

ANNUAL ENVIRONMENTAL REPORT 2014

Waste Licence Registration No.: W0076-1

Licencee: Limerick City Council

Location of Activity: Longpavement Landfill
Longpavement
Limerick

Attention: Ms Maria Lenihan
Office Environmental Enforcement
Environmental Protection Agency
Regional Inspectorate,
Inniscarra
Co. Cork

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Environment Department
Limerick City Council
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Limerick

Table of Contents

1.0	Reporting period	4
2.0	Report on restoration of completed cells / phases	4
3.0	Waste activities carried out at the facility	5
4.0	Summary of results & interpretation of environmental monitoring	5
4.1	Landfill gas	5
4.1.1	<i>Landfill gas wells</i>	5
4.1.2	<i>Perimeter gas wells</i>	5
4.2	Dust control - pm ₁₀ monitoring	6
4.3	Noise monitoring	6
4.4	Surface water	7
4.5	Groundwater	7
4.6	Leachate	8
4.7	Meteorological monitoring	9
4.8	Landfill gas combustion plant/enclosed flare monitoring	9
4.9	Monitoring of emissions to sewer	9
4.10	Monitoring of emissions from onsite leachate treatment plant	9
5.0	Volume of leachate produced & transported / discharged off-site	10
5.1	Leachate abstraction wells	10
6.0	Site survey showing existing levels of the facility at the end of the reporting period	10
7.0	Estimated annual & cumulative quantities of landfill gas emitted from the facility	11
8.0	Report on the progress towards achievement of the environmental objectives & targets contained in previous year's report	12
9.0	Schedule of environment objectives & targets for the forthcoming year	12
10.0	Reported incidents & complaint summaries	12
11.0	Review of nuisance controls	12
11.1	Pest control	12
11.2	Litter control	12
11.3	Dust control	12
11.4	Bird control	13

12.0 Reports on financial provision made under this licence, management & staffing
structure of the facility, & a programme for public information

13

Appendix A: Map

Appendix B: Monthly gas monitoring results.

Appendix C: First Quarterly Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period January-March 2014)

Appendix D: Second Quarterly Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period April-June 2014)

Appendix E: Third Quarterly Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period July-September 2014)

Appendix F: Fourth Quarterly Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period October-December 2014)

Appendix G: Annual Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period 2014)

Appendix H: Tables 4.1 to 4.8 indicating the parameters and frequencies to be monitored in accordance with the EPA licence 76-1.

1.0 REPORTING PERIOD

The period of reporting for this Report is from January 2014 to December 2014.

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 2014. 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. See appendix H for the parameters and frequencies to be monitored in accordance with the EPA licence 76-1.

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. These two wells were drilled directly into the main waste pile. Gas well LG14 could not be monitored throughout 2014 as it has been covered. Exceedances in CO₂ (12.4% to 29.6%) and CH₄ (55.8% to 82.2%) 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. Only eight wells were available for monitoring as some wells were covered or flooded during the surveys. No exceedance in CH₄ was detected in any of the perimeter boreholes during the monitoring period. CO₂ exceedances were detected on a number of occasions ranging from 1.6% to 6.2%.

4.1.3 Interpretation

There was no marked change in LG 01 and LG 05 within 2014 or 2013. In LG 03 there was a decrease in CO₂ levels across the year when compared to 2013. There were fluctuations in LG 06, LG 07 and LG 08 within 2014 for CO₂. These fluctuations were similar to 2013. LG 11 had a reduced level of methane in it over the measurable periods of 2014 when compared to 2013. LG 13 within the waste body showed a slight increase of 2% in levels of methane for 2014 when compared to 2013.

Overall, there is no evidence of gas migration from the site except towards LG 11 and LG 12. The methane levels at LG 11 indicate a reduction in methane when compared to 2013. In 2014 the methane levels at LG 11 are below the limits applicable to the site.

4.2 Dust Control - PM₁₀ Monitoring

As the landfill is now closed no dust monitoring was carried out in 2014.

No PM₁₀ 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 2014.

4.4 Surface Water

4.4.1 Surface Water Results

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, D, E, F and G of this report, within the various quarterly and annual reports.

4.4.2 Surface Water Interpretation

SW 01, SW 02 and SW 06 showed fluctuations in water quality through the year. SW 03 showed an increase in quality at the location. SW 04 started the year at a quality level of A2 but then decreased in quality for the last three quarters to A3. SW 05 was A2 quality for the first three quarters before decreasing in quality to A3 for the last quarter. SW 07 decreased in quality from A2 in the first half of the year to A3 in the second half of the year.

The overall trend would be that SW 04, SW 05 and SW 07 have decreased in quality while SW 01, SW 02, SW 03 and SW 06 have finished the year in better quality.

The annual surface water analysis shows some increases on 2013. The results show some exceedances when compared to drinking water limits and guideline values. However there are no gross exceedances when compared to the conservative limits and values.

4.5 Groundwater

4.5.1 Groundwater Results

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 shown in Appendix C, D, E, F and G of this report, within the various quarterly and annual reports.

4.5.2 Groundwater Interpretation

The annual analysis indicates an increase in the cyanide levels across the site. The maximum is in GW 3 deep at 5 times the threshold value in Schedule 5 of SI 9/2010 European Communities Environmental Objectives (Groundwater) Regulations 2010. This increase coincides with a change in laboratory procedure where samples in 2014 were preserved whilst in previous years they were not preserved. These levels of cyanide need to be reviewed in 2015 in order to see if this is an upward trend in cyanide level at the site or if the sudden jump in level is due to sample preservation.

Nickel and lead in GW 02 shallow and GW 03 deep have increased in level along with the cyanide. Again this may be linked to a change in sample preservation but will need to be reviewed in the next sampling round to see if it is an upward trend at the site.

The ground water at the site is classified as being at poor chemical status, under the SI 9/2010 regulations. This classification is the same as 2013.

4.6 Leachate

4.6.1 Leachate Results

There are 13 No. Leachate monitoring wells at the Longpavement landfill facility, which are currently 100mm 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 shown in Appendix C, D, E, F and G of this report, within the various quarterly and annual reports.

4.6.2 Leachate Interpretation

Leachate samples had typical characteristics of leachate, including strong odour, high turbidity, dark in colour, high levels of heavy metals such as lead, nickel and zinc, elevated ammonia, conductivity and chloride levels. BOD levels were above 10mg/l at the following locations, L01, L02, L03, L05, L06, L08, L09, L10 and L11.

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

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.

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

5.1 Leachate Abstraction Wells

An existing network of 7 No. leachate abstraction wells are present on the site. 3 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 will form part of the rehabilitation proposals. It is proposed to install a permanent gas collection and treatment system at the site. A series of vertical gas extraction wells are being installed to actively extract gas from the waste body. A horizontal gas drainage/equalizing layer consisting of a synthetic material will be 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).

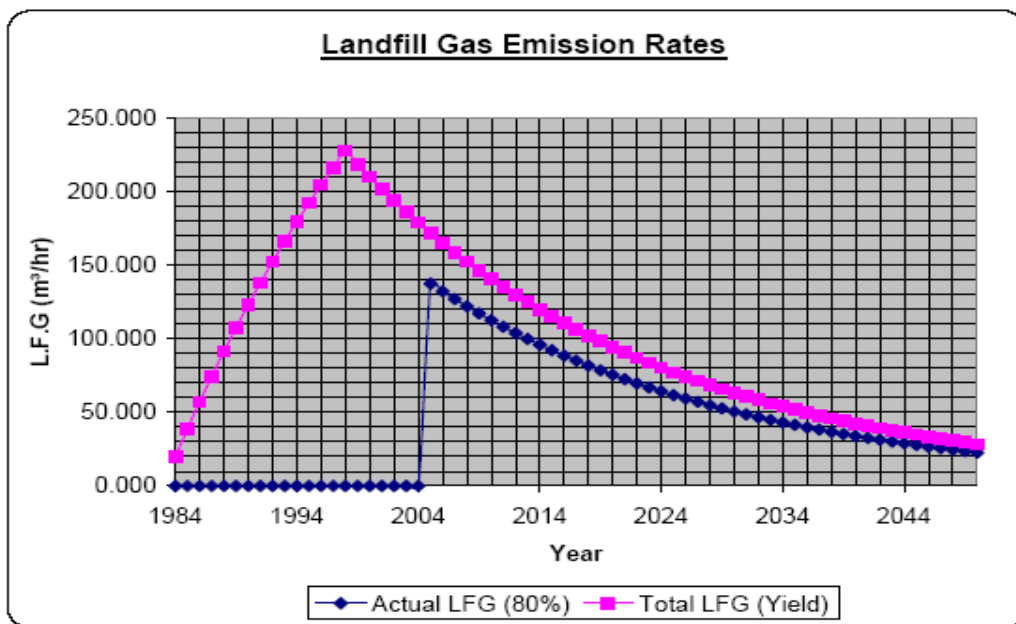


Figure 7.1: Projected Landfill Gas Emission Rates

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. 137m³/hr is theoretically available for extraction. It is estimated that gas production is on a downward cycle decreasing to 92m³/hr in 2015 and approx. 75m³/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 2014 to the December 2014.

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 2014.

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, & A PROGRAMME FOR PUBLIC INFORMATION

The contract value for the restoration works is €5.3m. 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 SEE in environment oversees any works at Longpavement. A programme for public information prepared by Limerick City Council is in place.

Appendix A

Site map showing sampling locations



Appendix B

Monthly Gas Monitoring Results

Parameter	Unit	limit
CH ₄	%v/v	1% v/v
CO ₂	%v/v	1.5% v/v
O ₂	%v/v	n/a
Temp.	°C	n/a
Pressure	mbar	n/a

Landfill Gas Monitoring Results – Longpavement Landfill 2014

Date	Operator	Location	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
29/01/2014	Dermot Condon	CH ₄	0.1	Flooded	0.1	Covered	0.1	0.1	0.1	0	Covered	Covered	Well blocked	Covered	76.9	Covered
		CO ₂	0.2		0.2		2	1.1	0.5	22.1						
		O ₂	19.9		20.9		20.9	15.9	18.6	19.5					0.1	
		Temp.	9		9		9	9	9	9						
		Pressure	995		995		995	995	995	995					995	
11/02/2014	Dermot Condon	CH ₄	0	Flooded	0	Covered	0	0.2	0	0	Covered	Covered	Well blocked	Covered	76.9	Covered
		CO ₂	0.3		3.6		0.3	2.1	2.1	0.3					22	
		O ₂	16.7		12.5		20.1	6.2	17.7	19.8					0.1	
		Temp.	4		4		4	4	4	4					4	
		Pressure	998		989		989	989	989	989					989	
28/03/2014	Dermot Condon	CH ₄	0	Flooded	0	Covered	0	0	0	0	Covered	Covered	Well blocked	Covered	82.2	Covered
		CO ₂	0.1		3.7		0.2	2.4	1.6	0.2					17.2	
		O ₂	20		10.1		22.3	16.8	19.7	20.9					0	
		Temp.	7		7		7	7	7	7					7	
		Pressure	1013		1014		1015	1015	1015	1014					1013	
25/04/2014	Dermot Condon	CH ₄	0	Flooded	0	Covered	0	0	0	0	Covered	Covered	Well blocked	Covered	77.3	Covered
		CO ₂	0.1		4.2		0.2	3.3	2.6	1.2					20.7	
		O ₂	20.9		10.1		20.5	13.4	17.4	18.8					0.1	
		Temp.	14		14		14	14	14	14					14	
		Pressure	1007		1007		1007	1007	1007	1007					1007	
13/05/2014	Dermot Condon	CH ₄	0	Flooded	0	Covered	0	0	0	0	Covered	Covered	Well blocked	Covered	76.8	Covered
		CO ₂	0.2		0.3		0.1	5.3	2.1	2					21.1	
		O ₂	18.3		18.1		20.4	18.1	18.1	18.1					0.9	
		Temp.	15		15		15	15	15	15					15	
		Pressure	1023		1023		1024	1024	1024	1024					1023	
17/06/2014	Dermot Condon	CH ₄	0	Flooded	0	Covered	0	0	0	0	Covered	Covered	0	0	71.5	Covered
		CO ₂	0.1		4.9		0.2	4.3	4.3	3.5					24.5	
		O ₂	20.4		7.7		19.9	10.1	15.2	13.1					0.1	
		Temp.	-		-		-	-	-	-					-	
		Pressure	1029		1030		1030	1030	1030	1029					1030	

Landfill Gas Monitoring Results – Longpavement Landfill 2014 contd.

Date	Operator	Location	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*
04/07/2014	Dermot Condon	CH ₄	0	Flooded	0	Covered	0	0	0	0	Covered	Covered	0.2	0.8	70.4	Covered
		CO ₂	0.1		5.6		0.2	4.9	0.6	0.4			0.9	1.3	28.3	
		O ₂	20.4		9.8		20.2	6.2	19.9	19.9			17.2	16	0.1	
		Temp.	16		16		16	16	16	16			16	16	16	
		Pressure	997		998		999	999	998	998			998	998	998	
22/08/2014	Dermot Condon	CH ₄	0.1	Flooded	0.1	Covered	0	0	0.1	0.1	Covered	Covered	0.1	Blocked	62.4	Covered
		CO ₂	0.8		5		0.1	0.1	2.8	2.8			0.7	28.7		
		O ₂	17.2		16.8		19.7	17.6	17.5	17.3			19.1	0.1		
		Temp.	17		17		17	17	17	17			17	17		
		Pressure	1012		1016		1016	1014	1016	1015			1015	1016		
30/09/2014	Aiden Daffy	CH ₄	0.1	Flooded	0.1	Covered	<0.1	0.1	0.1	0.1	Covered	Covered	Blocked	Blocked	68.3	Covered
		CO ₂	0.1		4.8		0.1	6.2	1.4	1.8			29.6			
		O ₂	20.8		17.9		20.9	5.8	20	19.3			<0.1			
		Temp.	17		17		17	17	17	17			17			
		Pressure	1014		1014		1014	1014	1014	1014			1014			
22/10/2014	Aiden Daffy	CH ₄	<0.1	Flooded	<0.1	Covered	<0.1	<0.1	<0.1	<0.1	Covered	Covered	Blocked	Blocked	55.8	Covered
		CO ₂	0.1		5.5		0.2	3.1	1	0.6			27.9			
		O ₂	21		17.5		20.5	15.8	20.2	20.8			0.1			
		Temp.	11		11		11	11	11	11			11			
		Pressure	1022		1022		1022	1022	1022	1022			1022			
26/11/2014	Aiden Daffy	CH ₄	<0.1	Flooded	<0.1	Covered	<0.1	<0.1	<0.1	<0.1	Covered	Covered	Blocked	Blocked	76	Covered
		CO ₂	0.2		4.3		<0.1	2.4	1.6	0.6			25.4			
		O ₂	18.6		16.4		21.3	17	18.6	20.1			<0.1			
		Temp.	8		8		9	8	8	8			8			
		Pressure	1008		1008		1008	1008	1008	1008			1008			
19/12/2014	Aiden Daffy	CH ₄	0.2	Flooded	0.2	Covered	0.2	0.2	0.2	0.2	Covered	Covered	Blocked	Flooded	81.3	Covered
		CO ₂	0.5		3.9		0.1	2.8	1.8	0.7			12.5			
		O ₂	12.1		15.2		21.4	17.5	20.8	20.7			0.1			
		Temp.	7.8		8		7.5	8	7.9	8.2			7.7			
		Pressure	1013		1013		1013	1013	1013	1013			1013			

Appendix C:

**First quarterly report covering groundwater, surfacewater
and leachate monitoring at Longpavement Landfill**

(Monitoring Period January-March 2014)

Analysing
Testing
Consulting
Calibrating

TEST REPORT 112322-112324

Client:
Limerick City Council
City Hall
Limerick

BHP Ref No.: 14/02/682-711
Order No.:
Date Received: 26th February 2014
Date Completed: 7th March 2014
Test Specification: Nil



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E Mail bhpcm2@bhp.ie

Item: Longpavement Landfill Site

Quarterly Report covering groundwater, surfacewater and leachate monitoring at Longpavement Landfill (Monitoring Period January-March 2014)

Limerick City Council
City Hall
Limerick City

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q1, 2014

For and on behalf of BHP Ltd.

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

Paul O'Sullivan

Date Issued: 11th March 2014

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

Table of Contents

1.0	Introduction	3
2.0	Sampling / Analysis	3
3.0	Results	6
	3.1 Ground waters	7
	3.2 Surface waters	18
	3.3 Leachate	26
4.0	Discussion/Interpretation	30

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 1st February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the first quarterly monitoring event of 2014 (January-March 2014). Details on the unavailability of sampling points may be found below.

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.

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, 22nd Edition, 2012, published by the American public health association.

Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 nd Edition
pH	4500-H ⁺ B
Temperature	2550B
Conductivity	2510B
COD	5220D
Colour	2120B
Turbidity	2130B
Total Suspended Solids	2540D
Alkalinity	2320B
Ammonia	4500-NH ₃ -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 ₂	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
2014**

TEST REPORT 112322.1

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/682
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

Analysing
Testing
Consulting
Calibrating



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

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01 Shallow	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Grey	Visual
Water Level		m	2.37	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	4.2	APHA-4500-NH3-D
Chloride Cl		mg/l	520.443	APHA-4110-D
Dissolved Oxygen		mg/l	48.8	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	4.21	APHA-2510-B
pH		-	7.05	APHA-4500-H+
Temperature		°C	8.5	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 : 10/03/14

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 112322.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/02/683
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

FTAO: Ursula Ahern

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

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 01 Deep	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Grey	Visual
Water Level		m	1	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	30.5	APHA-4500-NH3-D
Chloride Cl		mg/l	215.62	APHA-4110-D
Dissolved Oxygen		mg/l	9.3	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	2370	APHA-2510-B
pH		-	6.95	APHA-4500-H+
Temperature		°C	10.3	APHA-2550-B
Total Organic Carbon		mg/l	18.2	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 : 10/03/14

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 112322.3

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/684
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

Analysing
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Calibrating



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E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02 Shallow	-	None	APHA-2150-B
Visual Inspection		-	Brown/ Turbid	Visual
Water Level		m	0.98	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	8.5	APHA-4500-NH3-D
Chloride Cl		mg/l	101.758	APHA-4110-D
Dissolved Oxygen		mg/l	16.1	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	2320	APHA-2510-B
pH		-	7.61	APHA-4500-H+
Temperature		°C	9	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 : 10/03/14

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 112322.4

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/02/685
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

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

FTAO: Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 02 Deep	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Orange	Visual
Water Level		m	1.48	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	8.2	APHA-4500-NH3-D
Chloride Cl		mg/l	64.53	APHA-4110-D
Dissolved Oxygen		mg/l	41.8	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	1102	APHA-2510-B
pH		-	7.15	APHA-4500-H+
Temperature		°C	9.2	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 : 10/03/14

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 112322.5

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/02/686
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

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

FTAO: Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03 Shallow	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Orange	Visual
Water Level		m	1.2	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	2	APHA-4500-NH3-D
Chloride Cl		mg/l	19.927	APHA-4110-D
Dissolved Oxygen		mg/l	37.1	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	777	APHA-2510-B
pH		-	6.85	APHA-4500-H+
Temperature		°C	9	APHA-2550-B
Total Organic Carbon		mg/l	19.1	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 : 10/03/14

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 112322.6

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/02/687
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

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

FTAO: Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 03 Deep	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Orange	Visual
Water Level		m	1.2	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	3.2	APHA-4500-NH3-D
Chloride Cl		mg/l	20.974	APHA-4110-D
Dissolved Oxygen		mg/l	34.5	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	861	APHA-2510-B
pH		-	6.67	APHA-4500-H+
Temperature		°C	9	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 : 10/03/14

