAB	
Metals-Dissolved									
	Cadmium-Dissolved		EW188	0.1		<0.1	ug/L	INAB	
	Calcium-Dissolved		EW188	1.0		26.9	mg/L	INAB	
	Copper-Dissolved		EW188	0.003		<0.003	mg/L	INAB	
	Iron-Dissolved		EW188	20		850	ug/L		
	Lead-Dissolved		EW188	0.3		<0.3	ug/L	INAB	
	Magnesium-Dissolved		EW188	0.3		5.2	mg/L	INAB	
	Manganese-Dissolved		EW188	1.0		240	ug/L		
	Mercury-Dissolved		EW188	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EW188	0.2		4.9	mg/L	INAB	
	Sodium-Dissolved		EW188	0.5		9.5	mg/L	INAB	
	Zinc-Dissolved		EW188	1.0		2.5	ug/L	INAB	
Metals-Total									
	Chromium-Total		EW187	3.0		<3.0	ug/L	INAB	
Suspended Solids									
	Suspended Solids		EW013	5		<5	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		205	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		75	mg/L CaCO3	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**119265 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119265/002
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	13/11/2017
Quotation No	QN006417	**Sample Type**	Surface Waters
Customer Ref	BJD SW 2		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.10	mg/l P	INAB	

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**119265 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119265/003
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	13/11/2017
Quotation No	QN006417	**Sample Type**	Surface Waters
Customer Ref	BJD SW1		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		11	mg/L	INAB	
COD									
	COD		EW094	8		68	mg/L	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		6	mg/L	INAB	
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		0.033	mg/l N	INAB	
	Total Oxidised Nitrogen (TON) as N		EW175	0.15		0.36	mg/l N	INAB	
	Nitrate as N		EW175	0.15		0.36	mg/l N	INAB	
	Nitrite as N		EW175	0.005		<0.005	mg/l N	INAB	
	Chloride mg/L		EW175	1.0		16	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		11	mg/L	INAB	
Metals-Dissolved									
	Cadmium-Dissolved		EW188	0.1		<0.1	ug/L	INAB	
	Calcium-Dissolved		EW188	1.0		26.5	mg/L	INAB	
	Copper-Dissolved		EW188	0.003		<0.003	mg/L	INAB	
	Iron-Dissolved		EW188	20		950	ug/L		
	Lead-Dissolved		EW188	0.3		<0.3	ug/L	INAB	
	Magnesium-Dissolved		EW188	0.3		5.0	mg/L	INAB	
	Manganese-Dissolved		EW188	1.0		270	ug/L		
	Mercury-Dissolved		EW188	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EW188	0.2		4.9	mg/L	INAB	
	Sodium-Dissolved		EW188	0.5		9.2	mg/L	INAB	
	Zinc-Dissolved		EW188	1.0		2.8	ug/L	INAB	
Metals-Total									
	Chromium-Total		EW187	3.0		4.1	ug/L	INAB	
Suspended Solids									
	Suspended Solids		EW013	5		109	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.2	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		205	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		74	mg/L CaCO3	INAB	

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Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119265/003
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	13/11/2017
Quotation No	QN006417	**Sample Type**	Surface Waters
Customer Ref	BJD SW 1		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.45	mg/l P	INAB	

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5.0 APPENDIX -HISTORICAL RESULTS

	Surface Water Historical Results								
	Parameter	Ammonia	pH	Cond	BOD	COD	Total Suspended Solids	Cl	DO
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l
SW1	Second biannual 2017	0.033	7.2	205	***11***	68	***109***	16	6
	First biannual 2017	0.079	7.3	284	1.7	21	<5	17	7
	Second biannual 2016	0.112	7	239	***32***	61	***138***	12	<1
	First biannual 2016	0.2	7.5	191	1.5	19	9	12	10
	Second biannual 2015	0.071	7.5	304	<1	19	<5	15	9
SW2	Second biannual 2017	0.035	7.1	205	<2.0	35	<5	16	5
	First biannual 2017	0.069	7.2	286	1.7	23	<5	17	6
	Second biannual 2016	0.127	7.1	244	***9.5***	52	26	13	<1
	First biannual 2016	**0.29**	7.6	198	1.4	21	13	12	10
	Second biannual 2015	0.077	7.3	300	2.7	21	34	16	8
Discharge Cap	Second biannual 2017	***1.047***	7	438	<2.0	46	13	17	5
	First biannual 2017	***0.538***	7.8	318	1.7	14	<5	6.8	9
	Second biannual 2016	***0.353***	7.1	540	<2	19	11	3.5	7
	First biannual 2016	***1.2***	7.5	191	<1	19	<5	7.6	6
	Second biannual 2015	***7.9***	7.3	708	<2.6	19	8	20	4
S.I No. 294/1989 A1		0.2	≥5.5 and ≤8.5	1000	5		50	250	>60%

