COMHAIRLE CHONDAE AN CABHÁIN

Cavan County Council

Annual Environmental Report 2014

Bailieborough Landfill WL0091-1

Document Title	Annual Environmental Report 2014 Bailieborough Landfill WL0091-1		
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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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1.0 INTRODUCTION

Bailieborough Landfill has been operated as waste disposal facility by Cavan County Council since the late 1960s. The landfill is located on the outskirts of the town of Bailieborough, (c. 1 km from town centre), in the town land of Tanderagee, which was a commercially exploited bog. 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. The total area of the site comprises 2.23 hectares.

A Waste Licence for the facility was issued by the EPA on 22nd February 2002, when the site officially closed and was thereafter remediated. Condition 11.6 of Waste Licence Ref. 91-1 requires the submission of an Annual Environmental Report (AER) for Bailieborough Landfill facility. This document is produced in order to comply with requirements of Condition 11.6.

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".

2.0 REPORTING PERIOD

The reporting period for the purpose of this AER is 01st January 2014 - 31st December 2014.

3.0 WASTE ACTIVITIES CARRIED OUT AT THE FACILITY

There were no waste activities carried out at the facility.

4.0 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.

5.0 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.

Cavan County Council now carries out the full scope of sampling as required by the Licence. Monitoring had been reduced at the time of the restoration works and the full sampling regime had not been re-established until late 2009 when advised by the Agency.

5.1 Surface Water

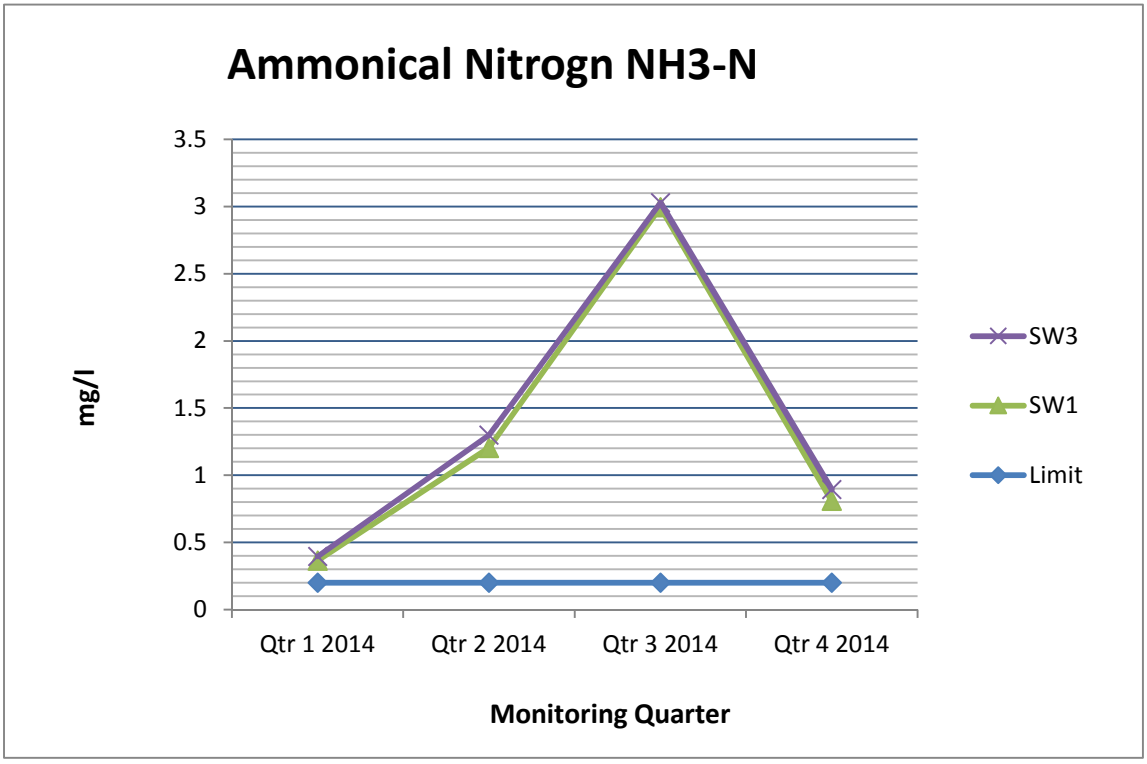
All monitoring locations are detailed in the site map which is presented in Appendix B.

As table 5.1 reveals, there were elevated levels of Ammonia, COD, Iron and Manganese levels recorded in the samples taken at the SW1 and SW3. SW1 is located downstream of the landfill while SW3 is located further downstream at the new monitoring location SW3 "Chapel Lough".

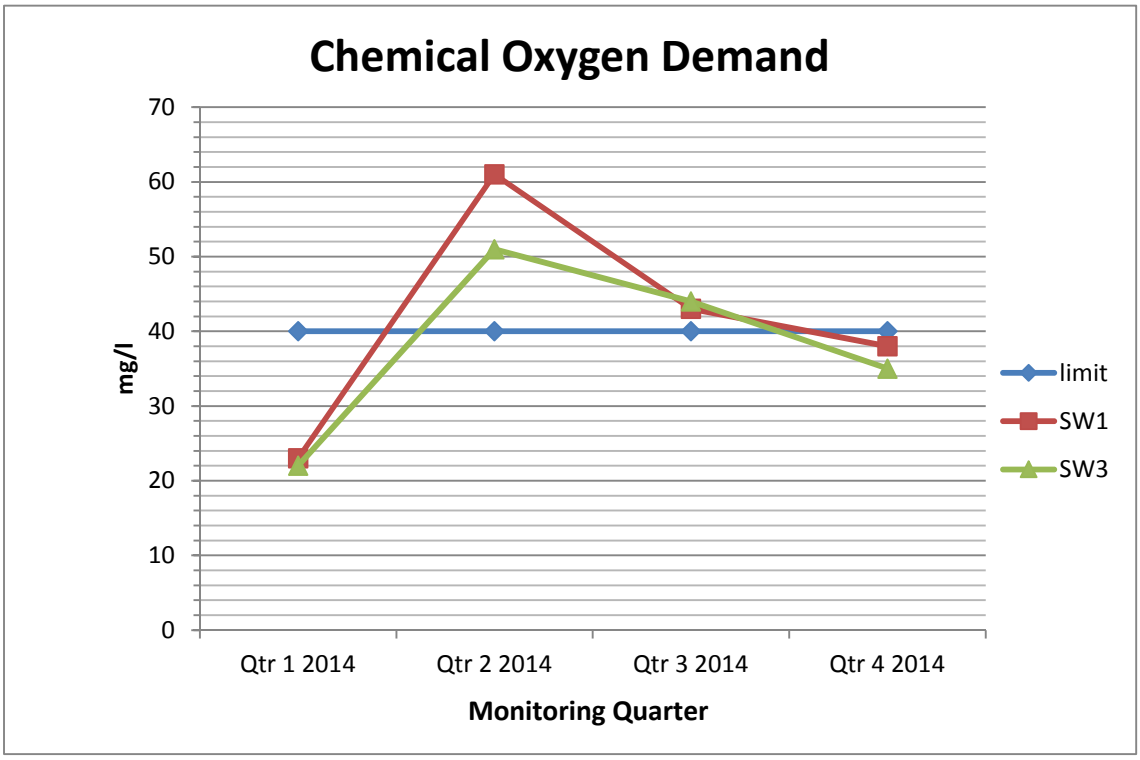
Table 5.1 Surface water summary results

	Parameter	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	DO	Fe	Mn	K	Na
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	ug/l	ug/l	mg/l	mg/l
Discharge Cap	Qtr 4 2014	0.083	7.8	423	<1	17	3.8	937	2.08	10	<20	29	7.1	6.5
	Qtr 3 2014	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2014	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 1 2014	0.026	7.2	173	<1	10	7.4	43.7	0.016	10	36.8	6	3.8	5.5
SW1	Qtr 4 2014	***0.61***	7	274	<1	38	13.5	45.8	2.501	8	***690***	***240***	4.8	11.9
	Qtr3 2014	***2.795***	7.2	410	4	***43***	18.9	4.8	0.096	9	***3738***	***1879.7***	7.4	16.4
	Qtr 2 2014	***1.003***	7	324	<1	***61***	13	4.2	<0.009	7	***1478.3***	***2929***	8.4	16
	Qtr 1 2014	0.165	6.9	212	<1	23	15.7	28.2	<0.009	8	***209.7***	41.2	5.7	10.8
SW3	Qtr 4 2014	0.084	7.2	273	<1	35	13	50.3	3.274	9	150	***65***	4.8	12.8
	Qtr 3 2014	0.034	7.2	325	5	***44***	16.1	18.3	0.017	9	***1900.9***	***972.5***	4.7	15.9
	Qtr 2 2014	0.096	7.1	265	<1	***51***	7.6	19.7	<0.009	8	***1002.4***	***1275.4***	5.1	13.8
	Qtr 1 2014	0.03	6.9	218	<1	22	17.3	31.1	<0.009	9	199.2	36	5.7	11.7
S.I No 294/1989		0.2	≥5.5 and ≤8.5	1000	5	40	250	200		NAC	200	50		