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 112322.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/688
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

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Test	Client Reference	Units	Results	Standard Reference
Odour	GW 05 Shallow	-	To Shallow to Sample	APHA-2150-B
Visual Inspection		-		Visual
Water Level		m		ISO 5667 - 11
Ammonical Nitrogen NH ₃ -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 ⁻¹		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 : 10/03/14

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 112322.8

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/689
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

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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	2.6	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	11.9	APHA-4500-NH3-D
Chloride Cl		mg/l	408.01	APHA-4110-D
Dissolved Oxygen		mg/l	9.3	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	2710	APHA-2510-B
pH		-	6.44	APHA-4500-H+
Temperature		°C	10.2	APHA-2550-B
Total Organic Carbon		mg/l	18.8	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 : 10/03/14

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 112322.9Analysing
Testing
Consulting
CalibratingClient: **Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick**BHP Ref. No.: 14/02/690
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014BHP
New Road
Thomondgate
Limerick
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

FTAO: Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04 Shallow	-	None	APHA-2150-B
Visual Inspection		-	Turbid/Grey	Visual
Water Level		m	0.98	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	3.3	APHA-4500-NH3-D
Chloride Cl		mg/l	32.47	APHA-4110-D
Dissolved Oxygen		mg/l	61.9	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	2250	APHA-2510-B
pH		-	7.64	APHA-4500-H+
Temperature		°C	7.8	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 : 10/03/14

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 112322.10

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/691
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Ground Water 2014

Analysing
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Calibrating



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E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	GW 04	-	None	APHA-2150-B
Visual Inspection	Deep	-	Turbid/Orange	Visual
Water Level		m	1.94	ISO 5667 - 11
Ammonical Nitrogen NH ₃ -N		mg/l	1	APHA-4500-NH3-D
Chloride Cl		mg/l	97.922	APHA-4110-D
Dissolved Oxygen		mg/l	30.6	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	3870	APHA-2510-B
pH		-	7.01	APHA-4500-H+
Temperature		°C	9.7	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 : 10/03/14

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
2014**

TEST REPORT 112323.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/02/692
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

FTAO: Ursula Ahern

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New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 01	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.22	APHA-4500-NH3-D
BOD		mg/l	3.5	APHA-5210-B
COD		mg/l	31	APHA-5220-D
Chloride Cl		mg/l	32.964	APHA-4110-D
Dissolved Oxygen		mg/l	99.3	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	469	APHA-2510-B
pH		-	8.04	APHA-4500-H+
Total Suspended Solids		mg/l	<1	APHA-2540-D
Temperature		°C	8.4	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 : 10/03/14

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 112323.2Analysing
Testing
Consulting
CalibratingBHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ieClient: **Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick**BHP Ref. No.: 14/02/693
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

FTAO: Ursula Ahern

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 02	-	None	APHA-2150-B
Visual Inspection		-	Clear	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.98	APHA-4500-NH3-D
BOD		mg/l	2.4	APHA-5210-B
COD		mg/l	10	APHA-5220-D
Chloride Cl		mg/l	27.158	APHA-4110-D
Dissolved Oxygen		mg/l	102.9	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	547	APHA-2510-B
pH		-	7.96	APHA-4500-H+
Total Suspended Solids		mg/l	3.5	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 : 10/03/14

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 112323.3

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/694
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

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

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 03	-	None	APHA-2150-B
Visual Inspection		-	Clear/ Slightly Turbid	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.3	APHA-4500-NH3-D
BOD		mg/l	2	APHA-5210-B
COD		mg/l	24	APHA-5220-D
Chloride Cl		mg/l	21.659	APHA-4110-D
Dissolved Oxygen		mg/l	102.2	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	391	APHA-2510-B
pH		-	8.04	APHA-4500-H+
Total Suspended Solids		mg/l	1	APHA-2540-D
Temperature		°C	6.7	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 : 10/03/14

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 112323.4

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/695
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

Analysing
Testing
Consulting
Calibrating



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

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 04	-	None	APHA-2150-B
Visual Inspection		-	Clear/Slightly Turbid	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.23	APHA-4500-NH3-D
BOD		mg/l	2.8	APHA-5210-B
COD		mg/l	25	APHA-5220-D
Chloride Cl		mg/l	23.592	APHA-4110-D
Dissolved Oxygen		mg/l	94.5	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	338	APHA-2510-B
pH		-	7.92	APHA-4500-H+
Total Suspended Solids		mg/l	3.5	APHA-2540-D
Temperature	°C	7.4	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 : 10/03/14

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 112323.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/02/696
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

FTAO: Ursula Ahern

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New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 05	-	None	APHA-2150-B
Visual Inspection		-	Clear/Slightly Turbid	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.47	APHA-4500-NH3-D
BOD		mg/l	2.4	APHA-5210-B
COD		mg/l	21	APHA-5220-D
Chloride Cl		mg/l	23.709	APHA-4110-D
Dissolved Oxygen		mg/l	93.8	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	368	APHA-2510-B
pH		-	7.52	APHA-4500-H+
Total Suspended Solids		mg/l	<1	APHA-2540-D
Temperature		°C	6.7	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 : 10/03/14

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 112323.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/02/697
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

FTAO: Ursula Ahern

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

Test	Client Reference	Units	Results	Standard Reference
Odour	SW 06	-	None	APHA-2150-B
Visual Inspection		-	Clear/Slightly Turbid	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.19	APHA-4500-NH3-D
BOD		mg/l	2.5	APHA-5210-B
COD		mg/l	22	APHA-5220-D
Chloride Cl		mg/l	23.143	APHA-4110-D
Dissolved Oxygen		mg/l	94.7	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	382	APHA-2510-B
pH		-	7.76	APHA-4500-H+
Total Suspended Solids		mg/l	1.5	APHA-2540-D
Temperature	°C	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 : 10/03/14

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 112323.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Ursula Ahern

BHP Ref. No.: 14/02/698
Order No.:
Date Received: 26/02/14
Date Completed: 07/03/14
Test Specification: Nil
Item: Q1 Surface Water 2014

Analysing
Testing
Consulting
Calibrating



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Test	Client Reference	Units	Results	Standard Reference
Odour	SW 07	-	None	APHA-2150-B
Visual Inspection		-	Clear/Slightly Turbid	Visual
Ammonical Nitrogen NH ₃ -N		mg/l	0.24	APHA-4500-NH3-D
BOD		mg/l	1.5	APHA-5210-B
COD		mg/l	18	APHA-5220-D
Chloride Cl		mg/l	34.424	APHA-4110-D
Dissolved Oxygen		mg/l	87.4	APHA-4500-O-G
Electrical Conductivity		uScm ⁻¹	696	APHA-2510-B
pH		-	7.32	APHA-4500-H+
Total Suspended Solids		mg/l	10.5	APHA-2540-D
Temperature		°C	8.1	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 : 10/03/14

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
2014**

TEST REPORT 112324

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/02/699-711
Order No.:
Date Received: 26/02/14
Date Completed: 03/03/14
Test Specification: Nil
Item: Q1 Leachate 2014

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Test	Client Reference	Units	Results	Standard Reference
Odour	L 01	-	No Odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	14.0	APHA-2550-B
Odour	L 02	-	No Odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	13.8	APHA-2550-B
Odour	L 03	-	No Odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	12.1	APHA-2550-B
Odour	L 04	-	No Odour	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	Visual
Temperature		°C	9.2	APHA-2550-B
Odour	L 05	-	No Odour	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	Visual
Temperature		°C	9.5	APHA-2550-B

Additional information :

All methods are from Standard Methods for the Examination of Water and Wastewater 22nd Edition.

For and on behalf of BHP laboratories :

Paul O'Sullivan
Issue Date : 11/03/14

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 112324

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/02/699-711
Order No.:
Date Received: 26/02/14
Date Completed: 03/03/14
Test Specification: Nil
Item: Q1 Leachate 2014

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Test	Client Reference	Units	Results	Standard Reference
Odour	L 06	-	No odour	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	Visual
Temperature		°C	8.2	APHA-2550-B
Odour	L 07	-	No odour	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	Visual
Temperature		°C	8.8	APHA-2550-B
Odour	L 08	-	No odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	11.9	APHA-2550-B
Odour	L 09	-	No odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	13.9	APHA-2550-B
Odour	L 10	-	No odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	14.4	APHA-2550-B

Additional information :

All methods are from Standard Methods for the Examination of Water and Wastewater 22nd Edition.

For and on behalf of BHP laboratories :

Paul O'Sullivan
Issue Date : 11/03/14

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 112324

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/02/699-711
Order No.:
Date Received: 26/02/14
Date Completed: 03/03/14
Test Specification: Nil
Item: Q1 Leachate 2014

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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	L 11	-	No odour	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	Visual
Temperature		°C	14.4	APHA-2550-B
Odour	Tank	-	No odour	APHA-2150-B
Visual Inspection		-	Red, slightly turbid	Visual
Temperature		°C	7.0	APHA-2550-B
Odour	Sump	-	No odour	APHA-2150-B
Visual Inspection		-	No colour, slightly turbid	Visual
Temperature		°C	8.3	APHA-2550-B

Additional information :

All methods are from Standard Methods for the Examination of Water and Wastewater 22nd Edition.

For and on behalf of BHP laboratories :

Paul O'Sullivan
Issue Date : 11/03/14

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	μScm^{-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)	Ammonia
GW-03 (D)	Ammonia
GW-04 (S)	Ammonia, Chloride, Conductivity
GW-04 (D)	Ammonia, Chloride, Conductivity
GW-05 (S)	Too shallow to sample
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	μScm^{-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
SW-02	A2	Ammonia
SW-03	A2	Ammonia
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, 2014. All had typical leachate colour and odour.

Appendix D:

**Second quarterly report covering groundwater,
surfacewater and leachate monitoring at Longpavement**

Landfill (Monitoring Period April-June 2014)

Analysing
Testing
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TEST REPORT 113607-113609

Client:
Limerick City Council
City Hall
Limerick

BHP Ref No.: 14/06/478-491
Order No.:
Date Received: 19th June 2014
Date Completed: 16th July 2014
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-July 2014)

Limerick City Council
City Hall
Limerick City

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q2, 2014

For and on behalf of BHP Ltd.

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

Paul O'Sullivan

Date Issued: 26th November 2014

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

Table of Contents

1.0	Introduction	3
2.0	Sampling / Analysis	3
3.0	Results	6
	3.1 Ground waters	7
	3.2 Surface waters	18
	3.3 Leachate	26
4.0	Discussion/Interpretation	30

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 1st February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the second quarterly monitoring event of 2014 (April-June 2014). Details on the unavailability of sampling points may be found below.

2.0 SAMPLING :

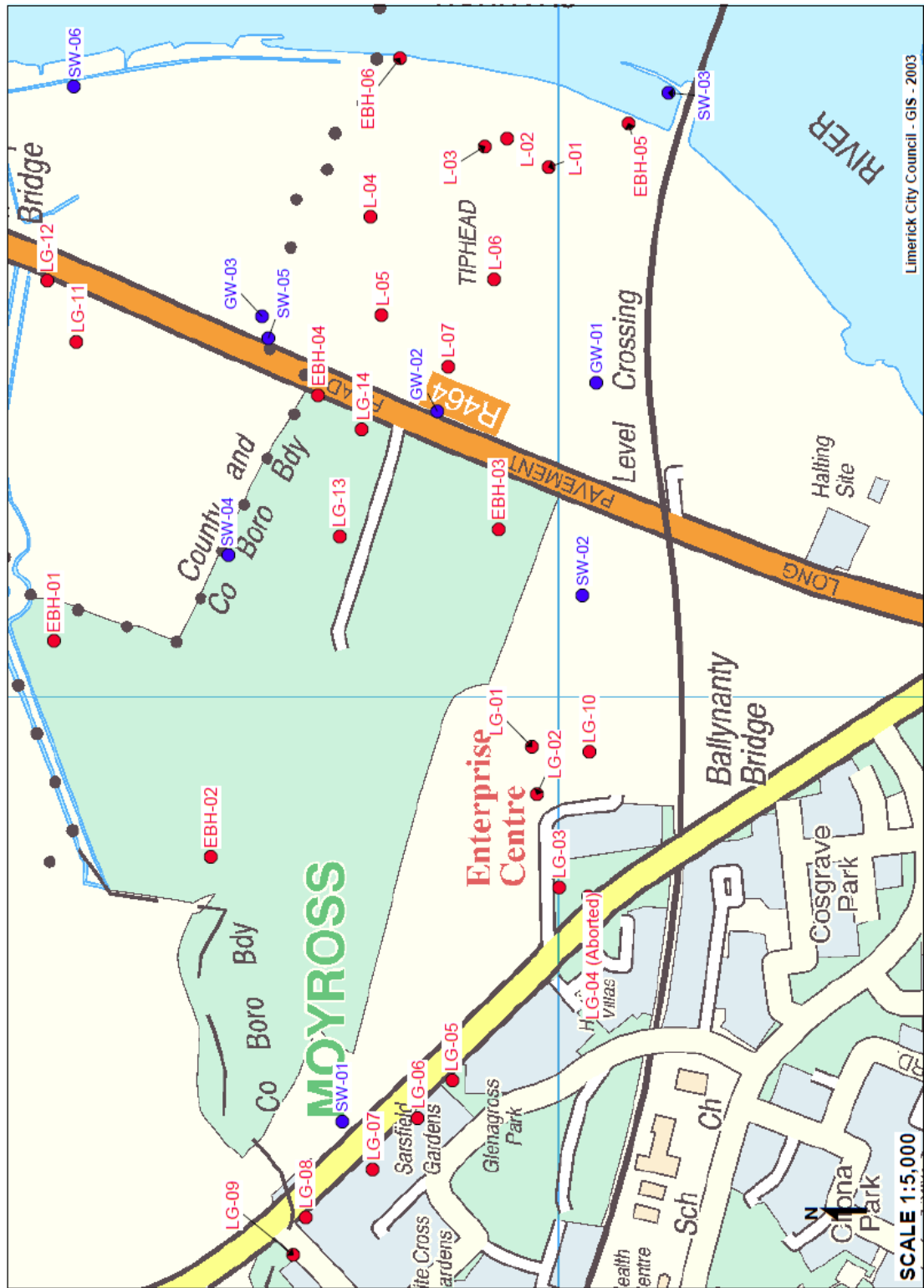
This monitoring is a continuation of an established monitoring program at Longpavement Landfill. As such, the borehole locations are as on previously drafted site maps. A site map is attached below showing the borehole locations. BHP sampled at 5 boreholes. Their individual references are as shown in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

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	2.41
GW-01 (D)	2.12
GW-02 (S)	1.00
GW-02 (D)	1.69
GW-03 (S)	Dry
GW-03 (D)	2.30
GW-04 (S)	Dry
GW-04 (D)	2.91
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. 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, 22nd Edition, 2012, published by the American public health association.

Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 nd Edition
pH	4500-H ⁺ B
Temperature	2550B
Conductivity	2510B
COD	5220D
Colour	2120B
Turbidity	2130B
Total Suspended Solids	2540D
Alkalinity	2320B
Ammonia	4500-NH ₃ -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 ₂	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
2014**

TEST REPORT 113607.1

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/06/478
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 01 Shallow	-	None	19/06/2014	APHA-2150-B
Visual Inspection		-	Brown	19/06/2014	APHA-2110
Water Level		m	2.41	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	132	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	428.86	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	75.6	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	3820	19/06/2014	APHA-2510-B
pH		-	7.11	19/06/2014	APHA-4500-H ⁺
Temperature		°C	13.8	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	19	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/479
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 01 Deep		None	19/06/2014	APHA-2150-B
Visual Inspection		-	Turbid/Grey	19/06/2014	APHA-2110
Water Level		m	2.12	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	55	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	198.45	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	11.5	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	1878	19/06/2014	APHA-2510-B
pH		-	7.07	19/06/2014	APHA-4500-H ⁺
Temperature		°C	12.9	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	19	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

*Sample location Dry

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 16/07/14

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 113607.3Analysing
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Tel +353 61 455399
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E Mail bhpccm2@bhp.ieClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/480
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 02	-	None	19/06/2014	APHA-2150-B
Visual Inspection	Shallow	-	Grey	19/06/2014	APHA-2110
Water Level		m	1	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	28	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	102.46	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	104.5	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	1975	19/06/2014	APHA-2510-B
pH		-	7.47	19/06/2014	APHA-4500-H ⁺
Temperature		°C	14.9	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	9.8	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.4

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/06/481
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 02	-	None	19/06/2014	APHA-2150-B
Visual Inspection	Deep	-	Clear/Stram	19/06/2014	APHA-2110
Water Level		m	1.69	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	34	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	120.57	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	97.6	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	1624	19/06/2014	APHA-2510-B
pH		-	6.92	19/06/2014	APHA-4500-H ⁺
Temperature		°C	13.2	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	20.1	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.5

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: N/A*
Order No.:
Date Received: N/A*
Date Completed: N/A*
Test Specification: Nil
Item: Q2 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 03 Shallow	-	N/A*	N/A*	APHA-2150-B
Visual Inspection		-	N/A*	N/A*	APHA-2110
Water Level		m	N/A*	N/A*	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A*	N/A*	APHA-4500-NH ₃ -D
Chloride		mg/L	N/A*	N/A*	APHA-4110-D
Dissolved Oxygen		%	N/A*	N/A*	APHA-4500-O-G
Electrical Conductivity		µS/cm	N/A*	N/A*	APHA-2510-B
pH		-	N/A*	N/A*	APHA-4500-H ⁺
Temperature		°C	N/A*	N/A*	APHA-2550-B
Total Organic Carbon		mg/L	N/A*	N/A*	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references
*Sample location Dry

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/482
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 03	-	Slight Odour	19/06/2014	APHA-2150-B
Visual Inspection	Deep	-	Orange/Brown	19/06/2014	APHA-2110
Water Level		m	2.3	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	17	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	14.87	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	109.1	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	823	19/06/2014	APHA-2510-B
pH		-	6.71	19/06/2014	APHA-4500-H ⁺
Temperature		°C	14	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	19.4	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: N/A*
Order No.:
Date Received: N/A*
Date Completed: N/A*
Test Specification: Nil
Item: Q2 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 04 Shallow	-	N/A*	N/A*	APHA-2150-B
Visual Inspection		-	N/A*	N/A*	APHA-2110
Water Level		m	N/A*	N/A*	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A*	N/A*	APHA-4500-NH ₃ -D
Chloride		mg/L	N/A*	N/A*	APHA-4110-D
Dissolved Oxygen		%	N/A*	N/A*	APHA-4500-O-G
Electrical Conductivity		µS/cm	N/A*	N/A*	APHA-2510-B
pH		-	N/A*	N/A*	APHA-4500-H ⁺
Temperature		°C	N/A*	N/A*	APHA-2550-B
Total Organic Carbon		mg/L	N/A*	N/A*	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

*Sample location Dry

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.8Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/483
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

FTAO: Tara Flanagan

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Fax + 353 61 455447
E Mail bhpocem2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 04	-	None	19/06/2014	APHA-2150-B
Visual Inspection	Deep	-	Clear	19/06/2014	APHA-2110
Water Level		m	2.91	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.62	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	37.33	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	110.3	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	445	19/06/2014	APHA-2510-B
pH		-	6.76	19/06/2014	APHA-4500-H ⁺
Temperature		°C	14.6	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	10.6	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.9Analysing
Testing
Consulting
CalibratingBHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ieClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A*
Order No.:
Date Received: N/A*
Date Completed: N/A*
Test Specification: Nil
Item: Q2 Ground Water 2014