WASTE WATER MONITORING REPORT
BALLYJAMESDUFF LANDFILL W0093-01
BI-ANNUAL 2 OF 2 2017

Document No.: CCC-03-01-07-03-Rev 1

Project No.: CCC-03-01

Client: Cavan County Council

Project Name: Ballyjamesduff Landfill
Derrylurgan
Ballyjamesduff
Co. Cavan

Summary of Document Revisions		
Rev No.	**Date Revised**	**Revision Description**

Prepared by	Terry Keating	23/01/18
Approved by	Gareth O'Brien	24/01/18

CONTENTS

LIST OF TABLES

1 SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out environmental monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan on a bi-annual basis 2017. This report documents the finding from the waste water (leachate) sampling and monitoring undertaken at Ballyjamesduff Landfill on 01st November 2017 (bi-annual 2 of 2).

2 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600 m north of Ballyjamesduff town centre in the townland of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 2002. A waste licence (W0093-01) was issued by the Environmental Protection Agency (EPA) after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the surface water, sampling programme conducted on site and also summarises findings and analytical results for Bi-annual 2 of 2 2017. The purpose of environmental monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behaviour with expected/modelled behaviour
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Ballyjamesduff landfill is situated in the R21 Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R21 Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste license - (EPA, Groundwater Protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

The generation of leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

3 METHODOLOGY

3.1 Environmental Monitoring and Sampling

The following procedure was conducted by Boylan Engineering to ensure accurate leachate monitoring:

- ISO 5667: Guidance on sampling of groundwater is adhered to.
- Prior to sampling, the depth of water in wells was measured by dipping.
- Sampling was conducted using a Waterra inertial lift pump and associated tubing, pumping water directly from the borehole to the appropriate sampling bottles.
- Designated tubing was used at each location.

- Having obtained a representative sample the following parameters are measured on-site using a Hanna HI 98129 combination waterproof high accuracy analyser and a Hanna 9164 meter, respectively.
    - Conductivity
    - Temperature
    - pH

3.2 Laboratory Analysis

- Samples were sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes ensure that samples are maintained at a consistent temperature between 0° C and 4° C on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0° C and 4° C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 2.

3.3 Weather Report

The weather report for Bi-annual 2 of 2 2017 are presented in the tables below.

Table 1 Weather Report Bi -annual 2 of 2 2017

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Maximum Gust	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
01/11/2017	0.3	13.9	9.2	6.4	5.3		

3.4 Monitoring Locations

Waste water (leachate) samples were retrieved from MW7 and MW8 during the Bi-annual 2 of 2 monitoring round. MW6 was unable to be accessed during the monitoring round due to a blockage. The monitoring locations presented in Table 2 below.

Table 2 Monitoring Locations Waste water Bi-annual 2 of 2 2017

Bi-annual 2 of 2 2017					
Monitoring Well	Sample Type	Cover Level M (OD Malin Head)	Water Level M (OD Malin Head)	Water Depth M (Top of Casing)	National Grid Co-Ordinates
MW6	Leachate	100.71	-	n/a	TBC
MW7	Leachate	97.54	-	4.1	TBC
MW8	Leachate	96.56	-	3.42	N291346.99 E252041.22

4 SUMMARY OF RESULTS

A summary of the waste water (leachate) monitoring results for Bi annual 2 of 2 2017 are presented in Table 3 below and Appendix 1.

