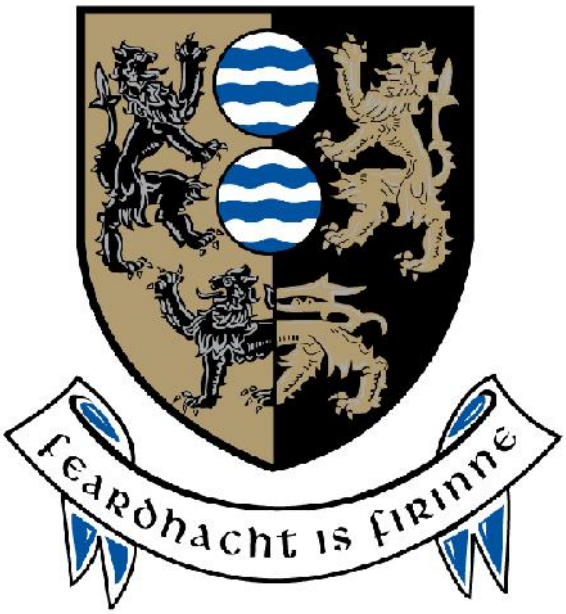
COMHAIRLE CHONDAE AN CABHÁIN

Cavan County Council



Annual Environmental Report 2014

Belturbet Landfill WL 92-1

Document Title	Annual Environmental Report 2014 Belturbet Landfill WL 0092-1		
Document ID	CCC-04-02-2014		
Revision	**Status**	**Author**	**Issue Date**
01	Draft	BK	09/04/15
02	Final Issue	BK/CB	09/04/15

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

Contents

List of Tables

List of Graphs

List of Appendices

1.0 INTRODUCTION

Belturbet Landfill has been operated as waste disposal facility by Cavan County Council since the late 1979. The site was operated as a traditional landfill and is located on the Belturbet - Ballyconnell road (R200) approximately 4.5km west of Belturbet on the north side. The site was originally operated as a limestone quarry and comprises of some 1.65 acres. The rock is composed of the Darty Limestone Formation from the Lower Carboniferous period.

A Waste Licence for the facility was issued by the EPA on 13th February 2002, Ref WL 92-1. Condition 11.4 of Waste Licence requires the submission of an Annual Environmental Report for Belturbet Landfill facility. This document is produced in order to comply with requirements of Condition 11.4. The site at Belturbet was closed in February 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".

2.0 REPORTING PERIOD

The reporting period for the purposes of this AER is 1st January 2014 to 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.

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

5.1 Surface Water

Killynaher Lake is part of the Lough Oughter System and is a Special Area of Conservation. The lake quality is A2 status.

Table 5.1 Surface water summary 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
SW Killynaher Lake	Qtr 4 2014	***0.42***	7.9	326	<1	20	<5	9.2	10
	Qtr 3 2014	0.121	8	341	<1	14	<5	19	10
	Qtr 2 2014	***1.225***	***8.6***	-	3	17	7	20	9
	Qtr 1 2014	0.101	8.2	323	2	15	<5	19	10
S.I No. 294/1989		**0.2**	**≥5.5 and ≤8.5**	**1000**	**5**	**40**	**50**	**250**	

There were only 1 marginal exceedance in the surface water sampling suite during 2014. This exceedance in Ammonia cannot be definitively attributed to the landfill as the surface water body “Killynaher Lake” lies within a predominant agricultural catchment which is exposed to activities such as slurry spreading.

5.2 Groundwater

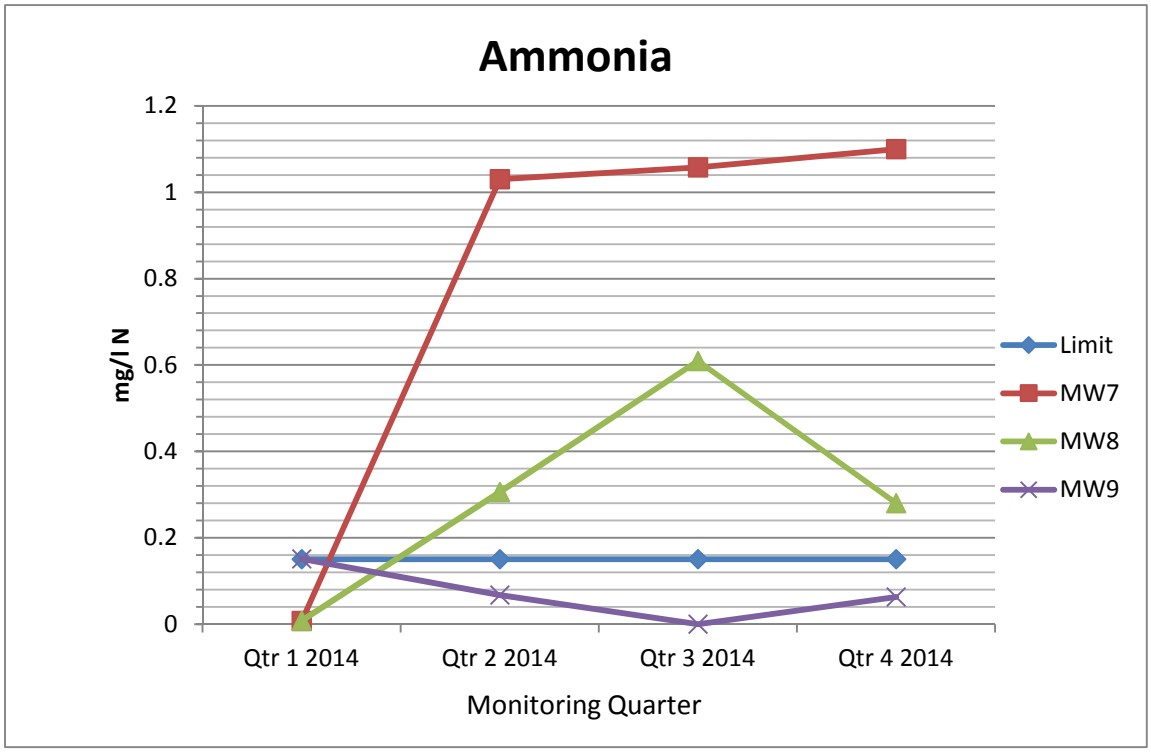
This landfill underwent the process of final capping during 2012. Ground water samples were extracted from MW 7 and MW 8 as per the waste licence. An addition ground water well was constructed along the South East boundary between the landfill and the nearest dwelling house; this well was constructed in conjunction with the capping works and is labelled MW 9. Monitoring of this well began in 2013 as per the waste licence.