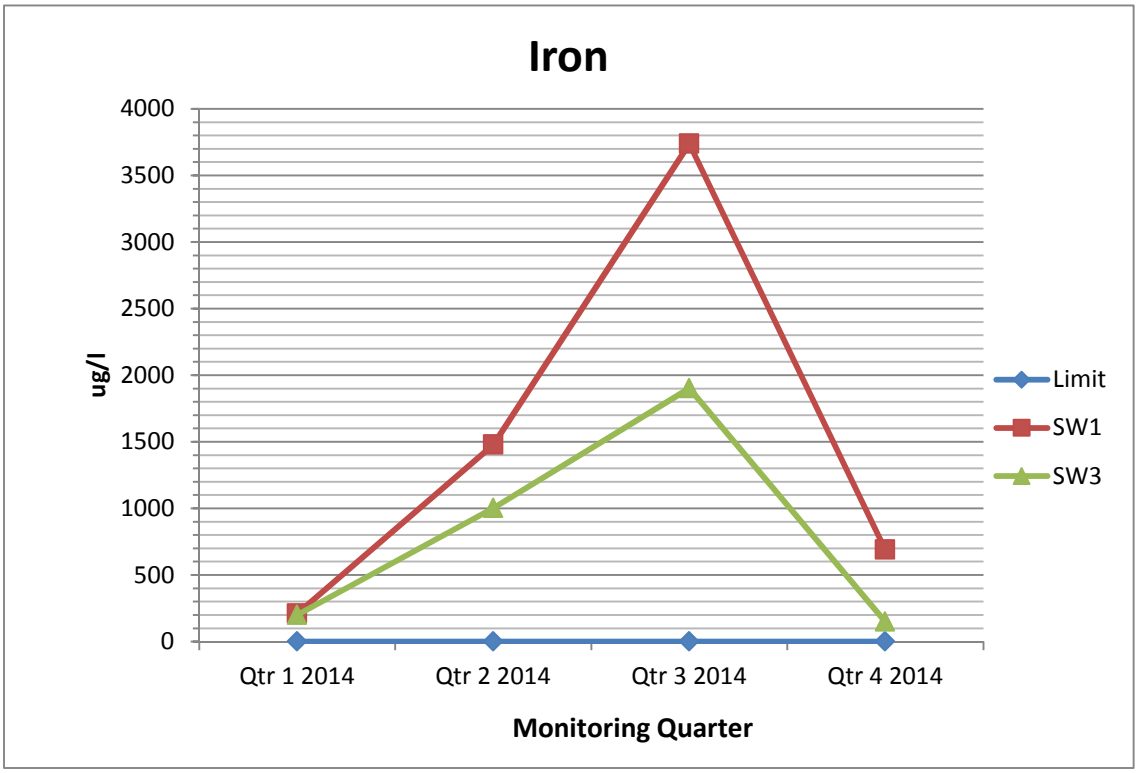
Graph 5.1



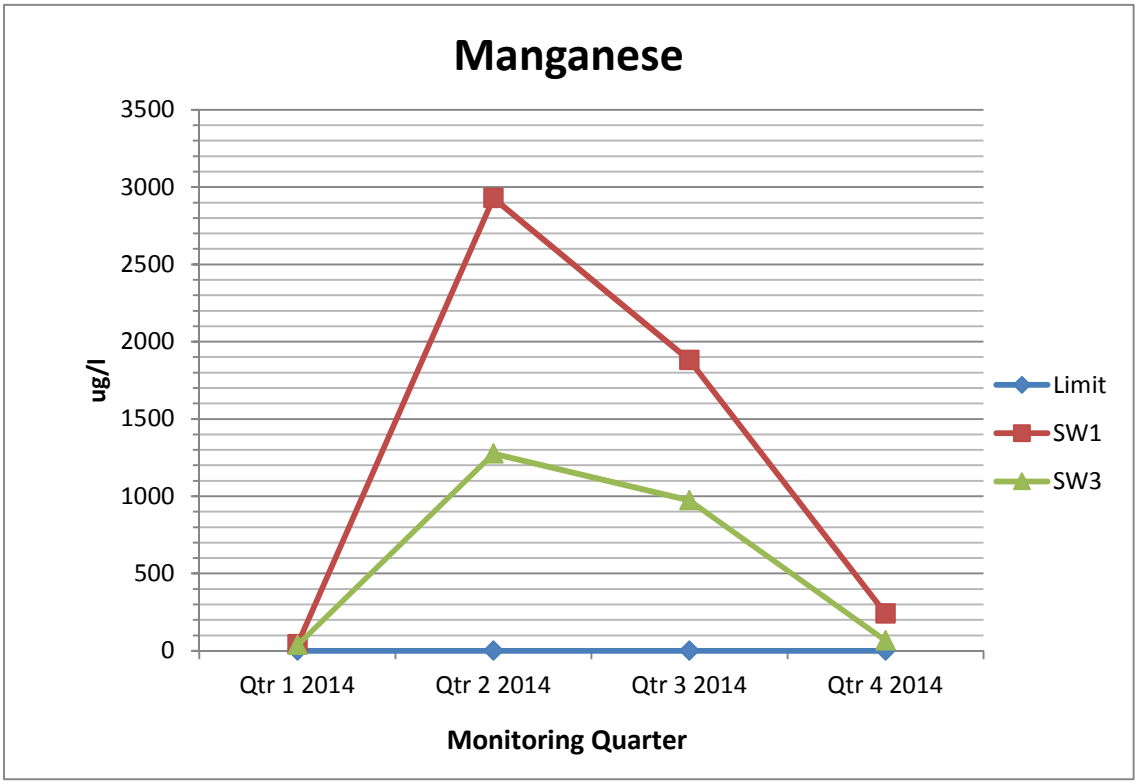
Graph 5.2



Graph 5.3



Graph 5.4



Elevated levels of Iron and Manganese can be attributed to the natural composition of the underlying geology however it is not uncommon to encounter high levels of both parameters in the vicinity of landfills. The elevated levels of Ammonia and COD encountered at SW1 and SW3 are attributed to low flows during which time the water may have become stagnant.

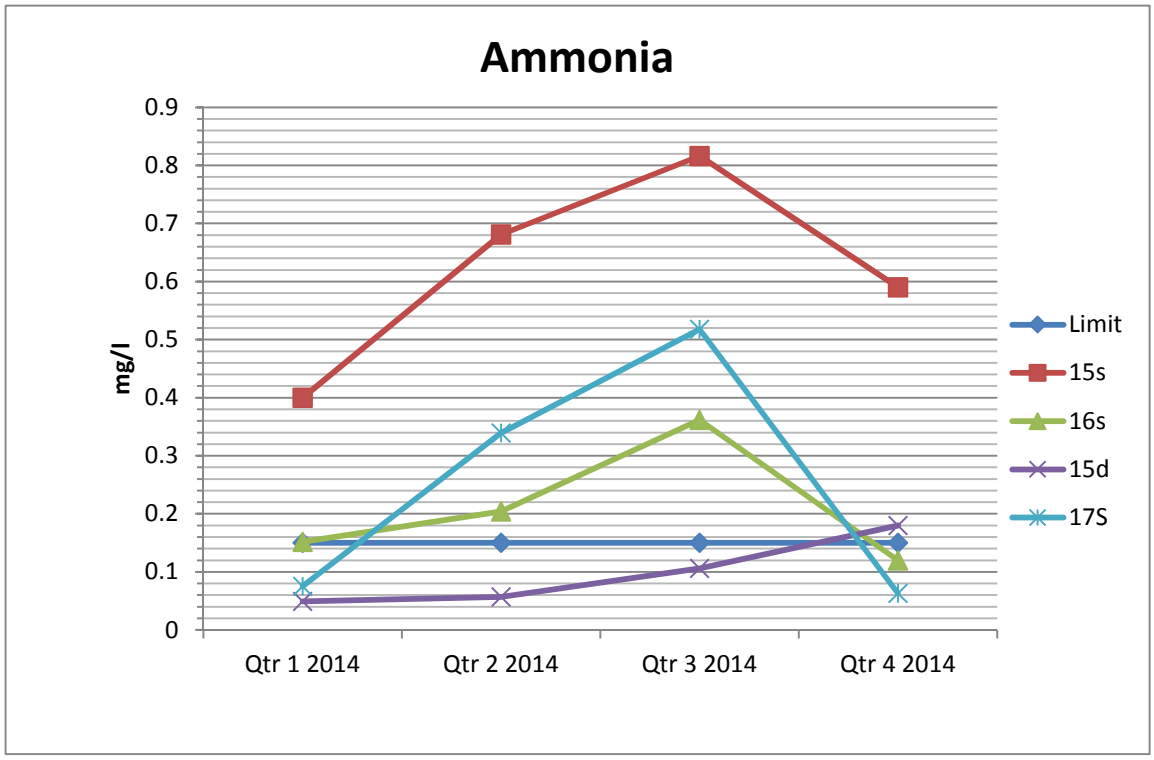
5.2 Groundwater

The following table details all reoccurring elevations at groundwater wells during 2014. Results in Bold Italics indicate where the interim guide value has been exceeded when compared to limits stipulated by the Environmental Protection Agency.