Table 3 Bi -annual 2 of 2 2017 Waste Water Monitoring Analytical Results

Report Number	119226
Monitoring Date:	01/11/2017

Method Number			**EW154M**	**EW154M**	**EW153**	**EW153**	**EW001**	**EW096**	**EW154M-1**		**MIC133**		**EW137**	**DEFAULT**	**EW146**
Parameter		Visual Inspection	Ammonia (as N)	TON (as N)(Calc)	pH	Conductivity @20 DegC	BOD	COD	Chloride	Sulphate	E. Coli	Total Coliforms	Fluoride	Total Cyanide High	Total Phosphorus-TP
Units			mg/l N	mg/l N	pH Units	uscm-1@20	mg/L	mg/L	mg/L	mg/L	MPN/100ml	MPN/100ml	mg/L	ug/L	mg/l P
Limit of Detection		-	0.007	0.138	0.3	25	1	8	2.6	1	0	0	0.1	10	0.01
Date Testing		1.11.17	2.11.17												
ELS Ref	**Client Ref**														
119226	MW7	Straw	***24***	<0.69	7.1	***1271***	35	347	23	<5.0	<10	***51***	<0.10	<9	1
119226	MW8	Straw	***39***	<0.69	7.1	***1483***	47	249	***35***	5.7	<10	***1198***	<0.10	<9	1.1
Inerim Guide Value			0.15	-	≥6.5&≤9.5	1000	-	-	30	200	0	0	1	0.01	-

Method Number		**EM130**												
Parameter		Chromium-Total	Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved
Units		ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	mg/L
Limit of Detection		1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1	0.02
Date Testing		2.11.17												
ELS Ref	**Client Ref**													
119226	MW7	28.9	***61000***	***4000***	***20.3***	21.6	<0.1	***206.8***	<0.003	<0.3	40.7	<0.02	2.2	0.00034
119226	MW8	14.3	***29000***	***1600***	***39.8***	36.8	<0.1	***210.5***	<0.003	<0.3	43.2	0.02	2.5	0.4
Inerim Guide Value		30	200	50	5	150	5	200	0.03	10	50	1	100	1

Exceedance

NOTES

1 Sub-contract analysis denoted by *

2 ND = Concentration was below the limit of detection

As there are no limits set in the waste licence for leachate, results are compared to the Interim Guideline Values (IGVs) for the protection of Groundwater in Ireland, where availab

5 DISCUSSION OF RESULTS

5.1 Discussion of Results

Leachate consists of water that has become contaminated as it passes through a waste disposal site. It contains insoluble waste constituents which have not degraded chemically or biochemically. This leachate can cause a threat to surrounding surface and groundwater. The composition of leachate will vary depending on the age of the landfill. As there are no limits set in the waste licence for leachate, results are compared to the Interim Guideline Values (IGVs) for the protection of Groundwater in Ireland, where available. Results in bold italics indicate where the IGVs has been exceeded.

Leachate samples were retrieved from MW7 and MW8 during monitoring. As previously noted, MW6 was unable to be accessed due to a blockage and remedial work is required. Results show that the IGVs were exceeded on this occasion at both monitoring wells for the ammonia, conductivity, total coliforms, iron, manganese and potassium, calcium. Additionally, chloride marginally exceeded the IGV at leachate monitoring well MW8. When compared to historical data, these results are consistent with those obtained in previous monitoring events. Historical leachate results are presented in Appendix 2.

6 CONCLUSION

The leachate results obtained are relatively consistent with previous monitoring events and do not show any signs of dramatic exceedances. Therefore there is no evidence of any major negative environmental impact associated with this landfill. Information relating to previous results can be seen in the historical data tables in Appendix 2.