Table 5.2 Ground water summary results

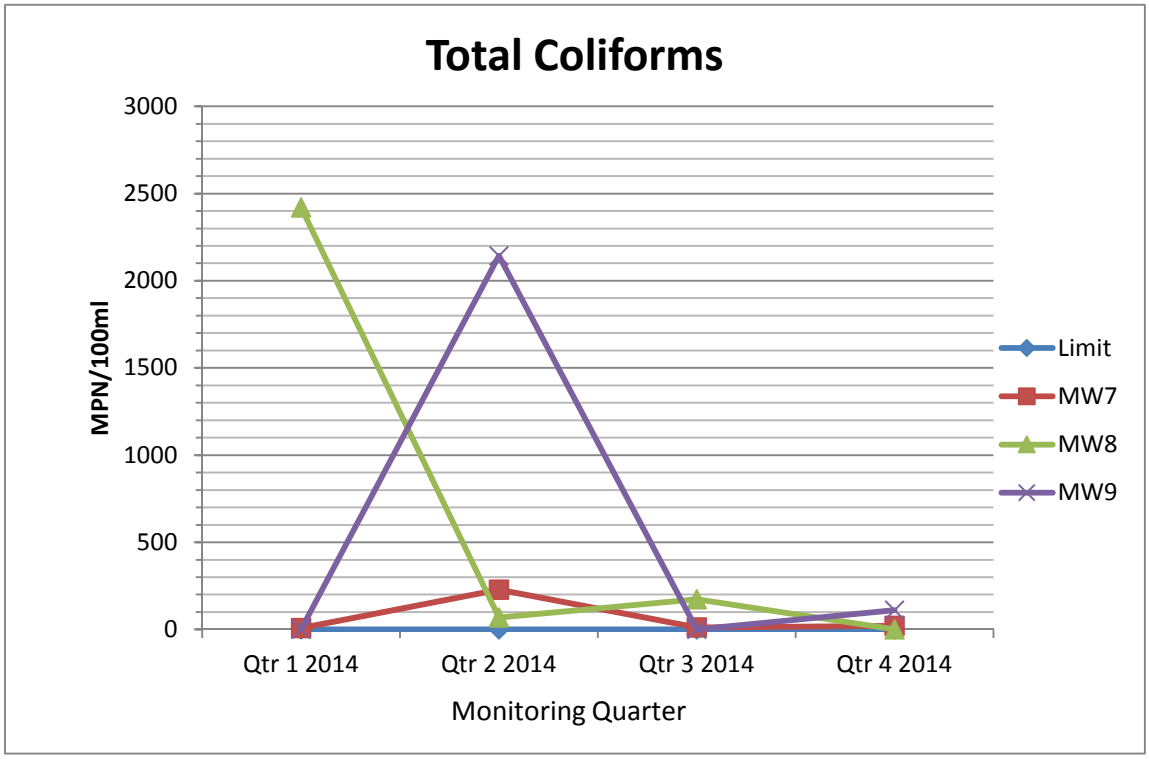
The following table and graphs show environmental monitoring results for the site.

	Parameter	TOC	E.Coli	Ammonia	TON	Tot Coliforms	pH	Cond	Cl	DO	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	mg/l	mg/l
MW 7	Qtr 4 2014	2.01	***10***	***1.1***	0.528	***20***	8	615	9.3	6	<20	***7.7***	47.7
	Qtr 3 2014	0.83	0	1.058	<0.138	11	7.8	648	10.4	8	34	8	44.6
	Qtr 2 2014	0.74	***51***	***1.03***	0.196	***228***	7.9	632	11.2	3	45.7	***10.2***	46.6
	Qtr 1 2014	0.91	0	<0.007	<0.138	***8***	7.8	569	8.8	6	<20	***8.9***	24.6
MW 8	Qtr 4 2014	1.36	0	***0.28***	1.214	0	7.6	***1035***	***194.5***	9	<20	4.2	42.4
	Qtr 3 2014	0.77	73	0.609	<0.138	173	7.4	881	92.9	8	51.5	5.9	30.8
	Qtr 2 2014	0.8	***48***	***0.306***	<0.138	***68***	7.4	***1034***	***152.9***	9	100.5	***7.9***	36.6
	Qtr 1 2014	1.22	0	0.008	<0.138	***2420***	7.5	839	***75.7***	7	<20	***8.5***	28
MW 9	Qtr 4 2014	1.2	0	0.063	0.196	***110***	7.6	691	3.6	9	<20	1.7	17.1
	Qtr 3 2014	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2014	1.16	***166***	0.067	<0.138	***2143***	7.3	689	3.2	9	<20	***5.7***	4.9
	Qtr 1 2014	1.41	0	0.151	<0.138	0	7.1	671	<2.6	8	<20	***5.1***	3.8
Interim Guide Value		**NAC**	**0**	**0.15**	**NAC**	**0**	**≥6.5 &≤9.5**	**1000**	**30**	**NAC**	**0.2**	**5**	**150**