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 05	-	N/A*	N/A*	APHA-2150-B
Visual Inspection	Shallow	-	N/A*	N/A*	APHA-2110
Water Level		m	N/A*	N/A*	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A*	N/A*	APHA-4500-NH ₃ -D
Chloride		mg/L	N/A*	N/A*	APHA-4110-D
Dissolved Oxygen		%	N/A*	N/A*	APHA-4500-O-G
Electrical Conductivity		µS/cm	N/A*	N/A*	APHA-2510-B
pH		-	N/A*	N/A*	APHA-4500-H ⁺
Temperature		°C	N/A*	N/A*	APHA-2550-B
Total Organic Carbon		mg/L	N/A*	N/A*	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

*Sample location Dry

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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 113607.10

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/06/484
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Ground Water 2014

Analysing
Testing
Consulting
Calibrating



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Limerick
Ireland
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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 05	-	None	19/06/2014	APHA-2150-B
Visual Inspection	Deep	-	Orange/Brown	19/06/2014	APHA-2110
Water Level		m	3.72	19/06/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	40	30/06/2014	APHA-4500-NH ₃ -D
Chloride		mg/L	370.29	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	73.1	19/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	2065	19/06/2014	APHA-2510-B
pH		-	6.33	19/06/2014	APHA-4500-H ⁺
Temperature		°C	14	19/06/2014	APHA-2550-B
Total Organic Carbon		mg/L	19	03/07/2014	APHA-5310-C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 16/07/14

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
2014**

TEST REPORT 113608.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: N/A*
Order No.:
Date Received: N/A*
Date Completed: N/A*
Test Specification: Nil
Item: Q2 Surface Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW 01	-	Dry*	N/A*	APHA-2150-B
Visual Inspection		-	Dry*	N/A*	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	Dry*	N/A*	APHA-4500-NH3-D
B.O.D.		mg/L	Dry*	N/A*	APHA-5210-B
C.O.D.		mg/L	Dry*	N/A*	APHA-5220-D
Chloride		mg/L	Dry*	N/A*	APHA-4110-D
Dissolved Oxygen		%	Dry*	N/A*	APHA-4500-O-G
Electrical Conductivity		µS/cm	Dry*	N/A*	APHA-2510-B
pH		-	Dry*	N/A*	APHA-4500-H+
Total Suspended Solids		mg/L	Dry*	N/A*	APHA-2540-D
Temperature		°C	Dry*	N/A*	APHA-2550-B

Additional information :

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

*Unable to sample, location dry

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 15/07/14

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 113608.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/06/485
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Surface Water 2014BHP
New Road
Thomondgate
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Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW02	-	Slight Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Clear/Yellow	19/06/2014	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.26	30/06/2014	APHA-4500-NH3-D
B.O.D.		mg/L	4.2	20/06/2014	APHA-5210-B
C.O.D.		mg/L	22	24/06/2014	APHA-5220-D
Chloride		mg/L	21.62	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	103.8	20/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	319	19/06/2014	APHA-2510-B
pH		-	10.06	19/06/2014	APHA-4500-H+
Total Suspended Solids		mg/L	18.0	26/06/2014	APHA-2540-D
Temperature		°C	24.9	19/06/2014	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 :John O' Halloran
Issue Date : 15/07/14

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 113608.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/486
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Surface Water 2014

FTAO: Tara Flanagan

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New Road
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Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW03	-	None	19/06/2014	APHA-2150-B
Visual Inspection		-	Clear	19/06/2014	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.29	30/06/2014	APHA-4500-NH3-D
B.O.D.		mg/L	2.4	20/06/2014	APHA-5210-B
C.O.D.		mg/L	23	24/06/2014	APHA-5220-D
Chloride		mg/L	18.83	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	109.2	20/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	381	19/06/2014	APHA-2510-B
pH		-	8.32	19/06/2014	APHA-4500-H+
Total Suspended Solids		mg/L	20.8	26/06/2014	APHA-2540-D
Temperature		°C	18.5	19/06/2014	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 :John O' Halloran
Issue Date : 15/07/14

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 113608.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/487
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Surface Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW04	-	None	19/06/2014	APHA-2150-B
Visual Inspection		-	Turbid/Yellow	19/06/2014	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	14.00	30/06/2014	APHA-4500-NH3-D
B.O.D.		mg/L	4.0	20/06/2014	APHA-5210-B
C.O.D.		mg/L	32	24/06/2014	APHA-5220-D
Chloride		mg/L	40.76	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	73.0	20/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	654	19/06/2014	APHA-2510-B
pH		-	7.23	19/06/2014	APHA-4500-H+
Total Suspended Solids		mg/L	16.7	26/06/2014	APHA-2540-D
Temperature		°C	18.9	19/06/2014	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 :John O' Halloran
Issue Date : 15/07/14

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 113608.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/488
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Surface Water 2014

FTAO: Tara Flanagan

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Limerick
Ireland
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Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW05	-	None	19/06/2014	APHA-2150-B
Visual Inspection		-	Slight Colour	19/06/2014	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.25	30/06/2014	APHA-4500-NH3-D
B.O.D.		mg/L	2.1	20/06/2014	APHA-5210-B
C.O.D.		mg/L	18	24/06/2014	APHA-5220-D
Chloride		mg/L	17.38	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	102.7	20/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	644	19/06/2014	APHA-2510-B
pH		-	7.21	19/06/2014	APHA-4500-H+
Total Suspended Solids		mg/L	4.4	26/06/2014	APHA-2540-D
Temperature		°C	18.2	19/06/2014	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 :John O' Halloran
Issue Date : 15/07/14

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 113608.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/06/489
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Surface Water 2014BHP
New Road
Thomondgate
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW06	-	None	19/06/2014	APHA-2150-B
Visual Inspection		-	Clear	19/06/2014	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	14.00	30/06/2014	APHA-4500-NH3-D
B.O.D.		mg/L	1.7	20/06/2014	APHA-5210-B
C.O.D.		mg/L	26	24/06/2014	APHA-5220-D
Chloride		mg/L	37.92	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	74.1	20/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	374	19/06/2014	APHA-2510-B
pH		-	8.40	19/06/2014	APHA-4500-H+
Total Suspended Solids		mg/L	10.8	26/06/2014	APHA-2540-D
Temperature		°C	19.1	19/06/2014	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 :John O' Halloran
Issue Date : 15/07/14

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 113608.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/06/490
Order No.:
Date Received: 19/06/14
Date Completed: 10/07/14
Test Specification: Nil
Item: Q2 Surface Water 2014

Analysing
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Consulting
Calibrating



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Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	SW07	-	None	19/06/2014	APHA-2150-B
Visual Inspection		-	Clear	19/06/2014	APHA-2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.30	30/06/2014	APHA-4500-NH3-D
B.O.D.		mg/L	2.0	20/06/2014	APHA-5210-B
C.O.D.		mg/L	26	24/06/2014	APHA-5220-D
Chloride		mg/L	20.08	10/07/2014	APHA-4110-D
Dissolved Oxygen		%	94.3	20/06/2014	APHA-4500-O-G
Electrical Conductivity		µS/cm	480	19/06/2014	APHA-2510-B
pH		-	7.41	19/06/2014	APHA-4500-H+
Total Suspended Solids		mg/L	18.4	26/06/2014	APHA-2540-D
Temperature		°C	16.0	19/06/2014	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 :

John O' Halloran
Issue Date : 15/07/14

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
2014**

TEST REPORT 113609

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/06/491
Order No.:
Date Received: 19/06/14
Date Completed: 19/06/14
Test Specification: Nil
Item: Q2 Leachate 2014

FTAO: Tara Flanagan

Analysing
Testing
Consulting
Calibrating



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E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	L 01	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	21.6	19/06/2014	APHA-2550-B
Odour	L 02	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Grey, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	19.8	19/06/2014	APHA-2550-B
Odour	L 03	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	21.6	19/06/2014	APHA-2550-B
Odour	L 04	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Brown, slightly turbid	19/06/2014	APHA-2110
Temperature		°C	13.2	19/06/2014	APHA-2550-B
Odour	L 05	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Brown, slightly turbid	19/06/2014	APHA-2110
Temperature		°C	15.3	19/06/2014	APHA-2550-B

Additional information : All methods are from Standard Methods for the Examination of Water and Wastewater 22nd Edition.

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 08/07/14

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 113609Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/06/491
Order No.:
Date Received: 19/06/14
Date Completed: 19/06/14
Test Specification: Nil
Item: Q2 Leachate 2014

FTAO: Tara Flanagan

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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	L 06	-	Slight Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Brown, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	13.3	19/06/2014	APHA-2550-B
Odour	L 07	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Grey, slightly turbid	19/06/2014	APHA-2110
Temperature		°C	13.1	19/06/2014	APHA-2550-B
Odour	L 08	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Black, very turbid	19/06/2014	APHA-2110
Temperature		°C	17.0	19/06/2014	APHA-2550-B
Odour	L 09	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Black, very turbid	19/06/2014	APHA-2110
Temperature		°C	21.3	19/06/2014	APHA-2550-B
Odour	L 10	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Grey, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	21.0	19/06/2014	APHA-2550-B

Additional information :

All methods are from Standard Methods for the Examination of Water and Wastewater 22nd Edition.

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 08/07/14

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 113609

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/06/491
Order No.:
Date Received: 19/06/14
Date Completed: 19/06/14
Test Specification: Nil
Item: Q2 Leachate 2014

FTAO: Tara Flanagan

Analysing
Testing
Consulting
Calibrating



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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference
Odour	L 11	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Black, very turbid	19/06/2014	APHA-2110
Temperature		°C	19.8	19/06/2014	APHA-2550-B
Odour	Sump	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	14.3	19/06/2014	APHA-2550-B
Odour	Tank	-	Strong Leachate Odour	19/06/2014	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	19/06/2014	APHA-2110
Temperature		°C	19.9	19/06/2014	APHA-2550-B

Additional information :

All methods are from Standard Methods for the Examination of Water and Wastewater 22nd Edition.

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 08/07/14

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	μScm^{-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
GW-04 (S)	Dry
GW-04 (D)	Ammonia, Chloride
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	μScm^{-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	Dry	-
SW-02	A3	pH
SW-03	A2	Ammonia
SW-04	A3	Ammonia
SW-05	A2	Ammonia
SW-06	A3	Ammonia
SW-07	A2	Ammonia

5.3 Leachate

13 leachate samples were available for quarter 2, 2014. All had typical leachate colour and odour.

Appendix E:

**Third quarterly report covering groundwater, surfacewater
and leachate monitoring at Longpavement Landfill**

(Monitoring Period July-September 2014)

Analysing
Testing
Consulting
Calibrating

TEST REPORT 114550-114552

Client:
Limerick City Council
City Hall
Limerick

BHP Ref No.: 14/09/219-245
Order No.:
Date Received: 9th September 2014
Date Completed: 30th September 2014
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 2014)

Limerick City Council
City Hall
Limerick City

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q3, 2014

For and on behalf of BHP Ltd.

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

Paul O'Sullivan

Date Issued: 27th November 2014

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

Table of Contents

1.0	Introduction	3
2.0	Sampling / Analysis	3
3.0	Results	6
	3.1 Ground waters	7
	3.2 Surface waters	18
	3.3 Leachate	26
4.0	Discussion/Interpretation	30

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 1st February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the third quarterly monitoring event of 2014 (July-September 2014). Details on the unavailability of sampling points may be found below.

2.0 SAMPLING :

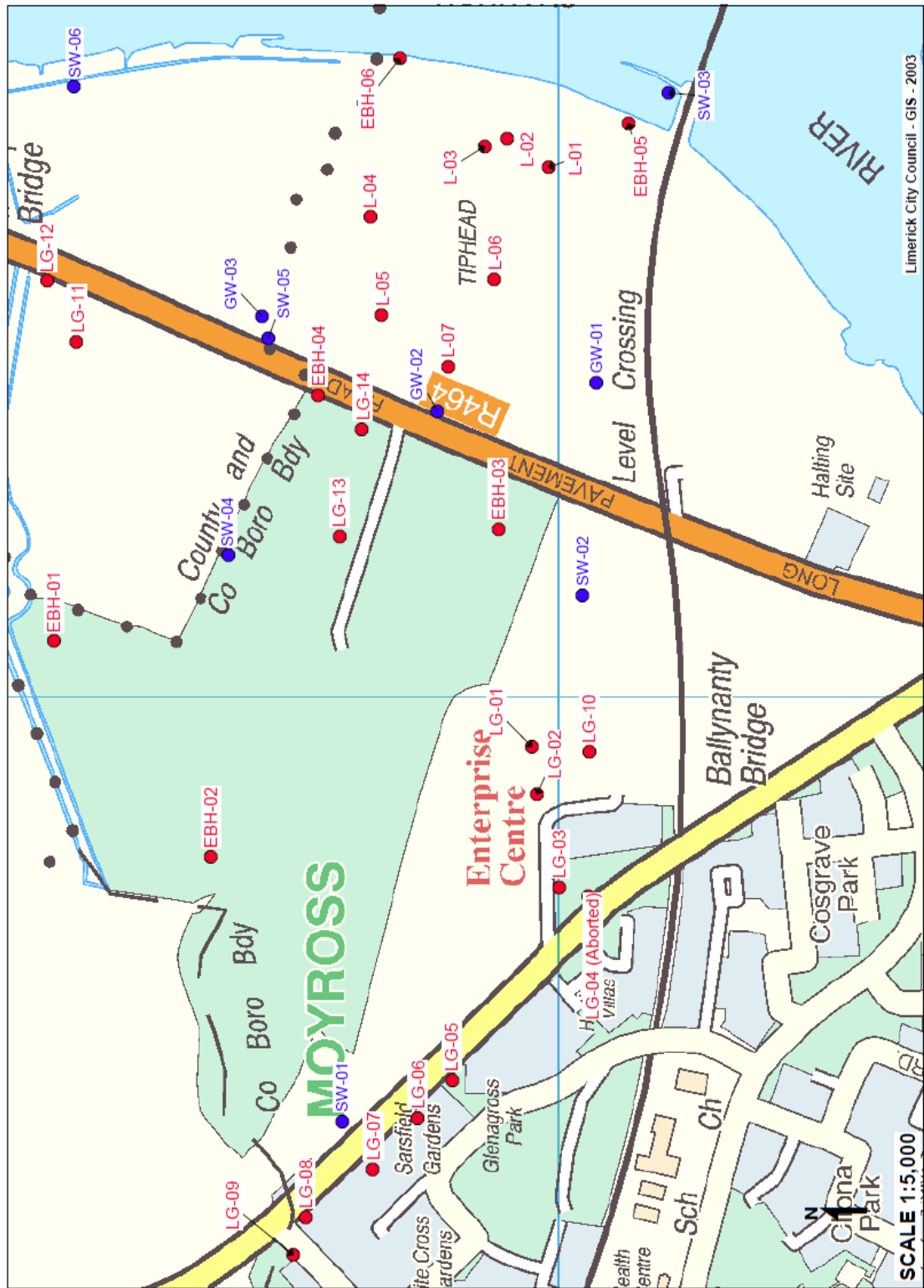
This monitoring is a continuation of an established monitoring program at Longpavement Landfill. As such, the borehole locations are as on previously drafted site maps. A site map is attached below showing the borehole locations. BHP sampled at 5 boreholes. Their individual references are as shown in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

Borehole Reference	Static Water Level
	(m)
GW-01 (S)	2.41
GW-01 (D)	2.12
GW-02 (S)	1.00
GW-02 (D)	1.69
GW-03 (S)	Dry
GW-03 (D)	2.30
GW-04 (S)	Dry
GW-04 (D)	2.91
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. 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, 22nd Edition, 2012, published by the American public health association.

Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 nd Edition
pH	4500-H ⁺ B
Temperature	2550B
Conductivity	2510B
COD	5220D
Colour	2120B
Turbidity	2130B
Total Suspended Solids	2540D
Alkalinity	2320B
Ammonia	4500-NH ₃ -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 ₂	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
2014**

TEST REPORT 114551.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/09/225
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 01 Shallow	-	Strong Odour	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Grey/Turbid	09/09/2014	APHA - 2110
Water Level		m	2.4	09/09/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	5.8	19/09/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	568.4	19/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	29.1	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	8810	09/09/2014	APHA - 2510 - B
pH		-	6.85	09/09/2014	APHA - 4500 - H ⁺
Temperature		°C	-	-	APHA - 2550 - B
Total Organic Carbon		mg/L	1.0	17/09/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.2

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/226
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

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Calibrating



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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 01 Deep		N/A**	N/A**	APHA - 2150 - B
Visual Inspection		-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/09/227
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 02	-	Slight Odour	09/09/2014	APHA - 2150 - B
Visual Inspection	Shallow	-	Grey/Turbid	09/09/2014	APHA - 2110
Water Level		m	1.07	09/09/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.07	19/09/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	147.1	19/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	36.5	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	4900	09/09/2014	APHA - 2510 - B
pH		-	7.38	09/09/2014	APHA - 4500 - H ⁺
Temperature		°C	17.2	09/09/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	1.5	17/09/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/09/228
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 02	-	Slight Odour	09/09/2014	APHA - 2150 - B
Visual Inspection	Deep	-	Grey	09/09/2014	APHA - 2110
Water Level		m	1.9	09/09/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	11.1	19/09/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	127.1	19/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	28.1	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	3190	09/09/2014	APHA - 2510 - B
pH		-	6.98	09/09/2014	APHA - 4500 - H ⁺
Temperature		°C	14.1	09/09/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	16.5	17/09/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.5

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/229
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 03	-	N/A**	N/A**	APHA - 2150 - B
Visual Inspection	Shallow	-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.6

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/230
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 03	-	Slight Odour	09/09/2014	APHA - 2150 - B
Visual Inspection	Deep	-	Light Brown	09/09/2014	APHA - 2110
Water Level		m	2.5	09/09/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	1.8	19/09/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	14.8	19/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	29.3	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	1656	09/09/2014	APHA - 2510 - B
pH		-	6.76	09/09/2014	APHA - 4500 - H ⁺
Temperature		°C	13.0	09/09/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	8.0	17/09/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/231
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 04	-	N/A**	N/A**	APHA - 2150 - B
Visual Inspection	Shallow	-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.8

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/232
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 04 Deep	-	Slight Odour	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Orange	09/09/2014	APHA - 2110
Water Level		m	2.94	09/09/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	1.6	19/09/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	224.5	19/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	38.7	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	2540	09/09/2014	APHA - 2510 - B
pH		-	6.71	09/09/2014	APHA - 4500 - H ⁺
Temperature		°C	17.5	09/09/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	10.5	17/09/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114551.9Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/09/233
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 05	-	N/A**	N/A**	APHA - 2150 - B
Visual Inspection	Shallow	-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 30/09/14

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 114551.10

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/234
Order No.:
Date Received: 09/09/14
Date Completed: 19/09/14
Test Specification: Nil
Item: Q3 Ground Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 05	-	Strong Odour	09/09/2014	APHA - 2150 - B
Visual Inspection	Deep	-	Grey	09/09/2014	APHA - 2110
Water Level		m	3.9	09/09/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	2.9	19/09/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	420.3	19/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	20.8	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	4300	09/09/2014	APHA - 2510 - B
pH		-	6.39	09/09/2014	APHA - 4500 - H ⁺
Temperature		°C	17.4	09/09/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	10.0	17/09/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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
2014**

TEST REPORT 114550.1

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/219
Order No.:
Date Received: 09/09/14
Date Completed: 30/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 01	-	No Odour	30/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	30/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.11	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	1.12	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	82	24/09/2014	APHA - 5220 - D
Chloride		mg/L	21.4	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	98.9	30/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	456	30/09/2014	APHA - 2510 - B
pH		-	7.53	30/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	24.4	24/09/2014	APHA - 2540 - D
Temperature		°C	-	-	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114550.2