2.0 Appendix - Analysis Method

ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW154
Chloride 2.6-250 mg/l EW154
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 mg/l EW094
Nitrate 0.12-50 mg/l N EW154
Nitrite 0.013-1 mg/l N EW154
pH 4 – 10 pH Units EW153
Phosphate 0.009-1 mg/l P EW154
Alkalinity 10-1000mg/l EW153
TOC 0.25-100mg/l EW123
BOD 1-1300mg/l EW001
Total Nitrogen 1-100mg/l N EW140
Total Phosphorous 0.01-40 mg/l P EW143
Suspended Solids 5-1000mg/l EW013
Dissolved Oxygen 1 to 10 mg/l EW043
Conductivity 25-6000 us/cm EW154

Miscellaneous (P,G,S)
Bromate 1 to 50ug/l BRO3 EW137
Colour 2.5-50mg/l PtCCo EW154
Sulphate 1-250mg/l SO4 EW154
Total Dissolved Solids 15-1000mg/l EW046
Total Hardness 3-330mg/l CaCO3 EM099
Total Oxidised Nitrogen 0.138-51mg/l N EW051
Turbidity 0.11-150 NTU EW136
TKN Calculation 1-49 mg/l EW010

Metals EM130 (P,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 – 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 20.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI439 Potable Water VOCs & THM
EO025 (P,G,S,W)
Benzene 0.1-35 µg/l
1.2-Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-150 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S,W)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether 0.5 - 35 µg/l
11 Dichloroethene 0.5 - 35 µg/l
Iodomethane/Mehyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride 0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene 0.5 - 35 µg/l
Trans-1,2 Dichloroethene 0.5 - 35 µg/l
MtBE 0.5 - 35 µg/l
11 Dichloroethane 0.5 - 35 µg/l
Cis-12 Dichloroethene 0.5 - 35 µg/l
Methyl Acrylate 5.0 - 35 µg/l
Bromochloromethane 0.5 - 35 µg/l
Tetrahydrofuran 5.0 - 35 µg/l
111 Trichloroethane 0.5 - 35 µg/l
1-Chlorobutane 0.5 - 35 µg/l
Carbon Tetrachloride 0.5 - 35 µg/l
11 Dichloropropene 0.5 - 35 µg/l
12 Dichloropropane 0.5 - 35 µg/l
Dibromomethane 0.5 - 35 µg/l
Methyl Methacrylate 0.5 - 35 µg/l
13 Dichloropropene, cis 2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene 0.5 - 35 µg/l
13 Dichloropropene,trans 2.0 - 35 µg/l
Ethyl Methacrylate 2.0 - 35 µg/l
112 Trichloroethane 0.5 - 35 µg/l
13 Dichloropropane 0.5 - 35 µg/l
2 Hexanone 1.0 - 35 µg/l
12 Dibromoethane 0.5 - 35 µg/l
Chlorobenzene 0.5 - 35 µg/l
1112 Tetrachloroethane 2.0 - 35 µg/l
Ethyl Benzene 0.5 - 35 µg/l
m & p Xylene 0.5 - 35 µg/l
O Xylene 0.5 - 35 µg/l
Stryene 2.0 - 35 µg/l
Isopropyl Benzene 0.5 - 35 µg/l
Bromobenzene 0.5 - 35 µg/l
1122 Tetrachloroethane 0.5 - 35 µg/l
123 Trichloropropane 2.0 - 35 µg/l
Propyl Benzene 0.5 - 35 µg/l
2-Chlorotoluene 0.5 - 35 µg/l
4 Chlorotoluene 0.5 - 35 µg/l
135 Trimenthylbenzene 0.5 - 35 µg/l
Tert Butyl Benzene 0.5 - 35 µg/l
124 Trimethlbenzene 0.5 - 35 µg/l
Sec Butyl Benzene 0.5 - 35 µg/l
13 Dichlorobenzene 0.5 - 35 µg/l
P Isopropyltoluene 0.5 - 35 µg/l
14 Dichlorobenzene 0.5 - 35 µg/l
12 Dichlorobenzene 0.5 - 35 µg/l
N Butyl Benzene 0.5 - 35 µg/l
Hexachloroethane 5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene 0.5 - 35 µg/l
123 Trichlorobenzene 0.5 - 35 µg/l

Other VOC's EO025 (P,G,S)
22 Dichloropropane 0.5 - 35 µg/l

PAH EO129 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H

Organophosphorus Pesticides(P,G,S)
Range 0.01 - 0.2 µg/l
Famphur OP
Methyl Parathion OP
Parathion OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P'-DDD OC
P,P'-DDT OC

