

# **ANNUAL ENVIRONMENTAL REPORT 2013**

**Waste Licence Registration No.:** W0076-1

**Licencee:** Limerick City Council

**Location of Activity:** Longpavement Landfill  
Longpavement  
Limerick

**Attention:** Office Environmental Enforcement  
Environmental Protection Agency  
Regional Inspectorate,  
Inniscarra  
Co. Cork

**Submitted by:** Ursula Ahern  
Environment Department  
Limerick City Council  
City Hall  
Limerick

## 1.0 REPORTING PERIOD

The period of reporting for this Report is from January 2013 to December 2013.

## 2.0 REPORT ON RESTORATION OF COMPLETED CELLS / PHASES

In February 2006 Tobin Consulting, Civil and Structural Engineers, acting on behalf of Limerick City Council tendered the following contract: “**Longpavement Landfill Restoration Capping of Waste Body, including Gas Collection, Leachate Collection, Methane Stripping and Civil Engineering Works**”.

McSweeney Building & Civil Engineering Ltd won the tender and was appointed in July 2006 and the following site works are now complete:

- **Landfill Gas:** The collection and flaring of landfill gases being generated by the decomposition of the material contained within the landfill mass.
- **Leachate:** The collection and treatment of leachate generated throughout the site.
- **The permanent capping of the landfill:** This involved covering the landfill with a synthetic sealing material and soils to prevent rainwater seeping into the landfill.
- **Reshaping and profiling** of the landfill mass, associated civil engineering works and landscaping. The landscape design now integrates the restored site into its surroundings and the area is now an amenity for the people of Limerick. New wetlands areas have been constructed which enhances existing wetlands.

The work involved a significant amount of earthworks in the capping of the landfill mass. As well as the landfill gas and leachate collection & treatment systems there is a new control building together with a compound, fencing and an access road to the Longpavement Road. It also involved the construction of pipelines, rising mains, manholes, a pumping station with associated mechanical and electrical aspects of the above elements.

### **3.0 WASTE ACTIVITIES CARRIED OUT AT THE FACILITY**

No material was imported on to the site in 2013. All works on the site are now complete

### **4.0 SUMMARY OF RESULTS & INTERPRETATION OF ENVIRONMENTAL MONITORING**

Drawing No. 2307-1004, contained in Appendix A of this Report, shows the locations of all the monitoring points at the Longpavement landfill facility. Monitoring was carried out by BHP Laboratories Ltd as part of compliance with EPA waste licence 76-1.

Tables 4.1 to 4.8 below indicate the parameters and frequencies to be monitored in accordance with the EPA licence 76-1.

**Table 4.1 Landfill Gas Monitoring and Parameters**

Parameter	Monitoring Frequency			Analysis Method <sup>Note 1</sup> / Technique <sup>Note 2</sup>
	Perimeter Boreholes <small>Note 3</small>	Other Boreholes/ Vents/Wells	Site Office	
Methane (CH <sub>4</sub> ) % v/v	Weekly	Monthly	Weekly	Infrared analyser/flame ionisation detector
Carbon dioxide (CO <sub>2</sub> )%v/v	Weekly	Monthly	Weekly	Infrared analyser/ flame ionisation detector
Oxygen(O <sub>2</sub> ) %v/v	Weekly	Monthly	Weekly	Electrochemical cell
Atmospheric Pressure	Weekly	Monthly	Weekly	Standard
Temperature	Weekly	Monthly	Weekly	Standard

Note 1: All monitoring equipment used should be intrinsically safe.

Note 2: Or other methods agreed in advance with the Agency.

Note 3: Weekly for first two months upon installation and monthly thereafter.

**Table 4.2 Dust/ PM<sub>10</sub> Monitoring Frequency**

Parameter (mg/m <sup>2</sup> /day)	Monitoring Frequency	Analysis Method/Technique
Dust	Three times a year <sup>Note 2</sup>	Standard Method <sup>Note 1</sup>
PM <sub>10</sub>	Quarterly	See <sup>Note 3</sup>

Note 1: Standard method VDI2119 (Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method) German Engineering Institute). Any modifications to eliminate interference due to algae growth in the gauge should be reported to the Agency.

Note 2: Twice during the period May to September.

Note 3: As described in prEN12341 or an equivalent agreed with the Agency.

**Table 4.3 Noise Monitoring Frequency**

Parameter	Monitoring Frequency	Analysis Method/Technique
L(A) <sub>EQ</sub> [30 minutes]	Bi-Annual	Standard <sup>Note 1</sup>
L(A) <sub>10</sub> [30 minutes]	Bi-Annual	Standard <sup>Note 1</sup>
L(A) <sub>90</sub> [30 minutes]	Bi-Annual	Standard <sup>Note 1</sup>
Frequency Analysis(1/3 Octave band analysis)	Bi-Annual	Standard <sup>Note 1</sup>

Note 1: "International Standards Organisation. ISO 1996. Acoustics - description and Measurement of Environmental noise. Parts 1, 2 and 3."



**Table 4.4 Surface Water, Groundwater & Leachate – Parameters/Frequency**

Parameter <sup>Note 1</sup>	SURFACE WATER <sup>Note 2</sup>	GROUNDWATER	LEACHATE <sup>Note 3</sup>
	Monitoring Frequency	Monitoring Frequency	Monitoring Frequency
Visual Inspection/Odour <sup>Note 2</sup>	Weekly	Quarterly	Quarterly
Groundwater Level	Not Applicable	Monthly	Not Applicable
Leachate Level	Not Applicable	Not Applicable	Continuous
Ammoniacal Nitrogen	Quarterly	Quarterly	Annually
BOD	Quarterly	Not Applicable	Annually
COD	Quarterly	Not Applicable	Annually
Chloride	Quarterly	Quarterly	Annually
Dissolved Oxygen	Quarterly	Quarterly	Not Applicable
Electrical Conductivity	Quarterly	Quarterly	Annually
pH	Quarterly	Quarterly	Annually
Total Suspended Solids	Quarterly	Not Applicable	Not Applicable
Temperature	Quarterly	Quarterly	Quarterly
Metals / Non Metals <sup>Note 3</sup>	Annually	Annually	Annually
Cyanide (Total)	Not Applicable	Annually	Annually
Fluoride	Not Applicable	Annually	Annually
List I/II Organic Substances <sup>Note 4</sup>	Once off <sup>Note 5</sup>	Annually <sup>Note 5</sup>	Once off <sup>Note 5</sup>
Mercury	Annually	Annually	Annually
Sulphate	Annually	Annually	Annually
Total Alkalinity	Annually	Annually	Not applicable
Total P/Orthophosphate	Annually	Annually	Annually
Total Oxidised Nitrogen	Annually	Annually	Annually
Total Organic Carbon	Not Applicable	Quarterly	Not Applicable
Residue on evaporation	Not Applicable	Annually	Not Applicable
Biological Assessment	Annually <sup>Note 6</sup>	Not Applicable	Not Applicable

Note 1: All the analysis shall be carried out by a competent laboratory using standard and internationally accepted procedures.

Note 2: Where there is evident gross contamination of leachate, additional samples should be analysed.

Note 3: Metals and elements to be analysed by AA/ICP should include as a minimum: boron, cadmium, calcium, chromium (total), copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and zinc.

Note 4: Samples screened for the presence of organic compounds using Gas Chromatography / Mass Spectrometry (GC/MS) or other appropriate techniques and using the list I/II Substances from EU Directive 76/464/EEC and 80/68/EEC as a guideline. Recommended analytical techniques include: volatiles (US Environmental Protection Agency method 524 or equivalent), semi-volatiles (USEPA method 525 or equivalent, and pesticides (USEPA method 608 or equivalent).

Note 5: 2 surface water locations, 3 groundwater locations and 2 leachate locations to be agreed with the Agency for these parameters.

Note 6: Appropriate biological methods (such as EPA Q-Rating System) to be used for the assessment of rivers and streams.

**Table 4.5 Meteorological Monitoring**

To be obtained from Shannon Airport or an agreed location.

Parameter	Monitoring Frequency	Analysis Method/Technique
Precipitation Volume	Daily	Standard
Temperature (min/max.)	Daily	Standard
Wind Force and Direction	Daily	Standard
Evaporation	Daily	Standard
Evapotranspiration <sup>Note 1</sup>	Daily	Standard
Humidity	Daily	Standard
Atmospheric Pressure <sup>Note 1</sup>	Daily	Standard

**Note 1:** Monitoring frequency for these parameters may be decreased with the agreement of the Agency.

**Table 4.6 Landfill Gas Combustion Plant/ Enclosed Flare Parameters**

Parameter	Flare (enclosed) Monitoring Frequency	Utilisation Plant Monitoring Frequency	Analysis Method <sup>Note1</sup> /Technique <sup>Note2</sup>
<b>Inlet</b>			
Methane (CH <sub>4</sub> ) % v/v	Continuous	Weekly	Infrared analyser/flame ionisation detector/thermal conductivity
Carbon dioxide (CO <sub>2</sub> )%v/v	Continuous	Weekly	Infrared analyser/ thermal conductivity
Oxygen (O <sub>2</sub> ) %v/v	Continuous	Weekly	Electrochemical/thermal conductivity
Total Sulphur	Annually	Annually	Ion chromatography
Total Chlorine	Annually	Annually	Ion chromatography
Total Fluorine	Annually	Annually	Ion Selective Electrode
<b>Process Parameters</b>			
Combustion Temperature	Continuous	Quarterly	Temperature Probe/datalogger
<b>Outlet</b>			
CO	Continuous	Continuous	Flue gas analyser/datalogger
NO <sub>x</sub>	Annually	Annually	Flue gas analyser
SO <sub>2</sub>	Annually	Annually	Flue gas analyser

Parameter	Flare (enclosed) Monitoring Frequency	Utilisation Plant Monitoring Frequency	Analysis Method <sup>Note1</sup> /Technique <sup>Note2</sup>
Particulates	Not applicable	Annually	Isokinetic/Gravimetric
TA Luft Class I, II, III organics	Not applicable	Annually	Adsorption/Desorption /GC/GCMS <sup>Note 3</sup>
TOC	Annually	Not applicable	Flame ionisation
Hydrochloric acid	Annually	Annually	Impinger / Ion Chromatography
Hydrogen fluoride	Annually	Annually	Impinger / Ion Chromatography

Note 1: All monitoring equipment used should be intrinsically safe.

Note 2: Or other methods agreed in advance with the Agency.

Note 3: Test methods should be capable of detecting acetonitrile, dichloromethane, tetrachlorethylene and vinyl chloride as a minimum.

**Table 4.7 Monitoring of Emissions to Sewer**

Parameter	Monitoring Frequency	Analysis Method/Technique <sup>Note 1</sup>
Methane	Continuous	Dissolved Methane Probe /Headspace methane monitor

Note 1: To be agreed in advance with the Agency.

**Table 4.8 Monitoring of Emissions from On-Site Leachate Treatment Plant**

Parameter	Monitoring Frequency	Analysis Method/Technique <sup>Note 1</sup>
Flow	Continuous	Flow meter / recorder
pH	Continuous	pH meter / recorder
Biochemical Oxygen Demand	Twice Weekly	Standard Method <sup>Note 2</sup>
Chemical Oxygen Demand	Weekly	Standard Method <sup>Note 2</sup>
Total Nitrogen	Twice Weekly	Standard Method <sup>Note 2</sup>
Total P (as P)	Monthly	Standard Method <sup>Note 2</sup>
Suspended Solids	Weekly	Gravimetric

## **4.1 Landfill Gas**

In accordance with licence 76-1 requirements, landfill gas has been monitored on a monthly basis since February 2003. There are thirteen gas wells located in the vicinity of the landfill overall; eleven perimeter gas wells and two located within the waste mass of the pre-1984 landfill. Results of the monthly monitoring are included in Appendix B of this Report.

### ***4.1.1 Landfill Gas Wells***

Two landfill gas wells are monitored on the pre-1984 landfill site, LG13 and LG14. Gas well LG14 was not monitored throughout 2013 but will be re-instated or re-located in 2014. Exceedances in CO<sub>2</sub> (16.7% to 30.0%) and CH<sub>4</sub> (47.7% to 81.9%) were detected in gas well LG13 throughout the year.

### ***4.1.2 Perimeter Gas Wells***

There are eleven gas-monitoring points installed at perimeter locations in the vicinity of the landfill. These were installed to determine the degree, if any, of subsurface landfill gas migration. Nine of these wells were located in Moyross between the landfill and local housing estates. No exceedance in CH<sub>4</sub> was detected in any of the perimeter boreholes during the monitoring period. CO<sub>2</sub> exceedances were detected on a number of occasions ranging from 1.6% to 9.4%.

The elevated Carbon dioxide levels were investigated further by a gas risk assessment carried out in 2011 that was submitted to the Agency.

The high incidence of carbon dioxide in the area is most likely as a result of aerobic respiration by microbes and vegetation and does not appear to be related to landfill gas as no methane was recorded during the monitoring period. The report concluded that the elevated carbon dioxide levels are not directly attributable to the licensed activities and the elevated levels were not recorded at the facility.

## **4.2 Dust Control - PM<sub>10</sub> Monitoring**

As the landfill is now closed no dust monitoring was carried out in 2013.

No PM<sub>10</sub> monitoring was carried out as the landfill is closed and has ceased operations.

### **4.3 Noise Monitoring**

The landfill at Longpavement has been closed for the acceptance of waste since 2002 and as restoration activity ceased in 2010, no noise monitoring was conducted in 2013.

#### **4.4 Surface Water**

Surface water sampling was carried out at 7 No. locations in the vicinity of the landfill boundary (SW-01, SW-02, SW-03, SW-04, SW-05, SW-06 and SW-07), refer to Drawing No 2307-1004 contained in Appendix A of this Report for exact locations. The quality of surface waters has been assessed against specific Environmental Quality Standards (EQS) listed in relevant legislation. Surface water limit concentrations have been evaluated against A1 – A3 quality standards in the surface water regulations 1989 and European Communities Environmental Objectives (Surface water) Regulations S.I No 272 of 2009. Surface water sampling results are shown in Appendix C and D of this Report.

#### **4.5 Groundwater**

There are 6 No. Groundwater monitoring wells at the Longpavement landfill facility, GW-01, GW-02, GW-03, GW-04, GW-05 and GW-06 as shown on Drawing No. 2307/1004 contained in Appendix A of this Report. Groundwater quality has been monitored on a quarterly and annual basis and assessed to European Communities Environmental Objectives (Groundwater) Regulations S.I No 9 of 2010. Results for groundwater monitoring at the facility are tabulated in Appendix C and D of this Report.

#### **4.6 Leachate**

There are 13 No. Leachate monitoring wells at the Longpavement landfill facility, which are currently 200mm in diameter. All available wells were sampled. These wells have been identified as L01 to L011, and are located on the landfill as shown on Drawing No. 2307-1004, contained in Appendix A of this Report. Results for Leachate monitoring at the facility are tabulated in Appendix C and D of this Report.

#### **4.7 Meteorological Monitoring**

Meteorological monitoring data for Shannon Airport is available can be submitted to the Agency if required.

#### **4.8 Landfill Gas Combustion Plant/Enclosed Flare Monitoring**

The commissioning of the Landfill gas flare took place in June 2010 and is continuingly in operation.

#### **4.9 Monitoring of Emissions to Sewer**

Leachate is emitted to sewer and the emissions are monitored in L12 and L13 (Tank & Sump). There are no emissions to sewer from the facility. However all emissions to sewer will be monitored when the treated leachate will be discharged from the treatment plant.

#### **4.10 Monitoring of Emissions from onsite Leachate Treatment Plant**

The construction of the on-site leachate treatment plant is now complete. See paragraph 4.9.

### **5.0 VOLUME OF LEACHATE PRODUCED & VOLUME OF LEACHATE TRANSPORTED / DISCHARGED OFF-SITE**

#### **5.1 Leachate Abstraction Wells**

An existing network of 11 No. leachate abstraction wells are present on the site. 7 wells at the post 1984 and 4 wells on the pre-1984 site.

### **6.0 SITE SURVEY SHOWING EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING PERIOD**

N/A



## 7.0 ESTIMATED ANNUAL & CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY

The installation of a landfill gas flare forms part of the rehabilitation proposals of the facility. A series of vertical gas extraction wells has been installed to actively extract gas from the waste body. A horizontal gas drainage/equalizing layer consisting of a synthetic material has been placed underneath the final cap.

A computer model was used to estimate the landfill gas production and extraction rates for the Longpavement landfill site. Full details of the computer model are given in Section 3.2.5 of the Longpavement Landfill Rehabilitation Design Report (April 2005) and the Design Report Addendum (July 2005). This report has been submitted to the Agency.

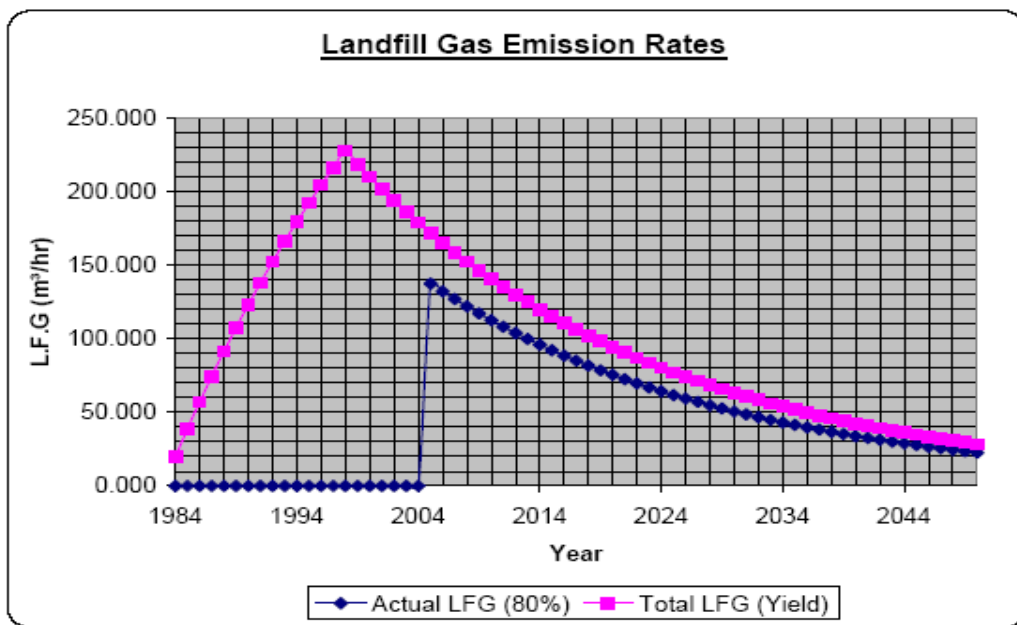


Figure 7.1: Projected Landfill Gas Emission Rates

The results of the model are presented in Figure 7.1. This model shows that in the course of the lifetime of the site that landfill gas production peaked in 1988 and that approx. 137m<sup>3</sup>/hr is theoretically available for extraction. It is estimated that gas production is on a downward cycle decreasing to 92m<sup>3</sup>/hr in 2015 and approx. 75m<sup>3</sup>/hr in 2020.