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/220
Order No.:
Date Received: 09/09/14
Date Completed: 24/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW02	-	No Odour	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	09/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.19	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	5	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	41	24/09/2014	APHA - 5220 - D
Chloride		mg/L	21.4	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	45.6	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	862	09/09/2014	APHA - 2510 - B
pH		-	7.22	09/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	69.6	24/09/2014	APHA - 2540 - D
Temperature		°C	14.8	09/09/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114550.3

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/264
Order No.:
Date Received: 10/09/14
Date Completed: 30/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW03	-	No Odour	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	09/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.09	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	0.24	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	28	24/09/2014	APHA - 5220 - D
Chloride		mg/L	18.5	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	88.5	30/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	389	30/09/2014	APHA - 2510 - B
pH		-	8.22	30/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	15.9	10/09/2014	APHA - 2540 - D
Temperature		°C	6.8	24/09/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114550.4

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/221
Order No.:
Date Received: 09/09/14
Date Completed: 24/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW04	-	None	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	09/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.29	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	2.28	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	41	24/09/2014	APHA - 5220 - D
Chloride		mg/L	18.8	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	83.5	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	694	09/09/2014	APHA - 2510 - B
pH		-	7.83	09/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	35.2	24/09/2014	APHA - 2540 - D
Temperature		°C	15.9	09/09/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114550.5

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/222
Order No.:
Date Received: 09/09/14
Date Completed: 24/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW05	-	None	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	09/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.25	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	1.62	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	28	24/09/2014	APHA - 5220 - D
Chloride		mg/L	18.1	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	91.9	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	688	09/09/2014	APHA - 2510 - B
pH		-	8.19	09/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	3.2	24/09/2014	APHA - 2540 - D
Temperature		°C	15.7	09/09/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114550.6

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/223
Order No.:
Date Received: 09/09/14
Date Completed: 24/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW06	-	None	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	09/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.91	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	0.74	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	21	24/09/2014	APHA - 5220 - D
Chloride		mg/L	25.0	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	56.7	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	853	09/09/2014	APHA - 2510 - B
pH		-	7.64	09/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	1.2	24/09/2014	APHA - 2540 - D
Temperature		°C	18.3	09/09/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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 114550.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/09/224
Order No.:
Date Received: 09/09/14
Date Completed: 24/09/14
Test Specification: Nil
Item: Q3 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW07	-	None	09/09/2014	APHA - 2150 - B
Visual Inspection		-	Clear	09/09/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	2.90	19/09/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	0.28	10/09/2014	APHA - 5210 - B
C.O.D.		mg/L	2.9	24/09/2014	APHA - 5220 - D
Chloride		mg/L	26.3	18/09/2014	APHA - 4110 - D
Dissolved Oxygen		%	39.9	09/09/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	1023	09/09/2014	APHA - 2510 - B
pH		-	7.50	09/09/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	<1	24/09/2014	APHA - 2540 - D
Temperature		°C	16.8	09/09/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 30/09/14

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
2014**

TEST REPORT NO.: 114552Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/09/235-245 & 265-266
Order No.:
Date Received: 09/09/14
Date Completed: 09/09/14
Test Specification: Nil
Item: Q3 Leachate 2014BHP
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FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	L 01	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	19.6	09/09/2014	APHA-2550-B
Odour	L 02	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	21.4	09/09/2014	APHA-2550-B
Odour	L 03	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	19.6	09/09/2014	APHA-2550-B
Odour	L 04	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Clear	09/09/2014	APHA-2110
Temperature		°C	11.8	09/09/2014	APHA-2550-B
Odour	L 05	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Light grey, slightly turbid	09/09/2014	APHA-2110
Temperature		°C	13.1	09/09/2014	APHA-2550-B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 15/09/14

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 NO.: 114552

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/09/235-245 & 265-266
Order No.:
Date Received: 09/09/14
Date Completed: 09/09/14
Test Specification: Nil
Item: Q3 Leachate 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	L 06	-	Leachate Odour	10/09/2014	APHA-2150-B
Visual Inspection		-	Grey, slightly turbid	10/09/2014	APHA-2110
Temperature		°C	12.3	10/09/2014	APHA-2550-B
Odour	L 07	-	Leachate Odour	10/09/2014	APHA-2150-B
Visual Inspection		-	Light grey, slightly turbid	10/09/2014	APHA-2110
Temperature		°C	12.4	10/09/2014	APHA-2550-B
Odour	L 08	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Grey, slightly turbid	09/09/2014	APHA-2110
Temperature		°C	19.2	09/09/2014	APHA-2550-B
Odour	L 09	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	20.1	09/09/2014	APHA-2550-B
Odour	L 10	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Black, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	19.3	09/09/2014	APHA-2550-B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 15/09/14

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 114552

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/09/235-245 & 265-266
Order No.:
Date Received: 09/09/14
Date Completed: 09/09/14
Test Specification: Nil
Item: Q3 Leachate 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	L 11	-	Leachate Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Black, very turbid	09/09/2014	APHA-2110
Temperature		°C	19.0	09/09/2014	APHA-2550-B
Odour	Sump	-	Slight Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	15.4	09/09/2014	APHA-2550-B
Odour	Tank	-	Slight Odour	09/09/2014	APHA-2150-B
Visual Inspection		-	Orange, visibly turbid	09/09/2014	APHA-2110
Temperature		°C	15.5	09/09/2014	APHA-2550-B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 15/09/14

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 ⁻¹	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)	Dry
GW-02 (S)	Ammonia, Chloride, Conductivity
GW-02 (D)	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	μScm^{-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	A3	COD
SW-02	A3	COD
SW-03	A1	-
SW-04	A3	COD
SW-05	A2	Ammonia
SW-06	A2	Ammonia
SW-07	A3	Ammonia

5.3 Leachate

13 leachate samples were available for quarter 3, 2014. All had typical leachate colour and odour.

Appendix F:

**Fourth quarterly report covering groundwater,
surfacewater and leachate monitoring at Longpavement
Landfill (Monitoring Period October- December 2014)**

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**TEST REPORT 115267, 115268 and
115305**



Client:
Limerick City Council
City Hall
Limerick

**BHP Ref No.: 14/11/292-306 and
14/11/408-420**
Order No.:
**Date Received: 13th and 19th November
2014**
Date Completed: 27th November 2014
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 2014)*

Limerick City Council
City Hall
Limerick City

FTAO: Ursula Ahern

Report on Longpavement Landfill for Q4, 2014

For and on behalf of BHP Ltd.

A handwritten signature in black ink, appearing to read 'Graeme Thornton'.

Graeme Thornton
Date Issued: 19th March 2015

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

Table of Contents

1.0	Introduction	3
2.0	Sampling / Analysis	3
3.0	Results	7
4.0	Discussion/Interpretation	7

**Appendix A: Quarter 4 Ground Water Monitoring results for Longpavement
Landfill 2014**

**Appendix B: Quarter 4 Surface Water Monitoring results for Longpavement
Landfill 2014**

**Appendix C: Quarter 4 Leachate Monitoring results for Longpavement
Landfill 2014**

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 1st February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the forth quarterly monitoring event of 2014 (October-December 2014). Details on the unavailability of sampling points may be found below.

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)	Dry
GW-01 (D)	1.93
GW-02 (S)	1.15
GW-02 (D)	1.43
GW-03 (S)	-
GW-03 (D)	-
GW-04 (S)	Dry
GW-04 (D)	-
GW-05 (S)	Dry
GW-05 (D)	-
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, 22nd Edition, 2012, published by the American public health association.

Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 nd Edition
pH	4500-H ⁺ B
Temperature	2550B
Conductivity	2510B
COD	5220D
Colour	2120B
Turbidity	2130B
Total Suspended Solids	2540D
Alkalinity	2320B
Ammonia	4500-NH ₃ -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 ₂	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 :

- 3.1 The ground water results are presented in Appendix A.
- 3.2 The surface water results are presented in Appendix B.
- 3.3 The leachate results are presented in Appendix C.

4.0 DISCUSSION/INTERPRETATION

4.1 Groundwaters

The results of the physical and chemical analysis conducted on the ground waters are presented in Section 4.

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 ⁻¹	1000
Dissolved Oxygen	%	No abnormal change
pH	pH unit	≥6.5 and ≤9.5
Temperature	°C	25
Total Organic Carbon	mg/l	No abnormal change

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)	Dry
GW-01 (D)	Ammonia, Chloride, Conductivity
GW-02 (S)	Ammonia, Chloride, Conductivity
GW-02 (D)	Ammonia, Chloride, Conductivity
GW-03 (S)	None
GW-03 (D)	None
GW-04 (S)	Dry
GW-04 (D)	None
GW-05 (S)	Dry
GW-05 (D)	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.

4.2 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	μScm^{-1}	1000	1000	1000
Ammonium (as NH ₄)	mg/l	0.2	1.5	4.0
Dissolved oxygen saturation rate	%	>60	>50	>30
COD	mg/l	-	-	40
BOD	mg/l	5	5	7
TSS	mg/l	-	-	50
Chloride	mg/l	250	250	250
Temperature	°C	25	25	25

SW Reference	Classification	Elevated parametric values
SW-01	A1	none
SW-02	A1	none
SW-03	A1	none
SW-04	A3	DO
SW-05	A3	Ammonium, DO
SW-06	A1	none
SW-07	A3	Ammonium

4.3 Leachate

13 leachate samples were available for quarter 4, 2014. All had typical leachate colour and odour.

Appendix A
Ground Water Monitoring results for
Longpavement Landfill
Quarter 4
2014

TEST REPORT 115268.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/299
Order No.:
Date Received: 13/11/14
Date Completed: 27/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 01 Deep	-	Yes	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Grey/Turbid	13/11/2014	APHA - 2110
Water Level		m	1.93	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	9.9	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	198.6	27/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	28.3	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	1709	13/11/2014	APHA - 2510 - B
pH		-	6.75	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	11.3	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.6	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 27/02/15

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 115268.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/300
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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Fax + 353 61 455447
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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 01 Shallow	-	N/A**	N/A**	APHA - 2150 - B
Visual Inspection		-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 27/02/15

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 115268.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/301
Order No.:
Date Received: 13/11/14
Date Completed: 27/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 02 Deep	-	No	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Brown	13/11/2014	APHA - 2110
Water Level		m	1.43	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	4.2	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	162.8	27/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	21.5	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	1746	13/11/2014	APHA - 2510 - B
pH		-	6.62	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	11.8	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.4	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 27/02/15

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 115268.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/302
Order No.:
Date Received: 13/11/14
Date Completed: 27/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 02 Shallow	-	Yes	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Straw yellow	13/11/2014	APHA - 2110
Water Level		m	1.15	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.21	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	157	27/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	81.4	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	2145	13/11/2014	APHA - 2510 - B
pH		-	7.60	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	10.1	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.7	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :**John O' Halloran**
Issue Date : 27/02/15

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 115268.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/303
Order No.:
Date Received: 13/11/14
Date Completed: 26/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 03 Deep	-	No	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Brown	13/11/2014	APHA - 2110
Water Level		m	-	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.03	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	16	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	33.4	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	823	13/11/2014	APHA - 2510 - B
pH		-	6.58	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	10.2	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.7	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 27/02/15

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 115268.6

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/304
Order No.:
Date Received: 13/11/14
Date Completed: 26/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

Analysing
Testing
Consulting
Calibrating



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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 03 Shallow	-	No	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Grey	13/11/2014	APHA - 2110
Water Level		m	-	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	<0.01	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	13.8	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	34.5	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	785	13/11/2014	APHA - 2510 - B
pH		-	6.76	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	10.4	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.6	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 27/02/15

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 115268.7Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/305
Order No.:
Date Received: 13/11/14
Date Completed: 26/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 04 Deep	-	No	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Light Brown	13/11/2014	APHA - 2110
Water Level		m	-	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.01	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	28.2	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	42	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	436	13/11/2014	APHA - 2510 - B
pH		-	6.75	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	10.7	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.5	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 27/02/15

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 115268.8Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 04 Shallow	-	N/A**	N/A**	APHA - 2150 - B
Visual Inspection		-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 27/02/15

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 115268.9

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/306
Order No.:
Date Received: 13/11/14
Date Completed: 27/11/14
Test Specification: Nil
Item: Q4 Ground Water 2014

Analysing
Testing
Consulting
Calibrating



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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 05 Deep	-	No	13/11/2014	APHA - 2150 - B
Visual Inspection		-	Brown	13/11/2014	APHA - 2110
Water Level		m	-	13/11/2014	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	<0.01	26/11/2014	APHA - 4500 - NH ₃ - D
Chloride		mg/L	462.9	27/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	30.1	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	1973	13/11/2014	APHA - 2510 - B
pH		-	6.09	13/11/2014	APHA - 4500 - H ⁺
Temperature		°C	11.6	13/11/2014	APHA - 2550 - B
Total Organic Carbon		mg/L	19.7	24/11/2014	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 27/02/15

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 115268.10Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Q4 Ground Water 2014

FTAO: Tara Flanagan

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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	GW 05 Shallow	-	N/A**	N/A**	APHA - 2150 - B
Visual Inspection		-	N/A**	N/A**	APHA - 2110
Water Level		m	N/A**	N/A**	ISO 5667 - 11
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	N/A**	N/A**	APHA - 4500 - NH ₃ - D
Chloride		mg/L	N/A**	N/A**	APHA - 4110 - D
Dissolved Oxygen		%	N/A**	N/A**	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	N/A**	N/A**	APHA - 2510 - B
pH		-	N/A**	N/A**	APHA - 4500 - H ⁺
Temperature		°C	N/A**	N/A**	APHA - 2550 - B
Total Organic Carbon		mg/L	N/A**	N/A**	APHA - 5310 - C

Additional information :

*Documented in-house methods based on stated standard references

**Sample location Dry

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 27/02/15

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

Appendix B
Surface Water Monitoring results for
Longpavement Landfill
Quarter 4
2014

TEST REPORT 115267.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/292

Order No.:

Date Received: 13/11/14

Date Completed: 25/11/14

Test Specification: Nil

Item: Q4 Surface Water 2014

FTAO: Tara Flanagan

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E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 01	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	<0.1	24/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	3.1	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	27	19/11/2014	APHA - 5220 - D
Chloride		mg/L	26.4	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	70.2	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	335	13/11/2014	APHA - 2510 - B
pH		-	7.16	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	3.0	17/11/2014	APHA - 2540 - D
Temperature		°C	9.1	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 06/01/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/293

Order No.:

Date Received: 13/11/14

Date Completed: 25/11/14

Test Specification: Nil

Item: Q4 Surface Water 2014

FTAO: Tara Flanagan

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New Road
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Limerick
Ireland
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E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 02	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	<0.1	24/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	2.2	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	9	19/11/2014	APHA - 5220 - D
Chloride		mg/L	21.3	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	81.7	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	352	13/11/2014	APHA - 2510 - B
pH		-	7.19	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	7.2	17/11/2014	APHA - 2540 - D
Temperature		°C	9.0	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 06/01/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/294
Order No.:
Date Received: 13/11/14
Date Completed: 25/11/14
Test Specification: Nil
Item: Q4 Surface Water 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 03	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	<0.1	24/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	3.0	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	8	19/11/2014	APHA - 5220 - D
Chloride		mg/L	21.1	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	94.1	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	306	13/11/2014	APHA - 2510 - B
pH		-	7.79	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	9.2	17/11/2014	APHA - 2540 - D
Temperature		°C	9.8	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 06/01/14

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TEST REPORT 115267.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/295

Order No.:

Date Received: 13/11/14

Date Completed: 23/12/14

Test Specification: Nil

Item: Q4 Surface Water 2014

FTAO: Tara Flanagan

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

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 04	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	0.6	24/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	3.2	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	19	19/11/2014	APHA - 5220 - D
Chloride		mg/L	23.6	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	36.0	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	322	13/11/2014	APHA - 2510 - B
pH		-	7.07	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	37.5	23/12/2014	APHA - 2540 - D
Temperature		°C	9.4	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 06/01/14

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TEST REPORT 115267.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/296

Order No.:

Date Received: 13/11/14

Date Completed: 23/12/14

Test Specification: Nil

Item: Q4 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 05	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	1.2	24/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	2.3	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	10	19/11/2014	APHA - 5220 - D
Chloride		mg/L	22.2	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	47.6	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	339	13/11/2014	APHA - 2510 - B
pH		-	7.09	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	8.5	23/12/2014	APHA - 2540 - D
Temperature		°C	9.9	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 06/01/14

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TEST REPORT 115267.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/297
Order No.:
Date Received: 13/11/14
Date Completed: 23/12/14
Test Specification: Nil
Item: Q4 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 06	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	<0.1	26/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	1.5	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	8	19/11/2014	APHA - 5220 - D
Chloride		mg/L	18.1	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	91.0	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	281	13/11/2014	APHA - 2510 - B
pH		-	7.80	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	<1	23/12/2014	APHA - 2540 - D
Temperature		°C	9.5	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :John O' Halloran
Issue Date : 06/01/14

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TEST REPORT 115267.7Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/298

Order No.:

Date Received: 13/11/14

Date Completed: 23/12/14

Test Specification: Nil

Item: Q4 Surface Water 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	SW 07	-	No Odour	13/11/2014	APHA - 2110
Visual Inspection		-	Clear	13/11/2014	APHA - 2110
Ammoniacal Nitrogen (as NH ₃ -N)		mg/L	2.1	24/11/2014	APHA - 4500 - NH ₃ - D
B.O.D.		mg/L	2.6	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	20	19/11/2014	APHA - 5220 - D
Chloride		mg/L	18.3	25/11/2014	APHA - 4110 - D
Dissolved Oxygen		%	74.0	13/11/2014	APHA - 4500 - O - G
Electrical Conductivity		µS/cm	467	13/11/2014	APHA - 2510 - B
pH		-	7.10	13/11/2014	APHA - 4500 - H ⁺
Total Suspended Solids		mg/L	4.0	23/12/2014	APHA - 2540 - D
Temperature		°C	9.6	13/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :**John O' Halloran****Issue Date : 06/01/14**

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Appendix C

Leachate Monitoring results for

Longpavement Landfill

**Quarter 4
2014**

TEST REPORT NO.: 115305Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/408-420
Order No.:
Date Received: 19/11/14
Date Completed: 19/11/14
Test Specification: Nil
Item: Q4 Leachate 2014

FTAO: Tara Flanagan

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	L 01	-	Strong Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Black, turbid	19/11/2014	APHA - 2110
Temperature		°C	16.0	19/11/2014	APHA - 2550 - B
Odour	L 02	-	Strong Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Grey, turbid	19/11/2014	APHA - 2110
Temperature		°C	15.1	19/11/2014	APHA - 2550 - B
Odour	L 03	-	Strong Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Black, turbid	19/11/2014	APHA - 2110
Temperature		°C	13.5	19/11/2014	APHA - 2550 - B
Odour	L 04	-	Strong Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Black, turbid	19/11/2014	APHA - 2110
Temperature		°C	10.6	19/11/2014	APHA - 2550 - B
Odour	L 05	-	Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Grey, turbid	19/11/2014	APHA - 2110
Temperature		°C	10.2	19/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :**John O' Halloran****Issue Date : 22/12/14**

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO.: 115305Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/408-420
Order No.:
Date Received: 19/11/14
Date Completed: 19/11/14
Test Specification: Nil
Item: Q4 Leachate 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	L 06	-	Slight Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Brown, turbid	19/11/2014	APHA - 2110
Temperature		°C	10.0	19/11/2014	APHA - 2550 - B
Odour	L 07	-	Slight Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Light brown, turbid	19/11/2014	APHA - 2110
Temperature		°C	10.2	19/11/2014	APHA - 2550 - B
Odour	L 08	-	Strong Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Black, turbid	19/11/2014	APHA - 2110
Temperature		°C	12.7	19/11/2014	APHA - 2550 - B
Odour	L 09	-	Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Yellow, turbid	19/11/2014	APHA - 2110
Temperature		°C	13.4	19/11/2014	APHA - 2550 - B
Odour	L 10	-	Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Yellow, turbid	19/11/2014	APHA - 2110
Temperature		°C	16.3	19/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :**John O' Halloran****Issue Date : 22/12/14**

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TEST REPORT NO.: 115305

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/408-420
Order No.:
Date Received: 19/11/14
Date Completed: 19/11/14
Test Specification: Nil
Item: Q4 Leachate 2014

FTAO: Tara Flanagan

Analysing
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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Odour	L 11	-	Strong Leachate Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Grey, turbid	19/11/2014	APHA - 2110
Temperature		°C	13.7	19/11/2014	APHA - 2550 - B
Odour	Sump	-	No Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Brown, turbid	19/11/2014	APHA - 2110
Temperature		°C	11.5	19/11/2014	APHA - 2550 - B
Odour	Tank	-	No Odour	19/11/2014	APHA - 2150 - B
Visual Inspection		-	Orange, turbid	19/11/2014	APHA - 2110
Temperature		°C	8.8	19/11/2014	APHA - 2550 - B

Additional information :

*Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date : 22/12/14

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Appendix G:

**Annual report covering groundwater, surfacewater and
leachate monitoring at Longpavement Landfill (Monitoring
Period 2014)**

Analysing
Testing
Consulting
Calibrating

TEST REPORT



Client:
Limerick City Council
County Buildings
Dooradoyle
Limerick

**BHP Ref No.: 115267, 115268 and
115305**
Order No.:
Date Received: 13/11/2014
Date Completed: 13/12/2014
Test Specification: Nil

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Item: Longpavement Landfill Site

*Annual Report covering groundwater, surfacewater and leachate monitoring at
Longpavement Landfill (Monitoring Period 2014)*

**Limerick City Council
County Buildings
Dooradoyle
Limerick**

FTAO: Ursula Ahern

Report on Longpavement Landfill for Annual Parameters, 2014

For and on behalf of BHP Ltd.

Graeme Thornton
Date Issued: 18th March 2015

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

Table of Contents

1.0 Introduction

2.0 Sampling / Analysis

3.0 Results

4.0 Discussion

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

**Appendix B: Annual Ground Water Monitoring results for Longpavement
Landfill 2014**

**Appendix C: Annual Surface Water Monitoring results for Longpavement
Landfill 2014**

**Appendix D: Annual Leachate Monitoring results for Longpavement Landfill
2014**

1.0 INTRODUCTION

BHP was 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 has undergone remediation and final capping works. The facility is operated under waste license no. 76-1, which was issued to Limerick City Council on the 1st February 2008 by the EPA.

This report covers surfacewater, groundwater and leachate monitoring at Longpavement for the annual monitoring event of 2014.

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)	Dry
GW-01 (D)	1.93
GW-02 (S)	1.15
GW-02 (D)	1.43
GW-03 (S)	-
GW-03 (D)	-
GW-04 (S)	Dry
GW-04 (D)	-
GW-05 (S)	Dry
GW-05 (D)	-
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, 22nd Edition, 1998, published by the American public health association.

Parameters for Laboratory Analysis

PARAMETER	Standard Method Reference APHA-AWWA-WEF * 22 nd Edition
pH	4500-H ⁺ B
Temperature	2550B
Conductivity	2510B
COD	5220D
Colour	2120B
Turbidity	2130B
Total Suspended Solids	2540D
Alkalinity	2320B
Ammonia	4500-NH ₃ -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 ₂	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

- 3.1 The ground water results are presented in Appendix B.
- 3.2 The surface water results are presented in Appendix C.
- 3.3 The leachate results are presented in Appendix D.

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 appendix B.

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.

Ground water results that exceeded the threshold value range are shown below.

Parameter	Unit	Limit	GW 1 deep	GW 2 deep	GW 2 shallow	GW 3 deep	GW 3 shallow
Boron	µg/l	750	-	-	<2300	-	-
Cadmium	µg/l	3.75	-	-	-	-	-
Total Chromium	µg/l	37.5	-	-	-	-	-
Copper	µg/l	1500	-	-	-	-	-
Lead	µg/l	18.75	-	-	119	34.1	-
Nickel	µg/l	15	-	-	220	23.2	-
Mercury	µg/l	0.75	-	-	0.79	-	-
Sodium	mg/l	150	241	-	336	-	-
Total Cyanide	µg/l	37.5	114	119	119	192	105
Sulphate	mg/l	187.5	-	-	1199.7	-	-
OrthoPhosphate	mg/l	0.035	0.04	-	-	-	-
Nitrate	mg/l	37.5	-	-	-	-	-
Nitrite	mg/l	0.375	-	-	-	-	-

GW2 shallow has a result of 119µg/l for lead. The new dutch list has an intervention limit of 75µg/l for lead. GW2 shallow has a result of 220µg/l for nickel. The new dutch list has an intervention limit of 75µg/l for nickel.

Total cyanide is exceeded in five of the seven results with the highest exceedance in GW3 deep at approximately six times the limit.

The ground water at the site is classified as being at poor chemical status, under the SI 9/2010 regulations.

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 Appendix C.

The limits for the relevant parameters are outlined below. The results are summarized in the below table and the results that have failed the relevant limits are highlighted:

Test	Limits mg/l	Limit ref.	SW01	SW02	SW03	SW04	SW05	SW06	SW07
Boron	1	IGV	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23
Cadmium	0.005	IGV	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Calcium	200	IGV	88.2	89.2	80.7	78.7	83.3	73.8	121
Chromium	0.05	DW	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper	5 or 30	SW EQS	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Iron	-		<0.23	0.787	<0.23	5.7	0.58	<0.23	0.405
Lead	0.01	DW	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Magnesium	50	DW	6.98	6.71	6.49	7.73	8.04	5.83	16.6
Manganese	0.05	DW	0.0477	0.11	0.0472	0.198	0.0598	0.0246	0.154
Nickel	0.02	DW	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0068
Potassium	5	IGV	6.75	3.98	2.39	4.54	4.32	2.1	4.85
Sodium	200	DW	14.9	9.3	9.45	12.3	11.9	8.67	12.1
Zinc	8-100	SW EQS	0.0546	<0.018	<0.018	<0.018	<0.018	<0.018	0.0266
Mercury	0.001	DW	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sulphate (as SO ₄)	200	IGV	59.7	67.4	17.6	17.1	21.5	11.2	86.7
Orthophosphate (as P)	-		0.47	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Nitrate (as NO ₃)	50	DW	5.0	4.5	2.1	9.5	8.1	2.1	1.3
Nitrite (as NO ₂)	0.1	DW	0.15	0.26	0.03	0.21	0.18	0.02	0.07
Total Oxidised Nitrogen (as N)			1.17	1.09	0.49	2.21	1.87	0.48	0.32
Alkalinity (as CaCO ₃)			154	177	187	181	199	184	267

Limit reference

IGV: Towards setting guideline values for the protection of groundwater in Ireland, interim report, EPA.

DW: SI 122, 2014 drinking water regulations.

SW EQS: Schedule 5 of SI 272/2010 European Communities Environmental Objectives (Surfacewater) Regulations 2009.

There are exceedances in both manganese and nitrites within the results. The limit employed is the drinking water regs. This regulation is very conservative and due to no gross exceedance of the limit these results should not be of great concern.

Lead, mercury and nickel results all look good considering exceedances at the site were found in the ground waters. This would indicate no major impact on the surface waters from the poor chemical status ground water at the site.

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, high levels of heavy metals such as lead, nickel and zinc, elevated ammonia, conductivity and chloride levels. BOD levels were above 10mg/l at the following locations, L01, L02, L03, L05, L06, 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 ^{Note 1}	SURFACE WATER ^{Note 2} Monitoring Frequency	GROUNDWATER Monitoring Frequency	LEACHATE ^{Note 3} Monitoring Frequency
Visual Inspection/Odour ^{Note 2}	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 ^{Note 3}	Annually	Annually	Annually
Cyanide (Total)	Not Applicable	Annually	Annually
Fluoride	Not Applicable	Annually	Annually
List I/II Organic Substances ^{Note 4}	Once off ^{Note 5}	Annually ^{Note 5}	Once off ^{Note 5}
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 ^{Note 6}	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 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 B
Annual Ground Water Monitoring results for
Longpavement Landfill
2014

TEST REPORT NO: 115268.1

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/299
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

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	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Deep				
Boron		mg/L	0.465	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	190	03/12/2014	Subcontract
Chromium		mg/L	<0.002	03/12/2014	Subcontract
Copper		mg/L	<0.009	03/12/2014	Subcontract
Iron		mg/L	1.4	03/12/2014	Subcontract
Lead		mg/L	<0.006	03/12/2014	Subcontract
Magnesium		mg/L	49.4	03/12/2014	Subcontract
Manganese		mg/L	0.785	03/12/2014	Subcontract
Nickel		mg/L	0.0069	03/12/2014	Subcontract
Potassium		mg/L	54	03/12/2014	Subcontract
Sodium		mg/L	241	03/12/2014	Subcontract
Zinc		mg/L	<0.018	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	28/11/2014	Subcontract
Fluoride		mg/L	0.12	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	1.7	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.04	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/299
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Deep				
Nitrate (as NO ₃)		mg/L	0.2	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.04	25/11/2014	Calculation
Cyanide		mg/L	0.114	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	1180	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	1967	03/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
Aldrin		ng/L	<4	13/12/2014	Subcontract
alpha-Endosulphan		ng/L	<4	13/12/2014	Subcontract
alpha-HCH		ng/L	<3	13/12/2014	Subcontract
beta-Endosulphan		ng/L	<4	13/12/2014	Subcontract
beta-HCH		ng/L	<3	13/12/2014	Subcontract
alpha-Chlordane		ng/L	<3	13/12/2014	Subcontract
Dichlobenil		ng/L	<2	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/299
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Deep				
Dieldrin		ng/L	<4	13/12/2014	Subcontract
Endrin		ng/L	<4	13/12/2014	Subcontract
gamma-HCH		ng/L	<3	13/12/2014	Subcontract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Subcontract
Hexachlorobenzene		ng/L	<2	13/12/2014	Subcontract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Subcontract
Isodrin		ng/L	<4	13/12/2014	Subcontract
o,p - DDE		ng/L	<2	13/12/2014	Subcontract
p,p - DDE		ng/L	<2	13/12/2014	Subcontract
o,p - TDE		ng/L	<2	13/12/2014	Subcontract
p,p - TDE		ng/L	<2	13/12/2014	Subcontract
o,p - DDT		ng/L	<2	13/12/2014	Subcontract
p,p - DDT		ng/L	<4	13/12/2014	Subcontract
Tecnazene		ng/L	<10	13/12/2014	Subcontract
gamma-Chlordane		ng/L	<4	13/12/2014	Subcontract
Triallate		ng/L	<10	13/12/2014	Subcontract
Trifluralin		ng/L	<30	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/299
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
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Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Deep				
Azinphos-ethyl		ng/L	<4	13/12/2014	Subcontract
Azinphos-methyl		ng/L	<2	13/12/2014	Subcontract
Carbophenothion		ng/L	<3	13/12/2014	Subcontract
Chlorfenvinphos		ng/L	<2	13/12/2014	Subcontract
Chlorpyrifos		ng/L	<2	13/12/2014	Subcontract
Diazinon		ng/L	<3	13/12/2014	Subcontract
Dichlorvos		ng/L	<2	13/12/2014	Subcontract
Dimethoate		ng/L	<20	13/12/2014	Subcontract
Fenitrothion		ng/L	<2	13/12/2014	Subcontract
Fenthion		ng/L	<2	13/12/2014	Subcontract
Malathion		ng/L	<4	13/12/2014	Subcontract
Mevinphos		ng/L	<20	13/12/2014	Subcontract
Parathion-ethyl		ng/L	<3	13/12/2014	Subcontract
Parathion-methyl		ng/L	<3	13/12/2014	Subcontract
Phorate		ng/L	<4	13/12/2014	Subcontract
Phosalone		ng/L	<4	13/12/2014	Subcontract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.1

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

BHP Ref. No.: 14/11/299
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Deep				
Propetamphos		ng/L	<3	13/12/2014	Subcontract
Triazophos		ng/L	<2	13/12/2014	Subcontract
Organo-tin		ng/L	<30	05/12/2014	Subcontract
Tributyl Tin		ng/L	<30	05/12/2014	Subcontract
Triphenyl Tin		ng/L	<30	05/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.2

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/300
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

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Calibrating



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New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Shallow				
Boron		mg/L	N/A**	N/A**	Subcontract
Cadmium		mg/L	N/A**	N/A**	Subcontract
Calcium		mg/L	N/A**	N/A**	Subcontract
Chromium		mg/L	N/A**	N/A**	Subcontract
Copper		mg/L	N/A**	N/A**	Subcontract
Iron		mg/L	N/A**	N/A**	Subcontract
Lead		mg/L	N/A**	N/A**	Subcontract
Magnesium		mg/L	N/A**	N/A**	Subcontract
Manganese		mg/L	N/A**	N/A**	Subcontract
Nickel		mg/L	N/A**	N/A**	Subcontract
Potassium		mg/L	N/A**	N/A**	Subcontract
Sodium		mg/L	N/A**	N/A**	Subcontract
Zinc		mg/L	N/A**	N/A**	Subcontract
Mercury		mg/L	N/A**	N/A**	Subcontract
Fluoride		mg/L	N/A**	N/A**	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	N/A**	N/A**	APHA - 4110 - B
Orthophosphate (as P)		mg/L	N/A**	N/A**	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.2

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/300
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

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Consulting
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New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Shallow				
Nitrate (as NO ₃)		mg/L	N/A**	N/A**	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	N/A**	N/A**	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	N/A**	N/A**	Calculation
Cyanide		mg/L	N/A**	N/A**	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	N/A**	N/A**	APHA - 2320 - B
Residue on Evaporation		mg/L	N/A**	N/A**	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,2,4-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,3,5-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
Aldrin		ng/L	N/A**	N/A**	Subcontract
alpha-Endosulphan		ng/L	N/A**	N/A**	Subcontract
alpha-HCH		ng/L	N/A**	N/A**	Subcontract
beta-Endosulphan		ng/L	N/A**	N/A**	Subcontract
beta-HCH		ng/L	N/A**	N/A**	Subcontract
alpha-Chlordane		ng/L	N/A**	N/A**	Subcontract
Dichlobenil		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/300
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Shallow				
Dieldrin		ng/L	N/A**	N/A**	Subcontract
Endrin		ng/L	N/A**	N/A**	Subcontract
gamma-HCH		ng/L	N/A**	N/A**	Subcontract
Heptachlor Epoxide		ng/L	N/A**	N/A**	Subcontract
Hexachlorobenzene		ng/L	N/A**	N/A**	Subcontract
Hexachlorobutadiene		ng/L	N/A**	N/A**	Subcontract
Isodrin		ng/L	N/A**	N/A**	Subcontract
o,p - DDE		ng/L	N/A**	N/A**	Subcontract
p,p - DDE		ng/L	N/A**	N/A**	Subcontract
o,p - TDE		ng/L	N/A**	N/A**	Subcontract
p,p - TDE		ng/L	N/A**	N/A**	Subcontract
o,p - DDT		ng/L	N/A**	N/A**	Subcontract
p,p - DDT		ng/L	N/A**	N/A**	Subcontract
Tecnazene		ng/L	N/A**	N/A**	Subcontract
gamma-Chlordane		ng/L	N/A**	N/A**	Subcontract
Triallate		ng/L	N/A**	N/A**	Subcontract
Trifluralin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/300
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpccm2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Shallow				
Azinphos-ethyl		ng/L	N/A**	N/A**	Subcontract
Azinphos-methyl		ng/L	N/A**	N/A**	Subcontract
Carbophenothion		ng/L	N/A**	N/A**	Subcontract
Chlorfenvinphos		ng/L	N/A**	N/A**	Subcontract
Chlorpyrifos		ng/L	N/A**	N/A**	Subcontract
Diazinon		ng/L	N/A**	N/A**	Subcontract
Dichlorvos		ng/L	N/A**	N/A**	Subcontract
Dimethoate		ng/L	N/A**	N/A**	Subcontract
Fenitrothion		ng/L	N/A**	N/A**	Subcontract
Fenthion		ng/L	N/A**	N/A**	Subcontract
Malathion		ng/L	N/A**	N/A**	Subcontract
Mevinphos		ng/L	N/A**	N/A**	Subcontract
Parathion-ethyl		ng/L	N/A**	N/A**	Subcontract
Parathion-methyl		ng/L	N/A**	N/A**	Subcontract
Phorate		ng/L	N/A**	N/A**	Subcontract
Phosalone		ng/L	N/A**	N/A**	Subcontract
Pirimiphos-methyl		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.2

Analysing
Testing
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Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/300
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
Thomondgate
Limerick
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 1 Shallow				
Propetamphos		ng/L	N/A**	N/A**	Subcontract
Triazophos		ng/L	N/A**	N/A**	Subcontract
Organo-tin		ng/L	N/A**	N/A**	Subcontract
Tributyl Tin		ng/L	N/A**	N/A**	Subcontract
Triphenyl Tin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.3

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/301
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

Analysing
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Calibrating



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

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Deep				
Boron		mg/L	<0.23	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	418	03/12/2014	Subcontract
Chromium		mg/L	0.002	03/12/2014	Subcontract
Copper		mg/L	<0.009	03/12/2014	Subcontract
Iron		mg/L	18.2	03/12/2014	Subcontract
Lead		mg/L	<0.006	03/12/2014	Subcontract
Magnesium		mg/L	30.3	03/12/2014	Subcontract
Manganese		mg/L	2.08	03/12/2014	Subcontract
Nickel		mg/L	0.0051	03/12/2014	Subcontract
Potassium		mg/L	25.3	03/12/2014	Subcontract
Sodium		mg/L	65.1	03/12/2014	Subcontract
Zinc		mg/L	<0.018	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	28/11/2014	Subcontract
Fluoride		mg/L	0.16	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	0.5	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.03	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/301
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Deep				
Nitrate (as NO ₃)		mg/L	0.3	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.06	25/11/2014	Calculation
Cyanide		mg/L	0.119	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	1285	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	1857	03/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
Aldrin		ng/L	<5	13/12/2014	Subcontract
alpha-Endosulphan		ng/L	<8	13/12/2014	Subcontract
alpha-HCH		ng/L	<4	13/12/2014	Subcontract
beta-Endosulphan		ng/L	<6	13/12/2014	Subcontract
beta-HCH		ng/L	<4	13/12/2014	Subcontract
alpha-Chlordane		ng/L	<6	13/12/2014	Subcontract
Dichlobenil		ng/L	<4	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/301
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
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	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Deep				
Dieldrin		ng/L	<5	13/12/2014	Subcontract
Endrin		ng/L	<6	13/12/2014	Subcontract
gamma-HCH		ng/L	<4	13/12/2014	Subcontract
Heptachlor Epoxide		ng/L	<6	13/12/2014	Subcontract
Hexachlorobenzene		ng/L	<4	13/12/2014	Subcontract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Subcontract
Isodrin		ng/L	<6	13/12/2014	Subcontract
o,p - DDE		ng/L	<4	13/12/2014	Subcontract
p,p - DDE		ng/L	<4	13/12/2014	Subcontract
o,p - TDE		ng/L	<4	13/12/2014	Subcontract
p,p - TDE		ng/L	<4	13/12/2014	Subcontract
o,p - DDT		ng/L	<5	13/12/2014	Subcontract
p,p - DDT		ng/L	<6	13/12/2014	Subcontract
Tecnazene		ng/L	<14	13/12/2014	Subcontract
gamma-Chlordane		ng/L	<6	13/12/2014	Subcontract
Triallate		ng/L	<17	13/12/2014	Subcontract
Trifluralin		ng/L	<30	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/301
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Deep				
Azinphos-ethyl		ng/L	<4	13/12/2014	Subcontract
Azinphos-methyl		ng/L	<4	13/12/2014	Subcontract
Carbophenothion		ng/L	<6	13/12/2014	Subcontract
Chlorfenvinphos		ng/L	<4	13/12/2014	Subcontract
Chlorpyriphos		ng/L	<4	13/12/2014	Subcontract
Diazinon		ng/L	<5	13/12/2014	Subcontract
Dichlorvos		ng/L	<2	13/12/2014	Subcontract
Dimethoate		ng/L	<20	13/12/2014	Subcontract
Fenitrothion		ng/L	<5	13/12/2014	Subcontract
Fenthion		ng/L	<5	13/12/2014	Subcontract
Malathion		ng/L	<4	13/12/2014	Subcontract
Mevinphos		ng/L	<20	13/12/2014	Subcontract
Parathion-ethyl		ng/L	<4	13/12/2014	Subcontract
Parathion-methyl		ng/L	<4	13/12/2014	Subcontract
Phorate		ng/L	<6	13/12/2014	Subcontract
Phosalone		ng/L	<7	13/12/2014	Subcontract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.3

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

BHP Ref. No.: 14/11/301
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Deep				
Propetamphos		ng/L	<3	13/12/2014	Subcontract
Triazophos		ng/L	<4	13/12/2014	Subcontract
Organo-tin		ng/L	<60	05/12/2014	Subcontract
Tributyl Tin		ng/L	<60	05/12/2014	Subcontract
Triphenyl Tin		ng/L	<60	05/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.4

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/302
Order No.:
Date Received: 13/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

Analysing
Testing
Consulting
Calibrating



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

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Shallow				
Boron		mg/L	<2.3	04/12/2014	Subcontract
Cadmium		mg/L	<0.006	04/12/2014	Subcontract
Calcium		mg/L	269	04/12/2014	Subcontract
Chromium		mg/L	0.028	04/12/2014	Subcontract
Copper		mg/L	0.227	04/12/2014	Subcontract
Iron		mg/L	43.7	04/12/2014	Subcontract
Lead		mg/L	0.119	04/12/2014	Subcontract
Magnesium		mg/L	72.0	04/12/2014	Subcontract
Manganese		mg/L	3.38	04/12/2014	Subcontract
Nickel		mg/L	0.22	04/12/2014	Subcontract
Potassium		mg/L	39.5	04/12/2014	Subcontract
Sodium		mg/L	336	04/12/2014	Subcontract
Zinc		mg/L	0.269	04/12/2014	Subcontract
Mercury		mg/L	0.00079	28/11/2014	Subcontract
Fluoride		mg/L	0.25	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	1199.7	01/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.01	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/302
Order No.:
Date Received: 13/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Shallow				
Nitrate (as NO ₃)		mg/L	1.2	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.28	25/11/2014	Calculation
Cyanide		mg/L	0.199	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	325	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	18120	03/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,2,4-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,3,5-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
Aldrin		ng/L	N/A**	N/A**	Subcontract
alpha-Endosulphan		ng/L	N/A**	N/A**	Subcontract
alpha-HCH		ng/L	N/A**	N/A**	Subcontract
beta-Endosulphan		ng/L	N/A**	N/A**	Subcontract
beta-HCH		ng/L	N/A**	N/A**	Subcontract
alpha-Chlordane		ng/L	N/A**	N/A**	Subcontract
Dichlobenil		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/302
Order No.:
Date Received: 13/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Shallow				
Dieldrin		ng/L	N/A**	N/A**	Subcontract
Endrin		ng/L	N/A**	N/A**	Subcontract
gamma-HCH		ng/L	N/A**	N/A**	Subcontract
Heptachlor Epoxide		ng/L	N/A**	N/A**	Subcontract
Hexachlorobenzene		ng/L	N/A**	N/A**	Subcontract
Hexachlorobutadiene		ng/L	N/A**	N/A**	Subcontract
Isodrin		ng/L	N/A**	N/A**	Subcontract
o,p - DDE		ng/L	N/A**	N/A**	Subcontract
p,p - DDE		ng/L	N/A**	N/A**	Subcontract
o,p - TDE		ng/L	N/A**	N/A**	Subcontract
p,p - TDE		ng/L	N/A**	N/A**	Subcontract
o,p - DDT		ng/L	N/A**	N/A**	Subcontract
p,p - DDT		ng/L	N/A**	N/A**	Subcontract
Tecnazene		ng/L	N/A**	N/A**	Subcontract
gamma-Chlordane		ng/L	N/A**	N/A**	Subcontract
Triallate		ng/L	N/A**	N/A**	Subcontract
Trifluralin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/302
Order No.:
Date Received: 13/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpem2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Shallow				
Azinphos-ethyl		ng/L	N/A**	N/A**	Subcontract
Azinphos-methyl		ng/L	N/A**	N/A**	Subcontract
Carbophenothion		ng/L	N/A**	N/A**	Subcontract
Chlorfenvinphos		ng/L	N/A**	N/A**	Subcontract
Chlorpyrifos		ng/L	N/A**	N/A**	Subcontract
Diazinon		ng/L	N/A**	N/A**	Subcontract
Dichlorvos		ng/L	N/A**	N/A**	Subcontract
Dimethoate		ng/L	N/A**	N/A**	Subcontract
Fenitrothion		ng/L	N/A**	N/A**	Subcontract
Fenthion		ng/L	N/A**	N/A**	Subcontract
Malathion		ng/L	N/A**	N/A**	Subcontract
Mevinphos		ng/L	N/A**	N/A**	Subcontract
Parathion-ethyl		ng/L	N/A**	N/A**	Subcontract
Parathion-methyl		ng/L	N/A**	N/A**	Subcontract
Phorate		ng/L	N/A**	N/A**	Subcontract
Phosalone		ng/L	N/A**	N/A**	Subcontract
Pirimiphos-methyl		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.4

Analysing
Testing
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Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/302
Order No.:
Date Received: 13/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

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

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 2 Shallow				
Propetamphos		ng/L	N/A**	N/A**	Subcontract
Triazophos		ng/L	N/A**	N/A**	Subcontract
Organo-tin		ng/L	N/A**	N/A**	Subcontract
Tributyl Tin		ng/L	N/A**	N/A**	Subcontract
Triphenyl Tin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references
**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.5

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/303
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

Analysing
Testing
Consulting
Calibrating



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

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Deep				
Boron		mg/L	<0.23	03/12/2014	Subcontract
Cadmium		mg/L	0.0009	03/12/2014	Subcontract
Calcium		mg/L	199	03/12/2014	Subcontract
Chromium		mg/L	0.0101	03/12/2014	Subcontract
Copper		mg/L	0.0236	03/12/2014	Subcontract
Iron		mg/L	20.9	03/12/2014	Subcontract
Lead		mg/L	0.0341	03/12/2014	Subcontract
Magnesium		mg/L	14.4	03/12/2014	Subcontract
Manganese		mg/L	2	03/12/2014	Subcontract
Nickel		mg/L	0.0232	03/12/2014	Subcontract
Potassium		mg/L	1.73	03/12/2014	Subcontract
Sodium		mg/L	5.41	03/12/2014	Subcontract
Zinc		mg/L	0.0517	03/12/2014	Subcontract
Mercury		mg/L	0.00011	28/11/2014	Subcontract
Fluoride		mg/L	0.08	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	126.0	27/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.03	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/303
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Deep				
Nitrate (as NO ₃)		mg/L	4.4	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1	25/11/2014	Calculation
Cyanide		mg/L	0.192	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	525	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	2098	03/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
Aldrin		ng/L	<4	13/12/2014	Subcontract
alpha-Endosulphan		ng/L	<4	13/12/2014	Subcontract
alpha-HCH		ng/L	<3	13/12/2014	Subcontract
beta-Endosulphan		ng/L	<4	13/12/2014	Subcontract
beta-HCH		ng/L	<3	13/12/2014	Subcontract
alpha-Chlordane		ng/L	<3	13/12/2014	Subcontract
Dichlobenil		ng/L	<2	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/303
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
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Limerick
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Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Deep				
Dieldrin		ng/L	<4	13/12/2014	Subcontract
Endrin		ng/L	<4	13/12/2014	Subcontract
gamma-HCH		ng/L	<3	13/12/2014	Subcontract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Subcontract
Hexachlorobenzene		ng/L	<2	13/12/2014	Subcontract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Subcontract
Isodrin		ng/L	<4	13/12/2014	Subcontract
o,p - DDE		ng/L	<2	13/12/2014	Subcontract
p,p - DDE		ng/L	<2	13/12/2014	Subcontract
o,p - TDE		ng/L	<2	13/12/2014	Subcontract
p,p - TDE		ng/L	<2	13/12/2014	Subcontract
o,p - DDT		ng/L	<2	13/12/2014	Subcontract
p,p - DDT		ng/L	<4	13/12/2014	Subcontract
Tecnazene		ng/L	<10	13/12/2014	Subcontract
gamma-Chlordane		ng/L	<4	13/12/2014	Subcontract
Triallate		ng/L	<10	13/12/2014	Subcontract
Trifluralin		ng/L	<30	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/303
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Deep				
Azinphos-ethyl		ng/L	<4	13/12/2014	Subcontract
Azinphos-methyl		ng/L	<2	13/12/2014	Subcontract
Carbophenothion		ng/L	<3	13/12/2014	Subcontract
Chlorfenvinphos		ng/L	<2	13/12/2014	Subcontract
Chlorpyrifos		ng/L	<2	13/12/2014	Subcontract
Diazinon		ng/L	<3	13/12/2014	Subcontract
Dichlorvos		ng/L	<2	13/12/2014	Subcontract
Dimethoate		ng/L	<20	13/12/2014	Subcontract
Fenitrothion		ng/L	<2	13/12/2014	Subcontract
Fenthion		ng/L	<2	13/12/2014	Subcontract
Malathion		ng/L	<4	13/12/2014	Subcontract
Mevinphos		ng/L	<20	13/12/2014	Subcontract
Parathion-ethyl		ng/L	<3	13/12/2014	Subcontract
Parathion-methyl		ng/L	<3	13/12/2014	Subcontract
Phorate		ng/L	<4	13/12/2014	Subcontract
Phosalone		ng/L	<4	13/12/2014	Subcontract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.5

Analysing
Testing
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Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/303
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

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New Road
Thomondgate
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Deep				
Propetamphos		ng/L	<3	13/12/2014	Subcontract
Triazophos		ng/L	<2	13/12/2014	Subcontract
Organo-tin		ng/L	<30	05/12/2014	Subcontract
Tributyl Tin		ng/L	<30	05/12/2014	Subcontract
Triphenyl Tin		ng/L	<30	05/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/304
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
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	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Shallow				
Boron		mg/L	<0.23	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	206	03/12/2014	Subcontract
Chromium		mg/L	<0.002	03/12/2014	Subcontract
Copper		mg/L	<0.009	03/12/2014	Subcontract
Iron		mg/L	3.8	03/12/2014	Subcontract
Lead		mg/L	<0.006	03/12/2014	Subcontract
Magnesium		mg/L	13.0	03/12/2014	Subcontract
Manganese		mg/L	0.921	03/12/2014	Subcontract
Nickel		mg/L	0.0116	03/12/2014	Subcontract
Potassium		mg/L	0.711	03/12/2014	Subcontract
Sodium		mg/L	7.67	03/12/2014	Subcontract
Zinc		mg/L	<0.018	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	28/11/2014	Subcontract
Fluoride		mg/L	0.09	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	99.4	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/304
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Shallow				
Nitrate (as NO ₃)		mg/L	23.1	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	5.23	25/11/2014	Calculation
Cyanide		mg/L	0.105	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	525	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	787	03/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
Aldrin		ng/L	<4	13/12/2014	Subcontract
alpha-Endosulphan		ng/L	<4	13/12/2014	Subcontract
alpha-HCH		ng/L	<3	13/12/2014	Subcontract
beta-Endosulphan		ng/L	<4	13/12/2014	Subcontract
beta-HCH		ng/L	<3	13/12/2014	Subcontract
alpha-Chlordane		ng/L	<3	13/12/2014	Subcontract
Dichlobenil		ng/L	<2	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/304
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpccem2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Shallow				
Dieldrin		ng/L	<4	13/12/2014	Subcontract
Endrin		ng/L	<4	13/12/2014	Subcontract
gamma-HCH		ng/L	<3	13/12/2014	Subcontract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Subcontract
Hexachlorobenzene		ng/L	<2	13/12/2014	Subcontract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Subcontract
Isodrin		ng/L	<4	13/12/2014	Subcontract
o,p - DDE		ng/L	<2	13/12/2014	Subcontract
p,p - DDE		ng/L	<2	13/12/2014	Subcontract
o,p - TDE		ng/L	<2	13/12/2014	Subcontract
p,p - TDE		ng/L	<2	13/12/2014	Subcontract
o,p - DDT		ng/L	<2	13/12/2014	Subcontract
p,p - DDT		ng/L	<4	13/12/2014	Subcontract
Tecnazene		ng/L	<10	13/12/2014	Subcontract
gamma-Chlordane		ng/L	<4	13/12/2014	Subcontract
Triallate		ng/L	<10	13/12/2014	Subcontract
Trifluralin		ng/L	<30	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/304
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Shallow				
Azinphos-ethyl		ng/L	<4	13/12/2014	Subcontract
Azinphos-methyl		ng/L	<2	13/12/2014	Subcontract
Carbophenothion		ng/L	<3	13/12/2014	Subcontract
Chlorfenvinphos		ng/L	<2	13/12/2014	Subcontract
Chlorpyrifos		ng/L	<2	13/12/2014	Subcontract
Diazinon		ng/L	<3	13/12/2014	Subcontract
Dichlorvos		ng/L	<2	13/12/2014	Subcontract
Dimethoate		ng/L	<20	13/12/2014	Subcontract
Fenitrothion		ng/L	<2	13/12/2014	Subcontract
Fenthion		ng/L	<2	13/12/2014	Subcontract
Malathion		ng/L	<4	13/12/2014	Subcontract
Mevinphos		ng/L	<20	13/12/2014	Subcontract
Parathion-ethyl		ng/L	<3	13/12/2014	Subcontract
Parathion-methyl		ng/L	<3	13/12/2014	Subcontract
Phorate		ng/L	<4	13/12/2014	Subcontract
Phosalone		ng/L	<4	13/12/2014	Subcontract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.6

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/304
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 3 Shallow				
Propetamphos		ng/L	<3	13/12/2014	Subcontract
Triazophos		ng/L	<2	13/12/2014	Subcontract
Organo-tin		ng/L	<20	05/12/2014	Subcontract
Tributyl Tin		ng/L	<20	05/12/2014	Subcontract
Triphenyl Tin		ng/L	<20	05/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.7

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/305
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

Analysing
Testing
Consulting
Calibrating



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

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Deep				
Boron		mg/L	<0.23	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	154	03/12/2014	Subcontract
Chromium		mg/L	<0.002	03/12/2014	Subcontract
Copper		mg/L	<0.009	03/12/2014	Subcontract
Iron		mg/L	6.7	03/12/2014	Subcontract
Lead		mg/L	<0.006	03/12/2014	Subcontract
Magnesium		mg/L	12.0	03/12/2014	Subcontract
Manganese		mg/L	0.989	03/12/2014	Subcontract
Nickel		mg/L	0.0038	03/12/2014	Subcontract
Potassium		mg/L	4.73	03/12/2014	Subcontract
Sodium		mg/L	36.5	03/12/2014	Subcontract
Zinc		mg/L	<0.018	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	28/11/2014	Subcontract
Fluoride		mg/L	0.12	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	53.3	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.01	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.7Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/305
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Deep				
Nitrate (as NO ₃)		mg/L	0.8	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.07	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.2	25/11/2014	Calculation
Cyanide		mg/L	0.035	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	260	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	430	07/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
Aldrin		ng/L	<4	13/12/2014	Subcontract
alpha-Endosulphan		ng/L	<4	13/12/2014	Subcontract
alpha-HCH		ng/L	<3	13/12/2014	Subcontract
beta-Endosulphan		ng/L	<4	13/12/2014	Subcontract
beta-HCH		ng/L	<3	13/12/2014	Subcontract
alpha-Chlordane		ng/L	<3	13/12/2014	Subcontract
Dichlobenil		ng/L	<2	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.7Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/305
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Deep				
Dieldrin		ng/L	<4	13/12/2014	Subcontract
Endrin		ng/L	<4	13/12/2014	Subcontract
gamma-HCH		ng/L	<3	13/12/2014	Subcontract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Subcontract
Hexachlorobenzene		ng/L	<2	13/12/2014	Subcontract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Subcontract
Isodrin		ng/L	<4	13/12/2014	Subcontract
o,p - DDE		ng/L	<2	13/12/2014	Subcontract
p,p - DDE		ng/L	<2	13/12/2014	Subcontract
o,p - TDE		ng/L	<2	13/12/2014	Subcontract
p,p - TDE		ng/L	<2	13/12/2014	Subcontract
o,p - DDT		ng/L	<2	13/12/2014	Subcontract
p,p - DDT		ng/L	<4	13/12/2014	Subcontract
Tecnazene		ng/L	<10	13/12/2014	Subcontract
gamma-Chlordane		ng/L	<4	13/12/2014	Subcontract
Triallate		ng/L	<10	13/12/2014	Subcontract
Trifluralin		ng/L	<30	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.7Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/305
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Deep				
Azinphos-ethyl		ng/L	<4	13/12/2014	Subcontract
Azinphos-methyl		ng/L	<2	13/12/2014	Subcontract
Carbophenothion		ng/L	<3	13/12/2014	Subcontract
Chlorfenvinphos		ng/L	<2	13/12/2014	Subcontract
Chlorpyriphos		ng/L	<2	13/12/2014	Subcontract
Diazinon		ng/L	<3	13/12/2014	Subcontract
Dichlorvos		ng/L	<2	13/12/2014	Subcontract
Dimethoate		ng/L	<20	13/12/2014	Subcontract
Fenitrothion		ng/L	<2	13/12/2014	Subcontract
Fenthion		ng/L	<2	13/12/2014	Subcontract
Malathion		ng/L	<4	13/12/2014	Subcontract
Mevinphos		ng/L	<20	13/12/2014	Subcontract
Parathion-ethyl		ng/L	<3	13/12/2014	Subcontract
Parathion-methyl		ng/L	<3	13/12/2014	Subcontract
Phorate		ng/L	<4	13/12/2014	Subcontract
Phosalone		ng/L	<4	13/12/2014	Subcontract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.7

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/305
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
Thomondgate
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Deep				
Propetamphos		ng/L	<3	13/12/2014	Subcontract
Triazophos		ng/L	<2	13/12/2014	Subcontract
Organo-tin		ng/L	<20	05/12/2014	Subcontract
Tributyl Tin		ng/L	<20	05/12/2014	Subcontract
Triphenyl Tin		ng/L	<20	05/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.8

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

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	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Shallow				
Boron		mg/L	N/A**	N/A**	Subcontract
Cadmium		mg/L	N/A**	N/A**	Subcontract
Calcium		mg/L	N/A**	N/A**	Subcontract
Chromium		mg/L	N/A**	N/A**	Subcontract
Copper		mg/L	N/A**	N/A**	Subcontract
Iron		mg/L	N/A**	N/A**	Subcontract
Lead		mg/L	N/A**	N/A**	Subcontract
Magnesium		mg/L	N/A**	N/A**	Subcontract
Manganese		mg/L	N/A**	N/A**	Subcontract
Nickel		mg/L	N/A**	N/A**	Subcontract
Potassium		mg/L	N/A**	N/A**	Subcontract
Sodium		mg/L	N/A**	N/A**	Subcontract
Zinc		mg/L	N/A**	N/A**	Subcontract
Mercury		mg/L	N/A**	N/A**	Subcontract
Fluoride		mg/L	N/A**	N/A**	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	N/A**	N/A**	APHA - 4110 - B
Orthophosphate (as P)		mg/L	N/A**	N/A**	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.8Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring				
	Groundwater 4 Shallow				
Nitrate (as NO ₃)		mg/L	N/A**	N/A**	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	N/A**	N/A**	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	N/A**	N/A**	Calculation
Cyanide		mg/L	N/A**	N/A**	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	N/A**	N/A**	APHA - 2320 - B
Residue on Evaporation		mg/L	N/A**	N/A**	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,2,4-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,3,5-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
Aldrin		ng/L	N/A**	N/A**	Subcontract
alpha-Endosulphan		ng/L	N/A**	N/A**	Subcontract
alpha-HCH		ng/L	N/A**	N/A**	Subcontract
beta-Endosulphan		ng/L	N/A**	N/A**	Subcontract
beta-HCH		ng/L	N/A**	N/A**	Subcontract
alpha-Chlordane		ng/L	N/A**	N/A**	Subcontract
Dichlobenil		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.8

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

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New Road
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Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Shallow				
Dieldrin		ng/L	N/A**	N/A**	Subcontract
Endrin		ng/L	N/A**	N/A**	Subcontract
gamma-HCH		ng/L	N/A**	N/A**	Subcontract
Heptachlor Epoxide		ng/L	N/A**	N/A**	Subcontract
Hexachlorobenzene		ng/L	N/A**	N/A**	Subcontract
Hexachlorobutadiene		ng/L	N/A**	N/A**	Subcontract
Isodrin		ng/L	N/A**	N/A**	Subcontract
o,p - DDE		ng/L	N/A**	N/A**	Subcontract
p,p - DDE		ng/L	N/A**	N/A**	Subcontract
o,p - TDE		ng/L	N/A**	N/A**	Subcontract
p,p - TDE		ng/L	N/A**	N/A**	Subcontract
o,p - DDT		ng/L	N/A**	N/A**	Subcontract
p,p - DDT		ng/L	N/A**	N/A**	Subcontract
Tecnazene		ng/L	N/A**	N/A**	Subcontract
gamma-Chlordane		ng/L	N/A**	N/A**	Subcontract
Triallate		ng/L	N/A**	N/A**	Subcontract
Trifluralin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.8

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

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

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Shallow				
Azinphos-ethyl		ng/L	N/A**	N/A**	Subcontract
Azinphos-methyl		ng/L	N/A**	N/A**	Subcontract
Carbophenothion		ng/L	N/A**	N/A**	Subcontract
Chlorfenvinphos		ng/L	N/A**	N/A**	Subcontract
Chlorpyrifos		ng/L	N/A**	N/A**	Subcontract
Diazinon		ng/L	N/A**	N/A**	Subcontract
Dichlorvos		ng/L	N/A**	N/A**	Subcontract
Dimethoate		ng/L	N/A**	N/A**	Subcontract
Fenitrothion		ng/L	N/A**	N/A**	Subcontract
Fenthion		ng/L	N/A**	N/A**	Subcontract
Malathion		ng/L	N/A**	N/A**	Subcontract
Mevinphos		ng/L	N/A**	N/A**	Subcontract
Parathion-ethyl		ng/L	N/A**	N/A**	Subcontract
Parathion-methyl		ng/L	N/A**	N/A**	Subcontract
Phorate		ng/L	N/A**	N/A**	Subcontract
Phosalone		ng/L	N/A**	N/A**	Subcontract
Pirimiphos-methyl		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.8

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 4 Shallow				
Propetamphos		ng/L	N/A**	N/A**	Subcontract
Triazophos		ng/L	N/A**	N/A**	Subcontract
Organo-tin		ng/L	N/A**	N/A**	Subcontract
Tributyl Tin		ng/L	N/A**	N/A**	Subcontract
Triphenyl Tin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.9

Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/306
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

FTAO: Tara Flanagan

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	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Deep				
Boron		mg/L	<0.23	04/12/2014	Subcontract
Cadmium		mg/L	0.0017	04/12/2014	Subcontract
Calcium		mg/L	285	04/12/2014	Subcontract
Chromium		mg/L	0.0117	04/12/2014	Subcontract
Copper		mg/L	0.0257	04/12/2014	Subcontract
Iron		mg/L	130	04/12/2014	Subcontract
Lead		mg/L	0.0407	04/12/2014	Subcontract
Magnesium		mg/L	20.0	04/12/2014	Subcontract
Manganese		mg/L	3.69	04/12/2014	Subcontract
Nickel		mg/L	0.0315	04/12/2014	Subcontract
Potassium		mg/L	1.07	04/12/2014	Subcontract
Sodium		mg/L	108	04/12/2014	Subcontract
Zinc		mg/L	0.107	04/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.33	25/11/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	0.3	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.9Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/306
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Deep				
Nitrate (as NO ₃)		mg/L	0.2	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	25/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.04	25/11/2014	Calculation
Cyanide		mg/L	0.017	05/12/2014	APHA - 4500 - CN ⁻
Alkalinity (as CaCO ₃)		mg/L	620	03/12/2014	APHA - 2320 - B
Residue on Evaporation		mg/L	2452	03/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Subcontract
Aldrin		ng/L	<4	13/12/2014	Subcontract
alpha-Endosulphan		ng/L	<4	13/12/2014	Subcontract
alpha-HCH		ng/L	<3	13/12/2014	Subcontract
beta-Endosulphan		ng/L	<4	13/12/2014	Subcontract
beta-HCH		ng/L	<3	13/12/2014	Subcontract
alpha-Chlordane		ng/L	<3	13/12/2014	Subcontract
Dichlobenil		ng/L	<2	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.9Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/306
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpccem2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Deep				
Dieldrin		ng/L	<4	13/12/2014	Subcontract
Endrin		ng/L	<4	13/12/2014	Subcontract
gamma-HCH		ng/L	<3	13/12/2014	Subcontract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Subcontract
Hexachlorobenzene		ng/L	<2	13/12/2014	Subcontract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Subcontract
Isodrin		ng/L	<4	13/12/2014	Subcontract
o,p - DDE		ng/L	<2	13/12/2014	Subcontract
p,p - DDE		ng/L	<2	13/12/2014	Subcontract
o,p - TDE		ng/L	<2	13/12/2014	Subcontract
p,p - TDE		ng/L	<2	13/12/2014	Subcontract
o,p - DDT		ng/L	<2	13/12/2014	Subcontract
p,p - DDT		ng/L	<4	13/12/2014	Subcontract
Tecnazene		ng/L	<10	13/12/2014	Subcontract
gamma-Chlordane		ng/L	<4	13/12/2014	Subcontract
Triallate		ng/L	<10	13/12/2014	Subcontract
Trifluralin		ng/L	<30	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.9Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: 14/11/306
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Deep				
Azinphos-ethyl		ng/L	<4	13/12/2014	Subcontract
Azinphos-methyl		ng/L	<2	13/12/2014	Subcontract
Carbophenothion		ng/L	<3	13/12/2014	Subcontract
Chlorfenvinphos		ng/L	<2	13/12/2014	Subcontract
Chlorpyrifos		ng/L	<2	13/12/2014	Subcontract
Diazinon		ng/L	<3	13/12/2014	Subcontract
Dichlorvos		ng/L	<2	13/12/2014	Subcontract
Dimethoate		ng/L	<20	13/12/2014	Subcontract
Fenitrothion		ng/L	<2	13/12/2014	Subcontract
Fenthion		ng/L	<2	13/12/2014	Subcontract
Malathion		ng/L	<4	13/12/2014	Subcontract
Mevinphos		ng/L	<20	13/12/2014	Subcontract
Parathion-ethyl		ng/L	<3	13/12/2014	Subcontract
Parathion-methyl		ng/L	<3	13/12/2014	Subcontract
Phorate		ng/L	<4	13/12/2014	Subcontract
Phosalone		ng/L	<4	13/12/2014	Subcontract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.9

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/306
Order No.:
Date Received: 13/11/14
Date Completed: 13/12/14
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Deep				
Propetamphos		ng/L	<3	13/12/2014	Subcontract
Triazophos		ng/L	<2	13/12/2014	Subcontract
Organo-tin		ng/L	<20	10/12/2014	Subcontract
Tributyl Tin		ng/L	<20	10/12/2014	Subcontract
Triphenyl Tin		ng/L	<20	10/12/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.10

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

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	Date Analysed	Standard Reference*
	Annual Monitoring				
Boron	Groundwater 5 Shallow	mg/L	N/A**	N/A**	Subcontract
Cadmium		mg/L	N/A**	N/A**	Subcontract
Calcium		mg/L	N/A**	N/A**	Subcontract
Chromium		mg/L	N/A**	N/A**	Subcontract
Copper		mg/L	N/A**	N/A**	Subcontract
Iron		mg/L	N/A**	N/A**	Subcontract
Lead		mg/L	N/A**	N/A**	Subcontract
Magnesium		mg/L	N/A**	N/A**	Subcontract
Manganese		mg/L	N/A**	N/A**	Subcontract
Nickel		mg/L	N/A**	N/A**	Subcontract
Potassium		mg/L	N/A**	N/A**	Subcontract
Sodium		mg/L	N/A**	N/A**	Subcontract
Zinc		mg/L	N/A**	N/A**	Subcontract
Mercury		mg/L	N/A**	N/A**	Subcontract
Fluoride		mg/L	N/A**	N/A**	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	N/A**	N/A**	APHA - 4110 - B
Orthophosphate (as P)		mg/L	N/A**	N/A**	APHA - 4500 - P - E

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

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TEST REPORT NO: 115268.10Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Shallow				
Nitrate (as NO ₃)		mg/L	N/A**	N/A**	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	N/A**	N/A**	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	N/A**	N/A**	Calculation
Cyanide		mg/L	N/A**	N/A**	APHA - 4500 - CN
Alkalinity (as CaCO ₃)		mg/L	N/A**	N/A**	APHA - 2320 - B
Residue on Evaporation		mg/L	N/A**	N/A**	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,2,4-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
1,3,5-Trichlorobenzene		ng/L	N/A**	N/A**	Subcontract
Aldrin		ng/L	N/A**	N/A**	Subcontract
alpha-Endosulphan		ng/L	N/A**	N/A**	Subcontract
alpha-HCH		ng/L	N/A**	N/A**	Subcontract
beta-Endosulphan		ng/L	N/A**	N/A**	Subcontract
beta-HCH		ng/L	N/A**	N/A**	Subcontract
alpha-Chlordane		ng/L	N/A**	N/A**	Subcontract
Dichlobenil		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.10Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014BHP
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	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Shallow				
Dieldrin		ng/L	N/A**	N/A**	Subcontract
Endrin		ng/L	N/A**	N/A**	Subcontract
gamma-HCH		ng/L	N/A**	N/A**	Subcontract
Heptachlor Epoxide		ng/L	N/A**	N/A**	Subcontract
Hexachlorobenzene		ng/L	N/A**	N/A**	Subcontract
Hexachlorobutadiene		ng/L	N/A**	N/A**	Subcontract
Isodrin		ng/L	N/A**	N/A**	Subcontract
o,p - DDE		ng/L	N/A**	N/A**	Subcontract
p,p - DDE		ng/L	N/A**	N/A**	Subcontract
o,p - TDE		ng/L	N/A**	N/A**	Subcontract
p,p - TDE		ng/L	N/A**	N/A**	Subcontract
o,p - DDT		ng/L	N/A**	N/A**	Subcontract
p,p - DDT		ng/L	N/A**	N/A**	Subcontract
Tecnazene		ng/L	N/A**	N/A**	Subcontract
gamma-Chlordane		ng/L	N/A**	N/A**	Subcontract
Triallate		ng/L	N/A**	N/A**	Subcontract
Trifluralin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.10Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. LimerickBHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpccm2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Shallow				
Azinphos-ethyl		ng/L	N/A**	N/A**	Subcontract
Azinphos-methyl		ng/L	N/A**	N/A**	Subcontract
Carbophenothion		ng/L	N/A**	N/A**	Subcontract
Chlorfenvinphos		ng/L	N/A**	N/A**	Subcontract
Chlorpyrifos		ng/L	N/A**	N/A**	Subcontract
Diazinon		ng/L	N/A**	N/A**	Subcontract
Dichlorvos		ng/L	N/A**	N/A**	Subcontract
Dimethoate		ng/L	N/A**	N/A**	Subcontract
Fenitrothion		ng/L	N/A**	N/A**	Subcontract
Fenthion		ng/L	N/A**	N/A**	Subcontract
Malathion		ng/L	N/A**	N/A**	Subcontract
Mevinphos		ng/L	N/A**	N/A**	Subcontract
Parathion-ethyl		ng/L	N/A**	N/A**	Subcontract
Parathion-methyl		ng/L	N/A**	N/A**	Subcontract
Phorate		ng/L	N/A**	N/A**	Subcontract
Phosalone		ng/L	N/A**	N/A**	Subcontract
Pirimiphos-methyl		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references

**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT NO: 115268.10

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: N/A**
Order No.:
Date Received: 13/11/14
Date Completed: N/A**
Test Specification: Nil
Item: Annual Ground Water 2014

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpцем2@bhp.ie

FTAO: Tara Flanagan

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Monitoring Groundwater 5 Shallow				
Propetamphos		ng/L	N/A**	N/A**	Subcontract
Triazophos		ng/L	N/A**	N/A**	Subcontract
Organo-tin		ng/L	N/A**	N/A**	Subcontract
Tributyl Tin		ng/L	N/A**	N/A**	Subcontract
Triphenyl Tin		ng/L	N/A**	N/A**	Subcontract

Additional information : *Documented in-house methods based on stated standard references
**Sample location dry

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 24/02/15

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

Appendix C
Annual Surface Water Monitoring results for
Longpavement Landfill
2014

TEST REPORT 115267.1Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/292
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW01	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	88.2	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	<0.23	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	6.98	03/12/2014	Sub Contracted
Manganese		mg/L	0.0477	03/12/2014	Sub Contracted
Nickel		mg/L	<0.003	03/12/2014	Sub Contracted
Potassium		mg/L	6.75	03/12/2014	Sub Contracted
Sodium		mg/L	14.9	03/12/2014	Sub Contracted
Zinc		mg/L	0.0546	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)		mg/L	59.7	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.47	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	5.0	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.15	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.17	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	154	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.2Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/293
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW02	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	89.2	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	0.787	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	6.71	03/12/2014	Sub Contracted
Manganese		mg/L	0.11	03/12/2014	Sub Contracted
Nickel		mg/L	<0.003	03/12/2014	Sub Contracted
Potassium		mg/L	3.98	03/12/2014	Sub Contracted
Sodium		mg/L	9.3	03/12/2014	Sub Contracted
Zinc		mg/L	<0.018	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)		mg/L	67.4	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	4.5	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.26	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.09	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	177	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.3Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/294
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW03	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	80.7	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	<0.23	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	6.49	03/12/2014	Sub Contracted
Manganese		mg/L	0.0472	03/12/2014	Sub Contracted
Nickel		mg/L	<0.003	03/12/2014	Sub Contracted
Potassium		mg/L	2.39	03/12/2014	Sub Contracted
Sodium		mg/L	9.45	03/12/2014	Sub Contracted
Zinc		mg/L	<0.018	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)		mg/L	17.6	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	2.1	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.03	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.49	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	187	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.4Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/295
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW04	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	78.7	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	5.7	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	7.73	03/12/2014	Sub Contracted
Manganese		mg/L	0.198	03/12/2014	Sub Contracted
Nickel		mg/L	<0.003	03/12/2014	Sub Contracted
Potassium		mg/L	4.54	03/12/2014	Sub Contracted
Sodium		mg/L	12.3	03/12/2014	Sub Contracted
Zinc		mg/L	<0.018	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)			mg/L	17.1	25/11/2014
Orthophosphate (as P)		mg/L	0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	9.5	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.21	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	2.21	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	181	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.5Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/296
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW05	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	83.3	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	0.58	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	8.04	03/12/2014	Sub Contracted
Manganese		mg/L	0.0598	03/12/2014	Sub Contracted
Nickel		mg/L	<0.003	03/12/2014	Sub Contracted
Potassium		mg/L	4.32	03/12/2014	Sub Contracted
Sodium		mg/L	11.9	03/12/2014	Sub Contracted
Zinc		mg/L	<0.018	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)		mg/L	21.5	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	8.1	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.18	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.87	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	199	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

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TEST REPORT 115267.6Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/297
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW06	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	73.8	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	<0.23	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	5.83	03/12/2014	Sub Contracted
Manganese		mg/L	0.0246	03/12/2014	Sub Contracted
Nickel		mg/L	<0.003	03/12/2014	Sub Contracted
Potassium		mg/L	2.1	03/12/2014	Sub Contracted
Sodium		mg/L	8.67	03/12/2014	Sub Contracted
Zinc		mg/L	<0.018	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)		mg/L	11.2	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	2.1	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.02	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.48	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	184	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

TEST REPORT 115267.7Analysing
Testing
Consulting
CalibratingClient: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

FTAO: Tara Flanagan

BHP Ref. No.: 14/11/298
Order No.:
Date Received: 13/11/14
Date Completed: 03/12/14
Test Specification: Nil
Item: Annual SW 2014BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	SW07	mg/L	<0.23	03/12/2014	Sub Contracted
Cadmium		mg/L	<0.0006	03/12/2014	Sub Contracted
Calcium		mg/L	121	03/12/2014	Sub Contracted
Chromium		mg/L	<0.002	03/12/2014	Sub Contracted
Copper		mg/L	<0.009	03/12/2014	Sub Contracted
Iron		mg/L	0.405	03/12/2014	Sub Contracted
Lead		mg/L	<0.006	03/12/2014	Sub Contracted
Magnesium		mg/L	16.6	03/12/2014	Sub Contracted
Manganese		mg/L	0.154	03/12/2014	Sub Contracted
Nickel		mg/L	0.0068	03/12/2014	Sub Contracted
Potassium		mg/L	4.85	03/12/2014	Sub Contracted
Sodium		mg/L	12.1	03/12/2014	Sub Contracted
Zinc		mg/L	0.0266	03/12/2014	Sub Contracted
Mercury		mg/L	<0.0001	28/11/2014	Sub Contracted
Sulphate (as SO ₄)		mg/L	86.7	25/11/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	1.3	25/11/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.07	27/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.32	27/11/2014	Calculation
Alkalinity (as CaCO ₃)		mg/L	267	02/12/2014	APHA - 2320 - B

Additional Information: *Documented in-house methods based on stated standard references**For and on behalf of BHP laboratories :****John O' Halloran**
Issue Date : 22/12/14

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

Appendix D
Annual Leachate Monitoring results for
Longpavement Landfill
2014

TEST REPORT 115305.1

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/408
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L01	mg/L	1.15	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	223	03/12/2014	Subcontract
Chromium		mg/L	<0.002	03/12/2014	Subcontract
Copper		mg/L	<0.009	03/12/2014	Subcontract
Iron		mg/L	39	03/12/2014	Subcontract
Lead		mg/L	<0.006	03/12/2014	Subcontract
Magnesium		mg/L	27.8	03/12/2014	Subcontract
Manganese		mg/L	2.8	03/12/2014	Subcontract
Nickel		mg/L	0.0063	03/12/2014	Subcontract
Potassium		mg/L	35.1	03/12/2014	Subcontract
Sodium		mg/L	82	03/12/2014	Subcontract
Zinc		mg/L	0.14	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.18	01/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	276	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.12	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	0.4	01/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	01/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.08	01/12/2014	Calculation
Cyanide		mg/L	0.061	05/12/2014	APHA - 4500 - CN
Ammonia (as N)		mg/L	1.36	02/12/2014	Nessler
B.O.D.		mg/L	18.7	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	45.5	20/11/2014	APHA - 5220 - D
pH		-	6.74	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	1839	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.2

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/409
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L02	mg/L	N/A**	N/A**	Subcontract
Cadmium		mg/L	N/A**	N/A**	Subcontract
Calcium		mg/L	N/A**	N/A**	Subcontract
Chromium		mg/L	N/A**	N/A**	Subcontract
Copper		mg/L	N/A**	N/A**	Subcontract
Iron		mg/L	N/A**	N/A**	Subcontract
Lead		mg/L	N/A**	N/A**	Subcontract
Magnesium		mg/L	N/A**	N/A**	Subcontract
Manganese		mg/L	N/A**	N/A**	Subcontract
Nickel		mg/L	N/A**	N/A**	Subcontract
Potassium		mg/L	N/A**	N/A**	Subcontract
Sodium		mg/L	N/A**	N/A**	Subcontract
Zinc		mg/L	N/A**	N/A**	Subcontract
Mercury		mg/L	N/A**	N/A**	Subcontract
Fluoride		mg/L	0.19	01/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	76.7	01/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.14	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	3.7	01/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	01/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.84	01/12/2014	Calculation
Cyanide	mg/L	0.098	05/12/2014	APHA - 4500 - CN ⁻	
Ammonia (as N)	mg/L	530	02/12/2014	Nessler	
B.O.D.	mg/L	129	20/11/2014	APHA - 5210 - B	
C.O.D.	mg/L	600	20/11/2014	APHA - 5220 - D	
pH	-	7.20	19/11/2014	APHA - 4500 - H ⁺	
Conductivity	µS/cm	9480	19/11/2014	APHA - 2510 - B	

Additional information: *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.3

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/410
Order No.:
Date Received: 19/11/14
Date Completed: 23/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L03	mg/L	<4.6	04/12/2014	Subcontract
Cadmium		mg/L	0.0453	04/12/2014	Subcontract
Calcium		mg/L	2090	04/12/2014	Subcontract
Chromium		mg/L	<0.04	04/12/2014	Subcontract
Copper		mg/L	<0.009	04/12/2014	Subcontract
Iron		mg/L	582	04/12/2014	Subcontract
Lead		mg/L	1.4	04/12/2014	Subcontract
Magnesium		mg/L	141	04/12/2014	Subcontract
Manganese		mg/L	30.6	04/12/2014	Subcontract
Nickel		mg/L	0.696	04/12/2014	Subcontract
Potassium		mg/L	117	04/12/2014	Subcontract
Sodium		mg/L	174	04/12/2014	Subcontract
Zinc		mg/L	13.8	04/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.23	01/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	77	01/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.78	23/12/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	2.0	01/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	01/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.46	01/12/2014	Calculation
Cyanide		mg/L	0.08	15/12/2014	APHA - 4500 - CN
Ammonia (as N)		mg/L	428	02/12/2014	Nessler
B.O.D.		mg/L	62	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	260	20/11/2014	APHA - 5220 - D
pH		-	6.97	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	6125	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.4

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/411
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L04	mg/L	1.69	03/12/2014	Subcontract
Cadmium		mg/L	0.0016	03/12/2014	Subcontract
Calcium		mg/L	232	03/12/2014	Subcontract
Chromium		mg/L	0.0144	03/12/2014	Subcontract
Copper		mg/L	0.13	03/12/2014	Subcontract
Iron		mg/L	98.5	03/12/2014	Subcontract
Lead		mg/L	0.118	03/12/2014	Subcontract
Magnesium		mg/L	39.7	03/12/2014	Subcontract
Manganese		mg/L	1.14	03/12/2014	Subcontract
Nickel		mg/L	0.198	03/12/2014	Subcontract
Potassium		mg/L	31.2	03/12/2014	Subcontract
Sodium		mg/L	32.4	03/12/2014	Subcontract
Zinc		mg/L	0.22	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.05	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	52.3	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	<0.1	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	<0.11	02/12/2014	Calculation
Cyanide		mg/L	0.022	05/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	0.98	02/12/2014	Nessler
B.O.D.		mg/L	6.0	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	79	21/11/2014	APHA - 5220 - D
pH		-	6.64	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	1840	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.5

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/412
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L05	mg/L	<23	04/12/2014	Subcontract
Cadmium		mg/L	<0.06	04/12/2014	Subcontract
Calcium		mg/L	3940	04/12/2014	Subcontract
Chromium		mg/L	<0.2	04/12/2014	Subcontract
Copper		mg/L	4.43	04/12/2014	Subcontract
Iron		mg/L	857	04/12/2014	Subcontract
Lead		mg/L	2.77	04/12/2014	Subcontract
Magnesium		mg/L	167	04/12/2014	Subcontract
Manganese		mg/L	37.8	04/12/2014	Subcontract
Nickel		mg/L	0.381	04/12/2014	Subcontract
Potassium		mg/L	<18	04/12/2014	Subcontract
Sodium		mg/L	107	04/12/2014	Subcontract
Zinc		mg/L	4.3	04/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.23	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	1.0	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	<0.1	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	<0.11	02/12/2014	Calculation
Cyanide		mg/L	0.05	05/12/2014	APHA - 4500 - CN
Ammonia (as N)		mg/L	34	02/12/2014	Nessler
B.O.D.		mg/L	70	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	260	20/11/2014	APHA - 5220 - D
pH		-	6.72	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	2638	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.6

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/413
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L06	mg/L	<11.5	04/12/2014	Subcontract
Cadmium		mg/L	<0.03	04/12/2014	Subcontract
Calcium		mg/L	517	04/12/2014	Subcontract
Chromium		mg/L	<0.1	04/12/2014	Subcontract
Copper		mg/L	0.929	04/12/2014	Subcontract
Iron		mg/L	205	04/12/2014	Subcontract
Lead		mg/L	1.39	04/12/2014	Subcontract
Magnesium		mg/L	44.6	04/12/2014	Subcontract
Manganese		mg/L	11.8	04/12/2014	Subcontract
Nickel		mg/L	0.38	04/12/2014	Subcontract
Potassium		mg/L	<9	04/12/2014	Subcontract
Sodium		mg/L	<15	04/12/2014	Subcontract
Zinc		mg/L	1.49	04/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.12	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	65.3	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.16	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	7.9	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.80	02/12/2014	Calculation
Cyanide		mg/L	0.039	05/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	23	02/12/2014	Nessler
B.O.D.		mg/L	17.8	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	85	20/11/2014	APHA - 5220 - D
pH		-	7.25	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	383	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.7

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/414
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L07	mg/L	<0.23	03/12/2014	Subcontract
Cadmium		mg/L	0.0009	03/12/2014	Subcontract
Calcium		mg/L	126	03/12/2014	Subcontract
Chromium		mg/L	0.0105	03/12/2014	Subcontract
Copper		mg/L	0.0459	03/12/2014	Subcontract
Iron		mg/L	13.8	03/12/2014	Subcontract
Lead		mg/L	0.0686	03/12/2014	Subcontract
Magnesium		mg/L	9.12	03/12/2014	Subcontract
Manganese		mg/L	0.745	03/12/2014	Subcontract
Nickel		mg/L	0.0776	03/12/2014	Subcontract
Potassium		mg/L	2.05	03/12/2014	Subcontract
Sodium		mg/L	7.6	03/12/2014	Subcontract
Zinc		mg/L	0.134	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.16	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	50.5	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	<0.01	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	6.0	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	0.11	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.38	02/12/2014	Calculation
Cyanide		mg/L	0.01	05/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	3.25	02/12/2014	Nessler
B.O.D.		mg/L	8.2	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	17	20/11/2014	APHA - 5220 - D
pH		-	7.13	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	575	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.8

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/415
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L08	mg/L	0.905	04/12/2014	Subcontract
Cadmium		mg/L	0.0009	04/12/2014	Subcontract
Calcium		mg/L	229	04/12/2014	Subcontract
Chromium		mg/L	1.69	04/12/2014	Subcontract
Copper		mg/L	0.209	04/12/2014	Subcontract
Iron		mg/L	52.6	04/12/2014	Subcontract
Lead		mg/L	0.274	04/12/2014	Subcontract
Magnesium		mg/L	51.1	04/12/2014	Subcontract
Manganese		mg/L	2.45	04/12/2014	Subcontract
Nickel		mg/L	0.397	04/12/2014	Subcontract
Potassium		mg/L	87.1	04/12/2014	Subcontract
Sodium		mg/L	208	04/12/2014	Subcontract
Zinc		mg/L	0.55	04/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.41	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	132	03/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.07	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	<0.1	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	<0.11	02/12/2014	Calculation
Cyanide		mg/L	0.097	05/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	239	02/12/2014	Nessler
B.O.D.		mg/L	11	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	226	20/11/2014	APHA - 5220 - D
pH		-	6.83	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	4463	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.9

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/416
Order No.:
Date Received: 19/11/14
Date Completed: 05/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L09	mg/L	1.26	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	187	03/12/2014	Subcontract
Chromium		mg/L	0.005	03/12/2014	Subcontract
Copper		mg/L	0.0154	03/12/2014	Subcontract
Iron		mg/L	43.4	03/12/2014	Subcontract
Lead		mg/L	0.0095	03/12/2014	Subcontract
Magnesium		mg/L	60.6	03/12/2014	Subcontract
Manganese		mg/L	0.961	03/12/2014	Subcontract
Nickel		mg/L	0.0237	03/12/2014	Subcontract
Potassium		mg/L	117	03/12/2014	Subcontract
Sodium		mg/L	155	03/12/2014	Subcontract
Zinc		mg/L	0.0454	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.21	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	63.3	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	N/A**	N/A**	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	0.3	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.06	02/12/2014	Calculation
Cyanide		mg/L	0.047	05/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	226	02/12/2014	Nessler
B.O.D.		mg/L	99	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	214	21/11/2014	APHA - 5220 - D
pH		-	6.82	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	3206	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.10

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/417
Order No.:
Date Received: 19/11/14
Date Completed: 10/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L10	mg/L	0.568	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	199	03/12/2014	Subcontract
Chromium		mg/L	<0.002	03/12/2014	Subcontract
Copper		mg/L	0.0226	03/12/2014	Subcontract
Iron		mg/L	4.6	03/12/2014	Subcontract
Lead		mg/L	0.0073	03/12/2014	Subcontract
Magnesium		mg/L	30	03/12/2014	Subcontract
Manganese		mg/L	0.78	03/12/2014	Subcontract
Nickel		mg/L	0.0243	03/12/2014	Subcontract
Potassium		mg/L	50.6	03/12/2014	Subcontract
Sodium		mg/L	80.8	03/12/2014	Subcontract
Zinc		mg/L	0.183	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.2	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	234	03/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.09	04/12/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	42.9	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	9.68	02/12/2014	Calculation
Cyanide		mg/L	0.057	10/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	69	02/12/2014	Nessler
B.O.D.		mg/L	43	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	131	20/11/2014	APHA - 5220 - D
pH		-	7.01	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	1852	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.11

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/418
Order No.:
Date Received: 19/11/14
Date Completed: 10/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	L11	mg/L	N/A**	N/A**	Subcontract
Cadmium		mg/L	N/A**	N/A**	Subcontract
Calcium		mg/L	N/A**	N/A**	Subcontract
Chromium		mg/L	N/A**	N/A**	Subcontract
Copper		mg/L	N/A**	N/A**	Subcontract
Iron		mg/L	N/A**	N/A**	Subcontract
Lead		mg/L	N/A**	N/A**	Subcontract
Magnesium		mg/L	N/A**	N/A**	Subcontract
Manganese		mg/L	N/A**	N/A**	Subcontract
Nickel		mg/L	N/A**	N/A**	Subcontract
Potassium		mg/L	N/A**	N/A**	Subcontract
Sodium		mg/L	N/A**	N/A**	Subcontract
Zinc		mg/L	N/A**	N/A**	Subcontract
Mercury		mg/L	N/A**	N/A**	Subcontract
Fluoride		mg/L	0.27	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	216	03/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.1	04/12/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	<0.1	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	<0.11	02/12/2014	Calculation
Cyanide		mg/L	0.023	10/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	230	02/12/2014	Nessler
B.O.D.		mg/L	65	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	195	20/11/2014	APHA - 5220 - D
pH		-	7.03	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	3230	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

**Insufficient sample

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.12

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/419
Order No.:
Date Received: 19/11/14
Date Completed: 10/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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

FTAO: Tara Flanagan

Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	Tank	mg/L	0.436	03/12/2014	Subcontract
Cadmium		mg/L	<0.0006	03/12/2014	Subcontract
Calcium		mg/L	133	03/12/2014	Subcontract
Chromium		mg/L	<0.002	03/12/2014	Subcontract
Copper		mg/L	0.0092	03/12/2014	Subcontract
Iron		mg/L	8	03/12/2014	Subcontract
Lead		mg/L	<0.006	03/12/2014	Subcontract
Magnesium		mg/L	16.3	03/12/2014	Subcontract
Manganese		mg/L	0.393	03/12/2014	Subcontract
Nickel		mg/L	0.0122	03/12/2014	Subcontract
Potassium		mg/L	16.7	03/12/2014	Subcontract
Sodium		mg/L	31.9	03/12/2014	Subcontract
Zinc		mg/L	0.0345	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.14	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	70.5	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.02	26/11/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	19.4	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	4.39	02/12/2014	Calculation
Cyanide	mg/L	0.017	10/12/2014	APHA - 4500 - CN	
Ammonia (as N)	mg/L	34.5	02/12/2014	Nessler	
B.O.D.	mg/L	10	20/11/2014	APHA - 5210 - B	
C.O.D.	mg/L	44	20/11/2014	APHA - 5220 - D	
pH	-	6.90	19/11/2014	APHA - 4500 - H ⁺	
Conductivity	µS/cm	1002	19/11/2014	APHA - 2510 - B	

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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 115305.13

Analysing
Testing
Consulting
Calibrating



Client: Environmental Department
Limerick City Council
Dooradoyle
Co. Limerick

BHP Ref. No.: 14/11/420
Order No.:
Date Received: 19/11/14
Date Completed: 10/12/14
Test Specification: Nil
Item: Annual Leachate 2014

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Test	Client Reference	Units	Results	Date Analysed	Standard Reference*
Boron	Sump	mg/L	1.26	03/12/2014	Subcontract
Cadmium		mg/L	0.0025	03/12/2014	Subcontract
Calcium		mg/L	1590	03/12/2014	Subcontract
Chromium		mg/L	0.0342	03/12/2014	Subcontract
Copper		mg/L	0.118	03/12/2014	Subcontract
Iron		mg/L	306	03/12/2014	Subcontract
Lead		mg/L	0.105	03/12/2014	Subcontract
Magnesium		mg/L	54.5	03/12/2014	Subcontract
Manganese		mg/L	9.14	03/12/2014	Subcontract
Nickel		mg/L	0.0264	03/12/2014	Subcontract
Potassium		mg/L	39.2	03/12/2014	Subcontract
Sodium		mg/L	35	03/12/2014	Subcontract
Zinc		mg/L	0.381	03/12/2014	Subcontract
Mercury		mg/L	<0.0001	27/11/2014	Subcontract
Fluoride		mg/L	0.09	02/12/2014	APHA - 4110 - B
Sulphate (as SO ₄)		mg/L	56.6	02/12/2014	APHA - 4110 - B
Orthophosphate (as P)		mg/L	0.02	04/12/2014	APHA - 4500 - P - E
Nitrate (as NO ₃)		mg/L	2.9	02/12/2014	APHA - 4110 - B
Nitrite (as NO ₂)		mg/L	<0.01	02/12/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.65	02/12/2014	Calculation
Cyanide		mg/L	0.048	10/12/2014	APHA - 4500 - CN ⁻
Ammonia (as N)		mg/L	27	02/12/2014	Nessler
B.O.D.		mg/L	10	20/11/2014	APHA - 5210 - B
C.O.D.		mg/L	57	20/11/2014	APHA - 5220 - D
pH		-	7.36	19/11/2014	APHA - 4500 - H ⁺
Conductivity		µS/cm	1055	19/11/2014	APHA - 2510 - B

Additional information: *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran

Issue Date : 27/02/15

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

Appendix H:

Tables 4.1 to 4.8 indicating 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 ^{Note 1} / Technique ^{Note 2}
	Perimeter Boreholes <small>Note 3</small>	Other Boreholes/ Vents/Wells	Site Office	
Methane (CH ₄) % v/v	Weekly	Monthly	Weekly	Infrared analyser/flame ionisation detector
Carbon dioxide (CO ₂)%v/v	Weekly	Monthly	Weekly	Infrared analyser/ flame ionisation detector
Oxygen(O ₂) %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/ PM₁₀ Monitoring Frequency

Parameter (mg/m ² /day)	Monitoring Frequency	Analysis Method/Technique
Dust	Three times a year ^{Note 2}	Standard Method ^{Note 1}
PM ₁₀	Quarterly	See ^{Note 3}

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) _{EQ} [30 minutes]	Bi-Annual	Standard ^{Note 1}
L(A) ₁₀ [30 minutes]	Bi-Annual	Standard ^{Note 1}
L(A) ₉₀ [30 minutes]	Bi-Annual	Standard ^{Note 1}
Frequency Analysis(1/3 Octave band analysis)	Bi-Annual	Standard ^{Note 1}

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 ^{Note 1}	SURFACE WATER ^{Note 2}	GROUNDWATER	LEACHATE ^{Note 3}
	Monitoring Frequency	Monitoring Frequency	Monitoring Frequency
Visual Inspection/Odour ^{Note 2}	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 ^{Note 3}	Annually	Annually	Annually
Cyanide (Total)	Not Applicable	Annually	Annually
Fluoride	Not Applicable	Annually	Annually
List I/II Organic Substances ^{Note 4}	Once off ^{Note 5}	Annually ^{Note 5}	Once off ^{Note 5}
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 ^{Note 6}	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 ^{Note 1}	Daily	Standard
Humidity	Daily	Standard
Atmospheric Pressure ^{Note 1}	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 ^{Note1} /Technique ^{Note2}
Inlet			
Methane (CH ₄) % v/v	Continuous	Weekly	Infrared analyser/flame ionisation detector/thermal conductivity
Carbon dioxide (CO ₂)%v/v	Continuous	Weekly	Infrared analyser/ thermal conductivity
Oxygen (O ₂) %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
Process Parameters			
Combustion Temperature	Continuous	Quarterly	Temperature Probe/datalogger
Outlet			
CO	Continuous	Continuous	Flue gas analyser/datalogger
NOx	Annually	Annually	Flue gas analyser
SO ₂	Annually	Annually	Flue gas analyser

Parameter	Flare (enclosed) Monitoring Frequency	Utilisation Plant Monitoring Frequency	Analysis Method ^{Note1} /Technique ^{Note2}
Particulates	Not applicable	Annually	Isokinetic/Gravimetric
TA Luft Class I, II, III organics	Not applicable	Annually	Adsorption/Desorption /GC/GCMS ^{Note 3}
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 ^{Note 1}
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 ^{Note 1}
Flow	Continuous	Flow meter / recorder
pH	Continuous	pH meter / recorder
Biochemical Oxygen Demand	Twice Weekly	Standard Method ^{Note 2}
Chemical Oxygen Demand	Weekly	Standard Method ^{Note 2}
Total Nitrogen	Twice Weekly	Standard Method ^{Note 2}
Total P (as P)	Monthly	Standard Method ^{Note 2}
Suspended Solids	Weekly	Gravimetric