Notes

1.Sample Matrix:P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Gareth O Brien	**Report Number**	**119266 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119266/001
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	17/11/2017
Quotation No	QN006417	**Sample Type**	Waste Water
Customer Ref	MW 7 WW		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.035		24	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.60		<0.60	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.065		<0.065	mg/l N	INAB	
TON (as N)		EW154M-1	0.69		<0.69	mg/l N		
AQ2-UP2								
Chloride		EW154M-1	13		23	mg/L	INAB	
Sulphate		EW154M-1	5.0		<5.0	mg/L	INAB	
BOD								
BOD		EW001	1		35	mg/L	INAB	
COD								
COD		EW094	8		347	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	10		51	MPN/100ml		
E. Coli		MIC133	10		<10	MPN/100ml	INAB	
Ion Chromatography								
Fluoride		EW137	0.10		<0.10	mg/L	INAB	
Metals-Dissolved								
Boron-Dissolved		EW188	0.02		0.34	ug/L		
Calcium-Dissolved		EW188	1.0		206.8	mg/L		
Iron-Dissolved		EW188	20		61000	ug/L		
Magnesium-Dissolved		EW188	0.3		40.7	mg/L		
Manganese-Dissolved		EW188	1.0		4000	ug/L		
Potassium-Dissolved		EW188	0.2		20.3	mg/L		
Sodium-Dissolved		EW188	0.5		21.6	mg/L		
Cadmium-Dissolved		EW188	0.1		<0.1	ug/L		
Copper-Dissolved		EW188	0.003		<0.003	mg/L		
Lead-Dissolved		EW188	0.3		<0.3	ug/L		
Zinc-Dissolved		EW188	1.0		2.2	ug/L		
Mercury-Dissolved		EW188	0.02		<0.02	ug/L		
Metals-Total								
Chromium-Total		EW187	3.0		28.9	ug/L	INAB	
Temperature (Site)								

Signed : _____ 17/11/2017

Domenico Giliberti-Technical Manager

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Contact Name	Gareth O Brien	**Report Number**	**119266 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119266/001
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	17/11/2017
Quotation No	QN006417	**Sample Type**	Waste Water
Customer Ref	MW 7 WW		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153			7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		1271	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	9		<9	ug/L	YES	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.1		1.0	mg/l P	INAB	

Signed : 17/11/2017

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Contact Name	Gareth O Brien	**Report Number**	**119266 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119266/002
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	17/11/2017
Quotation No	QN006417	**Sample Type**	Waste Water
Customer Ref	MW 8 WW		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.035		39	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.60		<0.60	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.065		<0.065	mg/l N	INAB	
TON (as N)		EW154M-1	0.69		<0.69	mg/l N		
AQ2-UP2								
Chloride		EW154M-1	13		35	mg/L	INAB	
Sulphate		EW154M-1	5.0		5.7	mg/L	INAB	
BOD								
BOD		EW001	1		47	mg/L	INAB	
COD								
COD		EW094	8		249	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	10		1198	MPN/100ml		
E. Coli		MIC133	10		<10	MPN/100ml	INAB	
Ion Chromatography								
Fluoride		EW137	0.10		<0.10	mg/L	INAB	
Metals-Dissolved								
Boron-Dissolved		EW188	0.02		0.40	ug/L		
Calcium-Dissolved		EW188	1.0		210.5	mg/L		
Iron-Dissolved		EW188	20		29000	ug/L		
Magnesium-Dissolved		EW188	0.3		43.2	mg/L		
Manganese-Dissolved		EW188	1.0		1600	ug/L		
Potassium-Dissolved		EW188	0.2		39.8	mg/L		
Sodium-Dissolved		EW188	0.5		36.8	mg/L		
Cadmium-Dissolved		EW188	0.1		<0.1	ug/L		
Copper-Dissolved		EW188	0.003		<0.003	mg/L		
Lead-Dissolved		EW188	0.3		<0.3	ug/L		
Zinc-Dissolved		EW188	1.0		2.5	ug/L		
Mercury-Dissolved		EW188	0.02		0.02	ug/L		
Metals-Total								
Chromium-Total		EW187	3.0		14.3	ug/L	INAB	
Temperature (Site)								
Temperature (Site)		Default	0.0		Not Analyzed	Deg C		