## 8.0 REPORT ON THE PROGRESS TOWARDS ACHIEVEMENT OF THE ENVIRONMENTAL OBJECTIVES & TARGETS CONTAINED IN PREVIOUS YEAR'S REPORT

All works are now complete on site. All equipment and systems on site were maintained.

## **9.0 SCHEDULE OF ENVIRONMENT OBJECTIVES & TARGETS FOR THE FORTHCOMING YEAR**

The objective for the coming year includes:

1. Maintenance of gas flare System
2. Maintenance of Leachate Collection System

## **10.0 REPORTED INCIDENTS & COMPLAINT SUMMARIES**

No complaints were received during the period from January 2013 to the December 2013.

## **11.0 REVIEW OF NUISANCE CONTROLS**

As the site is now rehabilitated No nuisances are present on site.

### **11.1 Pest Control**

Pest control is carried out regularly.

### **11.2 Litter Control**

Litter is not an issue on the rehabilitated site.

### **11.3 Dust Control**

No material was imported on to the site during 2013.

### **11.4 Bird Control**

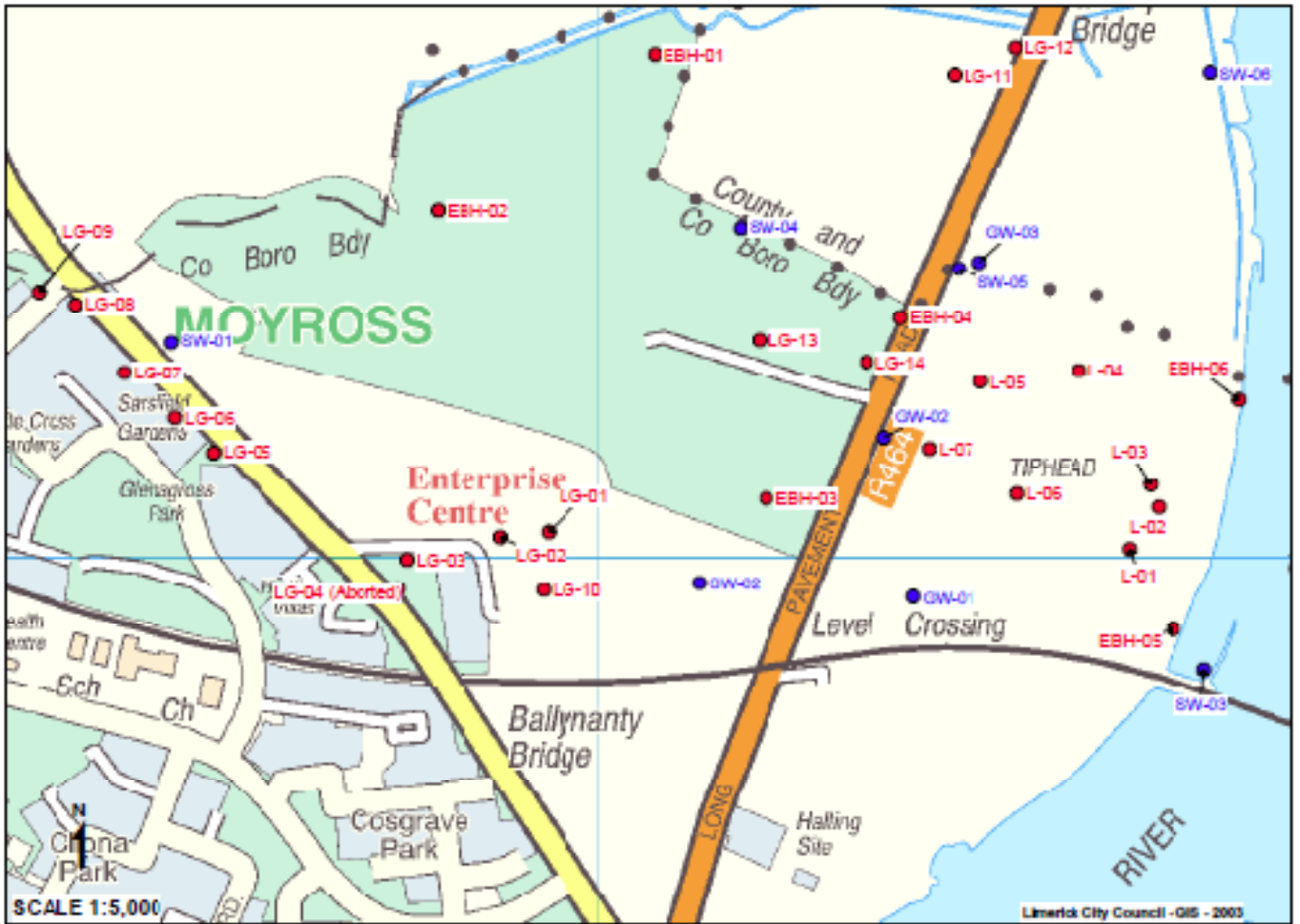
There is no evidence of bird nuisance at the landfill site. The site has closed for the acceptance of waste since March 1998.

## **12.0 REPORTS ON FINANCIAL PROVISION MADE UNDER THIS LICENCE, MANAGEMENT & STAFFING STRUCTURE OF THE FACILITY.**

The contract value for the restoration works including design and construction was €6.7 million. 75% of the 2008 expenditure is grant aided by the Department of the Environment Heritage and Local Government. The remaining 25% is funded by Limerick City Councils internal capital fund. An on-going maintenance budget of €80,000 to €90,000 per annum is also in place. The Senior Executive Engineer in Limerick City Council's Environment department oversees any works at Longpavement.

# Appendix A

## Site map showing sampling locations



## **Appendix B**

### **Monthly Gas Monitoring Results**

**Landfill Gas Monitoring Results – Longpavement Landfill 2013**

Date	Operator	Gas	LG 01	LG 02	LG 03	LG 04	LG 05	LG 06	LG 07	LG 08	LG 09	LG 10	LG 11	LG 12	LG 13	LG 14	
31/01/13	Dermot Condon	CH <sub>4</sub>	C	0.0	F	0.0	0.0	0.0	0.0	0.0	C	C	0.1	C	81.9	C	
		CO <sub>2</sub>		0.2		6.6	0.2	2.6	3.1	0.2				0.1		17.9	
		O <sub>2</sub>		19.9		5.8	20.4	15.6	14.1	20.5				11.2		0.2	
		Air Pressure		1005		1005	1005	1005	1005	1005				1005		1005	
25/02/13	Dermot Condon	CH <sub>4</sub>	C	0.0	F	0.0	0.0	0.0	0.0	0.0	C	C	VB	C	81.9	C	
		CO <sub>2</sub>		0.1		7.6	0.2	3.0	0.8	0.3						16.7	
		O <sub>2</sub>		19.5		4.0	19.6	14.7	19.3	19.7						0.1	
		Air Pressure		1027		1027	1027	1027	1027	1027						1027	
27/03/13	Dermot Condon	CH <sub>4</sub>	C	0.0	F	0.0	0.0	0.0	0.0	0.0	C	C	VB	C	81.6	C	
		CO <sub>2</sub>		0.1		8.3	0.1	2.7	0.8	0.2						18.7	
		O <sub>2</sub>		20.4		4.4	20.4	15.5	20.0	20.3						0.2	
		Air Pressure		1011		1011	1011	1011	1011	1011						1011	
29/04/13	Dermot Condon	CH <sub>4</sub>	C	0.0	F	0.0	0.0	0.0	0.0	0.0	C	C	1.1	C	75.3	C	
		CO <sub>2</sub>		0.1		7.8	0.1	2.6	1.3	1.6				0.1		22.4	
		O <sub>2</sub>		20.1		7.3	20.1	15.9	18.7	18.5				5.1		0.1	
		Air Pressure		1020		1020	1020	1020	1020	1020				1020		1020	
24/05/13	Dermot Condon	CH <sub>4</sub>	0.0	0.0	0.0	C	0.0	0.0	0.0	0.0	C	C	2.6	C	77.0	C	
		CO <sub>2</sub>	0.8	6.5	8.5		0.3	2.5	2.4	2.5				0.1		23.0	
		O <sub>2</sub>	18.6	15.4	7.3		19.8	16.4	17.8	17.2				5.6		0.1	
		Air Pressure	1017	1017	1017		1017	1017	1017	1017				1017		1017	
18/06/13	Dermot Condon	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	2.1	C	72.0	C	
		CO <sub>2</sub>	0.7		8.6		0.1	1.8	1.4	2.2				0.0		25.9	
		O <sub>2</sub>	12.9		8.0		19.0	16.1	18.5	16.5				1.8		0.2	
		Air Pressure	1015		1015		1015	1015	1015	1015				1015		1015	

**Landfill Gas Monitoring Results – Longpavement Landfill 2013 contd.**

Date	Operator	Gas	LG 01	LG 02	LG 03	LG 04	LG 05	LG 06	LG 07	LG 08	LG 09	LG 10	LG 11	LG 12	LG 13	LG 14	
24/07/13	Dermot Condon	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	VB	C	68.8	C	
		CO <sub>2</sub>	0.6		9.6		0.1	6.5	1.3	1.6						30.0	
		O <sub>2</sub>	16.4		11.5		19.2	5.9	18.8	18.0						0.2	
		Air Pressure	1005		1002		1005	1005	1005	1005						1005	
13/08/13	Dermot Condon	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	VB	C	60.7	C	
		CO <sub>2</sub>	0.1		8.2		0.1	5.3	0.9	1.4						28.6	
		O <sub>2</sub>	18.6		14.0		19.2	11.4	18.9	18.5						1.0	
		Air Pressure	1024		1024		1024	1024	1024	1024						1024	
09/09/13	Dermot Condon	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	VB	C	54.9	C	
		CO <sub>2</sub>	0.1		7.0		0.1	6.8	1.3	2.4						29.7	
		O <sub>2</sub>	19.5		15.9		19.3	6.1	18.6	17.2						0.4	
		Air Pressure	1018		1018		1018	1018	1018	1018						1018	
04/10/13	Dermot Condon	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	VB	C	47.7	C	
		CO <sub>2</sub>	0.7		6.5		0.1	6.0	1.8	3.2						29.0	
		O <sub>2</sub>	16.8		15.6		19.1	8.6	17.9	16.1						1.0	
		Air Pressure	1007		1007		1007	1007	1007	1007						1007	
06/11/13	Dermot Condon	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	VB	C	72.6	C	
		CO <sub>2</sub>	0.6		7.1		0.2	3.2	4.0	1.7						28.6	
		O <sub>2</sub>	14.2		15.8		19.2	15.4	15.1	17.4						0.2	
		Air Pressure	991		991		991	991	991	991						991	
19/12/13	Aidan Daffy	CH <sub>4</sub>	0.0	F	0.0	C	0.0	0.0	0.0	0.0	C	C	VB	C	75.5	C	
		CO <sub>2</sub>	0.4		4.7		0.1	0.4	3.7	0.7						27.3	
		O <sub>2</sub>	18.6		16.0		21.6	20.8	18.1	20.8						0.1	
		Air Pressure	995		995		995	995	995	995						995	

**LG 13 & LG 14 in waste body**

**F - Flooded**

**C - Covered**

**VB - Valve Blocked**

## **Appendix C**

### **Annual Surface Water, Ground Water and Leachate Monitoring Report**



**TEST REPORT**



**Client:**  
**Limerick City Council**  
**County Buildings**  
**Dooradoyle**  
**Limerick**

**BHP Ref No.: 110723-110725**  
**Order No.:**  
**Date Received: 19/09/2013**  
**Date Completed: 09/10/2013**  
**Test Specification: Nil**

**BHP**  
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Thomondgate  
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*Item: Longpavement Landfill Site*

*Annual Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period 2013)*

**Limerick City Council**  
**County Buildings**  
**Dooradoyle**  
**Limerick**

FTAO: Ursula Ahern

Report on Longpavement Landfill for Annual Parameters, 2013

**For and on behalf of BHP Ltd.**

A handwritten signature in blue ink that reads 'Paul O'Sullivan'.

**Paul O'Sullivan**

**Date Issued: 18<sup>th</sup> October 2013**

**Test results relate only to this item. This test report shall not be duplicated except in full and with the permission of the test laboratory**

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**2.0 Sampling / Analysis**

**3.0 Results**

**4.0 Discussion**

**Appendix A: Copy of Table D.5 (Licence Instructions for WL 76-1)**

## 1.0 INTRODUCTION

BHP were contracted by Limerick City Council to carry out environmental monitoring at Longpavement Landfill site which is located adjacent to the Longpavement road, Limerick City. This landfill is no longer operational and is currently undergoing remediation and final capping works. The facility is operated under waste license no. 76-1, which was issued to Limerick City Council on the 1<sup>st</sup> February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the annual monitoring event of 2013.

## 2.0 SAMPLING

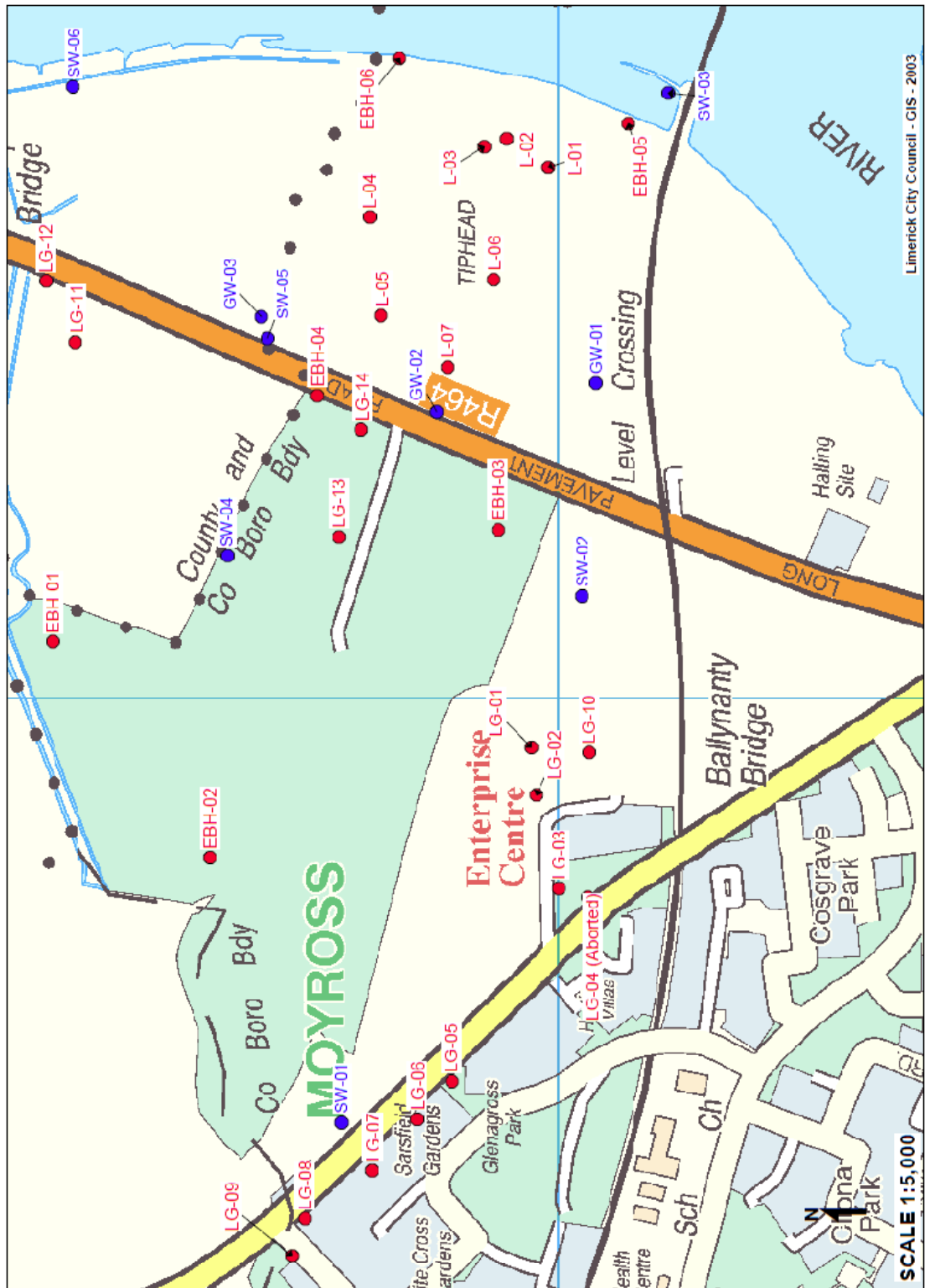
This monitoring is a continuation of an established monitoring program at Longpavement Landfill. As such, the borehole locations are as on previously drafted site maps. A site map is presented below showing the borehole locations. BHP sampled at 6 available boreholes. Their individual references are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

Table 1 : Borehole reference points and levels.

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	2.13
GW-01 (D)	2.13
GW-02 (S)	1.28
GW-02 (D)	1.64
GW-03 (S)	Dry
GW-03 (D)	2.55
GW-04 (S)	Dry
GW-04 (D)	2.80
GW-05 (S)	2.27
GW-05 (D)	3.64
GW-06 (S)	Not available
GW-06 (D)	Not available

Locations for surface waters and leachate wells are also shown in the map below.

Site map of Longpavement Landfill showing sampling locations



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 sub-strata (and not that of stagnant water in the standpipe). In order to achieve this, each borehole is purged of three 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).
  - 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. Dissolved Oxygen, Conductivity, pH and temperature are measured using a HACH HQ40d Portable Multi-meter which has Automatic Temperature Compensation functionality
3. BHP operates a chain of custody system.
4. All samples received by the Laboratory were stored between 0 and 6°C. Subsequent analysis of all samples was carried out in accordance with Standard Methods for the examination of water and wastewater, 22<sup>nd</sup> Edition, 2012, published by the American public health association.

## Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 <sup>nd</sup> Edition
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 RESULTS**

The results are presented in the following tables.