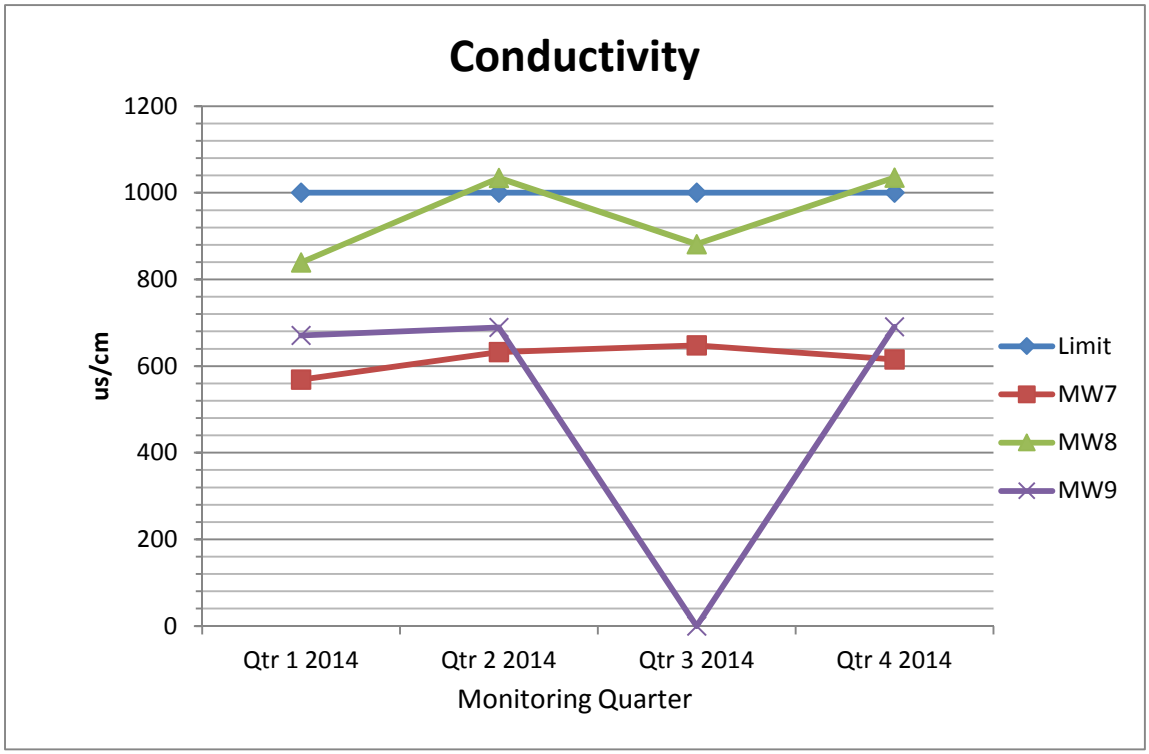
Graph 5.1



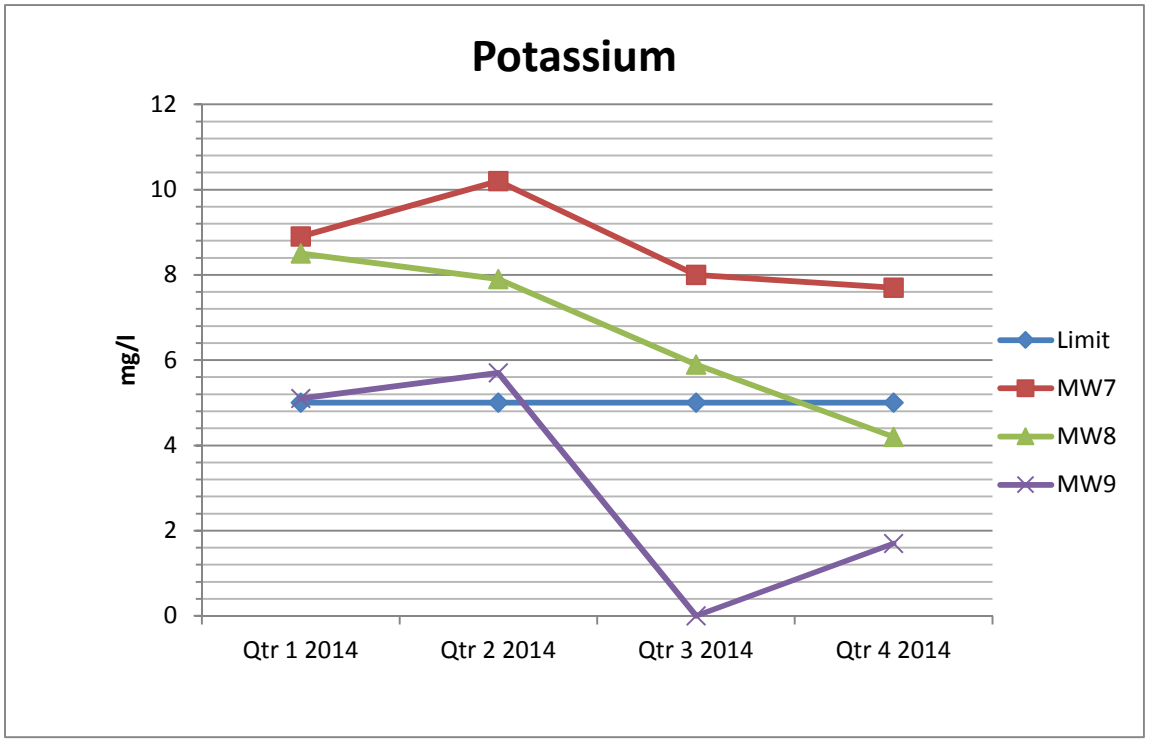
Graph 5.2



Graph 5.3



Graph 5.4



As detailed in the above graphs, there were numerous ground water exceedances at this landfill during 2014.

Exceedances occurred in the following parameters:

- Ammonia: Elevated levels of this parameter were prevalent during 2014. Levels such as those recorded are not unusual in a mature landfill such as this. Levels will gradually decrease as the landfill matures.
- Conductivity: Elevated levels of this parameter are commonly associated with pollution of an organic nature and therefore may be attributed to the landfill or surrounding agricultural sources.
- Total Coliforms: Exceedances in this parameter are attributed to the natural decomposition of the organic materials in this landfill.
- 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.

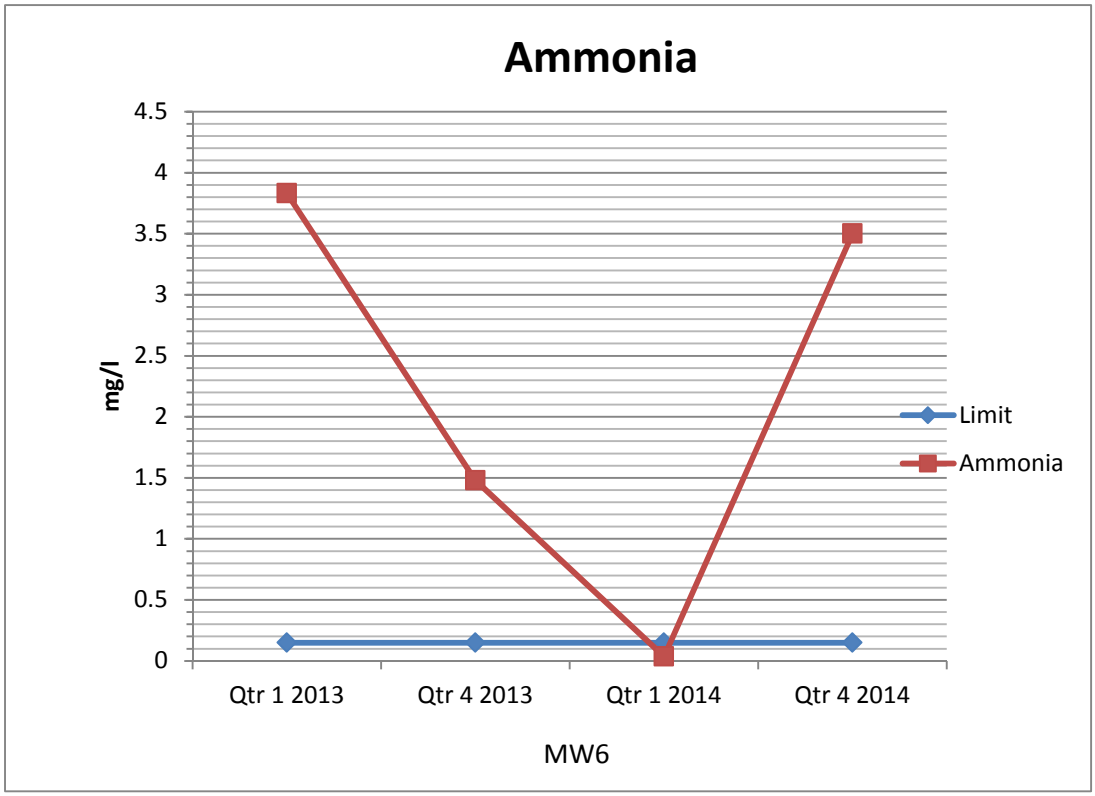
5.3 Leachate Monitoring

Monitoring Well MW5 was sampled for Leachate during quarter one of 2012. However after capping of the landfill the well was found to be dry and so samples have been obtained form Well MW6 since then.

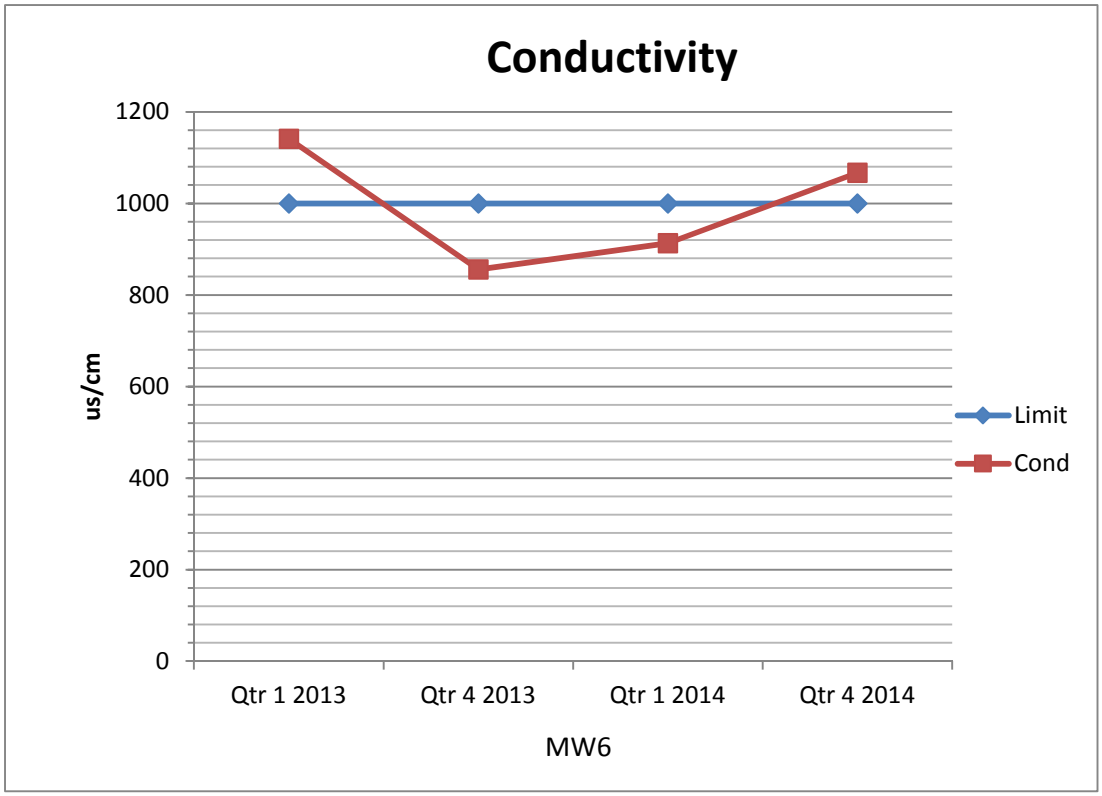
Table 5.3 Leachate summary results

	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
MW 6	Qtr 4 2014	***3.5***	1.813	7.5	***1067***	11	58	58
	Qtr 1 2014	<0.035	<0.690	7.3	913	9	75	43.5
	Qtr 4 2013	***1.478***	<0.69	7.4	856	7	15	62.7
	Qtr 3 2013	-	-	-	-	-	-	-
Interim Guide Values		**0.15**	**NAC**	**≥6.5&≤9.5**	**1000**			**200**