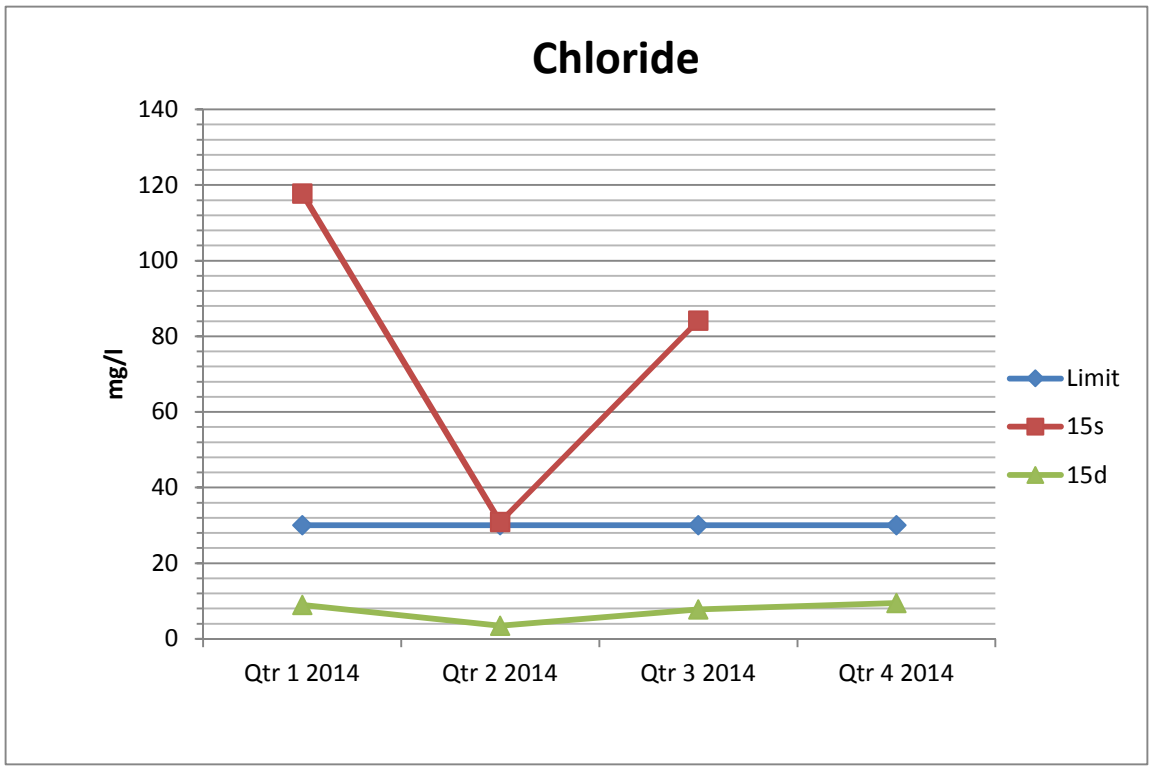
Table 5.2 Groundwater Summary Results

	Parameter	TOC	Ammonia	TON	pH	Cond	Cl	SO4	DO	Fe	Mn	K	Na
	Units	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l
WELL 15 S	Qtr 4 2014	12.27	0.59	1.422	6.1	228	8.3	70.8	8	19000	500	2.3	8.5
	Qtr 3 2014	10.18	***0.816***	0.365	***6.5***	512	***84.1***	91.5	5	***10560.5***	***378.5***	***5.4***	70
	Qtr 2 2014	13.75	***0.681***	0.205	***5.9***	233	***30.9***	63	4	***14230.6***	***409.1***	***7.8***	15.2
	Qtr 1 2014	14.44	***0.4***	0.541	***6.2***	194	***117.7***	***881.9***	2	***15446.7***	***499.5***	***5.7***	6.8
WELL 15 D	Qtr 4 2014	1.15	0.18	<0.138	8.6	312	9.5	24.5	7	<20	130	1.8	17.1
	Qtr 3 2014	0.99	0.106	<0.138	7.9	306	7.8	19	8	95.1	***119.4***	2.7	11.3
	Qtr 2 2014	1.1	0.057	<0.138	7.8	315	3.5	18.8	6	87.2	***149.5***	5	11.3
	Qtr 1 2014	1.12	0.049	<0.138	7.8	299	9	19.2	10	172.9	***174.1***	3.4	10
WELL 16 S	Qtr 4 2014	2.03	0.12	0.214	6.8	228	9.2	18.2	9	2200	290	5.5	9.2
	Qtr 3 2014	3.68	***0.362***	<0.138	6.7	282	7.2	30.5	7	***4479.8***	***524.6***	5.2	10.1
	Qtr 2 2014	2.63	***0.204***	<0.138	6.7	265	<2.6	25.3	8	***618.7***	***440.2***	4.6	9.7
	Qtr 1 2014	2.1	***0.152***	<0.138	6.8	252	8.1	24.6	7	***584.6***	***387.2***	3.6	9.1
WELL 16 D	Qtr 4 2014	<0.25	0.2	0.63	7.3	271	10.2	29.8	6	440	660	1.2	18.7
	Qtr 3 2014	0.53	***0.089***	<0.138	7.4	253	8.5	22.6	8	***430.2***	***598.1***	2.8	15.3
	Qtr 2 2014	0.67	0.049	<0.138	7.2	272	4	21.7	7	***358.1***	***640.9***	2.9	15.9
	Qtr 1 2014	0.58	0.035	<0.138	7.4	267	9.7	21.1	10	<20	***654.3***	4.2	14.6
MW 17 S	Qtr 4 2014	5.6	0.063	3.145	7.1	415	5.5	85.9	9	400	72	2	9.7
	Qtr 3 2014	4.93	***0.518***	0.178	7.1	432	14.7	44.3	8	***65.3***	***1796***	5.5	13
	Qtr 2 2014	4.91	***0.339***	<0.138	6.9	428	7.9	45.8	8	35.6	***1240***	***6.1***	12
	Qtr 1 2014	5.13	0.075	2.192	7.1	373	7.4	52.1	9	42.6	5.7	4.6	5.4
Well 17 D	Qtr 4 2014	2.83	0.046	<0.138	7.4	574	7.5	73.6	9	5200	4500	2.4	14.3
	Qtr 3 2014	3.16	***0.122***	<0.138	7.5	586	7.1	63	7	***24.4***	***1976***	3.5	14.6
	Qtr 2 2014	4.37	0.058	<0.138	7.4	569	<2.6	60	10	<20	***1976***	***5.5***	15.1
	Qtr 1 2014	3.55	0.017	0.354	7.6	488	7.1	35.4	8	<20	***477***	4	14.4
Interim Guide Value		NAC	0.15	NAC	≥6.5 &≤9.5	1000	30	200	NAC	200	50	5	150

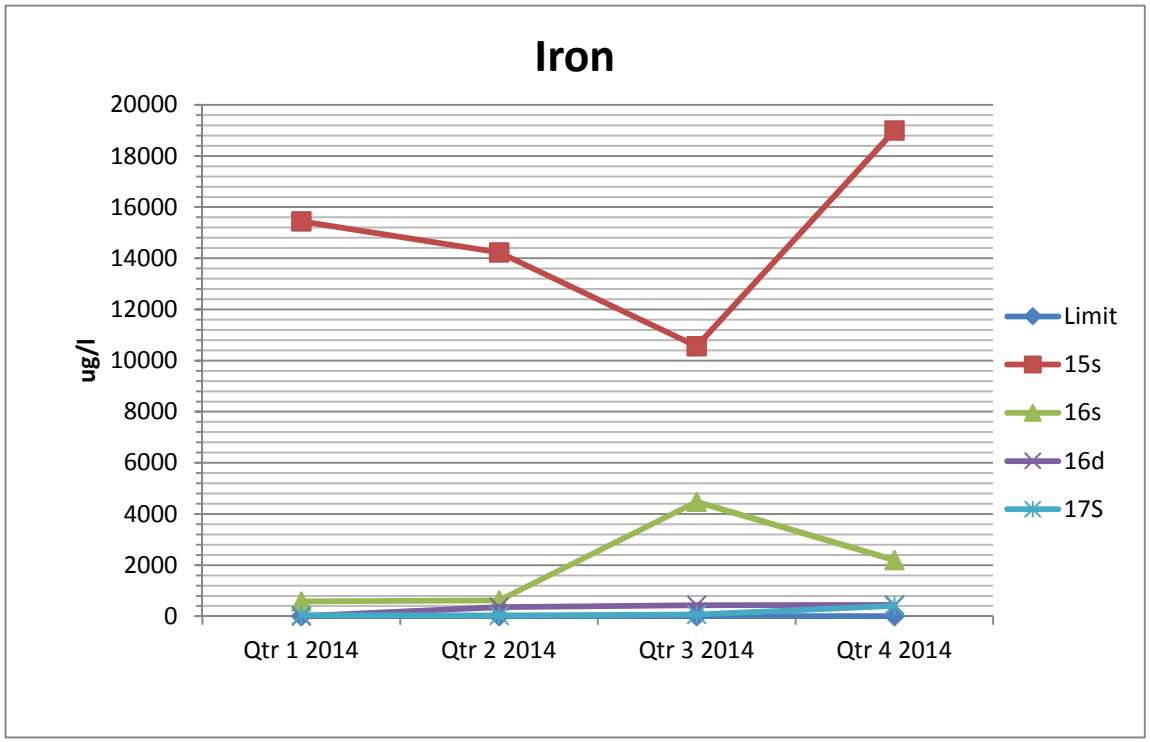
Graph 5.5



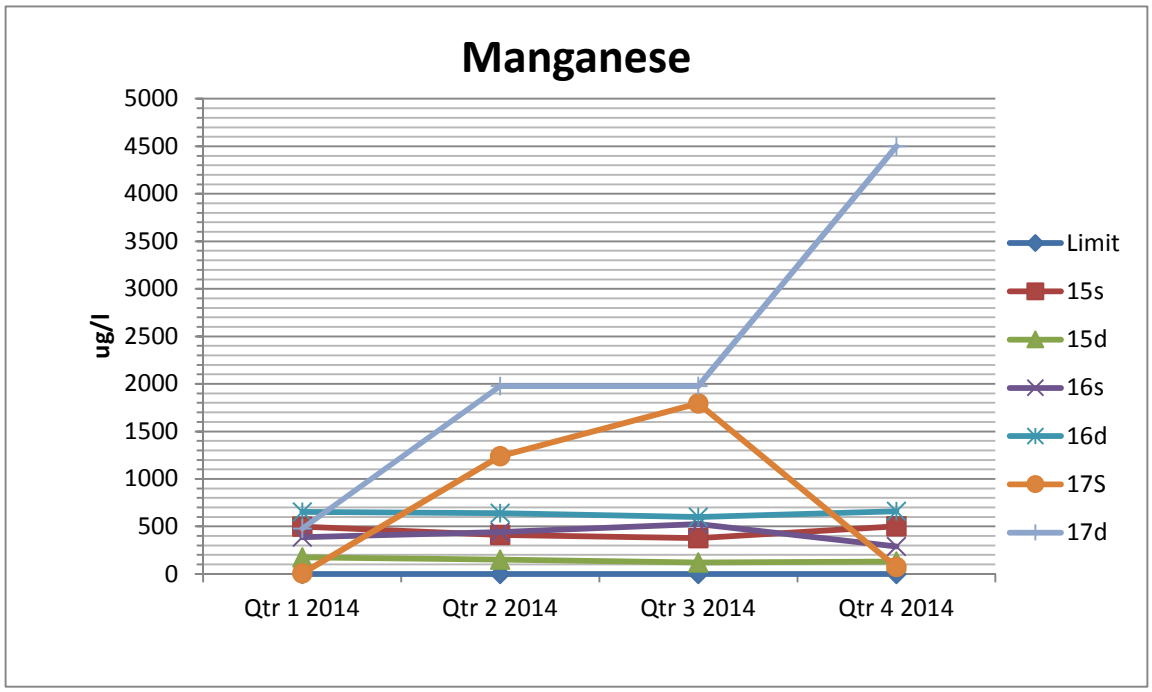
Graph 5.6



Graph 5.7



Graph 5.8



As detailed in the above graphs, there were numerous ground water elevations in the vicinity of this landfill during 2014.

Exceedances occurred in the following parameters:

- Ammonia: Elevated levels of this parameter were prevalent during 2014. Elevated levels of ammonia are strongly associated with pollution from waste water treatment systems as well as agricultural activates and so contamination of these wells by the landfill cannot be definitively concluded.
- 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: This parameter is an indication of contamination from a landfill source. In 2014 there was an elevated level of this parameter encountered at wells MW15S. This elevation was reported to the EPA and was attributed to contamination from an external source such as road salt.
- Manganese: Elevated levels of Manganese can be associated with landfill contamination but can also be attributed to the natural composition of the underlying soils.

5.3 Leachate Monitoring

Leachate monitoring is carried out annually in accordance with the licence.

Leachate samples were obtained from new leachate wells which were installed prior to quarter 4 monitoring 2012. The following table details all results obtained from these wells during 2014.

Table 5.3 Leachate Summary Results

	Parameter	Ammonia	Cl	TON	SO4	Cond	pH	COD	BOD
	Units	mg/l N	mg/l	mg/l N	mg/l	us/cm	pH Units	mg/l	mg/l
WELL MW 18	Qtr4 2014	310	140	<0.69	17	2690	7	219	<37
	Qtr3 2014	***301.058***	<0.69	7.2	***3757***	37	531	***186.7***	-
	Qtr 4 2013	***273***	<13	1.291	36.7	***3259***	7.1	890	98
	Qtr 3 2013	***278***	5.908	7.1	***4104***	81	3200	***199.7***	-
WELL MW 19	Qtr4 2014	-	-	-	-	-	-	-	-
	Qtr 3 2014	***21.037***	<0.69	6.6	924	29	253	***41.5***	-
	Qtr 4 2013	***4***	<13	<0.69	92.5	422	6.7	101	14
	Qtr 3 2013	***37***	<0.69	6.7	***1283***	10	670	***68.6***	-
Interim Guide Values		0.15	200	NAC	200	1000	≥6.5&≤9.5		

5.4 Gas Emissions

Landfill gas monitoring is conducted at thirteen sampling locations. These locations are situated both inside and outside the landfill mass. Historic results for the period 2014 are displayed below.