**Annual Ground Water Monitoring results for  
Longpavement Landfill  
2013**

## TEST REPORT 110723.1

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/446  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	GW01	mg/l	<0.001	APHA-3102-B
Cadmium	Shallow	mg/l	<0.02	APHA-3102-B
Calcium		mg/l	17.11	APHA-3102-B
Chromium		mg/l	0.017	APHA-3102-B
Copper		mg/l	0.024	APHA-3102-B
Iron		mg/l	0.061	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.019	APHA-3102-B
Manganese		mg/l	0.017	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.896	APHA-3102-B
Sodium		mg/l	9.117	APHA-3102-B
Zinc		mg/l	0.019	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.161	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	1288	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.035	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.07	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.029	APHA-4110-B
Cyanide		mg/l	0.03	APHA-4500-CN-E
Alkalinity (as CaCO <sub>3</sub> )		mg/l	523	APHA-2320-B
Residue on Evaporation		mg/l	38600	APHA-2540-B
List I/II Organic Substances		mg/l	<0.1	USEPA 502/524

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.2

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/447  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

Analysing  
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Consulting  
Calibrating



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Limerick  
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Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	GW01 Deep	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	<0.001	APHA-3102-B
Chromium		mg/l	<0.001	APHA-3102-B
Copper		mg/l	0.027	APHA-3102-B
Iron		mg/l	0.049	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.116	APHA-3102-B
Manganese		mg/l	0.021	APHA-3102-B
Nickel		mg/l	<0.001	APHA 3102 B
Potassium		mg/l	0.921	APHA-3102-B
Sodium		mg/l	10.104	APHA-3102-B
Zinc		mg/l	0.036	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	<0.01	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	2.975	APHA-4110-B
Orthophosphate (as P)		mg/l	0.158	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.074	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.017	APHA-4110-B
Cyanide	mg/l	<0.001	APHA-4500-CN-E	
Alkalinity (as CaCO <sub>3</sub> )	mg/l	929	APHA 2320 B	
Residue on Evaporation	mg/l	1691	APHA-2540-B	
List I/II Organic Substances	mg/l	<0.01	USEPA 502/524	

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.3

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

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Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	GW02	mg/l	Too shallow to sample	APHA-3102-B
Cadmium	Shallow	mg/l		APHA-3102-B
Calcium		mg/l		APHA-3102-B
Chromium		mg/l		APHA-3102-B
Copper		mg/l		APHA-3102-B
Iron		mg/l		APHA-3102-B
Lead		mg/l		APHA-3102-B
Magnesium		mg/l		APHA-3102-B
Manganese		mg/l		APHA-3102-B
Nickel		mg/l		APHA-3102-B
Potassium		mg/l		APHA-3102-B
Sodium		mg/l		APHA-3102-B
Zinc		mg/l		APHA-3102-B
Mercury		mg/l		APHA-3102-B
Fluoride		mg/l		APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l		APHA-4110-B
Orthophosphate (as P)		mg/l		APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l		APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l		APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l		APHA-4110-B
Cyanide		mg/l	APHA-4500-CN-E	
Alkalinity (as CaCO <sub>3</sub> )		mg/l	APHA-2320-B	
Residue on Evaporation		mg/l	APHA-2540-B	
List I/II Organic Substances		mg/l	USEPA 502/524	

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.4

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/448  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

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New Road  
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Fax + 353 61 455447  
E Mail bhpem2@bhp.ie

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	GW02 Deep	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	20.107	APHA-3102-B
Chromium		mg/l	<0.001	APHA-3102-B
Copper		mg/l	0.067	APHA-3102-B
Iron		mg/l	0.081	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	0.894	APHA-3102-B
Manganese		mg/l	0.034	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.721	APHA-3102-B
Sodium		mg/l	8.114	APHA-3102-B
Zinc		mg/l	0.027	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.104	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	11.101	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.105	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.127	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.063	APHA-4110-B
Cyanide	mg/l	<0.001	APHA-4500-CN-E	
Alkalinity (as CaCO <sub>3</sub> )	mg/l	1080	APHA-2320-B	
Residue on Evaporation	mg/l	1851	APHA-2540-B	
List I/II Organic Substances	mg/l	<0.01	USEPA 502/524	

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.5

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

Analysing  
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 Consulting  
 Calibrating



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 Tel +353 61 455399  
 Fax + 353 61 455447  
 E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	GW03	mg/l	Dry	APHA-3102-B
Cadmium	Shallow	mg/l		APHA-3102-B
Calcium		mg/l		APHA-3102-B
Chromium		mg/l		APHA-3102-B
Copper		mg/l		APHA-3102-B
Iron		mg/l		APHA-3102-B
Lead		mg/l		APHA-3102-B
Magnesium		mg/l		APHA-3102-B
Manganese		mg/l		APHA-3102-B
Nickel		mg/l		APHA-3102-B
Potassium		mg/l		APHA-3102-B
Sodium		mg/l		APHA-3102-B
Zinc		mg/l		APHA-3102-B
Mercury		mg/l		APHA-3102-B
Fluoride		mg/l		APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l		APHA-4110-B
Orthophosphate (as P)		mg/l		APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l		APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l		APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l		APHA-4110-B
Cyanide		mg/l	APHA-4500-CN-E	
Alkalinity (as CaCO <sub>3</sub> )		mg/l	APHA-2320-B	
Residue on Evaporation		mg/l	APHA-2540-B	
List I/II Organic Substances		mg/l	USEPA 502/524	

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.6

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/449  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

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Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpccm2@bhp.ie

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	GW03	mg/l	<0.001	APHA-3102-B
Cadmium	Deep	mg/l	<0.02	APHA-3102-B
Calcium		mg/l	23.409	APHA-3102-B
Chromium		mg/l	0.021	APHA-3102-B
Copper		mg/l	0.336	APHA-3102-B
Iron		mg/l	0.869	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.021	APHA-3102-B
Manganese		mg/l	0.381	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.896	APHA-3102-B
Sodium		mg/l	12.089	APHA-3102-B
Zinc		mg/l	0.036	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.072	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	0.262	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.023	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.007	APHA 1110 B
Cyanide		mg/l	<0.001	APHA-4500-CN-E
Alkalinity (as CaCO <sub>3</sub> )		mg/l	670	APHA-2320-B
Residue on Evaporation		mg/l	1051	APHA-2540-B
List I/II Organic Substances		mg/l	<0.01	USEPA 502/524

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.7

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	GW04	mg/l	Too shallow to sample	APHA-3102-B
Cadmium	Shallow	mg/l		APHA-3102-B
Calcium		mg/l		APHA-3102-B
Chromium		mg/l		APHA-3102-B
Copper		mg/l		APHA-3102-B
Iron		mg/l		APHA-3102-B
Lead		mg/l		APHA-3102-B
Magnesium		mg/l		APHA-3102-B
Manganese		mg/l		APHA-3102-B
Nickel		mg/l		APHA-3102-B
Potassium		mg/l		APHA-3102-B
Sodium		mg/l		APHA-3102-B
Zinc		mg/l		APHA-3102-B
Mercury		mg/l		APHA-3102-B
Fluoride		mg/l		APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l		APHA-4110-B
Orthophosphate (as P)		mg/l		APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l		APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l		APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l		APHA-4110-B
Cyanide		mg/l	APHA-4500-CN-E	
Alkalinity (as CaCO <sub>3</sub> )		mg/l	APHA-2320-B	
Residue on Evaporation		mg/l	APHA-2540-B	
List I/II Organic Substances		mg/l	USEPA 502/524	

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 110723.8

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/450  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

Analysing  
Testing  
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Calibrating



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Fax + 353 61 455447  
E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	GW04	mg/l	<0.001	APHA-3102-B
Cadmium	Deep	mg/l	<0.02	APHA-3102-B
Calcium		mg/l	48.117	APHA-3102-B
Chromium		mg/l	0.036	APHA-3102-B
Copper		mg/l	0.369	APHA-3102-B
Iron		mg/l	0.724	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.138	APHA-3102-B
Manganese		mg/l	0.289	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.714	APHA-3102-B
Sodium		mg/l	16.117	APHA-3102-B
Zinc		mg/l	0.068	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.091	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	37.185	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.959	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.071	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.239	APHA 4110 B
Cyanide		mg/l	<0.001	APHA-4500-CN-E
Alkalinity (as CaCO <sub>3</sub> )		mg/l	475	APHA-2320-B
Residue on Evaporation		mg/l	1527	APHA-2540-B
List I/II Organic Substances		mg/l	<0.01	USEPA 502/524

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.9

Analysing  
Testing  
Consulting  
Calibrating

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

BHP  
New Road  
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Limerick  
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Tel +353 61 455399  
Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Boron	GW05	mg/l	Too shallow to sample	APHA-3102-B
Cadmium	Deep	mg/l		APHA-3102-B
Calcium		mg/l		APHA-3102-B
Chromium		mg/l		APHA-3102-B
Copper		mg/l		APHA-3102-B
Iron		mg/l		APHA-3102-B
Lead		mg/l		APHA-3102-B
Magnesium		mg/l		APHA-3102-B
Manganese		mg/l		APHA-3102-B
Nickel		mg/l		APHA-3102-B
Potassium		mg/l		APHA-3102-B
Sodium		mg/l		APHA-3102-B
Zinc		mg/l		APHA-3102-B
Mercury		mg/l		APHA-3102-B
Fluoride		mg/l		APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l		APHA-4110-B
Orthophosphate (as P)		mg/l		APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l		APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l		APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l		APHA-4110-B
Cyanide		mg/l	APHA-4500-CN-E	
Alkalinity (as CaCO <sub>3</sub> )		mg/l	APHA-2320-B	
Residue on Evaporation		mg/l	APHA-2540-B	
List I/II Organic Substances		mg/l	USEPA 502/524	

**Additional information :**

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110723.10

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/451  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Ground Water 2013

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**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	GW05	mg/l	<0.001	APHA-3102-B
Cadmium	Deep	mg/l	<0.02	APHA-3102-B
Calcium		mg/l	36.109	APHA-3102-B
Chromium		mg/l	0.048	APHA-3102-B
Copper		mg/l	0.496	APHA-3102-B
Iron		mg/l	1.124	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	2.049	APHA-3102-B
Manganese		mg/l	0.816	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.609	APHA-3102-B
Sodium		mg/l	24.103	APHA-3102-B
Zinc		mg/l	0.112	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.162	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	0.555	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.01	APHA-4500-CN-E
Alkalinity (as CaCO <sub>3</sub> )		mg/l	700	APHA-2320-B
Residue on Evaporation		mg/l	4153	APHA-2540-B
List I/II Organic Substances		mg/l	<0.01	USEPA 502/524

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Annual Surface Water Monitoring results for  
Longpavement Landfill  
2013**

**TEST REPORT 110724.1**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/452  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	SW01	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	32.45	APHA-3102-B
Chromium		mg/l	0.019	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.00	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	0.891	APHA-3102-B
Manganese		mg/l	0.016	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.946	APHA-3102-B
Sodium		mg/l	12.22	APHA-3102-B
Zinc		mg/l	0.03	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	28.95	APHA-4110-B
Orthophosphate (as P)		mg/l	0.019	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.155	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.035	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	203	APHA-2320-B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110724.2**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/453  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	SW02	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	17.201	APHA-3102-B
Chromium		mg/l	0.007	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA 3102 B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.129	APIIA-3102-B
Manganese		mg/l	0.021	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.029	APHA-3102-B
Sodium		mg/l	20.089	APHA-3102-B
Zinc		mg/l	0.017	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	92.299	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	39	APHA-2320-B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110724.3**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/454  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Boron	SW03	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	26.222	APHA-3102-B
Chromium		mg/l	<0.001	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	0.712	APHA-3102-B
Manganese		mg/l	0.032	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.132	APHA 3102-B
Sodium		mg/l	11.224	APHA-3102-B
Zinc		mg/l	0.024	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	9.128	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	1.585	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.358	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	159	APIIA-2320-B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110724.4**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/455  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Tel +353 61 455399  
Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Boron	SW04	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	54.117	APHA-3102-B
Chromium		mg/l	0.043	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.047	APHA-3102-B
Manganese		mg/l	0.017	APHA 3102 B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		µg/l	1.169	APHA-3102-B
Sodium		mg/l	10.906	APHA-3102-B
Zinc		mg/l	0.036	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	8.931	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	3.886	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.633	APHA-4110-B
Total Oxidised Nitrogen (as N)		µg/l	1.071	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	187	APHA-2320-B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 110724.5

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Tara Flanagan

**BHP Ref. No.:** 13/09/456  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

Analysing  
 Testing  
 Consulting  
 Calibrating



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 Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Boron	SW05	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	69.084	APHA-3102-B
Chromium		mg/l	0.056	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.124	APHA-3102-B
Manganese		mg/l	0.023	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.409	APHA-3102-B
Sodium		mg/l	9.114	APHA-3102-B
Zinc		mg/l	0.048	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	9.407	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	3.533	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.488	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.947	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	188	APHA 2320 B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110724.6

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/457  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

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Fax + 353 61 455447  
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**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	SW06	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	22.113	APHA-3102-B
Chromium		mg/l	0.024	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.001	APHA-3102-B
Magnesium		mg/l	1.916	APHA-3102-B
Manganese		mg/l	0.018	APHA-3102-B
Nickel		mg/l	<0.001	APHA 3102 B
Potassium		mg/l	1.317	APHA-3102-B
Sodium		mg/l	9.896	APHA-3102-B
Zinc		mg/l	0.054	APHA-3102-B
Mercury		µg/l	<0.02	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	9.143	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	3.505	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.721	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	1.012	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	188	APHA-2320-B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110724.7

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/458  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 09/10/2013  
**Test Specification:** Nil  
**Item:** Annual Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Boron	SW07	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	10.008	APHA-3102-B
Chromium		mg/l	0.032	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	0.913	APHA-3102-B
Manganese		mg/l	0.012	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.524	APHA-3102-B
Sodium		mg/l	10.089	APHA-3102-B
Zinc		mg/l	0.063	APHA-3102-B
Mercury		mg/l	<0.01	APHA-3102-B
Sulphate (as SO <sub>4</sub> )		mg/l	82.581	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	2.416	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.214	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.611	APHA-4110-B
Alkalinity (as CaCO <sub>3</sub> )		mg/l	204	APHA-2320-B

**Additional information :**

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Annual Leachate Monitoring results for  
Longpavement Landfill  
2013**

## TEST REPORT 110725.1

Client: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Tara Flanagan

BHP Ref. No.: 13/09/459  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 14/10/2013  
Test Specification: Nil  
Item: Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Hoard  
Thomondgate  
Limerick  
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Tel +353 61 455399  
Fax + 353 61 455447

Test	Client Reference	Units	Results	Standard Reference
Boron	L01	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	29.11	APHA-3102-B
Chromium		mg/l	<0.001	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.049	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.669	APHA-3102-B
Sodium		mg/l	12.11	APHA-3102-B
Zinc		mg/l	0.012	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.648	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	81.63	APHA-4110-B
Orthophosphate (as P)		mg/l	0.335	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.05	APHA-4500-CN-E
Ammonia (as N)		mg/l	576	Nessler
BOD		mg/l	73.7	APHA-5210-B
COD		mg/l	947	APHA-5220-D
Chloride		mg/l	1356	APHA-4110-B
pH		-	7.33	APHA-4500-H+
Conductivity		uS/cm	9120	APHA-2510-B

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110725.2**Analysing  
Testing  
Consulting  
CalibratingClient: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. LimerickBHP Ref. No.: 13/09/460  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 14/10/2013  
Test Specification: Nil  
Item: Annual Leachate 2013BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	L02	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	39.139	APHA-3102-B
Chromium		mg/l	<0.001	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.127	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.847	APHA-3102-B
Sodium		mg/l	16.204	APHA-3102-B
Zinc		mg/l	0.051	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.674	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	25.915	APHA-4110-B
Orthophosphate (as P)		mg/l	0.294	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.08	APHA-4500-CN-E
Ammonia (as N)		mg/l	752	Nessler
BOD		mg/l	42.9	APHA-5210-B
COD		mg/l	1039	APHA-5220-D
Chloride		mg/l	2083.023	APHA-4110-B
pH		-	7.45	APHA-4500-H+
Conductivity		uS/cm	12810	APHA-2510-B

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.3

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/461  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
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Tel +353 61 455399  
Fax + 353 61 455447

Test	Client Reference	Units	Results	Standard Reference
Boron	L03	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	24.007	APHA-3102-B
Chromium		mg/l	<0.001	APHA 3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.914	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.319	APHA-3102-B
Sodium		mg/l	13.109	APHA-3102-B
Zinc		mg/l	0.036	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.541	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	11.774	APHA-4110-B
Orthophosphate (as P)		mg/l	0.016	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.07	APHA-4500-CN-E
Ammonia (as N)		mg/l	484	Nessler
BOD		mg/l	95.6	APHA-5210-B
COD		mg/l	3750	APHA-5220-D
Chloride		mg/l	823.079	APHA-4110-B
pH		-	7.31	APHA-4500-H+
Conductivity		uS/cm	7530	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110725.4**Analysing  
Testing  
Consulting  
CalibratingClient: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. LimerickBHP Ref. No.: 13/09/462  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 14/10/2013  
Test Specification: Nil  
Item: Annual Leachate 2013BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	L04	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	36.209	APHA-3102-B
Chromium		mg/l	0.036	APHA-3102-B
Copper		mg/l	0.339	APHA-3102-B
Iron		mg/l	0.896	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.209	APHA-3102-B
Manganese		mg/l	0.609	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.666	APHA-3102-B
Sodium		mg/l	10.049	APHA-3102-B
Zinc		mg/l	<0.001	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.036	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	0.643	APHA-4110-B
Orthophosphate (as P)		mg/l	0.023	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.06	APHA-4500-CN-E
Ammonia (as N)		mg/l	96	Nessler
BOD		mg/l	7.9	APHA-5210-B
COD		mg/l	71	APHA-5220-D
Chloride		mg/l	67.944	APHA-4110-B
pH		-	6.83	APHA-4500-H+
Conductivity		uS/cm	2026	APHA-2510-B

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 110725.5

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/463  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	L05	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	49.117	APHA-3102-B
Chromium		mg/l	0.084	APHA-3102-B
Copper		mg/l	0.496	APHA-3102-B
Iron		mg/l	1.124	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.147	APHA-3102-B
Manganese		mg/l	0.317	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.969	APHA-3102-B
Sodium		mg/l	11.261	APHA-3102-B
Zinc		mg/l	<0.001	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.102	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	1.877	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.035	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.011	APHA-4110-B
Cyanide		mg/l	0.08	APHA-4500-CN-E
Ammonia (as N)		mg/l	58.25	Nessler
BOD		mg/l	11.6	APHA-5210-B
COD		mg/l	89	APHA-5220-D
Chloride		mg/l	162.545	APHA-4110-B
pH		-	6.83	APHA-4500-H+
Conductivity		uS/cm	2163	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/464  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

Test	Client Reference	Units	Results	Standard Reference
Boron	L06	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	38.204	APHA-3102-B
Chromium		mg/l	0.076	APHA-3102-B
Copper		mg/l	0.204	APHA-3102-B
Iron		mg/l	0.907	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.396	APHA-3102-B
Manganese		mg/l	0.117	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	2.049	APHA-3102-B
Sodium		mg/l	13.904	APHA-3102-B
Zinc		mg/l	0.024	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.137	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	2.914	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.262	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.025	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.067	APHA-4110-B
Cyanide		mg/l	0.09	APHA-4500-CN-E
Ammonia (as N)		mg/l	5.25	Nessler
BOD		mg/l	4.2	APHA-5210-B
COD		mg/l	68	APHA-5220-D
Chloride		mg/l	39.157	APHA-4110-B
pH		-	7.09	APHA-4500-H+
Conductivity		uS/cm	1109	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.7

Client: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 13/09/465  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 14/10/2013  
Test Specification: Nil  
Item: Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