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Contact Name	Gareth O Brien	**Report Number**	**119266 - 1**
Address	Boylan Engineering & Environmental Ltd. Main Street,	**Sample Number**	119266/002
		Date of Receipt	02/11/2017
		Date Started	02/11/2017
Tel No	046 9286000	**Received or Collected**	Courier
Customer PO	Per Batch	**Date of Report**	17/11/2017
Quotation No	QN006417	**Sample Type**	Waste Water
Customer Ref	MW 8 WW		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153			7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		1483	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	9		<9	ug/L	YES	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.1		1.1	mg/l P	INAB	

Signed : 17/11/2017

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4.0 APPENDIX - HISTORICAL RESULTS

		Lechate historical Results						
	Parameter	Ammonia	TON	pH	Cond	BOD	COD	Cl
	Units	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l
WELL MW 7	Second biannual 2017	***24***	<0.69	7.1	***1271***	35	347	23
	First Biannual 2017	**-**	-	-	**-**	-	-	-
	Second biannual 2016	***34***	0.83	7.3	***1422***	27	30	***43***
	First Biannual 2016	***17***	<0.69	7	***1035***	21.9	65	15
	Second biannual 2015	***16***	<0.69	6.9	***1044***	<10	69	13
WELL MW 8	Second biannual 2016	***39***	<0.69	7.1	***1483***	47	249	***35***
	First Biannual 2017	***30***	<0.69	7.1	***1361***	29	42	***42***
	Second biannual 2016	***19***	<0.69	6.7	***1094***		30	21
	First Biannual 2016	***31***	<0.69	7.5	***1362***	18.9	46	***37***
	Second biannual 2015	***33***	1.1	7.4	***1447***	57	89	***37***
Interim Guide Values		0.15	NAC	≥6.5&≤9.5	1000			30

GAS MONITORING REPORT
BALLYJAMESDUFF LANDFILL W0093-01
Quarter 3 & 4 2017

Document No.: CCC-03-01-07-03-Rev 1

Project No.: CCC-03-01

Client: Cavan County Council

Project Name: Ballyjamesduff Landfill
Derrylurgan
Ballyjamesduff
Co. Cavan

Summary of Document Revisions		
Rev No.	**Date Revised**	**Revision Description**

Prepared by	Terry Keating	23/01/18
Approved by	Gareth O'Brien	24/01/18

CONTENTS

LIST OF TABLES

1 SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out environmental monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan for Quarter 3 (Q3) and Quarter 4 (Q4) 2017. This report documents the finding from the gas sampling and monitoring undertaken at Ballyjamesduff Landfill on 29th of August 2017 (Q3) and 14th of December 2017 (Q4).

2 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600m from Ballyjamesduff town centre in the town land of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 2002. A waste licence (W0093-01) was issued by the Environmental Protection Agency (EPA) after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the landfill gas sampling programme conducted on site and also summarises findings and analytical results for Q3 and Q4 of 2017. The purpose of environmental monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behaviour with expected/modelled behaviour
- Establish a reliable database of information for the landfill throughout its life

Landfill gas is generated by decomposition of organic materials in waste deposited at landfills. Typically, the gas is a mixture of Methane (up to 65% by volume) Carbon Dioxide (up to 35% per volume). It can also contain minor constituents at low concentrations (typically less than 1% volume contains 120-150 trace constituents). The landfill directive requires that appropriate measures are taken in order to control the accumulation and migration of landfill gas.

3 METHODOLOGY

3.1 Environmental Monitoring and Sampling

The following procedure is conducted by Boylan Engineering to ensure accurate gas monitoring:

- EPA, Landfill Manual, landfill monitoring 2nd Edition is adhered to.
- Prior to sampling, a dip meter is used to measure water levels, if present, in the wells.
- GA 2000 landfill gas analyser is used to measure the gas levels.
- The analyser is purged and connected to the sealed well monitoring nozzle.
- The monitoring nozzle is turned to the open position and the analyser measured the gas levels at 60 second intervals for no less than 10 minutes. The analyser is allowed to run for this period of time to allow for a representative average to be obtained.