Table 5.4 Gas Emissions Summary

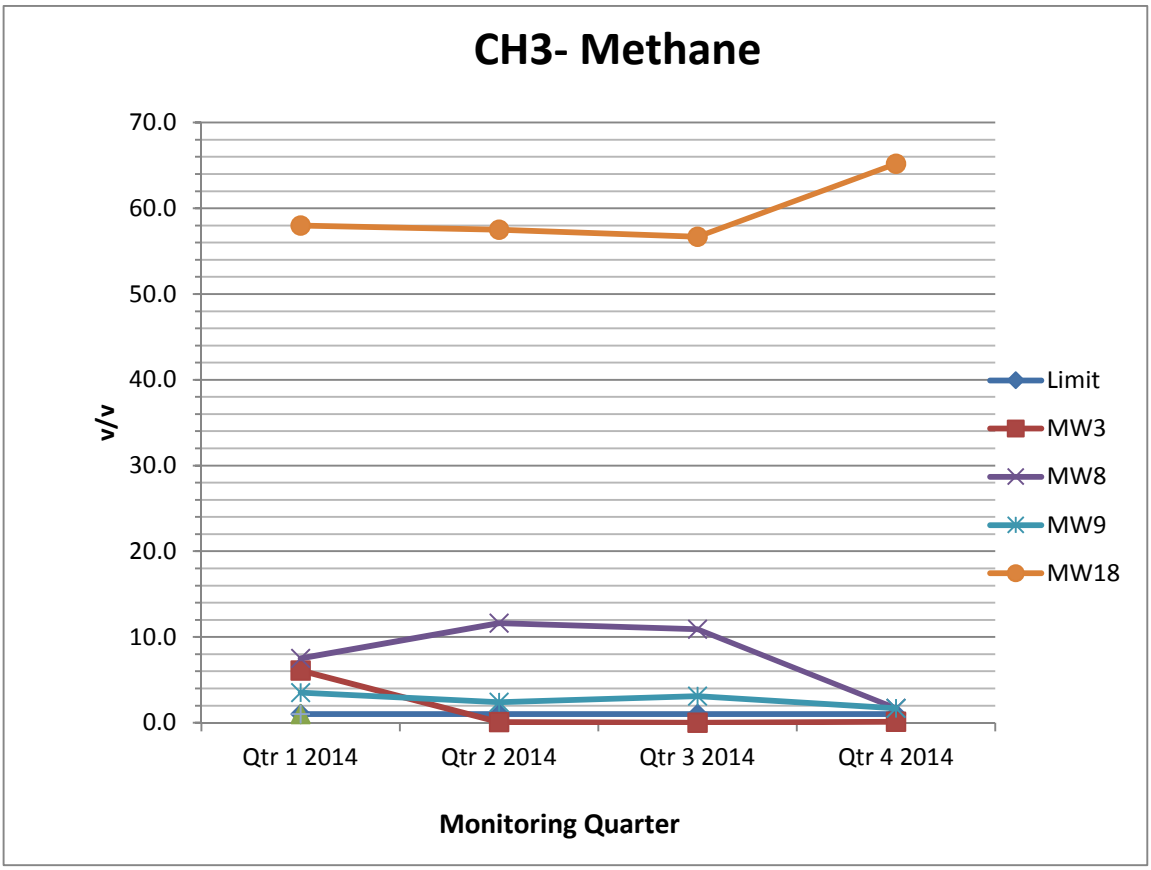
Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2014	-	-	-	-	
	Qtr 3 2014	0	0.1	21.2	0	1008
	Qtr 2 2014	0	0.14	21.4	0	990
	Qtr 1 2014	0	0.2	21.4	0	990
MW 2	Qtr 4 2014	0	0.1	21.2	0	1010
	Qtr 3 2014	0	1.4	21.8	0	1008
	Qtr 2 2014	0	1.3	21.9	0	993
	Qtr 1 2014	0	1.1	21.8	0	990
MW 3	Qtr 4 2014	0.1	0.3	21.2	0	1010
	Qtr 3 2014	0	0.2	21.3	0	1008
	Qtr 2 2014	0.06	0.26	21.26	0	993
	Qtr 1 2014	6.1	5.7	16.1	0	990
MW 6	Qtr 4 2014	0	0.7	20.7	0	1010
	Qtr 3 2014	0	0.7	20.7	0	1008
	Qtr 2 2014	0	0.8	20.7	0	992
	Qtr 1 2014	0	1.8	19.9	0	992
MW 7	Qtr 4 2014	-	-	-	-	
	Qtr 3 2014	-	-	-	-	-
	Qtr 2 2014	0	0.1	21.3	0	993
	Qtr 1 2014	0	0.2	21.5	0	990
MW 8	Qtr 4 2014	1.7	12.1	10.6	0	1010
	Qtr 3 2014	10.9	10.5	13.5	0	1008
	Qtr 2 2014	11.6	11.2	12.6	0	993
	Qtr 1 2014	7.5	9.3	13.2	0	990
MW 9	Qtr 4 2014	1.7	2.8	19.2	0	1010
	Qtr 3 2014	3.1	2.7	19.6	0	1008
	Qtr 2 2014	2.4	2.3	19.3	0	993
	Qtr 1 2014	3.5	3.7	16.7	0	990
	Limit	**1**	**1.5**			

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 10S	Qtr 4 2014	0.4	1.32	16.4	0	1010
	Qtr 3 2014	0	0.1	20.8	0	1008
	Qtr 2 2014	0	0.1	20.8	0	993
	Qtr 1 2014	0	0.2	20.4	0	993
MW 10D	Qtr 4 2014	0	0.1	20.8	0	1010
	Qtr 3 2014	0	1.7	19.7	0	1008
	Qtr 2 2014	0	1.3	16.4	0	993
	Qtr 1 2014	0	0.4	19.8	0	993
MW 17S	Qtr 4 2014	0	0.1	21.2	0	1010
	Qtr 3 2014	0	0.1	21.2	0	1008
	Qtr 2 2014	0	0.1	21.2	0	993
	Qtr 1 2014	0	0	20	0	990
MW 17D	Qtr 4 2014	0	0.12	21.18	0	1010
	Qtr 3 2014	0	0.3	20.9	0	1008
	Qtr 2 2014	0	0.2	21.1	0	993
	Qtr 1 2014	0	0	20.5	0	990
MW 18	Qtr 4 2014	65.2	22.8	-	0	1008
	Qtr 3 2014	56.7	31.8	0	0	1008
	Qtr 2 2014	57.5	28.4	0	0	993
	Qtr 1 2014	58	27	0	0	990
MW 19	Qtr 4 2014	-	-	-	-	
	Qtr 3 2014	31.2	10.5	2.5	0	1008
	Qtr 2 2014	0	0.2	21.2	0	993
	Qtr 1 2014	5.7	4.5	17.2	0	990
	Limit	**1**	**1.5**			

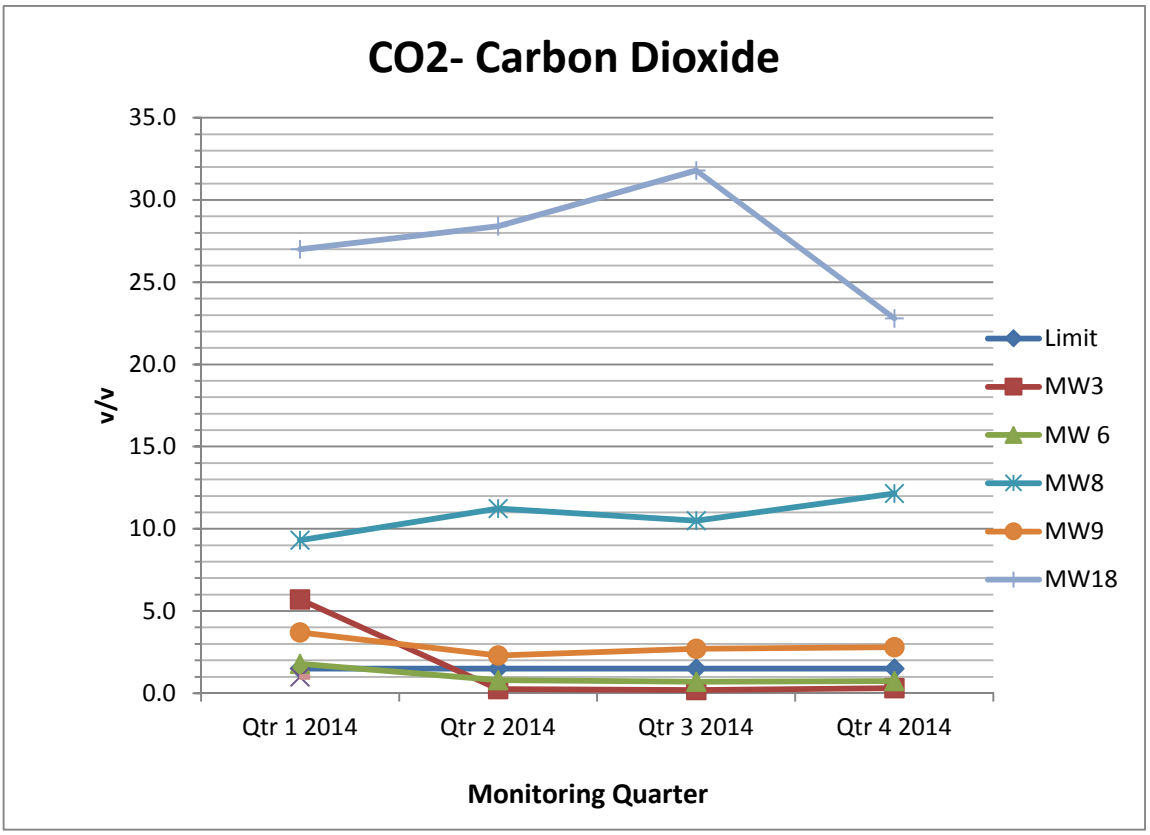
Results

The following graphs show gas monitoring results for 2014. These wells are located inside the waste mass.

Graph 5.9



Graph 6.0



Gas Monitoring on the site reveals typical low levels of Methane & Carbon Dioxide and higher levels of Oxygen. There were some high readings encountered at MW8 and MW18 and which are all located in the centre of the waste body. There was no significant gas migration recorded in monitoring wells outside of the waste body. The results are typical of a closed landfill.

6.0 SUMMARY OF RESULTS & INTERPRETATION OF ENVIRONMENTAL MONITORING

Included in Appendix C is a copy of the 4th quarter monitoring results as reported by Monitoring Company Boylan Engineering. 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.

7.0 RESOURCE & 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.

8.0 REPORT ON RESTORATION OF THE FACILITY

The site is fully restored and the cap intact. There was some horse grazing on the site at various times during 2014. Gorse overgrowth was remedied during 2014.

9.0 ESTIMATED ANNUAL & 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 53,700kgs/yr. Page one from the Annual Gas Survey is also presented in Appendix A.

10.0 FULL TITLE & WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR WHICH RELATES TOT HE FACILITY OPERATION

There was no change to or development of any procedures undertaken by the licensee or monitoring contractor in 2014. The environmental monitoring contractor 'Boylan Engineering' adhere to all standard practices for environmental monitoring.

11.0 REPORTED INCIDENTS & COMPLAINTS SUMMARY

An incident regarding an exceedance in the parameter Chloride was notified to the agency during 2014 via the Eden system. There were no complaints received by the EPA or the Local Authority regarding this facility in the reporting period 2014.

12.0 REVIEW OF NUISANCE CONTROLS

As there are no known nuisances associated with this site there are no nuisance controls in place for 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 substantiated by the absence of complaints regarding the facility. However, if any nuisances arise at the facility, the licensee will deal with them using appropriate measures and procedures.

13.0 REPORT ON TRAINING OF STAFF

Landfill Operations Manager Sinead Fox- for Cavan County Council deals with in full with any issues identified by the Agency Inspectors or any other party. Sinead has been fully trained in the control of landfill gas, the FAS Waste Management Training Course and carries a Safe Pass.

Table 13.1 Management Structure 2014

Position	Name	Duties
Director of Services Environment	Eoin Doyle	Oversee and assign responsibilities to staff regarding landfill
Senior Executive Officer	John Brannigan	Oversee general supervision, monitoring and reporting of the site.
Landfill Operations Manager	Sinead Fox	Responsible for general supervision, monitoring and reporting of the site.

Contact Person for Sanitary Authority for 2014/ 2015:

John Brannigan
Senior Executive Officer
Waste Management Section
Cavan County Council
Farnham Street,
Cavan

14.0 FINANCIAL PROVISION

Provision will be made in Cavan County Council Official Estimates for Charges as required under Condition 12 of Waste Licence Ref. 91-1.

15.0 ANY OTHER ITEMS AS SPECIFIED BY THE AGENCY

As requested by the Agency we have included in Appendix B a copy of the most recent Map of the site showing all Monitoring locations.