Test	Client Reference	Units	Results	Standard Reference
Boron	L07	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	31.227	APHA-3102-B
Chromium		mg/l	0.045	APHA-3102-B
Copper		mg/l	0.189	APHA-3102-B
Iron		mg/l	0.607	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.721	APHA-3102-B
Manganese		mg/l	0.229	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	2.217	APHA-3102-B
Sodium		mg/l	24.117	APHA-3102-B
Zinc		mg/l	0.036	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.127	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	5.737	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.04	APHA-4500-CN-E
Ammonia (as N)		mg/l	26	Nessler
BOD		mg/l	7.3	APHA-5210-B
COD		mg/l	79	APHA-5220-D
Chloride		mg/l	45.095	APHA-4110-B
pH		-	6.83	APHA-4500-H+
Conductivity		uS/cm	1066	APHA-2510-B

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.8

Client: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 13/09/466  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 14/10/2013  
Test Specification: Nil  
Item: Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
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Fax + 353 61 455447

Test	Client Reference	Units	Results	Standard Reference
Boron	L08	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	28.109	APHA-3102-B
Chromium		mg/l	0.067	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	2.009	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.814	APHA-3102-B
Sodium		mg/l	36.209	APHA-3102-B
Zinc		ug/l	0.054	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.145	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	14.448	APHA-4110-B
Orthophosphate (as P)		mg/l	0.019	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.02	APHA-4500-CN-E
Ammonia (as N)		mg/l	464	Nessler
BOD		mg/l	90.8	APHA-5210-B
COD		mg/l	2550	APHA-5220-D
Chloride		mg/l	896.185	APHA-4110-B
pH		-	7.12	APHA-4500-H+
Conductivity		uS/cm	7700	APHA-2510-B

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.9

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/467  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	L09	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	22.667	APHA-3102-B
Chromium		mg/l	0.054	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	2.137	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	0.996	APHA-3102-B
Sodium		mg/l	28.117	APHA-3102-B
Zinc		mg/l	0.018	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.459	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	5.419	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.01	APHA-4500-CN-E
Ammonia (as N)		mg/l	444	Nessler
BOD		mg/l	267	APHA-5210-B
COD		mg/l	2850	APHA-5220-D
Chloride		mg/l	529.447	APHA-4110-B
pH		-	7.22	APHA-4500-H+
Conductivity		uS/cm	6350	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.10

Analysing  
Testing  
Consulting  
Calibrating

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/468  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	L10	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	19.819	APHA-3102-B
Chromium		mg/l	0.069	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.104	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.124	APHA-3102-B
Sodium		mg/l	13.204	APHA-3102-B
Zinc		mg/l	0.029	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.682	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	12.833	APHA-4110-B
Orthophosphate (as P)		mg/l	0.019	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	0.024	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	0.005	APHA-4110-B
Cyanide		mg/l	0.01	APHA-4500-CN-E
Ammonia (as N)		mg/l	404	Nessler
BOD		mg/l	26.6	APHA-5210-B
COD		mg/l	721	APHA-5220-D
Chloride		mg/l	778.824	APHA-4110-B
pH		-	7.26	APHA-4500-H+
Conductivity		uS/cm	7170	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date :** 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.11

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/09/469  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Boron	L11	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	17.124	APHA-3102-B
Chromium		mg/l	0.072	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	0.899	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.209	APHA-3102-B
Sodium		mg/l	9.107	APHA-3102-B
Zinc		mg/l	0.032	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	<0.01	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	13.802	APHA-4110-B
Orthophosphate (as P)		mg/l	0.109	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	<0.01	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	<0.01	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	<0.01	APHA-4110-B
Cyanide		mg/l	0.03	APHA-4500-CN-E
Ammonia (as N)		mg/l	872	Nessler
BOD		mg/l	51.6	APHA-5210-B
COD		mg/l	1141	APHA-5220-D
Chloride		mg/l	1609.484	APHA-4110-B
pH		-	7.37	APHA-4500-H+
Conductivity		uS/cm	12020	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110725.12

Client: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 13/09/470  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 14/10/2013  
Test Specification: Nil  
Item: Annual Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



BHP  
New Road  
Thomondgate  
Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

Test	Client Reference	Units	Results	Standard Reference
Boron	L12	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	22.096	APHA-3102-B
Chromium		mg/l	0.059	APHA-3102-B
Copper		mg/l	0.339	APHA-3102-B
Iron		mg/l	2.049	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	0.961	APHA-3102-B
Manganese		mg/l	0.667	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.347	APHA-3102-B
Sodium		mg/l	28.409	APHA-3102-B
Zinc		mg/l	0.046	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.089	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	2.914	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	25.683	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	0.636	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	5.996	APHA-4110-B
Cyanide		mg/l	<0.001	APHA-4500-CN-E
Ammonia (as N)		mg/l	54	Nessler
BOD		mg/l	7.1	APHA-5210-B
COD		mg/l	156	APHA-5220-D
Chloride		mg/l	91.734	APHA-4110-B
pH		-	7.27	APHA-4500-H+
Conductivity		uS/cm	1484	APHA-2510-B

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 17/10/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 110725.13

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/471  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 14/10/2013  
**Test Specification:** Nil  
**Item:** Annual Leachate 2013

BHP  
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Limerick  
Ireland  
Tel +353 61 455399  
Fax + 353 61 455447

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Boron	L13	mg/l	<0.001	APHA-3102-B
Cadmium		mg/l	<0.02	APHA-3102-B
Calcium		mg/l	26.114	APHA-3102-B
Chromium		mg/l	0.064	APHA-3102-B
Copper		mg/l	<0.001	APHA-3102-B
Iron		mg/l	<0.001	APHA-3102-B
Lead		mg/l	<0.01	APHA-3102-B
Magnesium		mg/l	1.041	APHA-3102-B
Manganese		mg/l	<0.001	APHA-3102-B
Nickel		mg/l	<0.001	APHA-3102-B
Potassium		mg/l	1.621	APHA 3102 B
Sodium		mg/l	22.333	APHA-3102-B
Zinc		mg/l	0.03	APHA-3102-B
Mercury		mg/l	<0.02	APHA-3102-B
Fluoride		mg/l	0.086	APHA-4110-B
Sulphate (as SO <sub>4</sub> )		mg/l	17.871	APHA-4110-B
Orthophosphate (as P)		mg/l	<0.01	APHA-4110-B
Nitrate (as NO <sub>3</sub> )		mg/l	51.89	APHA-4110-B
Nitrite (as NO <sub>2</sub> )		mg/l	4.867	APHA-4110-B
Total Oxidised Nitrogen (as N)		mg/l	13.204	APHA-4110-B
Cyanide		mg/l	0.002	APHA-4500-CN-E
Ammonia (as N)		mg/l	20	Nessler
BOD		mg/l	4.2	APHA-5210-B
COD		mg/l	46	APHA-5220-D
Chloride		mg/l	92.272	APHA-4110-B
pH		-	7.31	APHA-4500-H+
Conductivity		uS/cm	1407	APHA-2510-B

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 17/10/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## **4.0 DISCUSSION/INTERPRETATION**

### **4.1 Ground Waters**

The locations of the various groundwater monitoring locations are shown in Section 2. The results of the chemical analysis conducted on the ground waters are presented in Section 3.

All results are assessed against the relevant overall threshold value range outlined in Schedule 5 (see below) of SI 9/2010 European Communities Environmental Objectives (Groundwater) Regulations 2010.

## SCHEDULE 5

*Groundwater Threshold Values*

Parameter	Units	Threshold Values for Chemical Status Tests <sup>1</sup>				Overall Threshold Value Range
		Column 1  Test: Assessment for the presence of saline or other intrusions.	Column 2  Test: Assessment of adverse impacts of chemical inputs from groundwater on associated surface water bodies	Column 3 <sup>2</sup>  Test: Assessment of whether groundwater intended for human consumption in drinking water protected areas is impacted by pollutants and/or is showing a significant and sustained rise in pollutant levels.	Column 4 <sup>3</sup>  Test: Assessment of the general quality of groundwater in a groundwater body in terms of whether its ability to support human uses has been significantly impaired by pollution.	
<b>Inorganic &amp; Metals</b>						
Electrical Conductivity	µS/cm	800	-	1875	-	800 — 1875
Molybdate Reactive Phosphorus	µg/l P	-	35	-	-	35
Ammonium	µg/l N	-	65	175	175	65 — 175
Nitrite	µg/l NO <sub>2</sub>	-	-	375	-	375
Nitrate	mg/l NO <sub>3</sub>	-	-	37.5	37.5	37.5
Chloride	mg/l Cl	24	-	187.5	-	24 — 187.5
Sulphate	mg/l SO <sub>4</sub>	-	-	187.5	187.5	187.5
Sodium	mg/l Na	-	-	150	-	150
Boron	µg/l B	-	-	750	750	750
Chromium	µg/l Cr	-	-	-	37.5	37.5
Arsenic	µg/l As	-	-	-	7.5	7.5
Lead	µg/l Pb	-	-	-	18.75	18.75
Nickel	µg/l Ni	-	-	-	15	15
Mercury	µg/l Hg	-	-	-	0.75	0.75
Cadmium	µg/l Cd	-	-	-	3.75	3.75
Copper	µg/l Cu	-	-	-	1500	1500
Aluminium	µg/l Al	-	-	-	150	150
Cyanide	µg/l Cn	-	-	-	37.5	37.5
<b>Pesticides</b>						
Atrazine	µg/l	-	-	0.075	0.075	0.075

Simazine	µg/l	-	-	0.075	0.075	0.075
MCPA	µg/l	-	-	0.075	0.075	0.075
Lindane	µg/l	-	-	0.075	0.075	0.075
Diuron	µg/l	-	-	0.075	0.075	0.075
4,4 — DDT	µg/l	-	-	0.075	0.075	0.075
Dieldrin	µg/l	-	-	0.075	0.075	0.075
Cypermethrin	µg/l	-	-	0.075	0.075	0.075
Bentazone	µg/l	-	-	0.075	0.075	0.075
Glyphosate	µg/l	-	-	0.075	0.075	0.075
Chlortoluron	µg/l	-	-	0.075	0.075	0.075
Mecoprop	µg/l	-	-	0.075	0.075	0.075
Isoproturon	µg/l	-	-	0.075	0.075	0.075
2,4 Dichlorophenoxyacetic acid	µg/l	-	-	0.075	0.075	0.075
Total Pesticides	µg/l	-	-	0.375	0.375	0.375
<b>Organics</b>						
1,2-Dichloroethane	µg/l	-	-	-	2.25	2.25
Vinyl Chloride	µg/l	-	-	-	0.375	0.375
Total Tetrachloroethene & Trichloroethene	µg/l	-	-	-	7.5	7.5
Benzene	µg/l	-	-	-	0.75	0.75
Benzo(alpha)pyrene	ng/l	-	-	-	7.5	7.5
Total Polycyclic Aromatic Hydrocarbons	µg/l	-	-	-	0.075	0.075
Total Trihalomethanes	µg/l	-	-	-	75	75

**Notes**

<sup>1</sup> "Threshold values" have been established for pollutants that are causing a risk to groundwater bodies. Exceedance of a relevant threshold value at a representative monitoring point triggers further investigation to confirm whether the criteria for poor groundwater chemical status are being met. If the criteria for poor chemical status are being met by one or more of the test procedures in Schedule 7, then a body or a group of bodies of groundwater is classified as being at poor chemical status.

Threshold values are expressed as annual arithmetic mean concentrations.

<sup>2</sup> For the drinking water test, further investigation includes an assessment of significant and sustained upward trends in concentration of the relevant pollutant at the monitoring point.

<sup>3</sup> For the general chemical test, further investigation includes the aggregation of data from a representative group of monitoring points, comparison of the aggregated annual arithmetic mean concentration of the relevant pollutant with the threshold value and confirmation of significant impairment of the groundwater body's ability to support human uses.

The limits for the relevant parameters are outlined below.

<b>Parameter</b>	<b>Unit</b>	<b>Limit</b>
Boron	µg/l	750
Cadmium	µg/l	3.75
Total Chromium	µg/l	37.5
Copper	µg/l	1500
Lead	µg/l	18.75
Nickel	µg/l	15
Mercury	µg/l	0.75
Sodium	mg/l	150
Total Cyanide	µg/l	37.5
Sulphate	mg/l	187.5
OrthoPhosphate	mg/l	0.035
Nitrate	mg/l	37.5
Nitrite	mg/l	0.375

Ground waters that exceeded the threshold value range are shown below.

**GW01S** has elevated sulphate levels when compared to the threshold value of 187.5mg/l.

## **4.2 Surface Waters**

7 surface waters were sampled in the vicinity of the landfill. The locations of the various surface water monitoring locations are shown in Section 2. The results of the chemical analysis conducted on the surface waters are presented in Section 3.

All results are assessed against the relevant Maximum Allowable Concentration outlined in Schedule 5 of SI 272/2010 European Communities Environmental Objectives (Surfacewater) Regulations 2009.

An extract of schedule 5 is given below

**Table 10**  
**Physico-chemical conditions supporting the biological elements**  
**PART B: Specific pollutants**

AA: annual average <sup>(1)</sup>

MAC: maximum allowable concentration

Unit: [µg/l]

Name of substance	Environmental quality standard (EQS) <sup>(2)(3)(6)</sup>			
	AA-EQS <sup>(7)</sup> Inland surface waters	AA-EQS Other surface waters	MAC-EQS <sup>(8)</sup> Inland surface waters	MAC-EQS Other surface waters
Arsenic	25	20	-	-
Chromium III	4.7	-	32	-
Chromium VI	3.4	0.6	-	32
Copper <sup>(4)</sup>	5 or 30	5	-	-
Cyanide	10	10	-	-
Diazinon	0.01	0.01	0.02	0.26
Dimethoate	0.8	0.8	4	4
Fluoride	500	1,500	-	-
Glyphosate	60	-	-	-
Linuron	0.7	0.7	0.7	0.7
Mancozeb	2	2	7.3	7.3
Monochlorobenzene	1.5	25	-	-
Phenol	8	8	46	46
Toluene	10	10	-	-
Xylenes	10	10	-	-
Zinc <sup>(5)</sup>	8 or 50 or 100	40	-	-

<sup>(1)</sup>The calculation of the arithmetic mean and the analytical method used must be in accordance with technical specifications to be adopted for chemical monitoring and quality of analytical results in accordance with Directive 2000/60/EC of the European Parliament and of the Council, including how to apply an EQS where there is no appropriate analytical method meeting the minimum performance criteria.

<sup>(2)</sup>The values for all metals are for dissolved metals i.e. after filtration through a 0.45 micron filter. In designing monitoring programmes, it was recommended that total chromium be determined. Where the result for total chromium is less than the EQS for Cr VI, no further investigation is deemed necessary. Where the total Chromium level is above the EQS, an assessment should be made of the potential discharges of Cr VI into the waterbody. Where there is a risk of Cr VI contamination, speciation studies should be included in the monitoring programme.

<sup>(3)</sup>The values for all metals, except Chromium VI, are as added values to background concentrations.

<sup>(4)</sup>In the case of Copper the value 5 applies where the water hardness measured in mg/l CaCO<sub>3</sub> is less than or equal to 100; the value 30 applies where the water hardness exceeds 100 mg/l CaCO<sub>3</sub>.

<sup>(5)</sup>In the case of Zinc, the standard shall be 8 µg/l for water hardness with annual average values less than or equal to 10 mg/l CaCO<sub>3</sub>, 50 µg/l for water hardness greater than 10 mg/l CaCO<sub>3</sub> and less than or equal to 100 mg/l CaCO<sub>3</sub> and 100 µg/l elsewhere.

<sup>(6)</sup>Standards for compounds other than metals refer to total concentrations in the whole water sample.

<sup>(7)</sup>AA-EQS means that for each representative monitoring point within the waterbody, the arithmetic mean of the concentrations measured over a twelve month monitoring period does not exceed the standard.

<sup>(8)</sup>MAC-EQS means that for each representative monitoring point within the waterbody no measured concentration exceeds the standard.

The limits for the relevant parameters from Schedule 5 are outlined below.

<b>Parameter</b>	<b>Unit</b>	<b>AA</b>	<b>MAC</b>
Chromium	µg/l	4.7	32
Copper (hardness <100mg/l as CaCO <sub>3</sub> )	µg/l	5	5
Copper (hardness >100mg/l as CaCO <sub>3</sub> )	µg/l	5	30
Zinc (hardness <10mg/l as CaCO <sub>3</sub> )	µg/l	8	-
Zinc (hardness 10-100mg/l as CaCO <sub>3</sub> )	µg/l	50	-
Zinc (hardness >100mg/l as CaCO <sub>3</sub> )	µg/l	100	-

Surface waters that exceeded the MAC are shown below.

**SW04 and SW05** have elevated Chromium levels when compared to the MAC value of 0.032mg/l.

### 4.3 Leachate

Leachate samples were taken at 13 sampling locations for annual analysis. All samples had typical characteristics of leachate, including strong odour, high turbidity, dark in colour, elevated ammonia, conductivity and chloride levels. BOD levels were above 10mg/l at the following locations, L01, L02, L03, L08, L09, L10 and L11.



## **Appendix A**

### **Copy of Table D.5 (Licence Instructions for WL 76-1)**

## D.5 Surface Water, Groundwater and Leachate

Table D.5.1 Water and Leachate - Parameters / Frequency

Parameter <sup>Note 1</sup>	SURFACE WATER <sup>Note 2</sup> Monitoring Frequency	GROUNDWATER Monitoring Frequency	LEACHATE <sup>Note 3</sup> Monitoring Frequency
Visual Inspection/Odour <sup>Note 2</sup>	Weekly	Quarterly	Quarterly
Groundwater Level	Not Applicable	Monthly	Not Applicable
Leachate Level	Not Applicable	Not Applicable	Continuous
Ammoniacal Nitrogen	Quarterly	Quarterly	Annually
BOD	Quarterly	Not Applicable	Annually
COD	Quarterly	Not Applicable	Annually
Chloride	Quarterly	Quarterly	Annually
Dissolved Oxygen	Quarterly	Quarterly	Not Applicable
Electrical Conductivity	Quarterly	Quarterly	Annually
pH	Quarterly	Quarterly	Annually
Total Suspended Solids	Quarterly	Not Applicable	Not Applicable
Temperature	Quarterly	Quarterly	Quarterly
Metals / Non Metals <sup>Note 3</sup>	Annually	Annually	Annually
Cyanide (Total)	Not Applicable	Annually	Annually
Fluoride	Not Applicable	Annually	Annually
List I/II Organic Substances <sup>Note 4</sup>	Once off <sup>Note 5</sup>	Annually <sup>Note 5</sup>	Once off <sup>Note 5</sup>
Mercury	Annually	Annually	Annually
Sulphate	Annually	Annually	Annually
Total Alkalinity	Annually	Annually	Not applicable
Total P/Orthophosphate	Annually	Annually	Annually
Total Oxidised Nitrogen	Annually	Annually	Annually
Total Organic Carbon	Not Applicable	Quarterly	Not Applicable
Residue on evaporation	Not Applicable	Annually	Not Applicable
Biological Assessment	Annually <sup>Note 6</sup>	Not Applicable	Not Applicable

Note 1: All the analysis shall be carried out by a competent laboratory using standard and internationally accepted procedures.