- All data is recorded on the Gas Analysis field sheet.
- The instrument is removed after 10 minutes and the monitoring nozzle returned to the closed position.
- The GA2000 is switched off between each monitoring location so as to allow the instrument to purge.
- This process is repeated at each monitoring location.
- Data for the GA 2000 was downloaded in the Boylan Engineering office.

3.2 Weather Report

The weather report for Q3 and Q4 gas monitoring are presented in the Table 1 and Table 2 below.

Table 1 Weather Report Quarter 3 of 4 2017

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min Temp (°C)	Mean Wind Speed (knots)	Maximum Gust (if >= 34 knots)	Sunshine (hours)
29/08/2017	4.2	13.9	8.6	3.3	4.2		

Table 2 Weather Report Quarter 4 of 4 2017

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min Temp (°C)	Mean Wind Speed (knots)	Maximum Gust (if >= 34 knots)	Sunshine (hours)
14/12/2017	10.4	5.6	1	-0.4	9.3		

3.3 Monitoring Locations

The gas monitoring locations for Q3 and Q4 of 2017 are presented in the Tables 3 and Table 4 below.

Table 3 Gas Monitoring Locations Quarter 3 of 4 of 2017

Quarter 3 2017					
Monitoring Well	**Sample Type**	**Cover Level M (OD Malin Head)**	**Water Level M (OD Malin Head)**	**Water Depth M (Top of Casing)**	**National Grid Co-Ordinates**
MW1	Gas	94.92	94.92		N291352.31 E252020.68
MW2	Gas	92.92	92.92		N291377.38 E252082.84
MW5	Gas	92.84	-	n/a	TBC
MW12	Gas	94.38	-	n/a	N291236.30 E252110.10
MW13	Gas	94.69	-	n/a	TBC
MW14	Gas	98.77	-	n/a	N291263.92 E252131.54
MW15	Gas	93.11	-	n/a	TBC

Table 4 Gas Monitoring Locations Quarter 4 of 4 2017

Q4 2017					
Monitoring Well	**Sample Type**	**Cover Level M (OD Malin Head)**	**Water Level M (OD Malin Head)**	**Water Depth M (Top of Casing)**	**National Grid Co-Ordinates**
MW1	Gas	94.92	94.92		N291352.31 E252020.68
MW2	Gas	92.92	92.92		N291377.38 E252082.84
MW5	Gas	92.84	-	n/a	TBC
MW12	Gas	94.38	-	n/a	N291236.30 E252110.10
MW13	Gas	94.69	-	n/a	TBC
MW14	Gas	98.77	-	n/a	N291263.92 E252131.54
MW15	Gas	93.11	-	n/a	TBC

4 SUMMARY OF RESULTS

A summary of the gas monitoring results for Q3 and Q4 of 2017 are presented in Table 5 and Table 6 below.

Table 5 Quarter 3 of 4 2017 Gas Monitoring Analytical Results

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000	
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure	Position to waste mass
Units		% v/v	% v/v	%	PPM	mb	
Date Testing		29/08/2017					
GA 2000 Ref	Client Ref						
1	MW 1	0	0.1	20.72	0	29.62	Outside
3	MW 2	0	0.2	20.5	0	29.62	Outside
7	MW5	0.1	0.1	20.7	0	29.62	Outside
6	MW 12	0.0	0.1	20.7	0	29.6	Inside
2	MW 13	0	0.1	20.32	0	29.62	Outside
4	MW 14	6.3	10.2	13.3	0	29.62	Inside
5	MW 15	0.0	0.3	20.4	0	29.6	Outside
	Limit	1	1.5				
Exceedance,outside waste mass							
NOTES							
1	Instrument Serial No: GA 07721						
2	Limit: Schedule C2, Licence						