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.18

REFERENCE YEAR	2014

1. FACILITY IDENTIFICATION

Parent Company Name	Cavan County Council
Facility Name	Bailieborough Landfill
PRTR Identification Number	W0091
Licence Number	W0091-01

Classes of Activity

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

Address 1	Tanderagee
Address 2	Bailieborough
Address 3	
Address 4	
	Cavan
Country	Ireland
Coordinates of Location	-6.97327 53.9092
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Sinead Fox
AER Returns Contact Email Address	sfox@cavancoco.ie
AER Returns Contact Position	Landfill Operations Manager
AER Returns Contact Telephone Number	0494378449
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	1
User Feedback/Comments	
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) ?	
Is the reduction scheme compliance route being used ?	

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

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	

This question is only applicable if you are an IPPC or Quarry site

4.1 RELEASES TO AIR

Link to previous years emissions data

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	151000.0	0.0	151000.0
01	**Methane (CH4)**	C	OTH	GASSIM	0.0	53700.0	0.0	53700.0

* 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

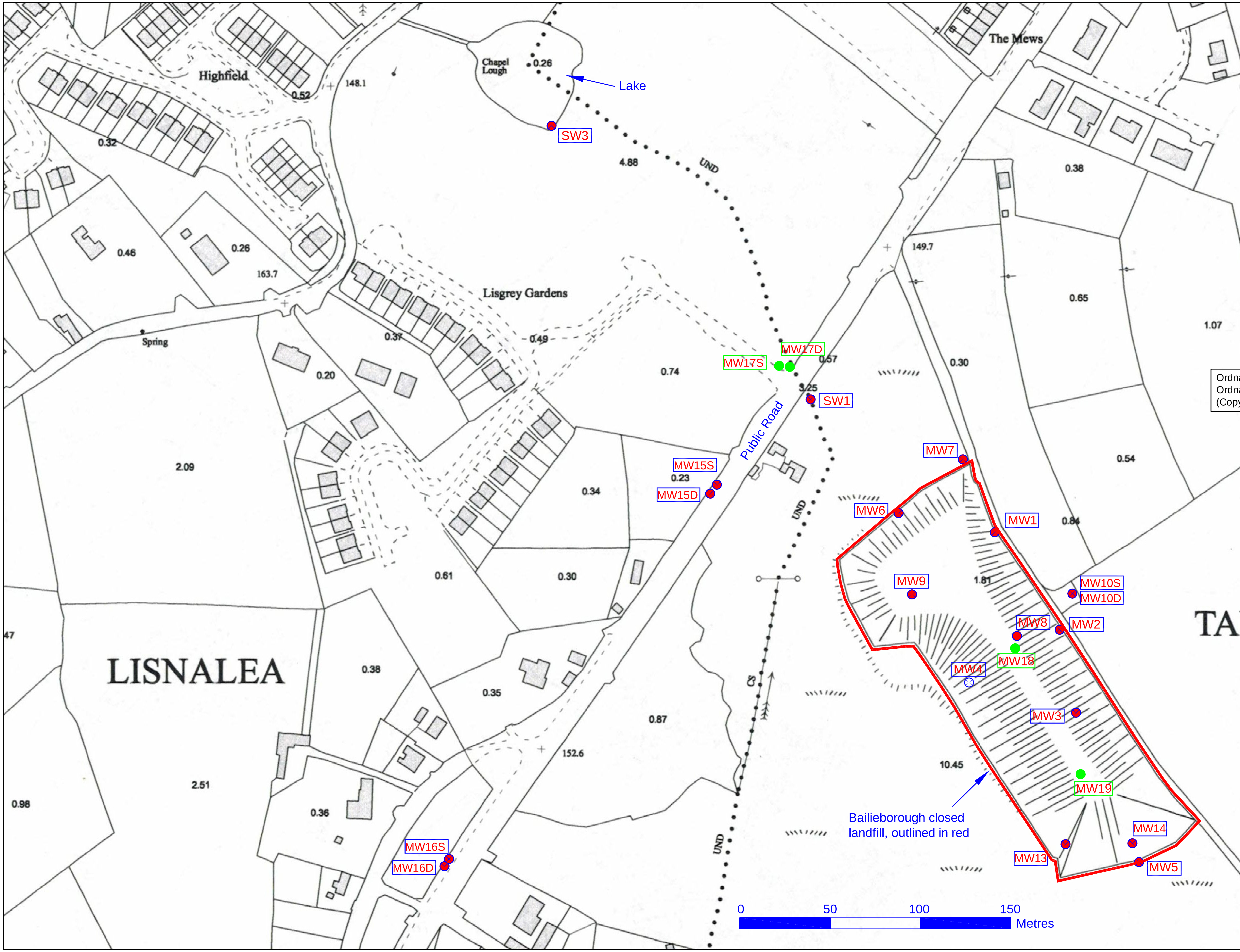
* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

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: Bailieborough 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)	53700.0	C	OTH	GASSIM	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)	53700.0	C	OTH	GASSIM	N/A	



NOTES / LEGEND

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.

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2	30.07.14	Additional wells
1	01.11.12	Additional wells

Client: Cavan County Council

Project:

Bailieborough Landfill (WL91-01)

Boylan engineering
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Website: www.boylanengineering.ie

Drawn By	Approved by
A. Clarke	B. Keating

Drawing No.	Drawing Name
001	Monitoring Well Locations

Date	Scale	Rev.
30.07.14	1:2000	001

GROUNDWATER MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-04-03&04-Rev 0

Produced by: Bróna Keating, B.Sc., Dip. Environmental Eng., M.Sc., MCIWM

Approved by: **Date:** 07th April 2015

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

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Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter three and four 2015.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

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List of Tables

Appendix

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency 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 quarters three and four 2014.

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 behavior with expected/modeled behavior
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (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).

2. METHODOLOGY

2.1 Environmental Sampling

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

- ISO 5667: Guidance on sampling of groundwaters is adhered to.
- Prior to sampling, the depth of water in groundwater wells is measured by dipping. Dipping the wells before sampling allows for calculation of the volume of water in the well. This data is recorded on the field sheet for volume calculation which is presented in appendix 3.
- Once the volume was calculated the boreholes are purged three times their volume before sampling.
- Sampling is conducted using a Waterra inertial lift pump and associated tubing, pumping water directly from the borehole to the appropriate sampling bottles.
- Designated tubing is 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.
    - Conductivity
    - Temperature
    - pH

- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times. These forms are located in the appendix 4.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0^{o}C and 4^{o}C 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.

2.3 Monitoring Locations

Quarter 3, 2014					
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	151.55	-	-	**N296071.96 E267506.68**
MW2	GAS	152.72	-	-	**N296018.08 E267540.57**
MW3	GAS	159.27	-	-	**N295972.19 E267549.66**
MW 4	Gas	156.74	-	-	**TBC**
MW6	GAS	150.27	-	-	**N296082.66 E267451.47**
MW8	Gas	160.74	-	-	**N296014.48 E267517.14**
MW9	Gas	157.94	-	-	**N296037.63 E267458.87**
MW10S	GAS	154.76	-	-	**N296038.12 E267458.8**
MW10D	GAS	154.76	-	-	**N296038.12 E267458.87**
MW15S	GW	150.36	148.41	1.95	**N296097.36 E267343.36**
MW15D	GW	150.39	148.49	1.9	**N296092.30 E267344.88**
MW16S	GW	152.6	150.87	1.73	**N295888.86 E267202.87**
MW16D	GW	152.53	151.05	1.48	**N295885.59 E267200.97**
MW17S	GW & GAS	149.58	148.58	1	**N296179.25 E267321.30**
MW17D	GW & GAS	149.49	148.19	1.3	**N296178.68 E267327.22**
MW18	Leachate & GAS	160.98	-	-	**N296023.13 E267452.20**
MW19	Leachate & GAS	162.12	-	-	**N295954.06 E267499.79**
SW1	SW	-	-	-	**N296160.79 E267338.62**
SW3	SW	-	-	-	**N296312.44 E267195.10**
CAP Discharge	SW	-	-	-	**N296078.86 E267348.65**

Quarter 4, 2014					
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	151.55	-	-	**N296071.96 E267506.68**
MW2	GAS	152.72	-	-	**N296018.08 E267540.57**
MW3	GAS	159.27	-	-	**N295972.19 E267549.66**
MW 4	Gas	156.74	-	-	**TBC**
MW6	GAS	150.27	-	-	**N296082.66 E267451.47**
MW8	Gas	160.74	-	-	**N296014.48 E267517.14**
MW9	Gas	157.94	-	-	**N296037.63 E267458.87**
MW10S	GAS	154.76	-	-	**N296038.12 E267458.8**
MW10D	GAS	154.76	-	-	**N296038.12 E267458.87**
MW15S	GW	150.36	148.96	1.4	**N296097.36 E267343.36**
MW15D	GW	150.39	149.24	1.15	**N296092.30 E267344.88**
MW16S	GW	152.6	151	1.6	**N295888.86 E267202.87**
MW16D	GW	152.53	151.03	1.5	**N295885.59 E267200.97**
MW17S	GW & GAS	149.58	148.2	1.38	**N296179.25 E267321.30**
MW17D	GW & GAS	149.49	148.19	1.3	**N296178.68 E267327.22**
MW18	Leachate & GAS	160.98	-	-	**N296023.13 E267452.20**
MW19	Leachate & GAS	162.12	-	-	**N295954.06 E267499.79**
SW1	SW	-	-	-	**N296160.79 E267338.62**
SW3	SW	-	-	-	**N296312.44 E267195.10**
CAP Discharge	SW	-	-	-	**N296078.86 E267348.65**

2.4 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min (°C)	Mean Wind Speed (knots)	Maximum (if >= 34 knots)	Sunshine (hours)
25/09/2014	0.5	18	12.8	11.8	8		

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)
03/12/2014	0	6.5	2.9	-1.1	1.9		

3.0 SUMMARY OF RESULTS

Table 1.0 03rd Quarter Ground water monitoring 2014

Report Number	79161
Monitoring Date:	25/09/2014

Method		Site Tests	Site Tests	Site Tests	Site Tests	Site Tests	TOC	Ammonia	AQ2-UP1	Titralab		AQ2-UP2		DO	Metals-Dissolved			
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**EW123**	**EW003**	**EW154M**	**EW138**	**EW139**	**EW015**	**EW015**	**EW043**	**EM130**			
Parameter		Sample temperature (to be done onsite)	Cond	pH	Water Level from TOC	Visual Inspection	TOC	Ammonia	TON (as N)(calc)	pH	Cond	Cl	SO4	DO	Fe	Mn	K	Na
Units		Deg C	us/cm	pH units	Meter's	-	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l
Limit of Detection		-	-	-	-	-	0.25	0.007	0.138	0.3	25	2.6	1.0	1.0	5	1	0.2	0.5
Date Testing Initiated		25.9.14					26.9.14											
ELS Ref	**Client Ref**																	
79161/001	MW 15 S	13.8	522	6.62	1.95	Rusty	10.18	***0.816***	0.365	6.5	512	84.1	91.5	5	***10560.5***	***378.5***	5.4	70
79161/002	MW 15 D	11.8	318	8.12	1.9	Clear	0.99	***0.106***	<0.138	7.9	306	7.8	19	8	***95.1***	***119.4***	2.7	11.3
79161/003	MW 16 S	13	295	6.75	1.73	Grey	3.68	***0.362***	<0.138	6.7	282	7.2	30.5	7	***4479.8***	***524.6***	5.2	10.1
79161/004	MW 16 D	11.4	258	7.52	1.48	Clear	0.53	***0.089***	<0.138	7.4	253	8.5	22.6	8	***430.2***	***598.1***	2.8	15.3
79161/005	MW 17 S	14.1	442	7.21	1	Heavy Silt	4.93	***0.518***	0.178	7.1	432	14.7	44.3	8	***65.3***	***1796.4***	5.5	13
79161/006	MW 17 D	12.3	597	7.65	1.3	Grey	3.16	***0.122***	<0.138	7.5	586	7.1	63	7	***24.4***	***1975.8***	3.5	14.6
IGV			1000	≥6.5 and ≤9.5			NAC	0.15		≥6.5 and ≤9.5	1000	30	200	NAC	200	50	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

Table 2.0 04th Quarter Ground water monitoring 2014

Report Number: 71140
Monitoring Date: 12.11.13

Method		Site Tests					TOC	Ammonia	AQ2-UP1	Titralab		Titralab	AQ2-UP2		DO	Total Cyanide High (Sub)	Total Phosphorus-TP	PhenolsTotal - Index (Sub1)
Method Number		Site Tests					DEFAULT	EW003	EW154M	EW153			EW154M		EW043	DEFAULT	EW146	DEFAULT
Parameter		Sample temperature (to be done onsite)	Cond	pH	Water Level from TOC	Visual Inspection	TOC	Ammonia	TON (as N)(calc)	pH	Cond	Alkalinity Total (R2 pH4.5)	Chloride	Sulphate	Dissolved Oxygen	Total Cyanide High	Total Phosphorus-TP	Phenols-Total
Units		Deg C	us/cm	pH units	Meter's	-	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/L CaCO3	mg/l	mg/l	mg/l	ug/L	mg/l P	mg/L
Limit of Detection		-	-	-	-	-	0.25	0.007	0.138	0.3	25	10	2.6	1.0	1.0	10	0.01	0.15
Date Testing		12.11.13					13.11.13											
ELS Ref	Client Ref																	
81011/001	MW 15S	11.5	232	6.15	1.4	Brown	12.27	***0.59***	1.422	***6.1***	228	51	8.3	70.8	8	<10	0.61	<0.15
81011/002	MW 15D	10.6	315	8.65	1.15	Clear	1.15	***0.18***	<0.138	8.6	312	148	9.5	24.5	7	<10	0.03	<0.15
81011/003	MW 16S	11.2	235	6.84	1.6	Grey	2.03	0.12	0.214	6.8	228	93	9.2	18.2	9	<10	0.28	<0.15
81011/004	MW 16D	10.1	290	7.35	1.5	Clear	<0.25	***0.2***	0.63	7.3	271	110	10.2	29.8	6	<10	0.09	<0.15
81011/005	MW 17S	11.1	418	7.13	1.38	Brown	5.6	0.063	3.145	7.1	415	141	5.5	85.9	9	<10	0.03	<0.15
81011/006	MW 17D	9.5	565	7.51	1.3	Clear	2.83	0.046	<0.138	7.4	574	450	7.5	73.6	9	<10	1.87	<0.15
IGV			1000	≥6.5 and ≤9.5			NAC	0.15	NAC	≥6.5 and ≤9.5	1000	NAC	30	200	NAC	10	-	-

Method		Coliforms	Coliforms	Ion Chromatography	Residue on Evaporation (Tot Solids-TS)	Metals-Total	Metals-Dissolved											
Method Number		MIC133		EW137	EW060	EM130												
Parameter		Total Coliforms	E. Coli	Fluoride	Residue on Evaporation (Tot Solids-TS)	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		MPN/100ml	MPN/100ml	mg/L	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	mg/L
Limit of Detection		0		0.1	10.0	1.0	20.0	0.001	0.2	0.5	0.1	1.0	0.00	0.3		0.02	1.0	0.02
Date Testing		13.11.13																
ELS Ref	Client Ref																	
81011/001	MW 15S	***60***	0	<0.1	220	7.5	***19000***	***500***	2.3	8.5	<0.1	25.5	0.006	2.8	5.3	<0.02	17	<0.02
81011/002	MW 15D	***24201***	0	0.12	155	<3	<20	***130***	1.8	17.1	<0.1	39.8	<0.003	<0.3	14.7	<0.02	1.1	<0.02
81011/003	MW 16S	***560***	0	0.13	125	<3	***2200***	***290***	***5.5***	9.2	<0.1	23.3	0.005	2	13.2	<0.02	15	<0.02
81011/004	MW 16D	0	0	0.31	150	<3	***440***	***660***	1.2	18.7	<0.1	31.3	<0.003	<0.3	10.2	<0.02	8.7	<0.02
81011/005	MW 17S	***2910***	0	0.12	300	<3	***400***	***72***	2	9.7	<0.1	74.3	0.007	1.4	11.9	<0.02	15	<0.02
81011/006	MW 17D	***40***	0	<0.1	3230	***205.3***	***5200***	***4500***	2.4	14.3	0.8	150.5	***0.09***	41	33.8	<0.02	49	<0.02
IGV		0	0	1	-	30	200	50	5	150	0.005	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
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 for the protection of Groundwater in Ireland, where available.

4.0 DISCUSSION

4.1 Ground water

Monitoring of groundwater is a common and necessary event in 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 constituents from the unit into the groundwater systems.

Monitoring was conducted on the 25th September and the 13th November 2014. Results in bold italics indicate where the interim guide value has been exceeded. Results from Quarter three and four2014 show that there were exceedances at various ground water monitoring locations for parameters; Ammonia, pH, Iron Manganese and total coliforms. Previous results detailed in the historical data show that exceedances for Ammonia, Iron and Manganese are on par with previous monitoring events. The exceedance in pH has been noted at location MW 15S on previous monitoring events.

Elevated Iron levels at the remaining wells can be an indication of contamination. However, the hypothesis that is 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 and Manganese from the underlying deposits. Elevated Iron may also be attributed to the natural composition of this area. All exceedances will be carefully examined in quarter 1, 2015 and compared to previous monitoring episodes.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedances therefore there is no evidence of any major negative environmental impact associated with this landfill.

APPENDIX 1 HISTORICAL DATA-TABLES

	Parameter	TOC	Ammonia	TON	pH	Cond	Cl	SO4	DO	Fe	Mn	K	Na
	Units	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l
WELL 15 S	Qtr 4 2014	12.27	***0.59***	1.422	***6.1***	228	8.3	70.8	8	***19000***	***500***	2.3	8.5
	Qtr 3 2014	10.18	***0.816***	0.365	***6.5***	512	***84.1***	91.5	5	***10560.5***	***378.5***	***5.4***	70
	Qtr 2 2014	13.75	***0.681***	0.205	***5.9***	233	***30.9***	63	4	***14230.6***	***409.1***	***7.8***	15.2
	Qtr 1 2014	14.44	***0.4***	0.541	***6.2***	194	***117.7***	***881.9***	2	***15446.7***	***499.5***	***5.7***	6.8
WELL 15 D	Qtr 4 2014	1.15	***0.18***	<0.138	8.6	312	9.5	24.5	7	<20	***130***	1.8	17.1
	Qtr 3 2014	0.99	0.106	<0.138	7.9	306	7.8	19	8	95.1	***119.4***	2.7	11.3
	Qtr 2 2014	1.1	0.057	<0.138	7.8	315	3.5	18.8	6	87.2	***149.5***	5	11.3
	Qtr 1 2014	1.12	0.049	<0.138	7.8	299	9	19.2	10	172.9	***174.1***	3.4	10
WELL 16 S	Qtr 4 2014	2.03	0.12	0.214	6.8	228	9.2	18.2	9	***2200***	***290***	5.5	9.2
	Qtr 3 2014	3.68	***0.362***	<0.138	6.7	282	7.2	30.5	7	***4479.8***	***524.6***	5.2	10.1
	Qtr 2 2014	2.63	***0.204***	<0.138	6.7	265	<2.6	25.3	8	***618.7***	***440.2***	4.6	9.7
	Qtr 1 2014	2.1	***0.152***	<0.138	6.8	252	8.1	24.6	7	***584.6***	***387.2***	3.6	9.1
WELL 16 D	Qtr 4 2014	<0.25	***0.2***	0.63	7.3	271	10.2	29.8	6	***440***	***660***	1.2	18.7
	Qtr 3 2014	0.53	***0.089***	<0.138	7.4	253	8.5	22.6	8	***430.2***	***598.1***	2.8	15.3
	Qtr 2 2014	0.67	0.049	<0.138	7.2	272	4	21.7	7	***358.1***	***640.9***	2.9	15.9
	Qtr 1 2014	0.58	0.035	<0.138	7.4	267	9.7	21.1	10	<20	***654.3***	4.2	14.6
MW 17 S	Qtr 4 2014	5.6	0.063	3.145	7.1	415	5.5	85.9	9	***400***	***72***	2	9.7
	Qtr 3 2014	4.93	***0.518***	0.178	7.1	432	14.7	44.3	8	***65.3***	***1796***	5.5	13
	Qtr 2 2014	4.91	***0.339***	<0.138	6.9	428	7.9	45.8	8	35.6	***1240***	***6.1***	12
	Qtr 1 2014	5.13	0.075	2.192	7.1	373	7.4	52.1	9	42.6	5.7	4.6	5.4
Well 17 D	Qtr 4 2014	2.83	0.046	<0.138	7.4	574	7.5	73.6	9	***5200***	***4500***	2.4	14.3
	Qtr 3 2014	3.16	***0.122***	<0.138	7.5	586	7.1	63	7	***24.4***	***1976***	3.5	14.6
	Qtr 2 2014	4.37	0.058	<0.138	7.4	569	<2.6	60	10	<20	***1976***	***5.5***	15.1
	Qtr 1 2014	3.55	0.017	0.354	7.6	488	7.1	35.4	8	<20	***477***	4	14.4
Interim Guide Value		NAC	0.15	NAC	≥6.5 &≤9.5	1000	30	200	NAC	200	50	5	150

GAS MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-04-03&04-Rev 0

Produced by: Bróna Keating, B.Sc., Dip. Environmental Eng., M.Sc., MCIWM

Approved by: **Date:** 07th April 2015

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Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Gas Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter 2 and three 2014.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

Table of Contents

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency 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 quarter three and four 2014.

The purpose of landfill gas 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 that the facility is not causing a nuisance through noise or odors
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behavior with expected/modeled behavior
- Assess the effectiveness of gas control measures installed at the site
- 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.

2. METHODOLOGY

2.1 Landfill Gas Analysis

The following procedure is employed by Bróna Keating of Boylan Engineering to ensure accurate 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 5 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.

2.3 Monitoring Locations

Quarter 4, 2014					
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	151.55	-	-	N296071.96 E267506.68
MW2	GAS	152.72	-	-	N296018.08 E267540.57
MW3	GAS	159.27	-	-	N295972.19 E267549.66
MW 4	Gas	156.74	-	-	TBC
MW6	GAS	150.27	-	-	N296082.66 E267451.47
MW8	Gas	160.74	-	-	N296014.48 E267517.14
MW9	Gas	157.94	-	-	N296037.63 E267458.87
MW10S	GAS	154.76	-	-	N296038.12 E267458.8
MW10D	GAS	154.76	-	-	N296038.12 E267458.87
MW15S	GW	150.36	148.96	1.4	N296097.36 E267343.36
MW15D	GW	150.39	149.24	1.15	N296092.30 E267344.88
MW16S	GW	152.6	151	1.6	N295888.86 E267202.87
MW16D	GW	152.53	151.03	1.5	N295885.59 E267200.97
MW17S	GW & GAS	149.58	148.2	1.38	N296179.25 E267321.30
MW17D	GW & GAS	149.49	148.19	1.3	N296178.68 E267327.22
MW18	Leachate & GAS	160.98	-	-	N296023.13 E267452.20
MW19	Leachate & GAS	162.12	-	-	N295954.06 E267499.79
SW1	SW	-	-	-	N296160.79 E267338.62
SW3	SW	-	-	-	N296312.44 E267195.10
CAP Discharge	SW	-	-	-	N296078.86 E267348.65

2.4 Weather Report

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)
30/07/2014	0.4	19.4	12.2	10.3	6.3		

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)
03/12/2014	0	6.5	2.9	-1.1	1.9		

2.0 SUMMARY OF RESULTS

Table 3.0 03rd Quarter Landfill Gas monitoring 2014

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		30/07/2014					
GA 2000 Ref	Client Ref						
7	MW 1	0	0.1	21.2	0	1008	Outside
12	MW 2	0	1.4	21.8	0	1008	Outside
9	MW 3	0	0.2	21.3	0	1008	Inside
5	MW 6	0	0.7	20.7	0	1008	Outside
	MW 7	-	-	-	-	-	Outside
10	MW 8	10.9	10.5	13.5	0	1008	Inside
6	MW 9	3.1	2.7	19.6	0	1008	Inside
3	MW 10 S	0	0.1	20.8	0	1008	Outside
4	MW 10 D	0	1.7	19.7	0	1008	Outside
2	MW17S	0	0.1	21.2	0	1008	Outside
1	MW17D	0	0.3	20.9	0	1008	Outside
11	MW18	56.7	31.8	0	0	1008	Inside
13	MW19	31.2	10.5	2.5	0	1008	Inside
	Limit	1	1.5				

Exceedance,outside waste mass

NOTES

1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence

Table 4.0 04th Quarter Landfill Gas monitoring 2014

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	03/12/2014					
Client Ref						
MW 1	-	-	-	-	-	Outside
MW 2	0	0.1	21.2	0	1010	Outside
MW 3	0.1	0.3	21.2	0	1010	Inside
MW 6	0	0.7	20.7	0	1010	Outside
MW 7	-	-	-	-	-	Outside
MW 8	1.7	12.1	10.6	0	1010	Inside
MW 9	1.7	2.8	19.2	0	1010	Inside
MW 10 S	0.4	1.32	16.4	0	1010	Outside
MW 10 D	0	0.1	20.8	0	1010	Outside
MW17S	0	0.1	21.2	0	1010	Outside
MW17D	0	0.12	21.18	0	1010	Outside
MW18	65.2	22.8	-	0	1008	Inside
MW19	-	-	-	-		Inside
Limit	1	1.5				

Exceedance,outside waste mass

NOTES

1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence

4.0 DISCUSSION

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 quarter three and four 2014 show that the levels of gas are relatively consistent with previous results in all existing wells. Results obtained from the new well MW18 which is within the waste mass was elevated for Methane and Carbon Dioxide. It is recommended that further gas monitoring is conducted for comparison purposes. Gas analysis of the new wells outside of the waste mass revealed that they did not contain Methane.

5.0 CONCLUSION

The results obtained from landfill gas analysis are also 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. 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 01st quarter of 2015.

APPENDIX 1 HISTORICAL DATA-TABLES

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2014	-	-	-	-	
	Qtr 3 2014	0	0.1	21.2	0	1008
	Qtr 2 2014	0	0.14	21.4	0	990
	Qtr 1 2014	0	0.2	21.4	0	990
MW 2	Qtr 4 2014	0	0.1	21.2	0	1010
	Qtr 3 2014	0	1.4	21.8	0	1008
	Qtr 2 2014	0	1.3	21.9	0	993
	Qtr 1 2014	0	1.1	21.8	0	990
MW 3	Qtr 4 2014	0.1	0.3	21.2	0	1010
	Qtr 3 2014	0	0.2	21.3	0	1008
	Qtr 2 2014	0.06	0.26	21.26	0	993
	Qtr 1 2014	6.1	5.7	16.1	0	990
MW 6	Qtr 4 2014	0	0.7	20.7	0	1010
	Qtr 3 2014	0	0.7	20.7	0	1008
	Qtr 2 2014	0	0.8	20.7	0	992
	Qtr 1 2014	0	1.8	19.9	0	992
MW 7	Qtr 4 2014	-	-	-	-	
	Qtr 3 2014	-	-	-	-	-
	Qtr 2 2014	0	0.1	21.3	0	993
	Qtr 1 2014	0	0.2	21.5	0	990
MW 8	Qtr 4 2014	1.7	12.1	10.6	0	1010
	Qtr 3 2014	10.9	10.5	13.5	0	1008
	Qtr 2 2014	11.6	11.2	12.6	0	993
	Qtr 1 2014	7.5	9.3	13.2	0	990
MW 9	Qtr 4 2014	1.7	2.8	19.2	0	1010
	Qtr 3 2014	3.1	2.7	19.6	0	1008
	Qtr 2 2014	2.4	2.3	19.3	0	993
	Qtr 1 2014	3.5	3.7	16.7	0	990
	Limit	**1**	**1.5**			

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 10S	Qtr 4 2014	0.4	1.32	16.4	0	1010
	Qtr 3 2014	0	0.1	20.8	0	1008
	Qtr 2 2014	0	0.1	20.8	0	993
	Qtr 1 2014	0	0.2	20.4	0	993
MW 10D	Qtr 4 2014	0	0.1	20.8	0	1010
	Qtr 3 2014	0	1.7	19.7	0	1008
	Qtr 2 2014	0	1.3	16.4	0	993
	Qtr 1 2014	0	0.4	19.8	0	993
MW 17S	Qtr 4 2014	0	0.1	21.2	0	1010
	Qtr 3 2014	0	0.1	21.2	0	1008
	Qtr 2 2014	0	0.1	21.2	0	993
	Qtr 1 2014	0	0	20	0	990
MW 17D	Qtr 4 2014	0	0.12	21.18	0	1010
	Qtr 3 2014	0	0.3	20.9	0	1008
	Qtr 2 2014	0	0.2	21.1	0	993
	Qtr 1 2014	0	0	20.5	0	990
MW 18	Qtr 4 2014	65.2	22.8	-	0	1008
	Qtr 3 2014	56.7	31.8	0	0	1008
	Qtr 2 2014	57.5	28.4	0	0	993
	Qtr 1 2014	58	27	0	0	990
MW 19	Qtr 4 2014	-	-	-	-	
	Qtr 3 2014	31.2	10.5	2.5	0	1008
	Qtr 2 2014	0	0.2	21.2	0	993
	Qtr 1 2014	5.7	4.5	17.2	0	990
	Limit	**1**	**1.5**			

SURFACE WATER MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-04-03&04-Rev 0

Produced by: Bróna Keating, B.Sc., Dip. Environmental Eng., M.Sc., MCIWM

Approved by: **Date:** 07th April 2015

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Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter three and four 2015.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

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Appendix

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency 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 quarter three and four 2014.

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 behavior with expected/modeled behavior
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (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).

2. METHODOLOGY

2.1 Environmental Sampling

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

- Surface water samples are taken by grab sample using a Telescoup and Pendulum beaker.
- Having obtained a representative sample the following parameters are 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. These forms are located in the appendix 4.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0^{o}C and 4^{o}C 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.

2.3 Monitoring Locations

Quarter 4, 2014					
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	151.55	-	-	N296071.96 E267506.68
MW2	GAS	152.72	-	-	N296018.08 E267540.57
MW3	GAS	159.27	-	-	N295972.19 E267549.66
MW 4	Gas	156.74	-	-	TBC
MW6	GAS	150.27	-	-	N296082.66 E267451.47
MW8	Gas	160.74	-	-	N296014.48 E267517.14
MW9	Gas	157.94	-	-	N296037.63 E267458.87
MW10S	GAS	154.76	-	-	N296038.12 E267458.8
MW10D	GAS	154.76	-	-	N296038.12 E267458.87
MW15S	GW	150.36	148.96	1.4	N296097.36 E267343.36
MW15D	GW	150.39	149.24	1.15	N296092.30 E267344.88
MW16S	GW	152.6	151	1.6	N295888.86 E267202.87
MW16D	GW	152.53	151.03	1.5	N295885.59 E267200.97
MW17S	GW & GAS	149.58	148.2	1.38	N296179.25 E267321.30
MW17D	GW & GAS	149.49	148.19	1.3	N296178.68 E267327.22
MW18	Leachate & GAS	160.98	-	-	N296023.13 E267452.20
MW19	Leachate & GAS	162.12	-	-	N295954.06 E267499.79
SW1	SW	-	-	-	N296160.79 E267338.62
SW3	SW	-	-	-	N296312.44 E267195.10
CAP Discharge	SW	-	-	-	N296078.86 E267348.65

2.4 Weather Report

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)
25/09/2014	0.5	18	12.8	11.8	8		
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)
26/11/2014	0.3	5	-0.9	-1.1	1.9		

3.0 SUMMARY OF RESULTS

Table 1.0 03rd Quarter Surface water monitoring 2014

Report Number		79162																
Monitoring Date		25/09/2014																
Method		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**AQ2**	**Titralab**		**5-Day**	**HACH**	**AQ2**			**Inolab**	**ICPMS**			
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**EW003**	**EW138**	**EW139**	**EW001**	**EW094**	**EW015**	**EW015**	**EW007**	**EW043**	**EM130**			
Parameter		Sample temperature (to be done onsite)	Cond	pH	Visual Inspection	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	DO	Fe	Mn	K	Na
Units		Deg C	us/cm	pH units	-	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	ug/l	ug/l	mg/l	mg/l
Limit of Detection		-	-	-	-	0.007	0.3	25	1	8	2.6	1.0	0.009	1.0	0.005	0.0	0.2	0.5
Date Testing Initiated		25.9.14				26.9.14												
ELS Ref	**Client Ref**																	
79162/001	SW1	12.8	423	7.26	Straw	***2.795***	7.2	410	4	***43***	18.9	4.8	0.096	9	***3738***	***1879.7***	7.4	16.4
79162/002	SW3	14.2	345	7.32	Straw	0.034	7.2	325	5	***44***	16.1	18.3	0.017	9	***1900.9***	***972.5***	4.7	15.9
S.I No. 294/1989						0.2	≥5.5 and ≤8.5	1000	5	40	250	200	-	-	200	50	-	-
Exceedance																		
NOTES																		
1	Sub-contract analysis denoted by *																	
2	ND - Concentration was below the limit of detection																	
3	NAC- No Abnormal Change																	