Note 2: Where there is evident gross contamination of leachate, additional samples should be analyzed.

Note 3: Metals and elements to be analyzed by AA/ICP should include as a minimum: boron, cadmium, calcium, chromium (total), copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and zinc.

Note 4: Samples screened for the presence of organic compounds using Gas Chromatography / Mass Spectrometry (GC/MS) or other appropriate techniques and using the list I/II Substances from EU Directive 76/464/EEC and 80/68/EEC as a guideline. Recommended analytical techniques include: volatiles (US Environmental Protection Agency method 524 or equivalent), semi-volatiles (USEPA method 525 or equivalent), and pesticides (USEPA method 608 or equivalent).

Note 5: 2 surface water locations, 3 groundwater locations and 2 leachate locations to be agreed with the Agency for these parameters.

Note 6: Appropriate biological methods (such as EPA Q-Rating System) to be used for the assessment of rivers and streams.

## **Appendix D**

### **Quarterly Surface Water, Ground Water and Leachate Monitoring Reports 2013**

**TEST REPORT**



**Client:**  
**Limerick City Council**  
**City Hall**  
**Limerick**

**BHP Ref No.: 108327-108329**  
**Order No.:**  
**Date Received: 15<sup>th</sup> March 2013**  
**Date Completed: 27<sup>th</sup> March 2013**  
**Test Specification: Nil**

**BHP**  
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Limerick  
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E Mail [bhpcem2@bhp.ie](mailto:bhpcem2@bhp.ie)

*Item: Longpavement Landfill Site*

*Quarterly Report covering groundwater, surfacewater and leachate monitoring at  
Longpavement Landfill (Monitoring Period January - March 2013)*

**Limerick City Council**  
**City Hall**  
**Limerick City**

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q1, 2013

**For and on behalf of BHP Ltd.**

A handwritten signature in blue ink that reads 'Paul O'Sullivan'. The signature is written in a cursive, flowing style.

**Paul O'Sullivan**

**Date Issued: 18<sup>th</sup> October 2013**

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

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## 1.0 INTRODUCTION :

BHP were contracted by Limerick City Council to carry out environmental monitoring at Longpavement Landfill site which is located adjacent to the Longpavement road, Limerick City. This landfill is no longer operational and is currently undergoing remediation and final capping works. The facility is operated under waste license no. 76-1, which was issued to Limerick City Council on the 1<sup>st</sup> February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the first quarterly monitoring event of 2013 (January-March 2013). Details on the unavailability of sampling points may be found in the site sheet in Appendix A.

## 2.0 SAMPLING :

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

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	2.60
GW-01 (D)	2.50
GW-02 (S)	1.17
GW-02 (D)	1.45
GW-03 (S)	1.94
GW-03 (D)	1.82
GW-04 (S)	Dry
GW-04 (D)	2.59
GW-05 (S)	Dry
GW-05 (D)	3.47
GW-06 (S)	Not available
GW-06 (D)	Not available

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

Locations for surface waters and leachate wells are also shown in the map below.

Site map of Longpavement Landfill showing sampling locations



Limerick City Council - GIS - 2003



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 sub-strata (and not that of stagnant water in the standpipe). In order to achieve this, each borehole is purged of three 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).
  - 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. Dissolved Oxygen, Conductivity, pH and temperature are measured using a HACH HQ40d Portable Multi-meter which has Automatic Temperature Compensation functionality
3. BHP operates a chain of custody system. The sample site-sheet / chain of custody form can be found in Appendix B.
4. All samples received by the Laboratory were stored between 0 and 6°C. Subsequent analysis of all samples was carried out in accordance with Standard Methods for the examination of water and wastewater, 22<sup>nd</sup> Edition, 2012, published by the American public health association.

## Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 <sup>nd</sup> Edition
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

#### **4.0 RESULTS :**

The results are presented in the following tables.

### **Ground Water Monitoring results for**

### **Longpavement Landfill**

### **Quarter 1**

**2013**

## TEST REPORT 108327.1

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/03/484  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

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Fax + 353 61 455447  
E Mail [bhpcm2@bhp.ie](mailto:bhpcm2@bhp.ie)

**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	Slight odour	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Black	Visual
Water Level		m	2.6	ISO 5667 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	5.25	APHA-4500-NH3-D
Chloride Cl		mg/l	625	APHA-4110-D
Dissolved Oxygen		mg/l	2.23	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	4000	APHA-2510-B
pH		-	7.51	APHA-4500-H+
Temperature		°C	8.3	APIA-2550-D
Total Organic Carbon		mg/l	17.3	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.2

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/03/485  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

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Fax + 353 61 455447  
E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01 Deep	-	Slight odour	APHA-2150-B
Visual Inspection		-	Turbid/Yellow	Visual
Water Level		m	2.5	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	21.75	APHA-4500-NH3-D
Chloride Cl		mg/l	317.6	APHA-4110-D
Dissolved Oxygen		mg/l	5.23	APHA 4500 O G
Electrical Conductivity		uScm <sup>-1</sup>	2710	APHA 2510 B
pH			7.05	APHA 1500 H+
Temperature		°C	10.4	APHA 2550 B
Total Organic Carbon		mg/l	20.1	APHA 5310 C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
Issue Date : 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.3

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/486  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02	-	Slight odour	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Grey	Visual
Water Level		m	1.17	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.05	APHA-4500-NH3-D
Chloride Cl		mg/l	181.6	APHA-4110-D
Dissolved Oxygen		mg/l	7.3	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	4240	APHA-2510-B
pH		-	7.5	APHA-4500-H+
Temperature		°C	7.5	APHA-2550-B
Total Organic Carbon		mg/l	13.2	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.4

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/487  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02	-	No odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	1.45	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	8.5	APIIA-4500-NH <sub>3</sub> -D
Chloride Cl		mg/l	193.3	APHA-4110-D
Dissolved Oxygen		mg/l	2.6	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2540	APHA-2510-B
pH			6.74	APHA 4500 H+
Temperature		°C	10.4	APHA 2550 B
Total Organic Carbon		mg/l	20.1	APHA 5310 C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.5

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/03/488  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	Leachate odour	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Black	Visual
Water Level		m	1.94	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	1.11	APHA-4500-NH3-D
Chloride Cl		mg/l	10.4	APHA-4110-D
Dissolved Oxygen		mg/l	8.43	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1020	APHA-2510-B
pH		-	7.03	APHA-4500-H+
Temperature		°C	8.4	APHA-2550-B
Total Organic Carbon		mg/l	20	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 108327.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/489  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
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Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	Strong odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	1.82	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> N		mg/l	0.71	APHA 4500 NH <sub>3</sub> D
Chloride Cl		mg/l	14.9	APHA-4110-D
Dissolved Oxygen		mg/l	6.57	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1108	APHA-2510-B
pH		-	6.72	APHA-4500-H+
Temperature		°C	9.9	APHA-2550-B
Total Organic Carbon		mg/l	20.1	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.7

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
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 Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04 Shallow	-	Dry	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 108327.8**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/490  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
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Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04	-	No odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	2.59	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.07	APHA-4500-NH3-D
Chloride Cl		mg/l	119.5	APHA 4110 D
Dissolved Oxygen		mg/l	4.95	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1011	APHA-2510-B
pH		-	6.74	APHA-4500-H+
Temperature		°C	10.5	APHA-2550-B
Total Organic Carbon		mg/l	20.1	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.9

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
 Testing  
 Consulting  
 Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05 Shallow	-	Dry	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108327.10

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/491  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 27/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Ground Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05	-	Leachate odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Grey	Visual
Water Level		m	3.47	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	6	APHA-4500-NH3-D
Chloride Cl		mg/l	491	APHA-4110-D
Dissolved Oxygen		mg/l	2.69	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2790	APHA-2510-B
pH		-	6.22	APHA-4500-H+
Temperature		°C	11.2	APHA-2550-B
Total Organic Carbon		mg/l	17.9	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Surface Water Monitoring results for**

**Longpavement Landfill**

**Quarter 1  
2013**

## TEST REPORT 108328.1

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/492  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

Analysing  
 Testing  
 Consulting  
 Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 01	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	<0.01	APHA-4500-NH3-D
BOD		mg/l	2.6	APHA-5210-B
COD		mg/l	6	APHA-5220-D
Chloride Cl		mg/l	23.1	APHA-4110-D
Dissolved Oxygen		mg/l	5.75	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	573	APHA-2510-B
pH		-	7.56	APHA-4500-H+
Total Suspended Solids		mg/l	2	APHA-2540-D
Temperature		°C	7.2	APHA 2550 B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 108328.2**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/493  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 02	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.44	APHA-4500-NH3-D
BOD		mg/l	2.6	APHA-5210-B
COD		mg/l	2	APHA-5220-D
Chloride Cl		mg/l	18.74	APHA-4110-D
Dissolved Oxygen		mg/l	11.73	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	508	APHA-2510-B
pH		-	7.85	APHA-4500-H+
Total Suspended Solids		mg/l	2.6	APHA-2540-D
Temperature		°C	8.9	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 108328.3

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/494  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

Analysing  
 Testing  
 Consulting  
 Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 03	-	None	APHA-2150-B
Visual Inspection		-	Clear/Straw yellow	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.02	APHA-4500-NH3-D
BOD		mg/l	2.5	APHA-5210-B
COD		mg/l	18	APHA-5220-D
Chloride Cl		mg/l	19.3	APHA-4110-D
Dissolved Oxygen		mg/l	10.1	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	442	APHA 2510 B
pH		-	7.84	APHA-4500-H+
Total Suspended Solids		mg/l	17.3	APHA-2540-D
Temperature		°C	7.3	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108328.4

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/03/495  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

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**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 04	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	1.48	APHA-4500-NH3-D
BOD		mg/l	4.9	APHA-5210-B
COD		mg/l	18	APHA-5220-D
Chloride Cl		mg/l	27	APHA-4110-D
Dissolved Oxygen		mg/l	10.1	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	428	APHA-2510-B
pH		-	7.78	APHA-4500-H+
Total Suspended Solids		mg/l	6	APHA-2540-D
Temperature		°C	7.3	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 108328.5**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/496  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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E Mail bhpocem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 05	-	No odour	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	1.05	APHA-4500-NH3-D
BOD		mg/l	2.9	APIA-5210-B
COD		mg/l	15	APHA-5220-D
Chloride Cl		mg/l	25.2	APHA-4110-D
Dissolved Oxygen		mg/l	5.91	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	506	APHA-2510-B
pH		-	7.96	APHA-4500-H+
Total Suspended Solids		mg/l	4.6	APHA-2540-D
Temperature		°C	7.6	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108328.6

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/03/497  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

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E Mail [btppcm2@btp.ie](mailto:btppcm2@btp.ie)

**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 06	-	No odour	APHA-2150-B
Visual Inspection		-	Clear/Straw yellow	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.05	APHA-4500-NH3-D
BOD		mg/l	2.3	APHA-5210-B
COD		mg/l	11	APHA-5220-D
Chloride Cl		mg/l	19.2	APHA-4110-D
Dissolved Oxygen		mg/l	5.42	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	530	APHA-2510-B
pH		-	7.68	APHA-4500-H+
Total Suspended Solids		mg/l	6	APHA-2540-D
Temperature		°C	7.8	APHA 2550 B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108328.7

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/03/498  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 28/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Surface Water 2013

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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 07	-	No odour	APHA-2150-B
Visual Inspection		-	Clear/Straw colour	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	2.5	APHA-4500-NH3-D
BOD		mg/l	3	APHA-5210-B
COD		mg/l	15	APHA-5220-D
Chloride Cl		mg/l	64.6	APHA-4110-D
Dissolved Oxygen		mg/l	7.03	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	734	APHA-2510-B
pH		-	7.37	APHA-4500-H+
Total Suspended Solids		mg/l	8.6	APHA-2540-D
Temperature		°C	7.6	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Leachate Monitoring results for  
Longpavement Landfill  
Quarter 1  
2013**

## TEST REPORT 108329

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/499-511  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 15/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Leachate 2013

Analysing  
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Consulting  
Calibrating



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Ireland  
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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	L 01	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	12.0	APHA-2550-B
Odour	L 02	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	10.1	APIIA-2550-D
Odour	L 03	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	10.1	APHA-2550-B
Odour	L 04	-	Slight odour	APHA-2150-B
Visual Inspection		-	Slightly turbid	Visual
Temperature		°C	10.2	APHA-2550-B
Odour	L 05	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	9.9	APHA-2550-B

**Additional Information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 108329

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/499-511  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 15/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	L 06	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	10.4	APHA-2550-B
Odour	L 07	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Grey turbid	Visual
Temperature		°C	10.5	APHA-2550-B
Odour	L 08	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Grey turbid	Visual
Temperature		°C	8.8	APHA-2550-B
Odour	L 09	-	Strong leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	11.4	APHA-2550-B
Odour	L 10	-	Strong leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	12.3	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 108329

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/03/499-511  
**Order No.:**  
**Date Received:** 15/03/2013  
**Date Completed:** 15/03/2013  
**Test Specification:** Nil  
**Item:** Q1 Leachate 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	L 11	-	Strong leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	13.4	APHA-2550-B
Odour	Sump	-	Slight odour	APHA-2150-B
Visual Inspection		-	Yellow, Turbid	Visual
Temperature		°C	7.9	APHA-2550-B
Odour	Tank	-	Strong leachate odour	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	6.4	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## 5.0 DISCUSSION/INTERPRETATION

### 5.1 Groundwaters

The results of the chemical and microbiological analysis conducted on the groundwaters are presented in Section 5.

All results are assessed against the interim guideline values for specific substances in ground water taken from the publication, 'Towards setting guideline values for the protection of groundwater in Ireland, Interim Report' as published by the EPA, 2003. The limits for the relevant parameters are outlined here.

Parameter	Unit	Limit
Ammonia (as N)	mg/l	0.12
Chloride	mg/l	30
Conductivity	uScm <sup>-1</sup>	1000
Dissolved Oxygen	%	-
pH	pH unit	>6.5 <9.5
Temperature	°C	25
Total Organic Carbon	mg/l	-

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. A summary of the parameters exceeded and the locations are presented in the table below.

GW Reference	Parameters above Limits
GW-01 (S)	Ammonia, Chloride, Conductivity
GW-01 (D)	Ammonia, Chloride, Conductivity
GW-02 (S)	Chloride, Conductivity
GW-02 (D)	Ammonia, Chloride, Conductivity
GW-03 (S)	Ammonia, Conductivity
GW-03 (D)	Ammonia, Conductivity
GW-04 (S)	Dry
GW-04 (D)	Chloride, Conductivity
GW-05 (S)	Dry
GW-05 (D)	Ammonia, Chloride, Conductivity
GW-06 (S)	Not available
GW-06 (D)	Not available

Overall the groundwater quality is poor defined as being significantly impaired by pollution.

## 5.2 Surface Waters

7 surfacewaters were sampled in the vicinity of the landfill. These have been assessed against the surface water limits as outlined in the European Communities (Quality of Surface water intended for the abstraction of drinking water) Regulations, 1989. The limit values for the relevant parameters are outlined here.

Parameter	Unit	A1 water	A2 water	A3 water
pH	pH unit	5.5-8.5	5.5-9.0	5.5-9.0
Conductivity	$\mu\text{Scm}^{-1}$	1000	1000	1000
Ammonia (as N)	mg/l	0.2	1.5	4.0
Dissolved Oxygen	%	-	-	-
COD	mg/l	-	-	40
BOD	mg/l	5	5	7
TSS	mg/l	50	50	50
Chloride	mg/l	250	250	250
Temperature	$^{\circ}\text{C}$	25	25	25

SW Reference	Classification	Elevated parametric values
SW-01	A1	-
SW-02	A2	Ammonia
SW-03	A1	
SW-04	A2	Ammonia
SW-05	A2	Ammonia
SW-06	A1	-
SW-07	A2	Ammonia

### **5.3 Leachate**

13 leachate samples were available for quarter 1, 2013. All had typical leachate colour and odour.

**TEST REPORT**



**Client:**  
**Limerick City Council**  
**City Hall**  
**Limerick**

**BHP Ref No.: 109710-109712**  
**Order No.:**  
**Date Received: 20<sup>th</sup> June 2013**  
**Date Completed: 27<sup>th</sup> June 2013**  
**Test Specification: Nil**

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*Item: Longpavement Landfill Site*

*Quarterly Report covering groundwater, surfacewater and leachate monitoring at  
Longpavement Landfill (Monitoring Period April-June 2013)*

**Limerick City Council**  
**City Hall**  
**Limerick City**

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q2, 2013

**For and on behalf of BHP Ltd.**

A handwritten signature in blue ink that reads 'Paul O'Sullivan'.

**Paul O'Sullivan**

**Date Issued: 12<sup>th</sup> September 2013**

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

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## 1.0 INTRODUCTION :

BHP were contracted by Limerick City Council to carry out environmental monitoring at Longpavement Landfill site which is located adjacent to the Longpavement road, Limerick City. This landfill is no longer operational and is currently undergoing remediation and final capping works. The facility is operated under waste license no. 76-1, which was issued to Limerick City Council on the 1<sup>st</sup> February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the second quarterly monitoring event of 2013 (April-June 2013). Details on the unavailability of sampling points may be found in the site sheet in Appendix A.

## 2.0 SAMPLING :

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

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	1.95
GW-01 (D)	2.07
GW-02 (S)	1.24
GW-02 (D)	1.56
GW-03 (S)	Dry
GW-03 (D)	2.38
GW-04 (S)	Dry
GW-04 (D)	2.98
GW-05 (S)	Dry
GW-05 (D)	3.72
GW-06 (S)	Not available
GW-06 (D)	Not available

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

Locations for surface waters and leachate wells are also shown in the map below.



Site map of Longpavement Landfill showing sampling locations



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 sub-strata (and not that of stagnant water in the standpipe). In order to achieve this, each borehole is purged of three 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).
  - 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. Dissolved Oxygen, Conductivity, pH and temperature are measured using a HACH HQ40d Portable Multi-meter which has Automatic Temperature Compensation functionality
3. BHP operates a chain of custody system. The sample site-sheet / chain of custody form can be found in Appendix B.
4. All samples received by the Laboratory were stored between 0 and 6°C. Subsequent analysis of all samples was carried out in accordance with Standard Methods for the examination of water and wastewater, 22<sup>nd</sup> Edition, 2012, published by the American public health association.

## Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 <sup>nd</sup> Edition
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

#### **4.0 RESULTS :**

The results are presented in the following tables.