Table 6 Quarter 4 of 4 2017 Gas Monitoring Analytical Results

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000	
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure	Position to waste mass
Units		% v/v	% v/v	%	PPM	mb	
Date Testing		14/12/2017					
GA 2000 Ref	Client Ref						
1	MW 1	0	0.1	19.78	0	29.62	Outside
3	MW 2	0	0.1	20.76	0	29.62	Outside
7	MW5	0.1	0.1	19.6	0	29.62	Outside
6	MW 12	0.0	0.1	20.7	0	29.6	Inside
2	MW 13	0	0.1	20.3	0	29.62	Outside
4	MW 14	7.46	10.18	38.16	0	29.62	Inside
5	MW 15	0.0	0.3	20.4	0	29.6	Outside
	Limit	1	1.5				
Exceedance,outside waste mass							
NOTES							
1	Instrument Serial No: GA 07721						
2	Limit: Schedule C2, Licence						

5 DISCUSSION OF RESULTS

5.1 Discussion of Results

The rate of gas generation at a landfill site varies through the life of a landfill and is dependent on several factors such as waste type, depths, moisture content, degree of compaction, landfill pH, temperature and the length of time since the waste was deposited. Landfill gas can move in any direction within the waste body and migrate from a site. The potential for gas migration will depend on the gas quality, volume, the site engineering works, geological characteristics of the surrounding strata and on man-made pathways such as sewers and drains.

Results obtained from monitoring during Q3 and Q4 of 2017 are relatively consistent with previous results and as the well is within the waste mass it is not observed as being an exceedance. It is preferable that the results are within the limits stipulated within the licence.

6 CONCLUSION

The results obtained from landfill gas monitoring are also relatively consistent with previous monitoring events and do not show any signs of dramatic exceedances and therefore there is no evidence of any major negative environmental impact associated with this landfill. However, it is important to monitor the trend in exceedance of methane at this landfill and any dramatic increase in the parameter should be regarded as critical. The methane content of landfill gas is flammable, forming potentially explosive mixtures in certain conditions, which raises concern about its uncontrolled migration and release. The next environmental and landfill gas monitoring will be conducted in the Q1 of 2018.

2.0 APPENDIX-HISTORICAL DATA

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		% v/v	% v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2017	0	0.1	19.78	0	29.62
	Qtr 3 2017	0	0.1	20.72	0	29.62
	Qtr 2 2017	0	0.1	19.76	0	996
	Qtr 1 2017	0	0.1	19.7	0	996
MW 2	Qtr 4 2017	0	0.1	20.76	0	29.62
	Qtr 3 2017	0	0.2	20.5	0	29.62
	Qtr 2 2017	0	0.1	19.58	0	996
	Qtr 1 2017	0	0.1	19.54	0	996
MW 5	Qtr 4 2017	0.1	0.1	19.6	0	29.62
	Qtr 3 2017	0.1	0.1	20.7	0	29.62
	Qtr 2 2017	0.1	0.1	20.28	0	999
	Qtr 1 2017	0.1	0.1	20.16	0	999
MW 12	Qtr 4 2017	0.0	0.1	20.7	0	29.6
	Qtr 3 2017	0.0	0.1	20.7	0	29.6
	Qtr 2 2017	0.0	0.1	20.9	0	994.0
	Qtr 1 2017	0.0	0.1	20.8	0	994.0
MW 13	Qtr 4 2017	0	0.1	20.3	0	29.62
	Qtr 3 2017	0	0.1	20.32	0	29.62
	Qtr 2 2017	0	0.1	21.5	0	996
	Qtr 1 2017	0	0.1	21.28	0	996
MW 14	Qtr 4 2017	7.46	10.18	38.16	0	29.62
	Qtr 3 2017	6.3	10.2	13.3	0	29.62
	Qtr 2 2017	9.32	10.4	13.24	0	995
	Qtr 1 2017	9.5	10.36	13.06	0	995
MW 15	Qtr 4 2017	0	0.32	20.42	0	29.62
	Qtr 3 2017	0	0.3	20.38	0	29.62
	Qtr 2 2017	0.54	0	18.14	0	994
	Qtr 1 2017	0.6	0	17.56	0	994
	Limit	**1**	**2**			
Exceedance of waste						

NOTES

1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence