

**COMHAIRLE CHONDAE AN CABHÁIN**

**Cavan County Council**



**Annual Environmental Report 2009**

**Bailieborough Landfill WL 91-1**

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# **Bailieborough Landfill**

## **Annual Environmental Report 2009**

### **Introduction & Site History**

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 22<sup>nd</sup> 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.

This Annual Environmental Report (AER) has been prepared in accordance with the conditions of the Waste Licence and the EPA “Draft Guidance on Environmental Management Systems and Reporting to the Agency, 1999”.

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

## **1. Reporting Period**

The reporting period for the purposes of this AER is 1st January 2009 to 31st December 2009.

## **2. Waste Activities carried out at the facility**

There were no waste activities carried out at the facility.

## **3. Quantity & Composition of waste received, disposed of and recovered during the reporting period and each previous year**

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

## **4. Summary Report on Emissions**

The summary of emissions is detailed in the Pollutant Release and Transfer Register (PRTR) Report which accompanies 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. Upon requests from the Agency Cavan County Council now carries out the full scope of sampling as required by the Licence. The monitoring had been reduced at the time of the restoration works and the full sampling regime had not been re-established until late 2010 when advised by the Agency.

### **4.1 Emissions to Water**

Please see paragraphs below for emissions relating to Water.

Please refer to the attached map in Appendix B for location points etc.

### **Leachate Levels**

Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) Ratio results listed below in table 1.0 show expected levels and are typical of a mature to medium aged landfill which is the case.

Table 1.0 Leachate Ratio Information

<u>Leachate Location</u>	<u>Sampling Quarter</u>	<u>BOD</u>	<u>COD</u>	<u>Ratio</u>
MW8	Q1	72	380	0.19
MW8	Q2	101	400	0.25
MW8	Q3	98	360	0.27

### Surface Water

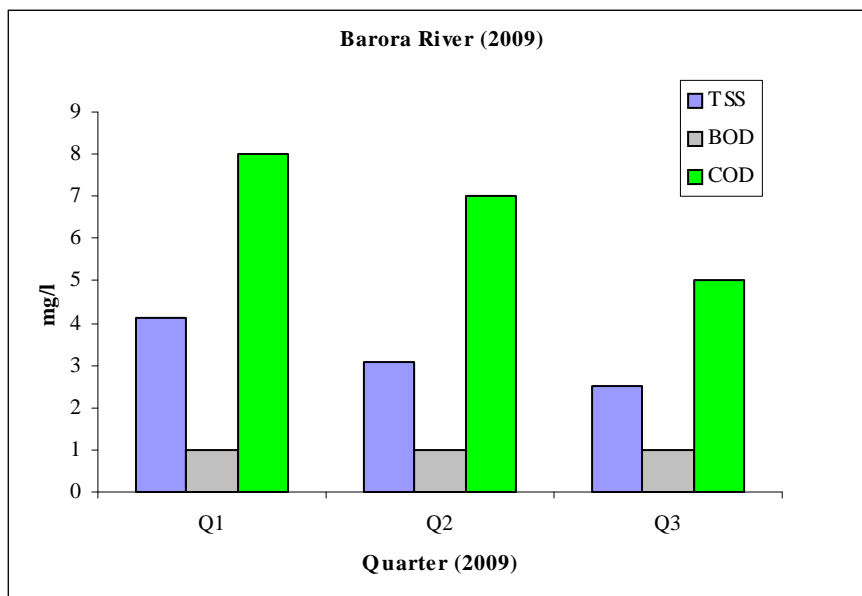
As the results show there is intermittently high Ammonia levels in the samples taken at SW1. However it has not been established if this is linked to the landfill or whether it is a natural occurrence due to the stagnant nature of the receiving waters.

Seven surface waters were sampled in the vicinity of the landfill. Please see the map in Appendix B showing monitoring points.

SW1 is classed as a category A1 in Quarter 3. Only a visual assessment was required in Quarter 4 and no change was noted. SW2 (River Barora) was found to be free of odour and no unusual visual anomaly was noted.

The surface water taken from the Barora River is classed as a category A1 in Quarter 3. Only a visual assessment was required in Quarter 4 and no change was noted. Graph 4.1 below shows the trend results for Total Suspended Solids (TSS), BOD & COD.

Graph 4.1



No surface water sample was taken from the discharge from the final cap but this location will be sampled going forward.

Overall the quality of all surface waters taken in 2009 were of good quality all meeting the A1 limits as outlined in S.I No.294/1989 for quality of surface water intended for the abstraction of drinking water.

### **Groundwater**

The current status and history of the groundwater wells are listed in the following table 4.1.

Table 4.1

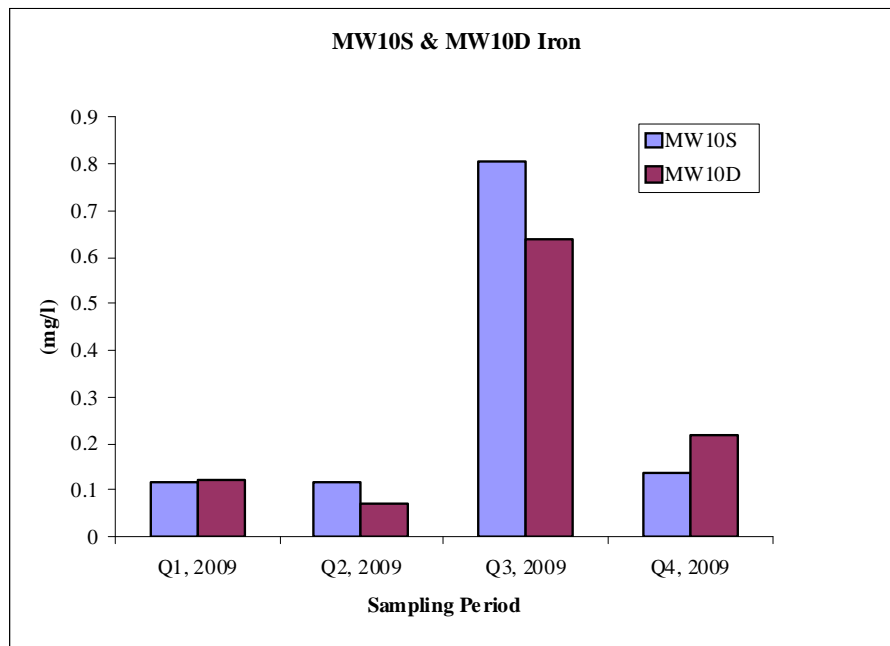
<b>Groundwater Well</b>	<b>Current Status</b>
MW11S	Destroyed and Replaced with MW15S
MW11D	Destroyed and Replaced with MW15D
MW12S	Destroyed and Replaced with MW16S
MW12D	Destroyed and Replaced with MW16D
MW10S	Current
MW10D	Current
MW15S	New well (April 2009)
MW15D	New well (April 2009)
MW16S	New well (April 2009)
MW16D	New well (April 2009)

Overall groundwater quality is good with the exception of elevated Iron levels in some samples. This is commonly associated with samples taken from landfills or in the vicinity of landfills. Overall the quality of the groundwater varied across the site and signs of contamination existed in all sampled groundwater wells in the vicinity of the landfill.

MW10D for Quarter 4 exceeded the interim guideline values for the protection of groundwater in Ireland for iron (0.22mg/l and total and faecal coliforms (146 and 1 cfu/100mls respectively). The exceedences are minor and are quite treatable should the water be considered for drinking purposes. See Graph 4.2 below.



Graph 4.2



MW10S for Quarter 4 exceeded the interim guideline values for the protection of groundwater in Ireland for nitrate, chloride, potassium and total coliforms. When compared to S.I No.278 of 2007, the drinking water standard, only potassium and the result for total coliforms are in exceedence. Both these parameters have consistently been above the guideline values. The health effects of potassium in drinking water is negligible to cause any health problem<sup>1</sup>. The exceedences are minor and are quite treatable should the water be considered for drinking purposes.

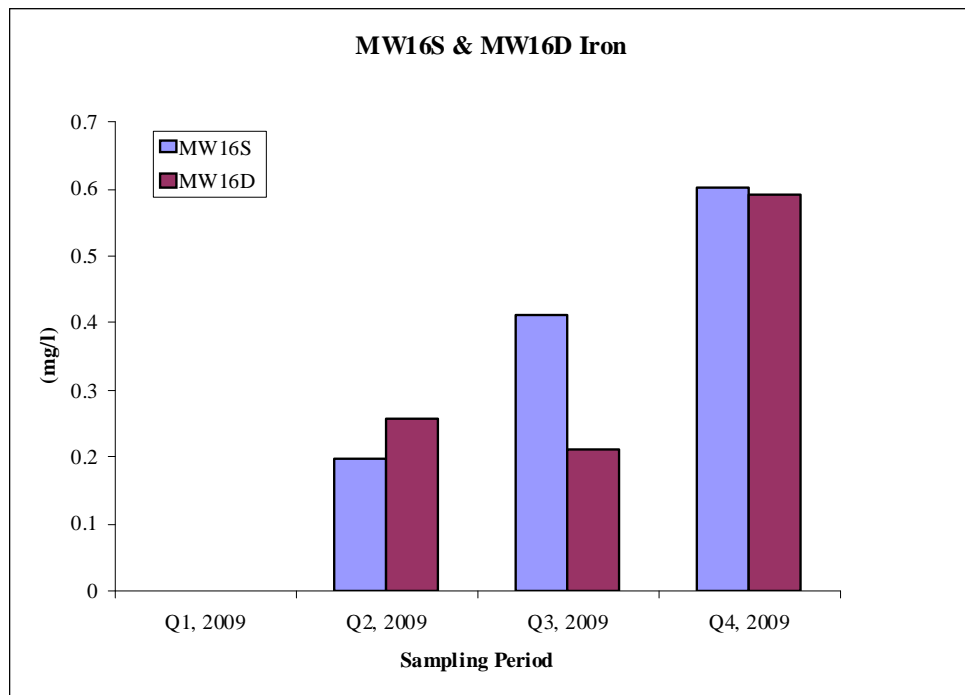
MW15D for quarter 4 has been considered to come under the same requirements as the old MW11D. Thus as per the licence requirements only the water level reading was taken in Quarter 4.

MW16D for Quarter 4 exceeded the interim guideline values for the protection of groundwater in Ireland for chloride, iron, potassium, phenols and total coliforms. When compared to S.I No.278 of 2007, the drinking water standard, the results for potassium, phenols and the result for total coliforms are in exceedence. The parameters iron, potassium, phenols and total coliforms are now in exceedence for this and the previous 2 quarters. The major concern in drinking water is the avoidance of bad taste that may develop especially for a groundwater that is disinfected by chlorination if intended for use as a drinking water. The phenol reading is trending

downwards along with the readings observed for total coliform bacteria. See Graph 4.3 below for these details.

MW16S for Quarter 4 exceeded the interim guideline values for the protection of groundwater in Ireland for chloride, iron, potassium and total coliforms. When compared to S.I No.278 of 2007, the drinking water standard, the results for potassium, iron and the result for total coliforms are in exceedence. The parameters Chloride, potassium and total coliforms are now in exceedence for this and the previous 2 quarters. The total coliform bacteria results are trending downwards along while all others are stable.

Graph 4.3



## 4.2 Emissions to Air

Gas Monitoring was not carried out on the site following remediation. This situation changed in late 2009 and sampling has returned to that as required by the Waste Licence.

## 5. Summary of results and interpretation of environmental monitoring

Included in this report is a copy of the annual monitoring results as reported by Monitoring Company BHP Laboratories. Interpretation of the results are in the report. We concur with the interpretations that BHP have reported on our behalf. 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.

## 6. Resource and energy consumption summary

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

## 7. Report on Restoration of the facility

The site is fully restored and the cap intact. There were additional Groundwater Monitoring wells drilled offsite this year to replace wells that were lost since the site restoration. The newly drilled wells replace those that were lost due to road works.

Table 7.1 below shows the well drilling details.

Table 7.1

Wells Previously Destroyed	11S, 11D & 12S, 12D
Replaced by (Downstream)	15S, 15D & 16S, 15D

(S = shallow, D = deep)

- Newly drilled roadside boreholes were named, surveyed and elevations recorded, given additional protection and permanent signage erected – see photo below 7.1.



Photo 7.1

- Borehole Logs for the newly drilled wells were submitted to the Agency.
- Groundwater Borehole MW10 was protected from any potential pollution/contamination associated with nearby animal pen. -See Photo 7.2

Photo 7.2



- Documentation showing the direction of groundwater flow was presented to the Agency.

- The direction of surface water flow was reported to the Agency

### **8. Estimated annual and cumulative quantities of landfill gas emitted from the facility**

Please refer to the Annual PRTR Report included in Appendix A which deals with the landfill gas emissions calculated using GASSIM.

### **9. Full title and written summary of any procedures developed by the licensee in the year which relates to the facility operation.**

Following written permission from the Agency it was decided to graze a small number of horses on the landfill for short periods in the growing season to control any excessive growth. This proved to be a very effective way of keeping the capped area neat and tidy. The excessive growth of gorse bush on areas of the cap will be addressed in the next reporting year. There was no change to or development of any other procedures undertaken by the licensee or monitoring contractor in 2009.

### **10. Reported Incidences and Complaints summaries**

There were no incidences in the reporting period 2009. There were no complaints received by the EPA or the Local Authority regarding this facility in the reporting period 2009.

### **11. Review of Nuisance Controls**

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

## 12. 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 and carries a Safe Pass.

Table 12.1

### Management Structure 2009-2010

Position	Name	Duties
Director of Services, Environment	Eoin Doyle	To oversee and assign responsibilities to staff regarding landfill
A/Senior Executive Officer	Padraig McGivney	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 2010:

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

## 13. 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.

**14. Any other items specified by the Agency**

As requested by the Agency we have included in Appendix B a colour A3 copy of the most recent Map of the site showing all Monitoring locations.

**Appendix A**  
**PRTR Emissions Report**



# AER Returns Worksheet

Version 1.1.10

<b>REFERENCE YEAR</b>	2009
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## 1. FACILITY IDENTIFICATION

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

### Waste or IPPC Classes of Activity

No.	class name
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.4	Recycling or reclamation of other inorganic materials.
Address 1	Tanderagee
Address 2	Bailieborough
Address 3	Co Cavan
Address 4	
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
<b>AER Returns Contact Name</b>	Sinead Fox
<b>AER Returns Contact Email Address</b>	sfox@cavancoco.ie
<b>AER Returns Contact Position</b>	Landfill Operations Manager
<b>AER Returns Contact Telephone Number</b>	049-437 8418
<b>AER Returns Contact Mobile Phone Number</b>	087 980 8507
<b>AER Returns Contact Fax Number</b>	049 4332299
<b>Production Volume</b>	0.0
<b>Production Volume Units</b>	
<b>Number of Installations</b>	0
<b>Number of Operating Hours in Year</b>	0
<b>Number of Employees</b>	0
<b>User Feedback/Comments</b>	Closed Landfill,
<b>Web Address</b>	

## 2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(a)	Installations for the recovery or disposal of 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?	

4.1 RELEASES TO AIR

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR								
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
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	MAB		0.0	238000.0	0.0	238000.0
01	Methane (CH4)	C	MAB		0.0	84700.0	0.0	84700.0

ADD NEW ROW | DELETE ROW \* \* 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								
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
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

ADD NEW ROW | DELETE ROW \* \* 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								
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
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

ADD NEW ROW | DELETE ROW \* \* 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:

Baillieborough 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)	84700.0	C	GASSIM	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)	0.0	C	MAB	GASSIM	N/A

#### 4.2 RELEASES TO WATERS

| PRTR#: W0091 | Facility Name: Baillieborough Landfill | Filename: W0091\_2009(1)PRTR.xls | Return Year: 2009 |

08/04/2010 16:51

#### SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / P RTP

RELEASES TO WATERS								
POLLUTANT		Method Used			ADD EMISSION POINT	QUANTITY		
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

ADD NEW ROW | DELETE ROW \* | \* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

#### SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS								
POLLUTANT		Method Used			ADD EMISSION POINT	QUANTITY		
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

ADD NEW ROW | DELETE ROW \* | \* 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 WATERS								
POLLUTANT		Method Used			ADD EMISSION POINT	QUANTITY		
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

**Appendix B**  
**Site Monitoring locations map**

REPRODUCED UNDER LICENSE NO. 1800000000



Ballisborough landfill (W/91-01)

Table 1: Monitoring Wells

Monitoring Well	Depth	Bottom Elevation (m)	Topsoil Elevation (m)	Depth to Groundwater (m)	Groundwater	Notes
MW1	1.5	100.5	102.0	1.5	Groundwater	...
MW2	1.5	100.5	102.0	1.5	Groundwater	...
MW3	1.5	100.5	102.0	1.5	Groundwater	...
MW4	1.5	100.5	102.0	1.5	Groundwater	...
MW5	1.5	100.5	102.0	1.5	Groundwater	...
MW6	1.5	100.5	102.0	1.5	Groundwater	...
MW7	1.5	100.5	102.0	1.5	Groundwater	...
MW8	1.5	100.5	102.0	1.5	Groundwater	...
MW9	1.5	100.5	102.0	1.5	Groundwater	...
MW10	1.5	100.5	102.0	1.5	Groundwater	...
MW11	1.5	100.5	102.0	1.5	Groundwater	...
MW12	1.5	100.5	102.0	1.5	Groundwater	...
MW13	1.5	100.5	102.0	1.5	Groundwater	...
MW14	1.5	100.5	102.0	1.5	Groundwater	...

**Appendix C**  
**Site Annual Monitoring Report**

BHP/CEM/23

Analysing  
Testing  
Consulting  
Calibrating

**TEST REPORT**

**Client:** Cavan Co. Co

**BHP Ref No.:** 86105-07-09  
**Order No.:**  
**Date Received:** 23<sup>rd</sup> April 2009  
**Date Completed:** 22<sup>nd</sup> May 2009  
**Test Specification:** Nil



**BHP**  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447  
E Mail [bhpcem2@bhp.ie](mailto:bhpcem2@bhp.ie)

*Item: Bailieborough Landfill Site*

*Annual Report covering groundwater, leachate and surfacewaters at Bailieborough Landfill for 2009.*

**Cavan County Council  
Courthouse  
Cavan Town  
Co. Cavan**

FTAO: Sinead Fox

Report on Bailieborough Landfill for annual parameters 2009

Issued on behalf of BHP Ltd.

Prepared by: P. Sullivan  
Issued: 21<sup>st</sup> July 2009

This report relates only to this item. This test report shall not be duplicated, except in full and with the permission of the test laboratory.

## Table of Contents

1.0	Introduction
2.0	Sampling / Analysis
3.0	Quality Assurance
4.0	Results
5.0	Discussion

Appendix A: Site Sampling Sheet/Chain of Custody

Appendix B: Site map showing sampling locations

Appendix C: List I/II Organics

### 1.0 Introduction :

BHP were contracted by Cavan County Council to carry out environmental monitoring at Bailieborough Landfill site which is located outside Bailieborough town, Co.Cavan. This landfill is no longer operational and is operated under waste license no. 91-1, which was issued to Cavan Co. Co. by the EPA.

This report covers surfacewater, leachate and groundwater at Bailieborough for the annual monitoring parameters of 2009 for the available monitoring locations. Private Well monitoring has been discontinued and no access was available for landfill gas monitoring.

### 2.0 Sampling :

This monitoring is a continuation of an established monitoring program at Bailieborough Landfill. As such, the borehole locations are as on previously drafted site maps. A site map is attached in the appendices showing the borehole locations. BHP sampled at 6 boreholes. Their individual references are as shown in table 1.



Borehole reference	Static water level (m)
<b>MW 10S</b>	5.90
MW 10D	5.90
MW 11S	1.80
MW 11D	1.80
MW 12D	1.30
MW 12S	1.30

**Table 1** : Borehole reference points and levels.

Locations for private wells, surfacewaters and landfill gas are also shown in the maps.

In order to ensure correct groundwater monitoring, the following steps were taken.

1. Chemical analysis according to standard testing methods (As shown in table 2).
2. Appropriate on-site sampling techniques were utilised.
  - ISO 5667 ; ‘Guidance on sampling of groundwaters’ was followed which is appropriate for the objective of monitoring groundwater quality.
  - A Waterra inertial lift pump was utilised which is designed for borehole monitoring in that at no time does the pump come in contact with the water sample. By utilising dedicated hosing at each borehole and new sample containers then any possibility of cross-contamination is eliminated.
  - In order to achieve representative sampling, the method used needs to be capable of withdrawing samples whose composition reflects that of the substrata (and not that of stagnant water in the standpipe). In order to achieve this, each borehole is purged of several times its volume before any sample is taken. This is estimated on-site using an electronic dip-meter to measure depth of water and then calculating volume of water present (after measuring radius of borehole).

3. Having taken a representative sample, several analysis parameters are time sensitive and therefore need to be measured on-site i.e. pH, temperature, conductivity and dissolved oxygen. All meters are calibrated before each site-visit.
  - pH and temperature are measured using a Hanna HI 9023 C portable pH meter and thermocouple. The pH meter automatically compensates for temperature variations
  - Dissolved oxygen is measured using a Hanna HI 9142 portable oxygen meter.
  - Conductivity is measured using a Hanna HI 9033 multi-range conductivity meter.
4. BHP operates a chain of custody system. The sample site-sheet / chain of custody form can be found in Appendix B.
5. All samples received by the Laboratory were stored between 0 and 4°C. Subsequent analysis of all samples was carried out in accordance with Standard Methods for the examination of water and wastewater, 20<sup>th</sup> Edition, 1998, published by the American public health association.

The methods and limits of detection are listed in the results section.

## Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference *** APHA-AWWA-WEF 20 <sup>th</sup>
pH	4500-H <sup>+</sup> B
Temperature	2550B
Conductivity	2510B
COD	5220D
Colour	2120B
Turbidity	2130B
Total Suspended Solids	2540D
Alkalinity	2320B
Ammonia	4500-NH <sub>3</sub> -D
TOC	5310A
Total Hardness	2340B
Calcium	3120B
Chloride	4110B
Fluoride	4110B
Nitrate	4110B
Magnesium	3120B
Potassium	3120B
Sodium	3120B
Sulphate	4110B
Phosphate	4110B
Iron	3120B
Aluminium	3120B
SiO <sub>2</sub>	3120B
Boron	3120B
Barium	3120B
Cadmium	3120B
Chromium	3120B
Copper	3120B
Lead	3120B
Manganese	3120B
Mercury	3112B
Nickel	3120B
Arsenic	3120B
Zinc	3120B
Tin	3120B
Antimony	3120B
Selenium	3120B
Cobalt	3120B
Beryllium	3120B
Silver	3120B

Table 2 : Table of chemical testing methods adopted by BHP Laboratories

\*\*\* APHA = American Public Health Association  
 AWWA = American Water Works Association

WEF = Water Environment Federation

### 3.0 Quality Assurance :

The Chemical and Environmental Monitoring laboratory (CEM) operates a rigorous approach to quality assurance. The central elements of the quality control system are outlined.

#### a) Chain of Custody and Client Instruction

Every sample received at BHP laboratories is inspected by the laboratory manager Pat O'Sullivan or by laboratory administrator, Mary Hehir.

A client instruction is required to start analysis.

All samples are then given a unique BHP reference number before storage between 0 and 4°C.

#### b) Training and Competence

All analysts conducting work at BHP are fully trained. Training involves demonstration of accuracy and precision of analysis. All analysts are subject to periodic reviews in their training. All training is fully documented and retrievable.

#### c) Validation

BHP procedures are subjected to a rigorous validation which includes the following;

- Evaluation of instrument detection limits and limits of detection.
- Evaluation of operator characteristics including bias, precision and uncertainty of measurement.
- Demonstration of Linearity.
- Evaluation of the standard error on the mean and evaluation of any systematic biases.
- Evaluation of total uncertainty and uncertainty budgets.
- Evaluation of the uncertainty in measurement at a regulatory limit.
- Demonstration of repeatability.
- Evaluation of Matrix effects.

d) Quality Control (Skewhart) Charts

Analysis in the CEM laboratory is monitored using control charts. Each analysis will have at least 3 charts monitoring;

- Certified Reference Material recovery
- Precision of analysis
- Accuracy of analysis

Batches of analyses are rejected if any of the control charts indicate a loss in control.

e) Interlaboratory Testing

The CEM laboratory are members of the W.R.C Aquacheck Scheme. The Laboratory also participates in the Environmental Protection Agency's Intercalibration Programme and is listed on the Agency's Register of Quality Approved Testing Laboratories.

The Laboratory participates on a bi-annual basis in the British Gas Interlaboratory Proficiency Schemes for the analysis of contaminated soils and waters.

#### 4.0 Results :

The results are presented in the following tables.



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:** Barora River

**Surface Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	08/10/948	09/04/806					
BHP Reference	Date	Date	Date	Date			
	4th Qtr 08	2nd Qtr 09					
pH	6.56	6.91			Grab	0 -14	Electrochemical
Temperature °C	7.3	11.4			Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity ECuScm <sup>-1</sup>	163.6	189			Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	0.02	0.03			Grab	0.01 mg/l	Photometric
Chemical Oxygen Demand	9	7			Grab	1 mg/l	Photometric
Biochemical Oxygen Demand	2	1			Grab	1 mg/l	Electrochemical
Dissolved Oxygen (% Sat. O <sub>2</sub> )	100	99.4			Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	0.6	1.03			Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	43	59			Grab	1 mg/l	Titration
Total Suspended Solids	3.6	3.1			Grab	1 mg/l	Gravimetric
Chloride Cl	9.51	12.54			Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1	<0.1			Grab	0.10 mg/l	IC
Nitrate NO <sub>3</sub>	2.68	4.58			Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	7.26	16.04			Grab	0.20 mg/l	IC



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** Barora river

**Surface Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	08/10/948 Date 4th Qtr 08	09/04/806 Date 2nd Qtr 09	Date	Date			
BHP Reference							
Calcium Ca	11.66	15.42			Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035	<0.0035			Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01	<0.01			Grab	0.01 mg/l	ICP
Copper Cu	<0.015	<0.015			Grab	0.015 mg/l	ICP
Iron Fe	<0.03	<0.03			Grab	0.03 mg/l	ICP
Lead Pb	0.006	0.005			Grab	0.002 mg/l	ICP
Magnesium Mg	2.83	1.89			Grab	0.01 mg/l	ICP
Manganese Mn	<0.014	<0.014			Grab	0.014 mg/l	ICP
Potassium K	2.39	2.25			Grab	0.10 mg/l	ICP
Sodium Na	6.42	7.15			Grab	0.03 mg/l	ICP
Zinc Zn	<0.011	<0.011			Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005	<0.0005			Grab	0.0005 mg/l	AAS
OrthoPhosphate P	0.07	0.08			Grab	0.01 mg/l	Photometric
Odour	None	None			Grab	-	Olefactory
Visual Inspection	Straw, Turbid	Straw, Clear			Grab	-	Visual

Signed for and on behalf of BHP Laboratories Ltd.



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 1)

**Monitoring Point / Grid Reference:** MW 08

**Leachate Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	08/10/949	09/04/803					
	4th Qtr 08	2nd Qtr 09					
Boron B	0.207	0.212			Grab	0.05 mg/l	ICP
Calcium Ca	307.5	218.2			Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035	<0.0035			Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01	<0.01			Grab	0.01 mg/l	ICP
Copper Cu	<0.015	<0.015			Grab	0.015 mg/l	ICP
Total Cyanide Cn	0.16	0.003			Grab	0.001 mg/l	Colourimetrically
Fluoride F	2.3	<0.08			Grab	0.08 mg/l	IC
Iron Fe	<0.03	<0.03			Grab	0.03 mg/l	ICP
Lead Pb	0.006	0.053			Grab	0.001 mg/l	ICP
Magnesium Mg	101	97.43			Grab	0.01 mg/l	ICP
Manganese Mn	<0.014	0.024			Grab	0.014 mg/l	ICP
Mercury Hg	<0.0005	<0.0005			Grab	0.0005 mg/l	AAS
Sulphate SO <sub>4</sub>	8.42	13.7			Grab	0.20 mg/l	IC
Potassium K	110.9	163.1			Grab	0.10 mg/l	ICP
Sodium Na	586	617.5			Grab	0.03 mg/l	ICP
Total Phosphorous P	0.26	1.25			Grab	0.01 mg/l	Photometric
Zinc Zn	<0.011	<0.011			Grab	0.011 mg/l	ICP
Total Coliforms	4500	2000			Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	118	10			Grab	1 to 2419 cfu/100ml	Quanti Cult

Signed for and on behalf of BHP Laboratories Ltd.





# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2) **Monitoring Point / Grid Reference:**           MW 10D          

## Ground Water Monitoring

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	08/10/946	09/04/797					
	4th Qtr 08	2nd Qtr 09					
pH	6.87	7.92			Grab	0 -14	Electrochemical
Temperature °C	8.4	10.3			Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity ECuScm <sup>-1</sup>	448	462			Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	0.01	0.09			Grab	0.01 mg/l	Photometric
Dissolved Oxygen (% Sat. O <sub>2</sub> )	61.7	97.1			Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	0.28	0.12			Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	165	179			Grab	1 mg/l	Titration
Total Organic Carbon TOC	<0.4	17.3			Grab	0.4	Persulphate Oxidation
Total Cyanide Cn	0.004	0.001			Grab	0.001 mg/l	Colourimetrically
Residue on Evaporation	327	234			Grab	1 mg/l	Evaporation
Boron B	0.019	0.079			Grab	0.05 mg/l	ICP
Chloride Cl	8.28	7.67			Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1	<0.1			Grab	0.10 mg/l	IC
Water Level	5.82	5.9			Grab	M	Dip Meter
Nitrate NO <sub>3</sub>	1.27	0.51			Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	130.9	62.7			Grab	0.20 mg/l	IC
Total Coliforms	None Found	2			Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	None Found	None Found			Grab	1 to 2419 cfu/100ml	Quanti Cult



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** MW 10D

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	08/10/946 Date 4th Qtr 08	09/04/797 Date 2nd Qtr 09	Date	Date			
Calcium Ca	33.45	23.61			Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035	<0.0035			Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01	<0.01			Grab	0.01 mg/l	ICP
Copper Cu	<0.015	<0.015			Grab	0.015 mg/l	ICP
Iron Fe	<0.03	0.07			Grab	0.03 mg/l	ICP
Lead Pb	0.006	0.008			Grab	0.002 mg/l	ICP
Magnesium Mg	17.08	10.94			Grab	0.01 mg/l	ICP
Manganese Mn	<0.014	<0.014			Grab	0.014 mg/l	ICP
Potassium K	1.74	1.37			Grab	0.10 mg/l	ICP
Sodium Na	30.55	24.2			Grab	0.03 mg/l	ICP
Zinc Zn	<0.011	<0.011			Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005	<0.0005			Grab	0.0005 mg/l	AAS
Phenol	<0.001	0.002			Grab	0.001 mg/l	Photometric
Total Phosphorous P	0.19	0.09			Grab	0.01 mg/l	Photometric
Fluoride F	0.12	0.21			Grab	0.08 mg/l	IC
List I Organics *	<0.01	<0.01			Grab	0.01 mg/l	GC - MS
List II Organics *	<0.01	<0.01			Grab	0.01 mg/l	GC - MS
Odour	None	None			Grab	-	Olefactory
Visual Inspection	Straw, Turbid	Straw			Grab	-	Visual

Signed for and on behalf of BHP Laboratories Ltd.



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:**         MW 10S        

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	08/10/945	09/04/796					
	4th Qtr 08	2nd Qtr 09					
pH	6.66	7.12			Grab	0 -14	Electrochemical
Temperature °C	7.8	10.3			Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity EC <sub>u</sub> Scm <sup>-1</sup>	416	374			Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	<0.01	0.11			Grab	0.01 mg/l	Photometric
Dissolved Oxygen (% Sat. O <sub>2</sub> )	100	97			Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	<0.1	0.45			Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	170	143			Grab	1 mg/l	Titration
Total Organic Carbon TOC	0.6	20			Grab	0.4	Persulphate Oxidation
Total Cyanide Cn	0.117	0.018			Grab	0.001 mg/l	Colourimetrically
Residue on Evaporation	3262	1488			Grab	1 mg/l	Evaporation
Boron B	0.043	0.395			Grab	0.05 mg/l	ICP
Chloride Cl	10.91	17.64			Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1	<0.1			Grab	0.10 mg/l	IC
Water Level	5.82	5.9			Grab	M	Dip Meter
Nitrate NO <sub>3</sub>	<0.1	2.02			Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	28.43	12.9			Grab	0.20 mg/l	IC
Total Coliforms	3810	35			Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	199	None Found			Grab	1 to 2419 cfu/100ml	Quanti Cult



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** \_\_\_\_\_ MW 10S \_\_\_\_\_

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	08/10/945 Date 4th Qtr 08	09/04/796 Date 2nd Qtr 09	Date	Date			
BHP Reference	08/10/945	09/04/796					
Calcium Ca	34.4	45.42			Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035	<0.0035			Grab	0.0035 mg/l	ICP
Total Chromium Cr	0.033	<0.01			Grab	0.01 mg/l	ICP
Copper Cu	<0.015	<0.015			Grab	0.015 mg/l	ICP
Iron Fe	0.124	0.119			Grab	0.03 mg/l	ICP
Lead Pb	0.007	0.008			Grab	0.002 mg/l	ICP
Magnesium Mg	49.27	60.4			Grab	0.01 mg/l	ICP
Manganese Mn	<0.014	<0.014			Grab	0.014 mg/l	ICP
Potassium K	16.12	15.99			Grab	0.10 mg/l	ICP
Sodium Na	19.11	20.23			Grab	0.03 mg/l	ICP
Zinc Zn	<0.011	<0.011			Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005	<0.0005			Grab	0.0005 mg/l	AAS
Phenol	<0.001	0.015			Grab	0.001 mg/l	Photometric
Total Phosphorous P	0.18	0.03			Grab	0.01 mg/l	Photometric
Fluoride F	0.15	0.31			Grab	0.08 mg/l	IC
List I Organics *	<0.01	<0.01			Grab	0.01 mg/l	GC - MS
List II Organics *	<0.01	<0.01			Grab	0.01 mg/l	GC - MS
Odour	None	None			Grab	-	Olefactory
Visual Inspection	Turbid/Brown	Turbid/Brown			Grab	-	Visual



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:** MW 11D

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/799						
	2nd Qtr 09						
pH	7.78				Grab	0 -14	Electrochemical
Temperature °C	10.6				Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity ECuScm <sup>-1</sup>	366				Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	2.73				Grab	0.01 mg/l	Photometric
Dissolved Oxygen (% Sat. O <sub>2</sub> )	87.5				Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	0.16				Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	161				Grab	1 mg/l	Titration
Total Organic Carbon TOC	18.4				Grab	0.4	Persulphate Oxidation
Total Cyanide Cn	0.024				Grab	0.001 mg/l	Colourimetrically
Residue on Evaporation	474				Grab	1 mg/l	Evaporation
Boron B	<0.05				Grab	0.05 mg/l	ICP
Chloride Cl	12.73				Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1				Grab	0.10 mg/l	IC
Water Level	1.8				Grab	M	Dip Meter
Nitrate NO <sub>3</sub>	0.72				Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	13.9				Grab	0.20 mg/l	IC
Total Coliforms	32				Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	1				Grab	1 to 2419 cfu/100ml	Quanti Cult

Signed for and on behalf of BHP Laboratories Ltd.

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# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** MW 11D

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/799						
	2nd Qtr 09						
Calcium Ca	25.23				Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035				Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01				Grab	0.01 mg/l	ICP
Copper Cu	<0.015				Grab	0.015 mg/l	ICP
Iron Fe	0.225				Grab	0.03 mg/l	ICP
Lead Pb	0.007				Grab	0.002 mg/l	ICP
Magnesium Mg	26.93				Grab	0.01 mg/l	ICP
Manganese Mn	<0.014				Grab	0.014 mg/l	ICP
Potassium K	11.6				Grab	0.10 mg/l	ICP
Sodium Na	13.39				Grab	0.03 mg/l	ICP
Zinc Zn	<0.011				Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005				Grab	0.0005 mg/l	AAS
Phenol	0.003				Grab	0.001 mg/l	Photometric
Total Phosphorous P	0.02				Grab	0.01 mg/l	Photometric
Fluoride F	0.32				Grab	0.08 mg/l	IC
List I Organics *	<0.01				Grab	0.01 mg/l	GC - MS
List II Organics *	<0.01				Grab	0.01 mg/l	GC - MS
Odour	None				Grab	-	Olefactory
Visual Inspection	Turbid/Brown				Grab	-	Visual



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co. Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:** MW 11S

Ground Water Monitoring

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/798						
	2nd Qtr 09						
pH	6.09				Grab	0 - 14	Electrochemical
Temperature °C	9				Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity ECuScm <sup>-1</sup>	222				Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	10.98				Grab	0.01 mg/l	Photometric
Dissolved Oxygen (% Sat. O <sub>2</sub> )	66.8				Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	0.72				Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	200				Grab	1 mg/l	Titration
Total Organic Carbon TOC	22.4				Grab	0.4	Persulphate Oxidation
Total Cyanide Cn	0.056				Grab	0.001 mg/l	Colourimetrically
Residue on Evaporation	1016				Grab	1 mg/l	Evaporation
Boron B	0.508				Grab	0.05 mg/l	ICP
Chloride Cl	70.4				Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1				Grab	0.10 mg/l	IC
Water Level	1.8				Grab	M	Dip Meter
Nitrate NO <sub>3</sub>	3.2				Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	28.7				Grab	0.20 mg/l	IC
Total Coliforms	12				Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	None Found				Grab	1 to 2419 cfu/100ml	Quanti Cult

Signed for and on behalf of BHP Laboratories Ltd.

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# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** MW 11S

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/798						
	2nd Qtr 09						
Calcium Ca	49.98				Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035				Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01				Grab	0.01 mg/l	ICP
Copper Cu	0.028				Grab	0.015 mg/l	ICP
Iron Fe	0.406				Grab	0.03 mg/l	ICP
Lead Pb	0.023				Grab	0.002 mg/l	ICP
Magnesium Mg	49.22				Grab	0.01 mg/l	ICP
Manganese Mn	0.124				Grab	0.014 mg/l	ICP
Potassium K	21.83				Grab	0.10 mg/l	ICP
Sodium Na	12.57				Grab	0.03 mg/l	ICP
Zinc Zn	<0.011				Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005				Grab	0.0005 mg/l	AAS
Phenol	0.004				Grab	0.001 mg/l	Photometric
Total Phosphorous P	0.21				Grab	0.01 mg/l	Photometric
Fluoride F	<0.08				Grab	0.08 mg/l	IC
List I Organics *	<0.01				Grab	0.01 mg/l	GC - MS
List II Organics *	<0.01				Grab	0.01 mg/l	GC - MS
Odour	None				Grab	-	Olefactory
Visual Inspection	Turbid/Brown				Grab	-	Visual

Signed for and on behalf of BHP Laboratories Ltd.





# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:** MW 12D

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/801						
	2nd Qtr 09						
pH	7.33				Grab	0 -14	Electrochemical
Temperature °C	10.5				Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity ECuScm <sup>-1</sup>	304				Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	20.37				Grab	0.01 mg/l	Photometric
Dissolved Oxygen (% Sat. O <sub>2</sub> )	94.6				Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	<0.10				Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	122				Grab	1 mg/l	Titration
Total Organic Carbon TOC	19.6				Grab	0.4	Persulphate Oxidation
Total Cyanide Cn	0.026				Grab	0.001 mg/l	Colourimetrically
Residue on Evaporation	2452				Grab	1 mg/l	Evaporation
Boron B	0.017				Grab	0.05 mg/l	ICP
Chloride Cl	10.15				Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1				Grab	0.10 mg/l	IC
Water Level	1.3				Grab	M	Dip Meter
Nitrate NO <sub>3</sub>	<0.1				Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	19.6				Grab	0.20 mg/l	IC
Total Coliforms	3870				Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	None Found				Grab	1 to 2419 cfu/100ml	Quanti Cult

Signed for and on behalf of BHP Laboratories Ltd.



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** MW 12D

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/801						
	2nd Qtr 09						
Calcium Ca	17.04				Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035				Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01				Grab	0.01 mg/l	ICP
Copper Cu	<0.015				Grab	0.015 mg/l	ICP
Iron Fe	0.257				Grab	0.03 mg/l	ICP
Lead Pb	0.009				Grab	0.002 mg/l	ICP
Magnesium Mg	46.94				Grab	0.01 mg/l	ICP
Manganese Mn	0.185				Grab	0.014 mg/l	ICP
Potassium K	28.12				Grab	0.10 mg/l	ICP
Sodium Na	19.66				Grab	0.03 mg/l	ICP
Zinc Zn	<0.011				Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005				Grab	0.0005 mg/l	AAS
Phenol	<0.001				Grab	0.001 mg/l	Photometric
Total Phosphorous P	0.1				Grab	0.01 mg/l	Photometric
Fluoride F	0.35				Grab	0.08 mg/l	IC
List I Organics *	<0.01				Grab	0.01 mg/l	GC - MS
List II Organics *	<0.01				Grab	0.01 mg/l	GC - MS
Odour	None				Grab	-	Olefactory
Visual Inspection	Turbid/Brown				Grab	-	Visual

Signed for and on behalf of BHP Laboratories Ltd.

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# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:** MW 12S

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/800						
	2nd Qtr 09						
pH	6.95				Grab	0 -14	Electrochemical
Temperature °C	9.4				Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity ECuScm <sup>-1</sup>	344				Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	33.55				Grab	0.01 mg/l	Photometric
Dissolved Oxygen (% Sat. O <sub>2</sub> )	75.7				Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	1.01				Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	146				Grab	1 mg/l	Titration
Total Organic Carbon TOC	21.6				Grab	0.4	Persulphate Oxidation
Total Cyanide Cn	0.2				Grab	0.001 mg/l	Colourimetrically
Residue on Evaporation	2350				Grab	1 mg/l	Evaporation
Boron B	0.026				Grab	0.05 mg/l	ICP
Chloride Cl	71.7				Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1				Grab	0.10 mg/l	IC
Water Level	1.3				Grab	M	Dip Meter
Nitrate NO <sub>3</sub>	4.5				Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	23.1				Grab	0.20 mg/l	IC
Total Coliforms	4120				Grab	1 to 2419 cfu/100ml	Quanti Cult
Faecal Coliforms	2				Grab	1 to 2419 cfu/100ml	Quanti Cult

Signed for and on behalf of BHP Laboratories Ltd.



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:**           MW 12S          

**Ground Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	Date	Date	Date	Date			
BHP Reference	09/04/800						
	2nd Qtr 09						
Calcium Ca	73.56			Grab	0.01 mg/l	ICP	
Cadmium Cd	<0.0035			Grab	0.0035 mg/l	ICP	
Total Chromium Cr	<0.01			Grab	0.01 mg/l	ICP	
Copper Cu	<0.015			Grab	0.015 mg/l	ICP	
Iron Fe	0.198			Grab	0.03 mg/l	ICP	
Lead Pb	0.011			Grab	0.002 mg/l	ICP	
Magnesium Mg	218.4			Grab	0.01 mg/l	ICP	
Manganese Mn	0.245			Grab	0.014 mg/l	ICP	
Potassium K	60.54			Grab	0.10 mg/l	ICP	
Sodium Na	11.07			Grab	0.03 mg/l	ICP	
Zinc Zn	<0.011			Grab	0.011 mg/l	ICP	
Mercury Hg	<0.0005			Grab	0.0005 mg/l	AAS	
Phenol	0.002			Grab	0.001 mg/l	Photometric	
Total Phosphorous P	1.35			Grab	0.01 mg/l	Photometric	
Fluoride F	0.27			Grab	0.08 mg/l	IC	
List I Organics *	<0.01			Grab	0.01 mg/l	GC - MS	
List II Organics *	<0.01			Grab	0.01 mg/l	GC - MS	
Odour	None			Grab	-	Olefactory	
Visual Inspection	Turbid/Brown			Grab	-	Visual	

Signed for and on behalf of BHP Laboratories Ltd.



# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co.Cavan

(Sheet 1 of 2)

**Monitoring Point / Grid Reference:** \_\_\_\_\_ SW 1 \_\_\_\_\_

**Surface Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	08/10/947	09/04/807					
BHP Reference	<b>Date</b>	<b>Date</b>	<b>Date</b>	<b>Date</b>			
	4th Qtr 08	2nd Qtr 09					
pH	6.80	6.88			Grab	0 -14	Electrochemical
Temperature °C	6.9	10.1			Grab	-5°C to 100°C	Electronic Thermocouple
Electrical Conductivity EC <sub>u</sub> Scm <sup>-1</sup>	330	333			Grab	1.0uScm <sup>-1</sup>	Electrochemical
Ammonical Nitrogen NH <sub>3</sub> -N	2.90	0.29			Grab	0.01 mg/l	Photometric
Chemical Oxygen Demand	51	13			Grab	1 mg/l	Photometric
Biochemical Oxygen Demand	2	1			Grab	1 mg/l	Electrochemical
Dissolved Oxygen (% Sat. O <sub>2</sub> )	91.8	95.4			Grab	1.2 % Saturation O <sub>2</sub>	Electrochemical
Total Oxidised Nitrogen TON	1.01	1.91			Grab	0.10 mg/l	Calculated from IC
Total Alkalinity (as CaCO <sub>3</sub> )	102	115			Grab	1 mg/l	Titration
Total Suspended Solids	6.8	8.4			Grab	1 mg/l	Gravimetric
Chloride Cl	19.12	19.54			Grab	0.22 mg/l	IC
Nitrite NO <sub>2</sub>	<0.1	<0.10			Grab	0.10 mg/l	IC
Nitrate NO <sub>3</sub>	4.5	8.49			Grab	0.10 mg/l	IC
Sulphate SO <sub>4</sub>	65.3	14.4			Grab	0.20 mg/l	IC

Signed for and on behalf of BHP Laboratories Ltd.

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# Chemical Analysis Report for Bailieborough Landfill Site

**Client:** Cavan Co. Co., Courthouse, Cavan, Co. Cavan.

**Site Address:** Bailieborough, Co. Cavan

(Sheet 2 of 2)

**Monitoring Point / Grid Reference:** \_\_\_\_\_ SW1 \_\_\_\_\_

**Surface Water Monitoring**

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range or Limit of detection (LOD)	Analysis method / technique
	08/10/947 Date	09/04/807 Date	Date	Date			
BHP Reference	4th Qtr 08	2nd Qtr 09					
Calcium Ca	25.83	24.65			Grab	0.01 mg/l	ICP
Cadmium Cd	<0.0035	<0.0035			Grab	0.0035 mg/l	ICP
Total Chromium Cr	<0.01	<0.01			Grab	0.01 mg/l	ICP
Copper Cu	<0.015	<0.015			Grab	0.015 mg/l	ICP
Iron Fe	<0.03	<0.03			Grab	0.03 mg/l	ICP
Lead Pb	0.007	0.008			Grab	0.002 mg/l	ICP
Magnesium Mg	7.29	5.76			Grab	0.01 mg/l	ICP
Manganese Mn	<0.014	<0.014			Grab	0.014 mg/l	ICP
Potassium K	6.08	4.43			Grab	0.10 mg/l	ICP
Sodium Na	11.08	13.3			Grab	0.03 mg/l	ICP
Zinc Zn	<0.001	<0.001			Grab	0.011 mg/l	ICP
Mercury Hg	<0.0005	<0.0005			Grab	0.0005 mg/l	AAS
OrthoPhosphate P	0.27	0.27			Grab	0.01 mg/l	Photometric
Odour	None	None			Grab	-	Olefactory
Visual Inspection	Straw, Turbid	Straw, Clear			Grab	-	Visual

## 5.0 Discussion/Interpretation

### 5.1 Groundwaters

The locations of the various groundwater monitoring locations are shown in Appendix B. The results of the chemical and microbiological analysis conducted on the groundwaters are presented in Section 5.

Bailieborough landfill is remediated and as such many of the original locations outlined in the licence are now inaccessible or missing.

MW10D and MW10S are located on the western edge of the landfill site. Overall both locations exhibited an improvement in water quality most notably for the level of iron found.

MW10D has a count of 2 of coliform bacteria per 100mls while 36 coliform per 100mls was found in MW10S.

MW11D and MW11S are located north of the landfill, approximately 50 meters from the landfill. MW11S contains an elevated level of iron at 0.406 mg/l. MW11D contains 31 coliform bacteria per 100 mls, while 11 coliform bacteria per 100 mls were found in MW11S. Both locations were turbid with discolouration.

In summary, however the level of contamination is low and is quite similar in quality to the previous annual monitoring event in 2008.

### 5.2 Surface Waters

2 surface waters were examined. At the Wilton Bridge, the Barora River (SW2) was sampled and found to be odourless with a straw yellow colour.

SW1 was found to be of a much improved quality to that seen in 2006 and 2007. The location was free flowing and the stagnation previously seen was not observed on site.

### 5.3 Leachate

One leachate at MW8 was available in 2009 for the annual monitoring. The results are typical. The leachate was high in ammonia and organic content.

Leachate consists of water that has become contaminated by wastes as it passes through a waste disposal site. It contains waste constituents that are soluble, not retained by soil, and not degraded chemically or biochemically. Some potentially harmful leachate constituents are products of chemical or biochemical transformations of wastes. If this leachate is allowed to migrate from the site, it may pose a threat to surrounding surface and ground waters.

Leachate composition within any landfill is unique. The characteristics of the leachate will depend on the waste types being deposited. The principal factors which can influence the generation of leachate include.

- a) Waste composition
- b) Phase of waste decomposition
- c) Waste density
- d) Meteorological conditions
- e) Depth of landfill
- f) Moisture content
- g) Rate of water movement

The chemical composition of leachate will vary depending on the age of the landfill.

### Analytical Interpretation:

The biological qualities of leachate will vary with time and can be monitored from assessing the BOD : COD ratio. The results for the 1 leachate are presented in the table.

<b>Leachate I.D</b>	<b>BOD</b>	<b>COD</b>	<b>Ratio</b>
MW8	101	400	0.25

Ratios in the range of 0.4 to 0.6 are indicative that the organic matter in the leachate is readily degradable (young/medium aged landfill). When a BOD:COD ratio is typically in the range 0.05 to 0.2, this suggests a mature landfill.

The results for this monitoring period indicate that the leachate is typical of a mature landfill.

### Conclusion

Outside of slight elevations in some parameters, there is no evidence of any negative environmental impact associated with this closed landfill. Parameters were generally found to be similar to the previous annual monitoring event in 2008.



**Appendix D**  
**Declaration of True Copy**



# Cavan County Council

Comhairle Chontae an Chabháin



**Courthouse**

Teach Na Cúirte

**Cavan**

An Cabháin

## Telephone Numbers

Central Council  
049 437 8300

Motor Tax  
049 437 8430

Planning  
049 437 8600

Corporate Services  
049 437 8601

Johnston Central Library  
049 437 8500

Finance Department  
049 437 8300

Roads  
049 437 8300

Housing  
049 437 8300

Community & Enterprise  
049 437 8602

Water Services  
049 437 8300

Email: [info@cavancoco.ie](mailto:info@cavancoco.ie)

## Declaration

Cavan County Council hereby certifies that the content of the full pdf AER W0091-012009AER.pdf uploaded to the EPA website is a true copy of the original AER.

Signed  Dated 7/4/10

Sinead Fox  
Landfill Operations Manager  
Cavan County Council

Fax: 049 436 1565

Web: [www.cavancoco.ie](http://www.cavancoco.ie)