### **Ground Water Monitoring results for**

### **Longpavement Landfill**

**Quarter 2  
2013**

**TEST REPORT 109710.1**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/507  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	Slight smell	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Black	Visual
Water Level		m	1.95	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	4.5	APHA-4500-NH3-D
Chloride Cl		mg/l	525	APHA-4110-D
Dissolved Oxygen		mg/l	0.59	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	3950	APHA-2510-B
pH		-	7.43	APHA-4500-H+
Temperature		°C	13.1	APHA-2550-B
Total Organic Carbon		mg/l	18.5	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109710.2

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/06/508  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

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**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	No Odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	2.07	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	19.5	APHA-4500-NH3-D
Chloride Cl		mg/l	271	APHA-4110-D
Dissolved Oxygen		mg/l	4.27	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2270	APHA-2510-B
pH		-	7.07	APHA-4500-H+
Temperature		°C	12.8	APHA-2550-B
Total Organic Carbon		mg/l	18.4	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 109710.3**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/509  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

Analysing  
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Consulting  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02	-	No odour	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Brown	Visual
Water Level		m	1.24	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.8	APIA-4500-NH3-D
Chloride Cl		mg/l	220	APHA-4110-D
Dissolved Oxygen		mg/l	9.13	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	4320	APHA-2510-B
pH		-	7.54	APHA-4500-H+
Temperature		°C	15.5	APHA-2550-B
Total Organic Carbon		mg/l	18.6	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109710.4

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/06/510  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02 Deep	-	No odour	APHA-2150-B
Visual Inspection			Turbid/Brown	Visual
Water Level		m	1.56	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	8	APHA-4500-NH3-D
Chloride Cl		mg/l	167	APHA-4110-D
Dissolved Oxygen		mg/l	8.92	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2270	APIA-2510-B
pH		-	7.09	APHA-4500-H+
Temperature		°C	12.5	APHA-2550-B
Total Organic Carbon		mg/l	18.1	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 109710.5

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

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**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03 Shallow	-	Dry	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109710.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/511  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Limerick  
Ireland  
Tel +353 61 455300  
Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	No odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	2.38	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	1.19	APHA-4500-NH3-D
Chloride Cl		mg/l	0.13	APHA-4110-D
Dissolved Oxygen		mg/l	4.07	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1145	APHA-2510-B
pH		-	6.74	APHA-4500-H+
Temperature		°C	11.2	APHA-2550-B
Total Organic Carbon		mg/l	18.3	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109710.7

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

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Fax + 353 61 455447  
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04 Shallow	-	Dry	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 109710.8**

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/06/512  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

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**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04	-	No odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	2.98	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.63	APHA-4500-NH3-D
Chloride Cl		mg/l	177	APHA-4110-D
Dissolved Oxygen		mg/l	3.75	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1286	APHA-2510-B
pH		-	6.51	APHA-4500-H+
Temperature		°C	12.4	APHA-2550-B
Total Organic Carbon		mg/l	18.4	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109710.9

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

Analysing  
 Testing  
 Consulting  
 Calibrating



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 Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05 Shallow	-	Dry	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109710.10

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Ursula Ahern

**BHP Ref. No.:** 13/06/513  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Ground Water 2013

Analysing  
 Testing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05	-	Gassy odour	APIIA-2150-D
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	3.72	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	3	APIIA-4500-NII3-D
Chloride Cl		mg/l	475	APIIA-4110-D
Dissolved Oxygen		mg/l	2.04	APHA-4500-O-C
Electrical Conductivity		uScm <sup>-1</sup>	2670	APHA-2510-B
pH		-	6.3	APHA-4500-H+
Temperature		°C	13.2	APHA-2550-B
Total Organic Carbon		mg/l	17.9	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Surface Water Monitoring results for**

**Longpavement Landfill**

**Quarter 2  
2013**

**TEST REPORT 109711.1**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/514  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

Analysing  
Testing  
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Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 01	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.82	APHA-4500-NH3-D
BOD		mg/l	5.3	APHA 5210 B
COD		mg/l	97	APHA-5220-D
Chloride Cl		mg/l	15.2	APHA-4110-D
Dissolved Oxygen		mg/l	7.06	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	734	APHA-2510-B
pH		-	7.41	APHA-4500-H+
Total Suspended Solids		mg/l	106	APHA-2540-D
Temperature		°C	14.6	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 109711.2

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/515  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

Analysing  
Testing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 02	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.12	APHA-4500-NH3-D
BOD		mg/l	4.3	APHA-5210-B
COD		mg/l	14	APHA-5220-D
Chloride Cl		mg/l	18.5	APHA-4110-D
Dissolved Oxygen		mg/l	13.5	APHA-4500-O-G
Electrical Conductivity		µS <sub>cm</sub> <sup>-1</sup>	405	APHA-2510-B
pH		-	7.74	APHA-4500-H+
Total Suspended Solids		mg/l	23	APHA-2540-D
Temperature		°C	18.3	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109711.3

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/516  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

Analysing  
Testing  
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Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 03	-	None	APHA-2150-B
Visual Inspection		-	Brown/Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.73	APHA-4500-NH3-D
BOD		mg/l	3.2	APHA-5210-B
COD		mg/l	24	APHA-5220-D
Chloride Cl		mg/l	18.4	APHA-4110-D
Dissolved Oxygen		mg/l	10.1	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	456	APHA-2510-B
pH		-	8.08	APHA-4500-H+
Total Suspended Solids		mg/l	21	APHA-2540-D
Temperature		°C	17.8	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109711.4

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/06/517  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

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**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 04	-	None	APHA-2150-B
Visual Inspection		-	Brown/Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	10.3	APHA-4500-NH3-D
BOD		mg/l	5.3	APHA-5210-B
COD		mg/l	52	APHA-5220-D
Chloride Cl		mg/l	44.4	APHA-4110-D
Dissolved Oxygen		mg/l	4.75	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	765	APHA-2510-B
pH		-	7.23	APHA-4500-H+
Total Suspended Solids		mg/l	39	APHA-2540-D
Temperature		°C	13.9	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109711.5

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/06/518  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 05	-	Slight odour	APHA-2150-B
Visual Inspection		-	Brown/Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	33.6	APHA-4500-NH3-D
BOD		mg/l	3.9	APHA-5210-B
COD		mg/l	42	APHA-5220-D
Chloride Cl		mg/l	57.1	APHA-4110-D
Dissolved Oxygen		mg/l	3.68	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1115	APHA-2510-B
pH		-	7.07	APHA-4500-H+
Total Suspended Solids		mg/l	62	APHA-2540-D
Temperature		°C	13.2	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109711.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/519  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

Analysing  
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Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 06	-	None	APHA-2150-B
Visual Inspection		-	Brown/Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	13.4	APHA-4500-NH3-D
BOD		mg/l	3.5	APHA-5210-B
COD		mg/l	34	APHA-5220-D
Chloride Cl		mg/l	71.1	APHA 4110 D
Dissolved Oxygen		mg/l	5.57	APHA-4500-C-G
Electrical Conductivity		uScm <sup>-1</sup>	854	APHA-2510-B
pH		-	7.36	APHA-4500-H+
Total Suspended Solids		mg/l	14.5	APHA-2540-D
Temperature		°C	14.7	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109711.7

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/520  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 27/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 07	-	None	APHA-2150-B
Visual Inspection		-	Brown/Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	2.2	APHA-4500-NH3-D
BOD		mg/l	2.8	APHA-5210-B
COD		mg/l	15	APHA-5220-D
Chloride Cl		mg/l	21.3	APHA-4110-D
Dissolved Oxygen		mg/l	6.94	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	673	APHA-2510-B
pH		-	7.25	APHA-4500-H+
Total Suspended Solids		mg/l	19	APHA-2540-D
Temperature		°C	14.7	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Leachate Monitoring results for  
Longpavement Landfill  
Quarter 2  
2013**

## TEST REPORT 109712

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/521-533  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 20/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Leachate 2013

Analysing  
Testing  
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Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	L 01	-	Gassy smell	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	18.2	APHA-2550-B
Odour	L 02	-	Chemical smell	APHA-2150-B
Visual Inspection		-	Brown, turbid	Visual
Temperature		°C	17.4	APHA-2550-B
Odour	L 03	-	Tar smell	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	18.6	APHA-2550-B
Odour	L 04	-	No smell	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	12.2	APHA-2550-B
Odour	L 05	-	Oily smell	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	12.1	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



**TEST REPORT 109712**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/521-533  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 20/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Leachate 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	L 06	-	No smell	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	12.7	APHA-2550-B
Odour	L 07	-	Earthy smell	APHA-2150-B
Visual Inspection		-	Brown, turbid	Visual
Temperature		°C	12.3	APHA-2550-B
Odour	L 08	-	Gassy smell	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	17.1	APHA-2550-B
Odour	L 09	-	Gassy smell	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	17.6	APHA-2550-B
Odour	I. 10	-	Gassy smell	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	18.5	APHA 2550 B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 27/08/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 109712

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/06/521-533  
**Order No.:**  
**Date Received:** 20/06/2013  
**Date Completed:** 20/06/2013  
**Test Specification:** Nil  
**Item:** Q2 Leachate 2013

Analysing  
Testing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	L 11	-	Gassy smell	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	18.6	APHA-2550-B
Odour	Sump	-	No smell	APHA-2150-B
Visual Inspection		-	Brown, Clear	Visual
Temperature		°C	13.8	APHA-2550-B
Odour	Tank	-	No smell	APHA-2150-B
Visual Inspection		-	Brown, Turbid	Visual
Temperature		°C	15.7	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 27/08/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## 5.0 DISCUSSION/INTERPRETATION

### 5.1 Groundwaters

The results of the chemical and microbiological analysis conducted on the groundwaters are presented in Section 5.

All results are assessed against the interim guideline values for specific substances in ground water taken from the publication, 'Towards setting guideline values for the protection of groundwater in Ireland, Interim Report' as published by the EPA, 2003. The limits for the relevant parameters are outlined here.

Parameter	Unit	Limit
Ammonia (as N)	mg/l	0.12
Chloride	mg/l	30
Conductivity	$\mu\text{Scm}^{-1}$	1000
Dissolved Oxygen	%	-
pH	pH unit	>6.5 <9.5
Temperature	$^{\circ}\text{C}$	25
Total Organic Carbon	mg/l	-

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. A summary of the parameters exceeded and the locations are presented in the table below.

GW Reference	Parameters above Limits
GW-01 (S)	Ammonia, Chloride, Conductivity
GW-01 (D)	Ammonia, Chloride, Conductivity
GW-02 (S)	Ammonia, Chloride, Conductivity
GW-02 (D)	Ammonia, Chloride, Conductivity
GW-03 (S)	Dry
GW-03 (D)	Ammonia, Conductivity
GW-04 (S)	Dry
GW-04 (D)	Ammonia, Chloride, Conductivity
GW-05 (S)	Dry
GW-05 (D)	Ammonia, Chloride, Conductivity, pH
GW-06 (S)	Not available
GW-06 (D)	Not available

Overall the groundwater quality is poor defined as being significantly impaired by pollution.

## 5.2 Surface Waters

7 surfacewaters were sampled in the vicinity of the landfill. These have been assessed against the surface water limits as outlined in the European Communities (Quality of Surface water intended for the abstraction of drinking water) Regulations, 1989. The limit values for the relevant parameters are outlined here.

Parameter	Unit	A1 water	A2 water	A3 water
pH	pH unit	5.5-8.5	5.5-9.0	5.5-9.0
Conductivity	$\mu\text{Scm}^{-1}$	1000	1000	1000
Ammonia (as N)	mg/l	0.2	1.5	4.0
Dissolved Oxygen	%	-	-	-
COD	mg/l	-	-	40
BOD	mg/l	5	5	7
TSS	mg/l	50	50	50
Chloride	mg/l	250	250	250
Temperature	$^{\circ}\text{C}$	25	25	25

SW Reference	Classification	Elevated parametric values
SW-01	A2	Ammonia, BOD
SW-02	A1	-
SW-03	A2	Ammonia
SW-04	A3	Ammonia, BOD
SW-05	A3	Ammonia
SW-06	A3	Ammonia
SW-07	A3	Ammonia

### **5.3 Leachate**

13 leachate samples were available for quarter 2, 2013. All had typical leachate colour and odour.

**TEST REPORT**



**Client:**  
**Limerick City Council**  
**City Hall**  
**Limerick**

**BHP Ref No.: 110720-110722**  
**Order No.:**  
**Date Received: 19<sup>th</sup> September 2013**  
**Date Completed: 24<sup>th</sup> September 2013**  
**Test Specification: Nil**

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*Item: Longpavement Landfill Site*

*Quarterly Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period July-September 2013)*

**Limerick City Council**  
**City Hall**  
**Limerick City**

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q3, 2013

**For and on behalf of BHP Ltd.**

A handwritten signature in blue ink, appearing to read 'Paul O'Sullivan'.

**Paul O'Sullivan**

**Date Issued: 8<sup>th</sup> October 2013**

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

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## 1.0 INTRODUCTION :

BHP were contracted by Limerick City Council to carry out environmental monitoring at Longpavement Landfill site which is located adjacent to the Longpavement road, Limerick City. This landfill is no longer operational and is currently undergoing remediation and final capping works. The facility is operated under waste license no. 76-1, which was issued to Limerick City Council on the 1<sup>st</sup> February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the third quarterly monitoring event of 2013 (July-September 2013). Details on the unavailability of sampling points may be found in the site sheet in Appendix A.

## 2.0 SAMPLING :

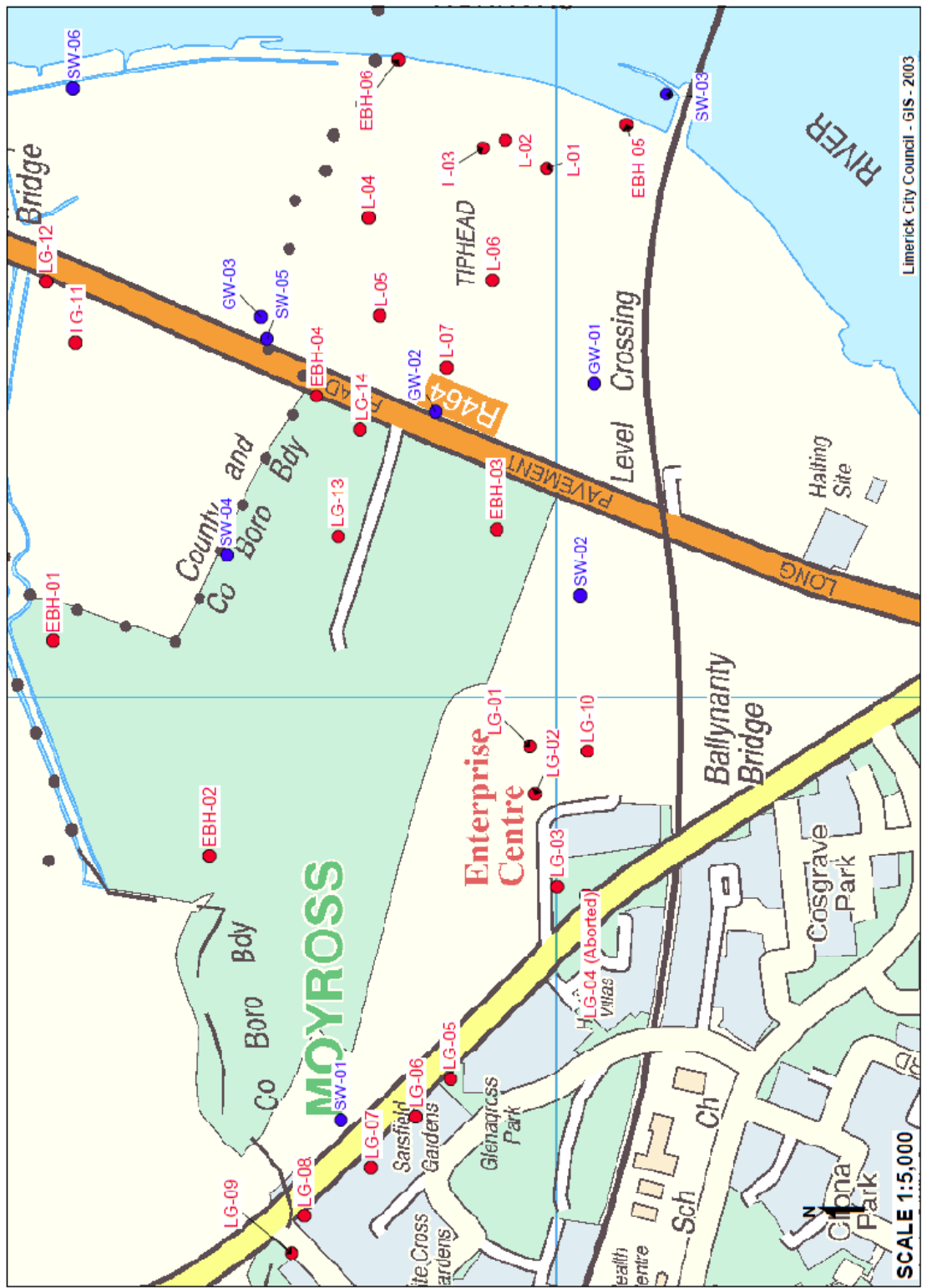
This monitoring is a continuation of an established monitoring program at Longpavement Landfill. As such, the borehole locations are as on previously drafted site maps. A site map is attached below showing the borehole locations. BHP sampled at 5 boreholes. Their individual references are as shown in table 1.

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	2.13
GW-01 (D)	2.13
GW-02 (S)	1.28
GW-02 (D)	1.64
GW-03 (S)	Dry
GW-03 (D)	2.55
GW-04 (S)	Dry
GW-04 (D)	2.80
GW-05 (S)	2.27
GW-05 (D)	3.64
GW-06 (S)	Not available
GW-06 (D)	Not available

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

Locations for surface waters and leachate wells are also shown in the map below.

Site map of Longpavement Landfill showing sampling locations



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 sub-strata (and not that of stagnant water in the standpipe). In order to achieve this, each borehole is purged of three 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).
  - 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. Dissolved Oxygen, Conductivity, pH and temperature are measured using a HACH HQ40d Portable Multi-meter which has Automatic Temperature Compensation functionality
3. BHP operates a chain of custody system. The sample site-sheet / chain of custody form can be found in Appendix B.
4. All samples received by the Laboratory were stored between 0 and 6°C. Subsequent analysis of all samples was carried out in accordance with Standard Methods for the examination of water and wastewater, 22<sup>nd</sup> Edition, 2012, published by the American public health association.

## Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 <sup>nd</sup> Edition
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

#### **4.0 RESULTS :**

The results are presented in the following tables.