Graph 5.5



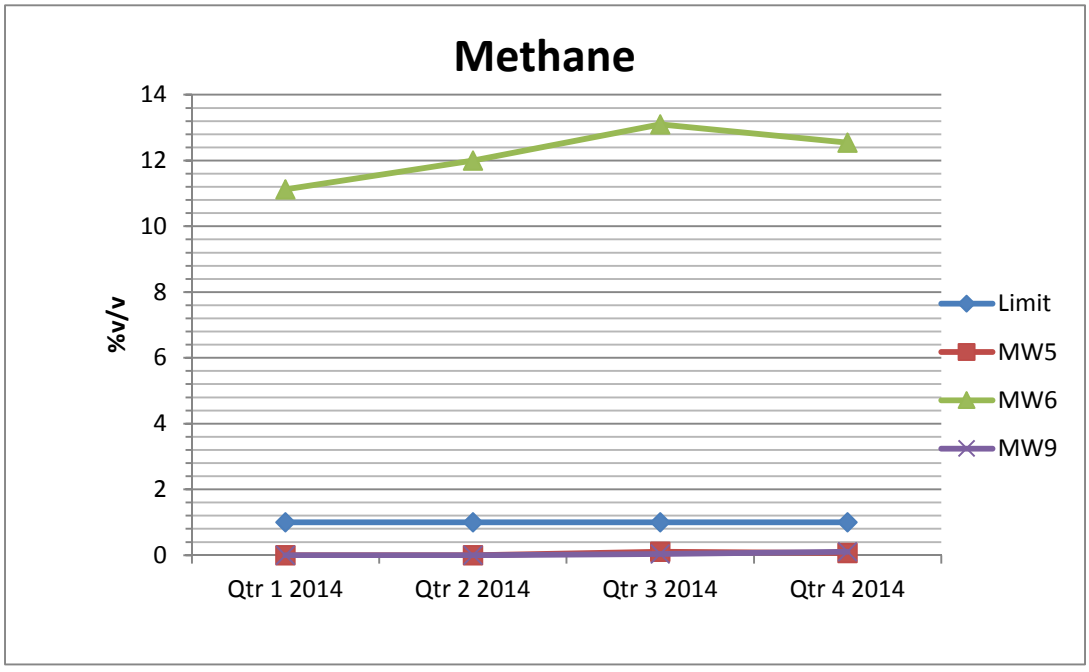
Graph 5.6



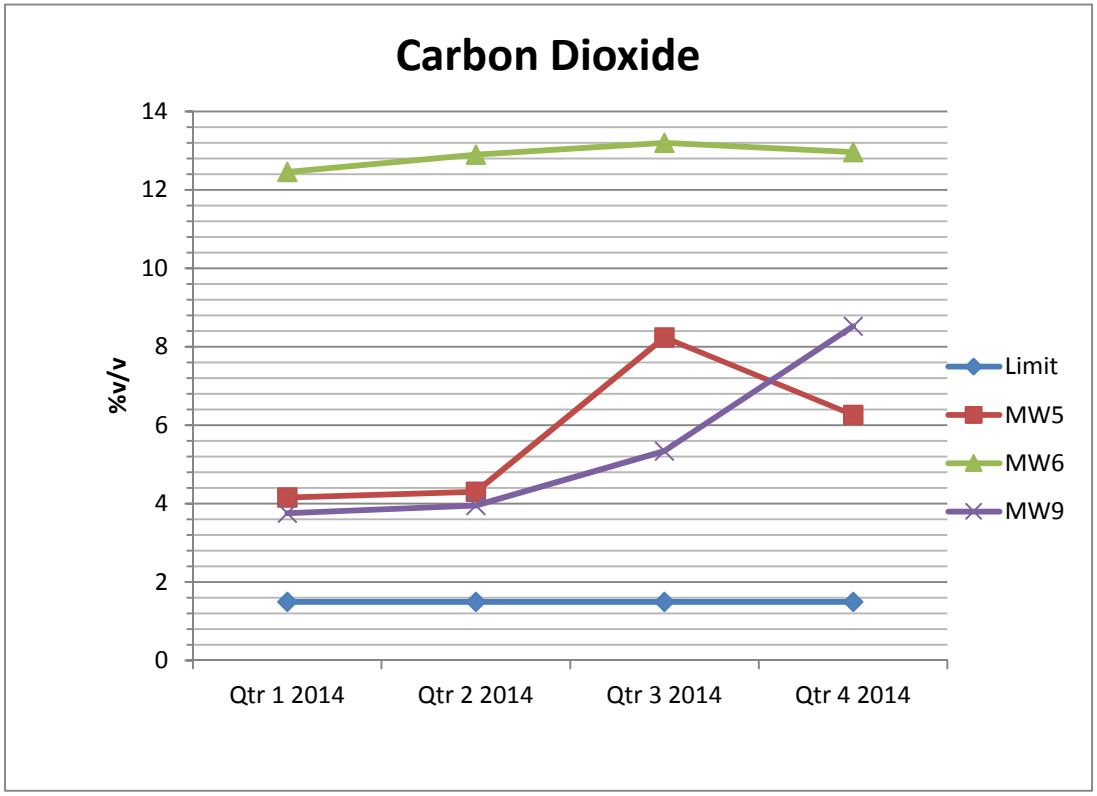
5.4 Gas Emissions monitoring summary results

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	**Qtr**	-	-	-	-	-
MW 5	Qtr 4 2014	0.1	6.3	15.3	0.0	998.0
	Qtr 3 2014	0.1	8.24	1.52	0	1006
	Qtr 2 2014	0	4.3	8.06	0	1004
	Qtr 1 2014	0.0	4.2	8.3	0.0	990.0
MW 6	Qtr 4 2014	12.5	13.0	0.0	0.0	998.0
	Qtr 3 2014	13.1	13.2	0	0	1006
	Qtr 2 2014	12	12.9	0.7	0	1003
	Qtr 1 2014	11.1	12.5	1.3	0.0	990.0
MW9	Qtr 4 2014	0.1	8.5	1.5	0.0	998.0
	Qtr 3 2014	0.04	5.34	16.26	0	1006
	Qtr 2 2014	0	3.95	15.9	0	1003
	Qtr 1 2014	0.0	3.8	15.5	0.0	990.0
	Limit	**1**	**1.5**			
Exceedance						
NOTES						
1	Instrument Serial No: GA 07721					
2	Limit: Schedule C2, Licence					

Graph 5.7



Graph 5.8



Gas emissions have remained steady at locations MW 5 and MW 6 during 2014 and are typical of a mature landfill. Monitoring of MW 9 a newly constructed gas migration well begun in quarter 4 2012. Results obtained show that there is very little methane present at this location.

6.0 SUMMARY OF RESULTS & INTERPRETATION OF ENVIRONMENTAL MONITORING

As presented in the information above and in Appendix 3, apart from slight elevations in certain parameters, there appears to be no environmental pollution associated with this landfill. We will continue to monitor this facility and monitoring will be increased following restoration works with the insertion of new boreholes on adjacent lands etc.

7.0 RESOURCE & ENERGY CONSUMPTION

There is no energy consumption or resource use on the site. There is no landfill gas of any value produced as can be seen from the PRTR Report

8.0 VOLUME OF LEACHATE PRODUCED

The volume of Leachate produced is unknown.

9.0 REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD AND A TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR

Final capping of this landfill was completed during 2012. However the final phase of works is on hold pending negotiations with the surrounding land owner. The proposed works will involve the installation of a piped conduit for the surface water cap discharge to Killynaher Lake and the addition of monitoring boreholes on adjacent farmlands.

10.0 REPORT ON THE RESTORATION OF COMPLETED CELLS/PHASES

Belturbet Landfill was capped in 2012 according to specifications submitted and approved by the EPA Castlebar office.

A fully engineered and lined system was installed and the site has been improved significantly. There is however some outstanding works unfinished. The cap surface water collection system and monitoring boreholes are due to be installed on Mr Reilly's lands as soon as agreement can be reached. Agreement was reached previously but other queries have arisen in the meantime.

11.0 SITE SURVEY SHOWING THE EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING PERIOD

The topographical levels at this site are static as the landfill is closed and no longer accepting waste. A monitoring location map is instead included in Appendix B.

12.0 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 15,200kgs/yr. Page one from the Annual Gas Survey is also presented in Appendix A.

13.0 FULL TITLE AND A WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENCE IN THE YEAR WHICH RELATES TO THE FACILITY

There are no written procedures required for this site.

14.0 TANK & BUND TESTING INSPECTION

There are no tanks or bunds on site.

15.0 REPORTING INCIDENTS & COMPLAINTS SUMMARIES

There were no complaints reported or recorded for this site during the reporting period.

16.0 REPORTS ON FINANCIAL PROVISION MADE UNDER THIS LICENCE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY AND A PROGRAMME FOR PUBLIC INFORMATION.

Provision will be made in Cavan County Council Official Estimates for Charges as required under Condition 12 of Waste Licence Ref. 92-1.

Table 16.1 Management Structure 2014-2015

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

Programme for Public Information:
Cavan County Council informs local residents of any works that are taking place at the landfill facility.

17.0 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 by the FAS Waste Management Training Course, Control of Landfill Gas and carries a Safe Pass.

18.0 ANY OTHER ITEMS SPECIFIED BY THE AGENCY

No other items have been specified.

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	Belturbet Landfill
PRTR Identification Number	W0092
Licence Number	W0092-01

Classes of Activity

No.	class_name
-	Refer to PRTR class activities below

Address 1	Rahaghan
Address 2	Belturbet
Address 3	
Address 4	
	Cavan
Country	Ireland
Coordinates of Location	-7.51132 54.0873
River Basin District	GBNIIENW
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	049-4378418
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 ?	
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) ?	No

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)	M	OTH	GASSIM	0.0	42500.0	0.0	42500.0
01	**Methane (CH4)**	M	OTH	GASSIM	0.0	15200.0	0.0	15200.0

* 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: Belturbet Landfill

Please enter summary data on the quantities of methane flared and / or utilised			Method Used			
	T (Total) kg/Year	**M/C/E**	**Method Code**	**Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as per site model)	15200.0	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)	15200.0	C	OTH	GASSIM	N/A	

Environmental Protection Agency

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2014

Please choose from the drop down menu the license number for your site	W0092
Please choose from the drop down menu the name of the landfill site	Belturbet Landfill
Please enter the number of flares operational at your site in 2014	0
Please enter the number of engines operational at your site in 2014	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 31/03/2015

Introduction

The Office of Climate Licensing and Resource Use (OCLR) 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 targets under the Kyoto Protocol. 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 waste 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_2014) to:
LFGProject@epa.ie

SURFACE WATER MONITORING REPORT FOR BELTURBET LANDFILL W0092-01

Client: **Cavan County Council**

Site Location: **Rahaghan, Belturbet**

Report No.: CCC-04-01-04-04-Rev-0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: _____ **Date:** 19th January 2015
Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
Company Reg. 430482
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Fax: 046 – 928 6002
Email: info@boylanengineering.ie
Web: www.boylanengineering.ie

Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Belturbet Landfill (W0092-01), Rahaghan, Belturbet, Co Cavan for quarter four 2014, Annual parameters.

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

Table of Contents

List of Tables

Appendix

1. INTRODUCTION

Belturbet landfill was operated as a disposal facility by Cavan County Council from 1979 until its closure in February 2002. The facility was operated as a traditional landfill and is located on the Belturbet Ballyconnell road (R200) approximately 4.5 kilometres West of Belturbet town. The site which was originally a limestone quarry comprises some 0.65 hectares. The bedrock surrounding the landfill is Darty Limestone Formation from the Lower Carboniferous period. A waste licence was issued by the EPA on the 13th of February 2002. Some remedial works were carried out after the closure of the site.

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 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, Belturbet landfill is situated in the R4 Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R4 Zones are unacceptable in accordance with today's standards detailed 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).

2.0 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.

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	GW	TBC	-	TBC	TBC
MW5	Gas & Leachate	TBC	-	TBC	TBC
MW6	Gas & Leachate	TBC	-	TBC	TBC
MW7	Gas & GW	TBC	-	TBC	TBC
MW 8	GW	TBC	-	TBC	TBC
MW 9	Gas & GW	TBC	-	TBC	TBC
Killynaher Lake	SW	TBC	-	TBC	TBC

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)
02/12/2014	0	7.7	-0.5	-5.4	3.6		

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Surface water monitoring 2014

Report Number 20690		81208														
Monitoring Date:		02/12/2014														
Method		**Site Tests**	**Site Tests**	**Site Tests**	**AQ2**	**Titralab**		**5-Day**	**HACH**	**Gravimetric**	**AQ2**	**Inolab**	**Titralab**	**AQ2-UP2**	**Total Phosphorus-TP**	**AQ2-UP1**
Method Number		**Site Tests**			**EW003**	**EW138**	**EW139**	**EW001**	**EW094**	**EW013**	**EW015**	**EW043**	**EW153**	**EW154M-1**	**EW146**	**EW154M**
Parameter		Sample temperature (to be tested onsite)	Cond	pH	Ammonia	pH	Cond	BOD	COD	Total Suspended Solids	Cl	DO	Alkalinity Total (R2 pH4.5)	Sulphate	Total Phosphorus-TP	TON (as N)(Calc)
Units		Deg C	us/cm	pH units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/L CaCO3	mg/L	mg/l P	mg/l N
Limit of Detection		-	-	-	0.007	25	25	1	8	5	2.6	1.0	10	5	0.1	0.138
Date Testing Initiated			2.12.14		3.12.14											
ELS Ref	**Client Ref**															
81208/001	SW1 Lake	6.8	334	7.94	***0.42***	7.9	326	<1	20	<5	9.2	10	141	12	0.043	0.798
S.I No. 294/1989					0.2	≥5.5 and ≤8.5	1000	5	40	50	250	-	NAC	200	-	

Method		**Metals-Dissolved**											**Metals-Total**
Method Number													
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
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
Limit of Detection		20	1	0.5	0.5	0.1	1	0.003	0.3	0.3	0.02	1	1
Date Testing Initiated		03.12.14											
ELS Ref	**Client Ref**												
81208/001	SW1 Lake	<20	26	2.4	12.5	<0.1	59.3	0.009	<0.3	3.9	<0.02	4.7	<3
S.I No. 294/1989		200	50	-	-	5	-	0.03	0.01	-	1	100	30

Exceedance of waste licence

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.

4.0 DISCUSSION

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

A surface water sample was taken at SW2 (Killynaher lake) which is in the vicinity of the landfill. Results show that all parameters with the exception of ammonia were within levels stipulated by the afore mentioned document. Ammonia in this instance could be caused by a number of factors, including runoff from the adjacent agricultural lands or possible contamination from a nearby effluent treatment system. Monitoring will be undertaken again in February 2015 whereby if this exceedance is found to reoccur, additional investigations will be undertaken.

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

5.0 CONCLUSION

The results obtained are relatively consistent with previous monitoring events and therefore there is no evidence of any major negative environmental impact associated with this landfill. The next environmental and landfill gas monitoring event will take place during the first quarter 2015.

LEACHATE MONITORING REPORT FOR BELTURBET LANDFILL W0092-01

Client: **Cavan County Council**

Site Location: **Rahaghan, Belturbet**

Report No.: CCC-04-01-04-04-Rev-0

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

Approved by: _____ **Date:** 19th January 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 Belturbet Landfill (W0092-01), Rahaghan, Belturbet, Co Cavan for quarter four 2014, Annual parameters.

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

Table of Contents

List of Tables

1. INTRODUCTION

Belturbet landfill was operated as a disposal facility by Cavan County Council from 1979 until its closure in February 2002. The facility was operated as a traditional landfill and is located on the Belturbet Ballyconnell road (R200) approximately 4.5 kilometres West of Belturbet town. The site which was originally a limestone quarry comprises some 0.65 hectares. The bedrock surrounding the landfill is Darty Limestone Formation from the Lower Carboniferous period. A waste licence was issued by the EPA on the 13th of February 2002. Some remedial works were carried out after the closure of the site.

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 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, Belturbet landfill is situated in the R4 Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R4 Zones are unacceptable in accordance with today's standards detailed 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).

2.0 METHODOLOGY

2.1 Environmental Sampling

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

- ISO 5667: Guidance on sampling of groundwaters is adhered to.
- Prior to sampling, the depth of water in leachate wells is measured by dipping. Dipping the wells before sampling allows for calculation of the volume of water in the well.
- 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.
- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times. These forms are located in the appendix 3.

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	GW	TBC	-	TBC	TBC
MW5	Gas & Leachate	TBC	-	TBC	TBC
MW6	Gas & Leachate	TBC	-	TBC	TBC
MW7	Gas & GW	TBC	-	TBC	TBC
MW 8	GW	TBC	-	TBC	TBC
MW 9	Gas & GW	TBC	-	TBC	TBC
Killynaher Lake	SW	TBC	-	TBC	TBC

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)
02/12/2014	0	7.7	-0.5	-5.4	3.6		

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Leachate monitoring 2014

Report Number		81207														
Monitoring Date		02/12/2014														
Method		**Site Tests**	**Site Tests**	**Site Tests**	**AQ2**							**Coliforms**		**Ion Chromatography**	**AQ2-UP2**	**Total Cyanide High (Sub)**
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**EW003**	**EW051**	**EW138**	**EW139**	**EW001**	**EW094**	**EW015**	**MIC133**		**EW137**	**EW154M-1**	**DEFAULT**
Parameter		Sample temperature (to be tested onsite)	Water Level from TOC	Visual Inspection	Ammonia	TON	pH	Cond	BOD	COD	Cl	E. Coli	Total Coliforms	Fluoride	Sulphate	Total Cyanide High
Units		Deg C	Meter's		mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	MPN/100ml		mg/L	mg/L	ug/L
Limit of Detection		-	-	-	0.035	0.69	0.3	25	1	8	13	10	10	0.1	5	9
Date Testing Initiated		2.12.14			3.12.14											
ELS Ref	**Client Ref**															
81207/001	MW6	-	-	-	***3.5***	1.813	7.5	***1067***	11	58	58	<10	***500***	***1.09***	***270***	<9
IGV					0.15	NAC	≥6.5&≤9.5	1000	-	-	200	0	0	1	200	10

Method		**Total Phosphorus-TP**	**Metals-Total**	**Metals-Dissolved**											
Method Number		**EW146**	**EM130**												
Parameter		Total Phosphorus-TP	Chromium-Total	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved	Iron-Dissolved
Units		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		0.1	1	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1	0.02	20
Date Testing Initiated		03.12.14													
ELS Ref	**Client Ref**														
81207/001	MW6	0.5	11.5	***420***	***9.6***	21	<0.1	167.6	0.009	<0.3	***54.5***	<0.02	17	0.16	<20
IGV		-	30	50	5	150	5	200	0.03	10	50	1	100	1	200

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

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. A leachate sample was abstracted from well MW5 during quarter four monitoring. Results show that elevations similar to those from in previous monitoring events were encountered. However, they are not of concern at present as leachate by its nature is often highly contaminated with various compounds.

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

5.0 CONCLUSION

The 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. The next environmental monitoring event will take place during the first quarter 2015.

GAS MONITORING REPORT FOR BELTURBET LANDFILL W0092-01

Client: **Cavan County Council**

Site Location: **Rahaghan, Belturbet**

Report No.: CCC-04-01-04-04-Rev-0

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

Approved by: _____ **Date:** 08th 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 Belturbet Landfill (W0092-01), Rahaghan, Belturbet, Co Cavan for quarter four 2014.

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

Table of Contents

Tables

Appendix

1. INTRODUCTION

Belturbet landfill was operated as a disposal facility by Cavan County Council from 1979 until its closure in February 2002. The facility was operated as a traditional landfill and is located on the Belturbet Ballyconnell road (R200) approximately 4.5 kilometres West of Belturbet town. The site which was originally a limestone quarry comprises some 0.65 hectares. The bedrock surrounding the landfill is Darty Limestone Formation from the Lower Carboniferous period. A waste licence was issued by the EPA on the 13th of February 2002. Some remedial works were carried out after the closure of the site.

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 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.

2.0 METHODOLOGY

2.1 Landfill Gas Analysis

The following procedure is employed by Brona 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 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.

2.3 Monitoring Locations

2.4 Weather Report

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Landfill Gas monitoring 2014

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H2S	Barometric Pressure
Units		% v/v	% v/v	%	PPM	mb
Date Testing		25/11/2014				
GA 2000 Ref	Client Ref					
2	MW 5	0.1	6.3	15.3	0.0	998.0
3	MW 6	12.5	13.0	0.0	0.0	998.0
1	MW9	0.1	8.5	1.5	0.0	998.0
	Limit	1	1.5			

4.0 DISCUSSION

4.4 Landfill Gas

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 four 2014 show elevated readings for Methane and Carbon Dioxide at well MW 6. However, this well is located within the waste mass and elevated levels of these gases are not uncommon. This result is relatively consistent with previous readings. Although it is preferable that the results are within the limits stipulated within the licence, it is worth while noting that they have not increased since previous monitoring events.

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 first 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 5	Qtr 4 2014	0.1	6.3	15.3	0.0	998.0
	Qtr 3 2014	0.1	8.24	1.52	0	1006
	Qtr 2 2014	0	4.3	8.06	0	1004
	Qtr 1 2014	0.0	4.2	8.3	0.0	990.0
MW 6	Qtr 4 2014	12.5	13.0	0.0	0.0	998.0
	Qtr 3 2014	13.1	13.2	0	0	1006
	Qtr 2 2014	12	12.9	0.7	0	1003
	Qtr 1 2014	11.1	12.5	1.3	0.0	990.0
MW9	Qtr 4 2014	0.1	8.5	1.5	0.0	998.0
	Qtr 3 2014	0.04	5.34	16.26	0	1006
	Qtr 2 2014	0	3.95	15.9	0	1003
	Qtr 1 2014	0.0	3.8	15.5	0.0	990.0
	Limit	**1**	**1.5**			
Exceedance						
NOTES						
1	Instrument Serial No: GA 07721					
2	Limit: Schedule C2, Licence					

APPENDIX 2- LANDFILL GAS BREAKDOWN

MW 5

DATE	CH4	CO2	O2	H2S	BARO
25/11/2014 14:29	0.1	6.4	15.2	0.0	998.0
25/11/2014 14:30	0.1	6.3	15.3	0.0	998.0
25/11/2014 14:31	0.0	6.2	15.4	0.0	998.0
25/11/2014 14:32	0.1	6.2	15.4	0.0	998.0
25/11/2014 14:33	0.0	6.2	15.4	0.0	998.0

MW 6

DATE	CH4	CO2	O2	H2S	BARO
25/11/2014 14:41	12.5	13.1	0.0	0.0	998.0
25/11/2014 14:42	12.5	13.0	0.0	0.0	998.0
25/11/2014 14:43	12.6	13.0	0.0	0.0	998.0
25/11/2014 14:44	12.6	12.9	0.0	0.0	998.0
25/11/2014 14:45	12.5	12.8	0.0	0.0	998.0

MW 9

DATE	CH4	CO2	O2	H2S	BARO
25/11/2014 14:35	0.1	8.4	1.6	0.0	998.0
25/11/2014 14:36	0.1	8.5	1.6	0.0	998.0
25/11/2014 14:37	0.1	8.6	1.5	0.0	998.0
25/11/2014 14:38	0.1	8.6	1.5	0.0	998.0
25/11/2014 14:39	0.1	8.5	1.5	0.0	998.0

GROUND WATER MONITORING REPORT FOR BELTURBET LANDFILL W0092-01

Client: **Cavan County Council**

Site Location: **Rahaghan, Belturbet**

Report No.: CCC-04-01-04-04-Rev-0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: _____ **Date:** 16th January 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 Belturbet Landfill (W0092-01), Rahaghan, Belturbet, Co Cavan for quarter four 2014.

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

Table of Contents

List of Tables

Appendix

1. INTRODUCTION

Belturbet landfill was operated as a disposal facility by Cavan County Council from 1979 until its closure in February 2002. The facility was operated as a traditional landfill and is located on the Belturbet Ballyconnell road (R200) approximately 4.5 kilometres West of Belturbet town. The site which was originally a limestone quarry comprises some 0.65 hectares. The bedrock surrounding the landfill is Darty Limestone Formation from the Lower Carboniferous period. A waste licence was issued by the EPA on the 13th of February 2002. Some remedial works were carried out after the closure of the site.

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 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, Belturbet landfill is situated in the R4 Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R4 Zones are unacceptable in accordance with today's standards detailed 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).

2.0 METHODOLOGY

2.1 Environmental Sampling

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

- ISO 5667: Guidance on sampling of ground waters 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 3.

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	GW	TBC	-	TBC	TBC
MW5	Gas & Leachate	TBC	-	TBC	TBC
MW6	Gas & Leachate	TBC	-	TBC	TBC
MW7	Gas & GW	TBC	-	TBC	TBC
MW 8	GW	TBC	-	TBC	TBC
MW 9	Gas & GW	TBC	-	TBC	TBC
Killynaher Lake	SW	TBC	-	TBC	TBC

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)
02/12/2014	0	7.7	-0.5	-5.4	3.6		

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Ground water monitoring 2014

Report Number		81206																
Monitoring Date:		02/12/2014																
Method		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Total Organic Carbon (TOC)**	**Coliforms**	**Ammonia**	**AQ2-UP1**	**Coliforms**	**Titralab**		**AQ2-UP2**	**Dissolved Oxygen**	**Ion Chromatography**	**Titralab**	
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**EW123**	**MIC133**	**EW154M**	**EW154M**	**MIC133**	**EW153**		**EW154M-1**	**EW043**	**EW137**	**EW153**	
Parameter		Sample temperature (to be tested onsite)	Cond	pH	Water Level from TOC	Visual Inspection	Total Organic Carbon (TOC)	E. Coli	Ammonia (as N)	TON (as N)(Calc)	Total Coliforms	pH	Conductivity @20 DegC	Chloride	Dissolved Oxygen	Fluoride	Alkalinity Total (R2 pH4.5)	
Units		**Deg C**	us/cm	pH units	Meter's		mg/L	MPN/100ml	mg/l N	mg/l N	MPN/100ml	pH Units	uscm-1@20	mg/L	mg/L	mg/L	mg/L CaCO3	
Limit of Detection		-	-	-	-	-	0.25	0	0.007	0.138	0	0.3	25	2.6	1.0	0.1	10	
Date Testing Initiated		2.12.14					3.12.14											
ELS Ref	**Client Ref**																	
81206/001	MW 7	9.8	634	8.1	-	clear	2.01	***10***	***1.1***	0.528	***20***	8	615	9.3	6	***2.3***	313	
81206/002	MW 8	9.6	1064	7.7	5.1	clear	1.36	0	***0.28***	1.214	0	7.6	***1035***	***194.5***	9	0.29	343	
81206/003	MW 9	10.1	723	7.8	6.2	heavy silt	1.2	0	0.063	0.196	***110***	7.6	691	3.6	9	0.14	400	
IGV			1000	≥6.5 and ≤9.5			NAC	0	0.15		0	≥6.5 and ≤9.5	1000	30	NAC	1	NAC	

Method		**Metals-Dissolved**												**AQ2-UP2**	**Total Cyanide High (Sub)**	**Total Phosphorus-TP**	**Residue on Evaporation (Tot Solids-TS)**	
Method Number		**EM130**												**EW154M-1**	**DEFAULT**	**EW146**	**EW060**	
Parameter		Iron-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Chromium-Total	Manganese-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved	Sulphate	Total Cyanide High	Total Phosphorus-TP	Residue on Evaporation (Tot Solids-TS)
Units		ug/L	mg/L	mg/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/l P	mg/L
Limit of Detection		20.0	0.2	0.5	0.1	1	1	1	0.003	0.3	0.3	0.02	1	0.02	5	9	0.1	10
Date Testing Initiated		03.12.14																
ELS Ref	**Client Ref**																	
81206/001	MW 7	<20	***7.7***	47.7	<0.1	<3	16	39.1	0.009	<0.3	46	<0.02	6	0.42	49.2	<10	<0.01	400
81206/002	MW 8	<20	4.2	42.4	<0.1	<3	19	151.7	0.009	<0.3	37.3	<0.02	4.3	0.04	67.3	<10	<0.01	525
81206/003	MW 9	<20	1.7	17.1	<0.1	5.6	3.6	149.7	0.009	<0.3	13.6	<0.02	11	<0.02	14	<10	0.04	600
IGV		200	5	150	5	30	50	200	0.03	10	50	1	100	1	200	10	-	-

Exceedance

NOTES

NAC- No Abnormal Change

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

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 02nd December 2014. Results in Bold Italics indicate where the interim guide value has been exceeded. Results from the fourth quarter 2014 show that there were exceedances at the ground water monitoring locations for parameters; Ecoli, Ammonia, Total Coliforms, Conductivity, Chloride, Fluoride and potassium as detailed in table 1.0 Previous results detailed in the historical data show that exceedances for these parameters are 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 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. The next environmental and landfill gas monitoring event will take place during the first quarter 2015.