Table 2.0 04th Quarter Surface water monitoring 2014

Report Number	81012
Monitoring Date	26/11/2014

Method		Site Tests	Site Tests	Site Tests	Site Tests	AQ2	Titralab		5-Day	HACH	AQ2-UP1			SS	Titralab
Method Number		Site Tests	Site Tests	Site Tests	Site Tests	EW003	EW138	EW139	EW001	EW094	EW015	EW015	EW007	EW153	EW013
Parameter		Sample temperature (to be done onsite)	Cond	pH	Visual Inspection	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	Suspended Solids	Alkalinity
Units		Deg C	us/cm	pH units	-	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	mg/l CaCO3
Limit of Detection		-	-	-	-	0.007	0.3	25	1	8	2.6	1.0	0.009	5	10
Date Testing Initiated		26.11.14				27.11.14									
ELS Ref	Client Ref														
81012/001	SW1	7	328	7.11	Straw	***0.61***	7	274	<1	38	13.5	45.8	2.501	<5	91
81012/002	SW CAP	7	326	7.12	Clear	0.083	7.8	423	<1	17	3.8	937	2.08	<5	160
81012/003	SW3 /Lake	9.1	511	7.41	Clear	0.084	7.2	273	<1	35	13	50.3	3.274	<5	87
S.I No. 294/1989						0.2	≥5.5 and ≤8.5	1000	5	40	250	200	-	-	-

Method		ICPMS				Metals Dissolved							Metals Total	AQ2-UP1	Inolab
Method Number		EM130												EW154M	EW043
Parameter		Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Chromium-Total	TON (as N)(Calc)	DO
Units		ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/l N	mg/l
Limit of Detection		20.000	1.0	0.2	0.5	0.1	1	20	0.3	0.3	0.02	1	1	0.138	1.0
Date Testing Initiated		27.11.14													
ELS Ref	Client Ref														
81012/001	SW1	***690***	***240***	4.8	11.9	<0.1	35.7	<0.003	<0.3	7.9	<0.02	8.5	<3	1.671	8
81012/002	SW CAP	<20	29	7.1	6.5	<0.1	79	0.009	<0.3	10.2	0.02	62	<3	0.205	10
81012/003	SW3 /Lake	150	***65***	4.8	12.8	<0.1	37.7	<0.003	<0.3	8.3	0.02	9.5	<3	1.541	9
S.I No. 294/1989		200	50	-	-	5	-	0.03	10	-	1	100	30	-	-

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.

4.0 DISCUSSION

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.

Surface water samples were taken at SW1 (downstream of landfill), the discharge cap as well as SW3.

With regard to all surface water samples, results in bold italics indicate that limits were exceeded for the following parameters: Ammonia, COD, Iron and Manganese. Previous results detailed in the historical data show that exceedances for each of these parameters is on par with previous monitoring events.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedances therefore there is no evidence of any major negative environmental impact associated with this landfill.

APPENDIX 1 HISTORICAL DATA-TABLES

	Parameter	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	DO	Fe	Mn	K	Na
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	ug/l	ug/l	mg/l	mg/l
Discharge Cap	Qtr 4 2014	0.083	7.8	423	<1	17	3.8	937	2.08	10	<20	29	7.1	6.5
	Qtr 3 2014	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2014	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 1 2014	0.026	7.2	173	<1	10	7.4	43.7	0.016	10	36.8	6	3.8	5.5
SW1	Qtr 4 2014	***0.61***	7	274	<1	38	13.5	45.8	2.501	8	***690***	***240***	4.8	11.9
	Qtr3 2014	***2.795***	7.2	410	4	***43***	18.9	4.8	0.096	9	***3738***	***1879.7***	7.4	16.4
	Qtr 2 2014	***1.003***	7	324	<1	***61***	13	4.2	<0.009	7	***1478.3***	***2929***	8.4	16
	Qtr 1 2014	0.165	6.9	212	<1	23	15.7	28.2	<0.009	8	***209.7***	41.2	5.7	10.8
SW3	Qtr 4 2014	0.084	7.2	273	<1	35	13	50.3	3.274	9	150	***65***	4.8	12.8
	Qtr 3 2014	0.034	7.2	325	5	***44***	16.1	18.3	0.017	9	***1900.9***	***972.5***	4.7	15.9
	Qtr 2 2014	0.096	7.1	265	<1	***51***	7.6	19.7	<0.009	8	***1002.4***	***1275.4***	5.1	13.8
	Qtr 1 2014	0.03	6.9	218	<1	22	17.3	31.1	<0.009	9	199.2	36	5.7	11.7
S.I No 294/1989		0.2	≥5.5 and ≤8.5	1000	5	40	250	200		NAC	200	50		

LEACHATE MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-04- 03&04-Rev 0

Produced by: Bróna Keating, B.Sc., Dip. Environmental Eng., M.Sc., MCIWM

Approved by: **Date:** 07th April 2015

Cathal Boylan, BEng, CEng, MIEI
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Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter three & four 2013.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

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Appendix

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency 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 leachate sampling programme conducted on site and also summarises findings and analytical results for quarter four 2013.

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 behavior with expected/modeled behavior
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (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).

2. METHODOLOGY

2.1 Environmental Sampling

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

- Leachate samples are taken by grab sample using a Telescoup and Pendulum beaker.
- Having obtained a representative sample the following parameters are 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. These forms are located in the appendix 4.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0^{o}C and 4^{o}C 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.

2.3 Monitoring Locations

Quarter 4 2013					
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	151.55	148.75	2.8	N296071.96 E267506.68
MW2	Gas	152.72	150.12	2.6	N296018.08 E267540.57
MW3	GW	159.27	155.97	3.3	N295972.19 E267549.66
MW6	Gas	150.27	147.07	3.2	N296082.66 E267451.47
MW8	Leachate	160.74	157.54	3.2	N296014.48 E267517.14
MW9	Leachate	157.94	153.44	4.5	N296037.63 E267458.87
MW10S	GW	154.76	149.06	5.7	N296038.12 E267458.8
MW10D	GW	154.76	149.06	5.7	N296038.12 E267458.87
MW15S	GW	150.36	148.73	1.63	N296097.36 E267343.36
MW15D	Gas	150.39	148.79	1.6	N296092.30 E267344.88
MW16S	Gas	152.6	151.15	1.45	N295888.86 E267202.87
MW16D	GW	152.53	151.33	1.2	N295885.59 E267200.97
SW1	GW	-	-	-	n/a
SW3	GW	-	-	-	n/a
CAP Discharge	GW	-	-	-	n/a
MW17S	GW	149.7	148.27	1.43	N296174 E267321
MW17D	GW	149.61	148.61	1	N296176 E267327
MW18	Leachate	161.1	-	-	N296018 E267451
MW19	Leachate	162.24	-	-	N295948 E267487

2.4 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min Temp (°C)	Mean Wind Speed (knots)	Gusts (if >= 34 knots)	Sunshine (hours)
12/11/2013	0.1	10.1	3.8	0.9	6.4		

3.0 SUMMARY OF RESULTS

Table 1.0 03rd Quarter Leachate monitoring 2014

Monitoring Date		26/09/2014							
Monitoring Report		79163							
Method		**Site Tests**	**AQ2**	**AQ2**	**Titralab**		**5-Day**	**HACH**	**AQ2**
Method Number		**Site Tests**	**EW003**	**EW154M**	**EW138**	**EW139**	**EW001**	**EW094**	**EW015**
Parameter		Visual Inspection	Ammonia	TON	pH	Cond	BOD	COD	Cl
Units		-	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l
Limit of Detection		-	0.007	0.69	0.3	25	1	8	2.6
Date Testing Initiated			26.9.14						
ELS Ref	**Client Ref**								
79163/001	MW18	black	***301.058***	<0.69	7.2	***3757***	37	531	***186.7***
79163/002	MW19	black	***21.037***	<0.69	6.6	924	29	253	***41.5***
Interim Guide Values			0.15		≥5.5 and ≤8.5	1000	-	-	30

Exceedance

NOTES	
1	Sub-contract analysis denoted by *
2	ND - Concentration was below the limit of detection
3	NAC- No Abnormal Change

Table 2.0 04th Quarter Leachate monitoring 2014

Report Number:	81014
Monitoring Date:	26.11.14

Method		Site Tests	Ammonia	AQ2-UP1	Titralab		AQ2-UP2		5-Day	HACH	Coliforms		Ion Chromatography	AQ2-UP1
Method Number		**Site Tests**	**EW003**	**EW154M**	**EW153**		**EW154M-1**		**EW001**	**EW094**	MIC133		EW137	EW154M
Parameter		Visual Inspection	Ammonia	TON (as N)(calc)	pH	Cond	Sulphate	Cl	BOD	COD	E. Coli	Total Coliforms	Fluoride	Phosphate-Ortho(as P) (MRP)
Units		-	mg/l N	mg/l N	pH Units	us/cm	mg/L	mg/l	mg/l	mg/l	MPN/100 ml	MPN/100ml	mg/L	mg/l P
Limit of Detection		-	0.035	0.69	0.3	25	5	13	1.0	8.0	10	10	0.1	0.045
Date Testing Initiated			27.11.14											
ELS Ref	**Client Ref**													
81014/001	MW18	Brown	***310***	<0.69	7	***2690***	17	***140***	<37	219	<10	<10	<0.1	<0.045
IGV			0.15	-	≥6.5 and ≤9.5	1000	200	30	200	NAC	0	0	1	-

Method		Total Cyanide High (Sub)	Total Phosphorus-TP	Metals-Total	Metals-Dissolved										
Method Number		DEFAULT	EW146	EM130											
Parameter		Total Cyanide High	Total Phosphorus-TP	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	mg/l P	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L
Limit of Detection		9	0.1	1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1	0.02
Date Testing Initiated		27.11.14														
ELS Ref	**Client Ref**															
81014/001	MW18	<9	1.2	***33.6***	77	<1	***109.9***	110.6	<0.1	98.8	<0.003	<0.3	***87.4***	0.14	2.1	***1.06***
IGV		10	-	30	200	50	5	150	0.005	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

3 NAC- No Abnormal Change

As there are no limits set in the waste licence for leachate, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available.

4.0 DISCUSSION

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 treat to surrounding surface and ground waters. 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 Guide Values for the protection of Groundwater in Ireland, where available. Results in Hatched Red indicate where the interim guide value has been exceeded. A leachate sample was abstracted from wells MW18 and MW19 during quarter three monitoring and from well MW18 during quarter 4. Results show that the Interim Guide Value was exceeded at on this occasion for the parameters Ammonia, Conductivity, Potassium and Chromium. These results are consistent with those obtained in previous monitoring events.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedances therefore there is no evidence of any major negative environmental impact associated with this landfill.

APPENDIX 1 HISTORICAL DATA-TABLES

	Parameter	Ammonia	Cl	TON	SO4	Cond	pH	COD	BOD
	Units	mg/l N	mg/l	mg/l N	mg/l	us/cm	pH Units	mg/l	mg/l
WELL MW 18	Qtr4 2014	310	140	<0.69	17	2690	7	219	<37
	Qtr3 2014	***301.058***	<0.69	7.2	***3757***	37	531	***186.7***	-
	Qtr 4 2013	***273***	<13	1.291	36.7	***3259***	7.1	890	98
	Qtr 3 2013	***278***	5.908	7.1	***4104***	81	3200	***199.7***	-
WELL MW 19	Qtr4 2014	-	-	-	-	-	-	-	-
	Qtr 3 2014	***21.037***	<0.69	6.6	924	29	253	***41.5***	-
	Qtr 4 2013	***4***	<13	<0.69	92.5	422	6.7	101	14
	Qtr 3 2013	***37***	<0.69	6.7	***1283***	10	670	***68.6***	-
Interim Guide Values		0.15	200	NAC	200	1000	≥6.5&≤9.5		