### **Ground Water Monitoring results for**

### **Longpavement Landfill**

### **Quarter 3**

**2013**

## TEST REPORT 110720.1

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/420  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	Gassy odour	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Black	Visual
Water Level		m	2.13	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	5.9	APHA-4500-NH3-D
Chloride Cl		mg/l	560	APHA-4110-D
Dissolved Oxygen		mg/l	3.74	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	4250	APHA-2510-B
pH		-	7.26	APHA-4500-H+
Temperature		°C	15.5	APHA-2550-B
Total Organic Carbon		mg/l	12.3	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

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## TEST REPORT 110720.2

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**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/421  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

**FTAO:** Ursula Ahern

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	Gassy odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Black	Visual
Water Level		m	2.13	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	37	APHA-4500-NH3-D
Chloride Cl		mg/l	219	APHA-4110-D
Dissolved Oxygen		mg/l	0.45	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2350	APHA-2510-B
pH		-	6.84	APHA-4500-H+
Temperature		°C	13.1	APHA 2550 B
Total Organic Carbon		mg/l	82.5	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

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## TEST REPORT 110720.3

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02	-	Too shallow to sample	APHA-2150-B
Visual Inspection	Shallow	-	-	Visual
Water Level		m	1.23	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	-	APHA-4500-NH3-D
Chloride Cl		mg/l	-	APHA-4110-D
Dissolved Oxygen		mg/l	-	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	-	APHA-2510-B
pH		-	-	APHA-4500-H+
Temperature		°C	-	APHA-2550-B
Total Organic Carbon		mg/l	-	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 110720.4

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/422  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02	-	Earthy odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Drown	Visual
Water Level		m	1.64	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	11.5	APHA-4500-NH3-D
Chloride Cl		mg/l	171	APHA-4110-D
Dissolved Oxygen		mg/l	1.76	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2410	APHA-2510-B
pH		-	7.1	APHA-4500-H+
Temperature		°C	14.1	APHA-2550-B
Total Organic Carbon		mg/l	36.5	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110720.5

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
**FTAO:** Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	Dry	APHA-2150-B
Visual Inspection	Shallow			Visual
Water Level		m	-	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	-	APHA-4500-NH3-D
Chloride Cl		mg/l	-	APHA-4110-D
Dissolved Oxygen		mg/l	-	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	-	APHA-2510-B
pH		-	-	APHA-4500-H+
Temperature		°C	-	APHA-2550-B
Total Organic Carbon		mg/l		APHA 5310 C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

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## TEST REPORT 110720.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/423  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	No odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	2.55	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	1.33	APHA-4500-NH3-D
Chloride Cl		mg/l	14.2	APHA-4110-D
Dissolved Oxygen		mg/l	1.94	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1223	APHA-2510-B
pH		-	6.72	APHA-4500-H+
Temperature		°C	12.6	APHA-2550-B
Total Organic Carbon		mg/l	19.5	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/tested items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110720.7**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04	-	Dry	APHA-2150-B
Visual Inspection	Shallow	-	-	Visual
Water Level		m	-	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	-	APHA-4500-NH3-D
Chloride Cl		mg/l	-	APHA-4110-D
Dissolved Oxygen		mg/l	-	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	-	APHA-2510-B
pH		-	-	APHA-4500-H+
Temperature		°C	-	APHA-2550-B
Total Organic Carbon		mg/l	-	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110720.8

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/424  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04 Deep	-	No odour	APHA-2150-B
Visual Inspection		-	Turbid/Brown	Visual
Water Level		m	2.8	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.97	APHA-4500-NH <sub>3</sub> -D
Chloride Cl		mg/l	332	APHA-4110-D
Dissolved Oxygen		mg/l	6.04	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	194	APHA-2510-B
pH		-	6.49	APHA-4500-H+
Temperature		°C	13.3	APHA-2550-B
Total Organic Carbon		mg/l	13.9	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110720.9

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
**FTAO:** Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05	-	Too shallow to sample	APHA-2150-B
Visual Inspection	Shallow	-	-	Visual
Water Level		m	2.27	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	-	APHA-4500-NH3-D
Chloride Cl		mg/l	-	APHA-4110-D
Dissolved Oxygen		mg/l	-	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	-	APHA-2510-B
pH		-	-	APHA-4500-H+
Temperature		°C	-	APHA-2550-B
Total Organic Carbon		mg/l	-	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/tested items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110720.10

Analysing  
Testing  
Consulting  
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**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/09/425  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Ground Water 2013

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E Mail bhpcem2@bhp.ie

**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05	-	Oily odour	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	3.64	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	6.1	APHA-4500-NH3-D
Chloride Cl		mg/l	465	APHA-4110-D
Dissolved Oxygen		mg/l	0.63	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2700	APHA-2510-B
pH		-	6.29	APHA-4500-H+
Temperature		°C	13.5	APHA-2550-B
Total Organic Carbon		mg/l	28	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 08/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Surface Water Monitoring results for**

**Longpavement Landfill**

**Quarter 3  
2013**



**TEST REPORT 110721.1**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/426  
**Order No.:**  
**Date Received:** 18/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 01	-	None	APHA-2150-B
Visual Inspection		-	Light brown, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.12	APHA-4500-NH3-D
BOD		mg/l	2.3	APHA-5210-B
COD		mg/l	35	APHA-5220-D
Chloride Cl		mg/l	21.7	APHA-4110-D
Dissolved Oxygen		mg/l	9.53	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	506	APHA-2510-B
pH		-	7.56	APHA-4500-H+
Total Suspended Solids		mg/l	6	APHA-2540-D
Temperature		°C	13.6	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 07/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110721.2**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/09/427  
**Order No.:**  
**Date Received:** 18/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Surface Water 2013

Analysing  
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Consulting  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 02	-	None	APHA-2150-B
Visual Inspection		-	No colour, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.01	APHA-4500-NH3-D
BOD		mg/l	1.6	APHA-5210-B
COD		mg/l	15	APHA-5220-D
Chloride Cl		mg/l	18.8	APHA-4110-D
Dissolved Oxygen		mg/l	9.98	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	310	APHA-2510-B
pH		-	9.52	APHA-4500-H+
Total Suspended Solids		mg/l	2	APHA-2540-D
Temperature		°C	16.5	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 07/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110721.3**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/09/428  
**Order No.:**  
**Date Received:** 18/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Surface Water 2013

Analysing  
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Consulting  
Calibrating



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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 03	-	None	APHA-2150-B
Visual Inspection		-	Brown, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.12	APHA-4500-NH3-D
BOD		mg/l	1.1	APHA-5210-B
COD		mg/l	31	APHA-5220-D
Chloride Cl		mg/l	16.6	APHA-4110-D
Dissolved Oxygen		mg/l	10.15	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	380	APHA-2510-B
pH		-	8.3	APHA-4500-H+
Total Suspended Solids		mg/l	1.6	APHA-2540-D
Temperature		°C	14.7	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 07/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110721.4

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/429  
**Order No.:**  
**Date Received:** 18/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Surface Water 2013

Analysing  
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Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 04	-	Slight leafy odour	APHA-2150-B
Visual Inspection		-	Light brown, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.67	APHA-4500-NH3-D
BOD		mg/l	1.1	APHA-5210-B
COD		mg/l	27	APHA-5220-D
Chloride Cl		mg/l	26.1	APHA-4110-D
Dissolved Oxygen		mg/l	8.54	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	490	APHA-2510-B
pH		-	7.37	APHA-4500-H+
Total Suspended Solids		mg/l	1.2	APHA-2540-D
Temperature		°C	13.9	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 07/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110721.5**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/09/430  
**Order No.:**  
**Date Received:** 18/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Surface Water 2013

Analysing  
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Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 05	-	No odour	APHA-2150-B
Visual Inspection		-	Light brown, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.52	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	18	APHA-5220-D
Chloride Cl		mg/l	25.1	APHA-4110-D
Dissolved Oxygen		mg/l	9.05	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	483	APHA-2510-B
pH		-	7.33	APHA-4500-H+
Total Suspended Solids		mg/l	<1	APHA-2540-D
Temperature		°C	14.8	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 07/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110721.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/431  
**Order No.:**  
**Date Received:** 18/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Surface Water 2013

Analysing  
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Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 06	-	No odour	APHA-2150-B
Visual Inspection		-	Light brown, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.21	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	22	APHA-5220-D
Chloride Cl		mg/l	24.2	APHA-4110-D
Dissolved Oxygen		mg/l	9.36	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	467	APHA 2510 B
pH		-	7.44	APHA-4500-H+
Total Suspended Solids		mg/l	<1	APHA-2540-D
Temperature		°C	14	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 07/10/2013**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 110721.7**Analysing  
Testing  
Consulting  
CalibratingClient: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. LimerickBHP Ref. No.: 13/09/432  
Order No.:  
Date Received: 18/09/2013  
Date Completed: 24/09/2013  
Test Specification: Nil  
Item: Q3 Surface Water 2013

FTAO: Ursula Ahern

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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 07	-	No odour	APHA-2150-B
Visual Inspection		-	Light brown, slightly turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.92	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	14	APHA 5220 D
Chloride Cl		mg/l	23.5	APHA-4110-D
Dissolved Oxygen		mg/l	9.83	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	614	APHA-2510-B
pH		-	7.21	APHA-4500-H+
Total Suspended Solids		mg/l	<1	APHA-2540-D
Temperature		°C	13	APIIA-2550-D

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**Paul O'Sullivan  
Issue Date : 07/10/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**Leachate Monitoring results for  
Longpavement Landfill  
Quarter 3  
2013**



## TEST REPORT 110722

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/433-445  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Leachate 2013

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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	L 01	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	15.4	APHA-2550-B
Odour	L 02	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Black turbid	Visual
Temperature		°C	15.9	APHA-2550-B
Odour	L 03	-	Leachate odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	17.6	APHA-2550-B
Odour	L 04	-	No odour	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	13.4	APHA-2550-B
Odour	L 05	-	No odour	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	14.3	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 07/10/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110722

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/09/433-445  
**Order No.:**  
**Date Received:** 19/09/2013  
**Date Completed:** 24/09/2013  
**Test Specification:** Nil  
**Item:** Q3 Leachate 2013

Analysing  
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Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	L 06	-	No odour	APHA-2150-B
Visual Inspection		-	Brown, very turbid	Visual
Temperature		°C	12.6	APHA-2550-B
Odour	L 07	-	Earthy odour	APHA-2150-B
Visual Inspection		-	Brown, turbid	Visual
Temperature		°C	13.3	APHA-2550-B
Odour	L 08	-	Gassy/oily odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	13.8	APHA-2550-B
Odour	L 09	-	Oily odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	16.1	APHA-2550-B
Odour	L 10	-	No odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	16.6	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

For and on behalf of BHP laboratories :

**Paul O'Sullivan**  
**Issue Date :** 07/10/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 110722

Client: Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 13/09/433-445  
Order No.:  
Date Received: 19/09/2013  
Date Completed: 24/09/2013  
Test Specification: Nil  
Item: Q3 Leachate 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	L 11	-	Concrete odour	APHA-2150-B
Visual Inspection		-	Black, very turbid	Visual
Temperature		°C	15.2	APHA-2550-B
Odour	Sump	-	No odour	APHA-2150-B
Visual Inspection		-	Brown, Clear	Visual
Temperature		°C	14.6	APHA-2550-B
Odour	Tank	-	No odour	APHA-2150-B
Visual Inspection		-	Brown, Turbid	Visual
Temperature		°C	14.9	APHA-2550-B

Additional information : All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

For and on behalf of BHP laboratories :

Paul O'Sullivan  
Issue Date : 07/10/2013

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## 5.0 DISCUSSION/INTERPRETATION

### 5.1 Groundwaters

The results of the chemical and microbiological analysis conducted on the ground waters are presented in Section 5.

All results are assessed against the interim guideline values for specific substances in ground water taken from the publication, 'Towards setting guideline values for the protection of groundwater in Ireland, Interim Report' as published by the EPA, 2003. The limits for the relevant parameters are outlined here.

Parameter	Unit	Limit
Ammonia (as N)	mg/l	0.12
Chloride	mg/l	30
Conductivity	uScm <sup>-1</sup>	1000
Dissolved Oxygen	%	-
pH	pH unit	>6.5 <9.5
Temperature	°C	25
Total Organic Carbon	mg/l	-

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. A summary of the parameters exceeded and the locations are presented in the table below.

GW Reference	Parameters above Limits
GW-01 (S)	Ammonia, Chloride, Conductivity
GW-01 (D)	Ammonia, Chloride, Conductivity
GW-02 (S)	Too shallow to sample
GW-02 (D)	Ammonia, Chloride, Conductivity
GW-03 (S)	Dry
GW-03 (D)	Ammonia, Conductivity
GW-04 (S)	Dry
GW-04 (D)	Ammonia, Chloride, Conductivity
GW-05 (S)	Dry
GW-05 (D)	Ammonia, Chloride, Conductivity, pH
GW-06 (S)	Not available
GW-06 (D)	Not available

Overall the groundwater quality is poor defined as being significantly impaired by pollution.

## 5.2 Surface Waters

7 surface waters were sampled in the vicinity of the landfill. These have been assessed against the surface water limits as outlined in the European Communities (Quality of Surface water intended for the abstraction of drinking water) Regulations, 1989. The limit values for the relevant parameters are outlined here.

Parameter	Unit	A1 water	A2 water	A3 water
pH	pH unit	5.5-8.5	5.5-9.0	5.5-9.0
Conductivity	$\mu\text{Scm}^{-1}$	1000	1000	1000
Ammonia (as N)	mg/l	0.2	1.5	4.0
Dissolved Oxygen	%	-	-	-
COD	mg/l	-	-	40
BOD	mg/l	5	5	7
TSS	mg/l	50	50	50
Chloride	mg/l	250	250	250
Temperature	$^{\circ}\text{C}$	25	25	25

SW Reference	Classification	Elevated parametric values
SW-01	A1	-
SW-02	Not suitable	pH
SW-03	A1	-
SW-04	A2	Ammonia
SW-05	A2	Ammonia
SW-06	A2	Ammonia
SW-07	A2	Ammonia

### **5.3 Leachate**

13 leachate samples were available for quarter 3, 2013. All had typical leachate colour and odour.

Analysing  
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**TEST REPORT 111356-111358**



**Client:**  
**Limerick City Council**  
**City Hall**  
**Limerick**

**BHP Ref No.: 13/11/400-426**  
**Order No.:**  
**Date Received: 13<sup>th</sup> November 2013**  
**Date Completed: 19<sup>th</sup> November 2013**  
**Test Specification: Nil**

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*Item: Longpavement Landfill Site*

*Quarterly Report covering groundwater, surfacewater and leachate monitoring at  
Longpavement Landfill (Monitoring Period October-December 2013)*

**Limerick City Council**  
**City Hall**  
**Limerick City**

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q4, 2013

**For and on behalf of BHP Ltd.**

A handwritten signature in blue ink, appearing to read 'Paul O'Sullivan'.

**Paul O'Sullivan**

**Date Issued: 25<sup>th</sup> November 2013**

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



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## 1.0 INTRODUCTION :

BHP were contracted by Limerick City Council to carry out environmental monitoring at Longpavement Landfill site which is located adjacent to the Longpavement road, Limerick City. This landfill is no longer operational and is currently undergoing remediation and final capping works. The facility is operated under waste license no. 76-1, which was issued to Limerick City Council on the 1<sup>st</sup> February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the fourth quarterly monitoring event of 2013 (October-December 2013). Details on the unavailability of sampling points may be found in the site sheet in Appendix A.

## 2.0 SAMPLING :

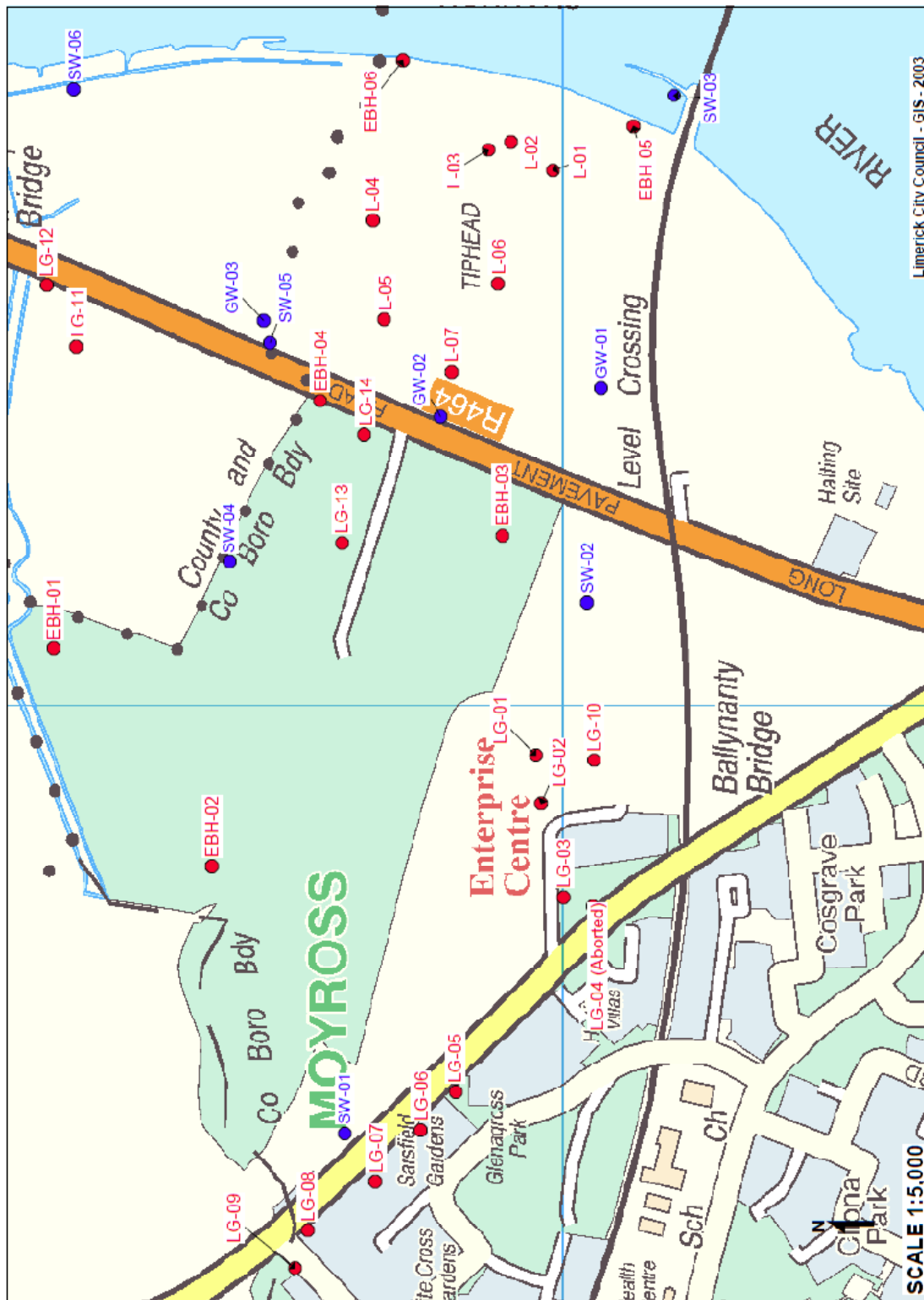
This monitoring is a continuation of an established monitoring program at Longpavement Landfill. As such, the borehole locations are as on previously drafted site maps. A site map is attached below showing the borehole locations. BHP sampled at 5 boreholes. Their individual references are as shown in table 1.

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	2.04
GW-01 (D)	2.10
GW-02 (S)	1.28
GW-02 (D)	1.63
GW-03 (S)	1.35
GW-03 (D)	1.35
GW-04 (S)	Dry
GW-04 (D)	2.90
GW-05 (S)	Dry
GW-05 (D)	3.50
GW-06 (S)	Not available
GW-06 (D)	Not available

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

Locations for surface waters and leachate wells are also shown in the map below.

Site map of Longpavement Landfill showing sampling locations



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 sub-strata (and not that of stagnant water in the standpipe). In order to achieve this, each borehole is purged of three 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).
  - 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. Dissolved Oxygen, Conductivity, pH and temperature are measured using a HACH HQ40d Portable Multi-meter which has Automatic Temperature Compensation functionality
3. All samples received by the Laboratory were stored between 0 and 6°C. Subsequent analysis of all samples was carried out in accordance with Standard Methods for the examination of water and wastewater, 22<sup>nd</sup> Edition, 2012, published by the American public health association.

## Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 <sup>nd</sup> Edition
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

#### **4.0 RESULTS :**

The results are presented in the following tables.

#### **Ground Water Monitoring results for**

#### **Longpavement Landfill**

**Quarter 4  
2013**

## TEST REPORT 111356.1

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/400  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	Tar Smell	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Black	Visual
Water Level		m	2.04	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	4.25	APHA-4500-NH3-D
Chloride Cl		mg/l	502.331	APHA-4110-D
Dissolved Oxygen		mg/l	1.62	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	4190	APHA-2510-B
pH		-	7.72	APHA-4500-H+
Temperature		°C	11.5	APHA-2550-B
Total Organic Carbon		mg/l	11.8	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111356.2**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/401  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01	-	Drain Smell	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	2.1	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	53.5	APHA-4500-NH3-D
Chloride Cl		mg/l	194.677	APHA-4110-D
Dissolved Oxygen		mg/l	3.04	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2720	APHA-2510-B
pH		-	6.88	APHA-4500-H+
Temperature		°C	11.3	APHA-2550-B
Total Organic Carbon		mg/l	85	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



## TEST REPORT 111356.3

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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 Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02 Shallow	-	To shallow to sample	APHA-2150-B Visual
Visual Inspection		-		ISO 5667 - 11
Water Level		m	1.68	APHA-4500-NH3-D
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4110-D
Chloride Cl		mg/l		APHA-4500-O-G
Dissolved Oxygen		mg/l		APHA-2510-B
Electrical Conductivity		uScm <sup>1</sup>		APHA 1500 H+
pH				APHA-2550-B
Temperature		°C		APHA - 5310 - C
Total Organic Carbon		mg/l		

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111356.4**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/402  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02	-	None	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Rust Brown	Visual
Water Level		m	1.63	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	10.5	APHA-4500-NH3-D
Chloride Cl		mg/l	152.469	APHA-4110-D
Dissolved Oxygen		mg/l	1.92	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2610	APHA-2510-B
pH		-	6.9	APHA-4500-H+
Temperature		°C	11.9	APHA-2550-B
Total Organic Carbon		mg/l	27	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**

**Issue Date :** 20/11/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111356.5**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/403  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	None	APHA-2150-B
Visual Inspection	Shallow	-	Turbid/Rust Brown	Visual
Water Level		m	1.35	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.62	APHA-4500-NH3-D
Chloride Cl		mg/l	11.146	APHA-4110-D
Dissolved Oxygen		mg/l	2.34	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1008	APHA-2510-B
pH		-	6.63	APHA-4500-H+
Temperature		°C	11.8	APHA-2550-B
Total Organic Carbon		mg/l	8.6	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 111356.6

Analysing  
Testing  
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**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/11/404  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

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**FTAO:** Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03	-	None	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Rust Brown	Visual
Water Level		m	5.53	ISO 5667 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	1.62	APHA-4500-NH3-D
Chloride Cl		mg/l	11.036	APHA-4110-D
Dissolved Oxygen		mg/l	5.53	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	1156	APHA-2510-B
pH		-	6.66	APHA-4500-H+
Temperature		°C	11.8	APHA-2550-B
Total Organic Carbon		mg/l	11.2	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date :** 20/11/13

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 111356.7

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04 Shallow	-	Dry	APHA-2150-B
Visual Inspection				Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111356.8**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick  
  
FTAO: Ursula Ahern

**BHP Ref. No.:** 13/11/405  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04 Deep	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Rust Brown	Visual
Water Level		m	2.9	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	2.4	APHA-4500-NH3-D
Chloride Cl		mg/l	76.939	APHA-4110-D
Dissolved Oxygen		mg/l	3.37	APHA-4500-O-G
Electrical Conductivity		uScm <sup>1</sup>	1169	APHA-2510-B
pH			6.66	APHA 1500 H+
Temperature		°C	12	APHA-2550-B
Total Organic Carbon		mg/l	8.4	APHA - 5310 - C

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 111356.9

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
**FTAO:** Ursula Ahern

**BHP Ref. No.:** n/a  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05 Shallow	-	Dry	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l		APHA-4500-NH3-D
Chloride Cl		mg/l		APHA-4110-D
Dissolved Oxygen		mg/l		APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>		APHA-2510-B
pH		-		APHA-4500-H+
Temperature		°C		APHA-2550-B
Total Organic Carbon		mg/l		APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 111356.10

**Client:** Environmental Department  
 Limerick City Council  
 Dooradoyle  
 Co. Limerick  
  
 FTAO: Ursula Ahern

**BHP Ref. No.:** 13/11/406  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Ground Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05	-	None	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Brown	Visual
Water Level		m	3.5	ISO 5667 - 11
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	3.4	APHA-4500-NH3-D
Chloride Cl		mg/l	385.125	APHA-4110-D
Dissolved Oxygen		mg/l	2.65	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	2890	APHA-2510-B
pH			6.37	APHA 1500 H+
Temperature		°C	12.7	APHA-2550-B
Total Organic Carbon		mg/l	66	APHA - 5310 - C

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.



**Surface Water Monitoring results for**

**Longpavement Landfill**

**Quarter 4  
2013**

**TEST REPORT 111357.1**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/407  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 01	-	None	APHA-2150-B
Visual Inspection		-	Brown/Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> N		mg/l	0.55	APHA 4500 NH <sub>3</sub> D
BOD		mg/l	10.1	APHA-5210-B
COD		mg/l	134	APHA-5220-D
Chloride Cl		mg/l	26.438	APHA-4110-D
Dissolved Oxygen		mg/l	3.06	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	730	APHA-2510-B
pH		-	7.16	APHA-4500-H+
Total Suspended Solids		mg/l	146	APHA-2540-D
Temperature		°C	10.8	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111357.2**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/408  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 02	-	None	APHA-2150-B
Visual Inspection		-	Clear/Slightly Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.2	APHA-4500-NH <sub>3</sub> -D
BOD		mg/l	1.8	APHA-5210-B
COD		mg/l	13	APHA-5220-D
Chloride Cl		mg/l	17.221	APIA-4110-D
Dissolved Oxygen		mg/l	14.73	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	518	APHA-2510-B
pH		-	7.75	APHA-4500-H+
Total Suspended Solids		mg/l	6.4	APIA-2540-D
Temperature		°C	9.6	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111357.3**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/409  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 03	-	None	APHA-2150-B
Visual Inspection		-	Pale Yellow/Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.04	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	16	APHA-5220-D
Chloride Cl		mg/l	15.057	APHA-4110-D
Dissolved Oxygen		mg/l	10.48	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	440	APHA-2510-B
pH		-	7.83	APHA-4500-H+
Total Suspended Solids		mg/l	3.2	APHA-2540-D
Temperature		°C	7.7	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111357.4**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/410  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 04	-	None	APHA-2150-B
Visual Inspection		-	Pale Yellow/Slightly Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	0.25	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	23	APHA-5220-D
Chloride Cl		mg/l	21.909	APHA-4110-D
Dissolved Oxygen		mg/l	2.87	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	464	APHA-2510-B
pH		-	7.19	APHA-4500-H+
Total Suspended Solids		mg/l	8	APHA-2540-D
Temperature		°C	9.4	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111357.5**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/411  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

Analysing  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 05	-	None	APHA-2150-B
Visual Inspection		-	Pale Yellow/Slightly Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> N		mg/l	2.3	APHA 4500 NH3 D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	28	APHA-5220-D
Chloride Cl		mg/l	30.236	APHA-4110-D
Dissolved Oxygen		mg/l	3.98	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	627	APHA-2510-B
pH		-	7.15	APHA-4500-H+
Total Suspended Solids		mg/l	7.2	APHA-2540-D
Temperature		°C	9.5	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 111357.6

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/412  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Fax + 353 61 455447  
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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 06	-	None	APHA-2150-B
Visual Inspection		-	Pale Yellow/Clear	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	2.49	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	23	APHA-5220-D
Chloride Cl		mg/l	31.631	APHA-4110-D
Dissolved Oxygen		mg/l	7.93	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	571	APHA-2510-B
pH		-	7.29	APHA-4500-H+
Total Suspended Solids		mg/l	2.8	APHA-2540-D
Temperature		°C	8.2	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

**TEST REPORT 111357.7**

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Ursula Ahern

**BHP Ref. No.:** 13/11/413  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 19/11/13  
**Test Specification:** Nil  
**Item:** Q4 Surface Water 2013

Analysing  
Testing  
Consulting  
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 07	-	None	APHA-2150-B
Visual Inspection		-	Pale Yellow/Slightly Turbid	Visual
Ammonical Nitrogen NH <sub>3</sub> -N		mg/l	3.3	APHA-4500-NH3-D
BOD		mg/l	<1	APHA-5210-B
COD		mg/l	24	APHA-5220-D
Chloride Cl		mg/l	24.597	APHA-4110-D
Dissolved Oxygen		mg/l	7.8	APHA-4500-O-G
Electrical Conductivity		uScm <sup>-1</sup>	793	APHA-2510-B
pH		-	7.35	APHA-4500-H+
Total Suspended Solids		mg/l	8.4	APHA-2540-D
Temperature		°C	7.6	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 20/11/13**

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**Leachate Monitoring results for  
Longpavement Landfill  
Quarter 4  
2013**

## TEST REPORT 111358

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/11/414-426  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 15/11/13  
**Test Specification:** Nil  
**Item:** Q4 Leachate 2013

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**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Odour	L 01	-	No Odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	14.5	APHA-2550-B
Odour	L 02	-	Char Smell	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	14.7	APHA-2550-B
Odour	L 03	-	Char Smell	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	12.6	APHA-2550-B
Odour	L 04	-	Gassy Smell	APHA-2150-B
Visual Inspection		-	Brown, visibly turbid	Visual
Temperature		°C	11.9	APHA-2550-B
Odour	L 05	-	Gassy Smell	APHA-2150-B
Visual Inspection		-	Rust Brown, visibly turbid	Visual
Temperature		°C	12.5	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 18/11/13**

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**TEST REPORT 111358**

Analysing  
Testing  
Consulting  
Calibrating



**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**BHP Ref. No.:** 13/11/414-426  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 15/11/13  
**Test Specification:** Nil  
**Item:** Q4 Leachate 2013

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E Mail bhpce2@bhp.ie

**FTAO:** Tara Flanagan

Test	Client Reference	Units	Results	Standard Reference
Odour	L 06	-	No odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	10.2	APHA-2550-B
Odour	L 07	-	No odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	11.1	APHA-2550-B
Odour	L 08	-	Woody sweet smell	APHA-2150-B
Visual Inspection		-	Dark brown, visibly turbid	Visual
Temperature		°C	12.2	APHA-2550-B
Odour	L 09	-	Woody sweet smell	APHA-2150-B
Visual Inspection		-	Dark brown, visibly turbid	Visual
Temperature		°C	14.2	APHA-2550-B
Odour	L 10	-	No odour	APHA 2150 B
Visual Inspection		-	Dark brown, visibly turbid	Visual
Temperature		°C	15.2	APHA-2550-B

**Additional information :** All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 18/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## TEST REPORT 111358

**Client:** Environmental Department  
Limerick City Council  
Dooradoyle  
Co. Limerick

**FTAO:** Tara Flanagan

**BHP Ref. No.:** 13/11/414-426  
**Order No.:**  
**Date Received:** 13/11/13  
**Date Completed:** 15/11/13  
**Test Specification:** Nil  
**Item:** Q4 Leachate 2013

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E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	L 11	-	Woody sweet smell	APHA-2150-B
Visual Inspection			Black, visibly turbid	Visual
Temperature		°C	15.6	APHA-2550-B
Odour	Tank	-	No odour	APHA-2150-B
Visual Inspection		-	Light red brown, slightly turbid	Visual
Temperature		°C	7.7	APHA-2550-B
Odour	Sump	-	No odour	APHA-2150-B
Visual Inspection		-	Clear	Visual
Temperature		°C	11.3	APHA-2550-B

**Additional information :**

All methods are from Standard Methods for the Examination of Water and Wastewater 20th Edition.

**For and on behalf of BHP laboratories :**

**Paul O'Sullivan**  
**Issue Date : 18/11/13**

Test results relate only to this/these items. This test report shall not be duplicated in full without the permission of the test laboratory.

## 5.0 DISCUSSION/INTERPRETATION

### 5.1 Groundwaters

The results of the chemical and microbiological analysis conducted on the ground waters are presented in Section 5.

All results are assessed against the interim guideline values for specific substances in ground water taken from the publication, 'Towards setting guideline values for the protection of groundwater in Ireland, Interim Report' as published by the EPA, 2003. The limits for the relevant parameters are outlined here.

Parameter	Unit	Limit
Ammonia (as N)	mg/l	0.12
Chloride	mg/l	30
Conductivity	uScm <sup>-1</sup>	1000
Dissolved Oxygen	%	-
pH	pH unit	>6.5 <9.5
Temperature	°C	25
Total Organic Carbon	mg/l	-

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. A summary of the parameters exceeded and the locations are presented in the table below.

GW Reference	Parameters above Limits
GW-01 (S)	Ammonia, Chloride, Conductivity
GW-01 (D)	Ammonia, Chloride, Conductivity
GW-02 (S)	Too shallow to sample
GW-02 (D)	Ammonia, Chloride, Conductivity
GW-03 (S)	Ammonia, Conductivity
GW-03 (D)	Ammonia, Conductivity
GW-04 (S)	Dry
GW-04 (D)	Ammonia, Chloride, Conductivity
GW-05 (S)	Dry
GW-05 (D)	Ammonia, Chloride, Conductivity
GW-06 (S)	Not available
GW-06 (D)	Not available

Overall the groundwater quality is poor defined as being significantly impaired by pollution.

## 5.2 Surface Waters

7 surface waters were sampled in the vicinity of the landfill. These have been assessed against the surface water limits as outlined in the European Communities (Quality of Surface water intended for the abstraction of drinking water) Regulations, 1989. The limit values for the relevant parameters are outlined here.

Parameter	Unit	A1 water	A2 water	A3 water
pH	pH unit	5.5-8.5	5.5-9.0	5.5-9.0
Conductivity	$\mu\text{Scm}^{-1}$	1000	1000	1000
Ammonia (as N)	mg/l	0.2	1.5	4.0
Dissolved Oxygen	%	-	-	-
COD	mg/l	-	-	40
BOD	mg/l	5	5	7
TSS	mg/l	50	50	50
Chloride	mg/l	250	250	250
Temperature	$^{\circ}\text{C}$	25	25	25

SW Reference	Classification	Elevated parametric values
SW-01	Not suitable	BOD, TSS
SW-02	A1	-
SW-03	A1	-
SW-04	A2	Ammonia
SW-05	A3	Ammonia
SW-06	A3	Ammonia
SW-07	A3	Ammonia

### **5.3 Leachate**

13 leachate samples were available for quarter 4, 2013. All had typical leachate colour and odour.

<b>REFERENCE YEAR</b>	2013
-----------------------	------

**1. FACILITY IDENTIFICATION**

Parent Company Name	Limerick City Council
Facility Name	Longpavement landfill site
PRTR Identification Number	W0076
Licence Number	W0076-01

Waste or IPPC Classes of Activity

No.	class_name
4.4	Recycling or reclamation of other inorganic materials.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.7	#####
4.1	Solvent reclamation or regeneration.
4.9	Use of any waste principally as a fuel or other means to generate energy.
Address 1	Monabraher
Address 2	Limerick
Address 3	
Address 4	
	Limerick
Country	Ireland
Coordinates of Location	-8.6335 52.6832
River Basin District	IEGBNISH
NACE Code	3832
Main Economic Activity	Recovery of sorted materials
<b>AER Returns Contact Name</b>	Tara Flanagan
<b>AER Returns Contact Email Address</b>	tara.flanagan@limerick.ie
<b>AER Returns Contact Position</b>	Senior Executive Engineer
<b>AER Returns Contact Telephone Number</b>	061 496547
<b>AER Returns Contact Mobile Phone Number</b>	087 9295256
<b>AER Returns Contact Fax Number</b>	
<b>Production Volume</b>	
<b>Production Volume Units</b>	
<b>Number of Installations</b>	
<b>Number of Operating Hours in Year</b>	
<b>Number of Employees</b>	
<b>User Feedback/Comments</b>	
<b>Web Address</b>	

**2. PRTR CLASS ACTIVITIES**

Activity Number	Activity Name
50.1	General
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?	
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) ?	
--	--

**4.1 RELEASES TO AIR**

[Link to previous years emissions data](#)

| PRTR# : W0076 | Facility Name : Longpavement landfill site | Filename : W0076\_2013 (1).xls | Return Year : 2013 |

05/06/2014 10:45

**SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS**

RELEASES TO AIR					ADD EMISSION POINT quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
No. Annex II	Name	M/ C/ E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				
01	Methane (CH4)	C	OTH	US EPA Land Gem	415900.0	415900.0	0.0	0.0
03	Carbon dioxide (CO2)	C	OTH	US EPA Land Gem	137478.66	137478.66	0.0	0.0

\* Select a row by double-clicking on the (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			
No. Annex II	Name	M/ C/ E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				



methane flared and / or utilised	T (Total) kg/Year	M/ C/ E	Meth od Code	Designati on or Descriptio n	Facility Total Capacity m3 per hour	
Total estimated methane generation (as per site model)	536112.0	C	OTH	US EPA land Gem	N/A	
Methane flared	120212.0	E	OTH	Enclosed Flare	150.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	415900.0	E	OTH	US EPA land Gem	N/A	



**5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE**

| PRTR# : W0076 | Facility Name : Longpavement landfill site | Filename : W0076\_2013 (1).xls | Return Year : 2013 |

05/06/20  
14 10:45

**Please enter all quantities on this sheet in Tonnes**

5

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste : Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and Licence / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
<b>Within the Country</b>	<b>19 07 03</b>	<b>No</b>	2000.0	landfill leachate other than those mentioned in 19 07 02	R10	C	<b>Volume Calculation</b>	Offsite in Ireland	Limerick City Council, D00 13-01	Bunlickey Waste Water Treatment Plant, Limerick, Ireland		

