BHP/CEM/23/A



TECHNICAL REPORT

Analysing Testing Consulting Calibrating

Client:

Limerick County Council Aras an Chontae Dooradoyle Co. Limerick BHP Ref No.: 102502-503-539(2)

Order No.:

Date Received: 14th & 16th February

2012

Date Completed: 05th March 2012

Test Specification: Nil

BHP

New Road Thomondgate Limerick Ireland Tel +353 61 455399

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

FAO: Finbarr Murphy

Item: Survey, sampling and analysis of Waste material from Landfill in Churchtown, Newcastle West, Co. Limerick

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COUNTY COUNCIL

1 1 APR 2012

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LIMERICK

For and on behalf of BHP Ltd.

Joan Mc Carthy

Date Issued: 05th April 2012 Supplement to report No. N/A

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Environment Section

1.0 EXECUTIVE SUMMARY

An on-site investigation of a historical landfill site located in Churchtown, Newcastle West, Co. Limerick, was conducted on the 14th and 16th February 2012, by BHP Personnel.

This investigation forms part of a Tier 2 Preliminary Investigation carried out carried out in accordance with the EPA Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites.

A walk over survey revealed that the site was closed and covered in bush and scrub. The intrusive investigation that followed showed varying concentrations of municipal waste (EWC 20 03 01) landfilled. On exposure there was a notable decomposition odour indicating that the waste within the landfill is continuing to undergo anaerobic decomposition. Further investigation would be required to determine risks posed to the neighbouring residential area.

Leachate and landfill gas migration pathways and possible receptors need to be established to quantify risk posed to residents and the environment.



2.0 INTRODUCTION

2.1 Background

At the request of Finbarr Murphy of Limerick County Council, BHP conducted sampling and analysis of waste material from a landfill site located at Churchtown, Newcastle West, Co. Limerick. The purpose of the sampling and analysis program was to classify buried material on site and determine its approximate extent.

The location of the landfill was in the immediate vicinity of a residential area. An aerial photograph of the area under investigation is presented below.



Photograph of the Churchtown site, Newcastle West, showing landfill area under investigation

2.2 Legislation

Arising from the Waste Framework Directive (75/442/EEC), and in particular the European Court of Justice Decision C-494/01, all historic unregulated waste disposal sites need to be identified, and the risks posed to the environment and human health needs to be assessed. The most relevant legislation for historic landfill sites include Waste Management (Certification of Historic Unlicenced Waste Disposal and Recovery Activity) Regulations and the Waste Management Acts 1996 to 2011. Under the Waste Management Acts 1996 to 2011, local authorities were given responsibility for the completion of an inventory and risk assessment of all non-licensed closed landfills. The EPA have produced a Code of Practice to assist Local Authorities in this regard.

Remediation measures chosen for each closed landfill must ensure that there is no significant pollutant linkage remaining after remediation has taken place. Remediation may involve the removal of landfilled material to an appropriate waste disposal facility.

Current legislation governing waste disposal and waste acceptance criteria is set down

in Council Decision 2003/33/EC ('on establishing criteria and procedures for the acceptance of waste at Landfill)'. This decision lays down uniform waste classification and acceptance procedures according to Annex II to Directive 1999/31/EC on the landfill of waste (the 'Landfill Directive').

3.0 SAMPLING

3.1 Site Survey Observations

Photographs of the historical landfill investigated are presented below:

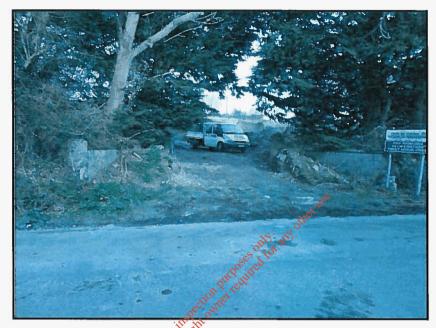


Image of the site entrance

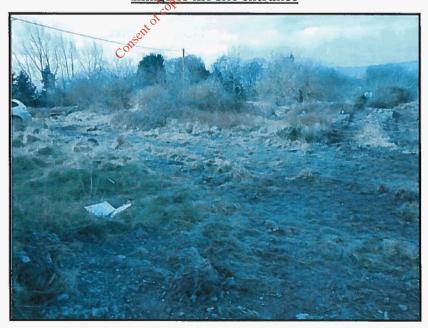


Image A of Site



Image B of Site

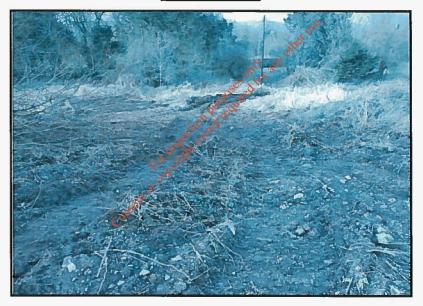


Image C of Site



Image D of Site

Trial holes were excavated at 4 locations across the area under investigation, typically down to approximately 6 metres in depth.

Sampling notes taken during trial hole excapation are given as follows:

Trial Hole	Depth	Description	ÈWC#
TH2	Surface to 0.50m	Clean Aggregate	-
	0.50m to 6m of 15	Mixed municipal waste	20-03-01
TH3	Surface to 2.5m	Mixed municipal waste	20-03-01
	2.5m to 3.0m	Aggregate	-
	3.0m to 6.0m	Mixed municipal waste	-
TH4	Surface to 0.3m	Topsoil	-
. 48, 11 10	0.3m to 0.5m	Aggregate	-
	0.5m to 6m	Mixed municipal waste	20-03-01
TH5	0.3m to 4m	Mixed municipal waste	20-03-01
<u> </u>	4m to 5m	Clay	-

Photographs of the excavated material are presented on the following page. This is a typical example of what was encountered for each of the trial holes excavated. The

evidence of municipal waste (EWC 20 03 01) is clear from these photographs. Further photographs taken during trial pit excavation are presented in Appendix 2.



Photograph of TH2 showing municipal waste from just under the surface to the bottom of the pit.



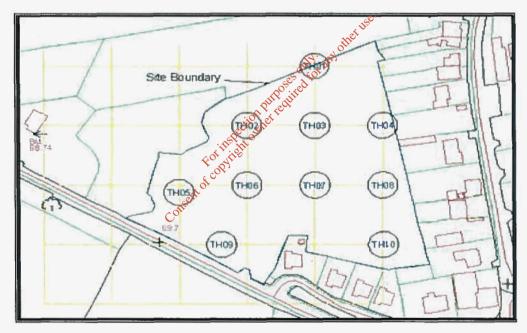
Photograph of excavated material from TH3

3.2 Sampling and Testing of Material

Sampling was carried out on the 14th and 16th February 2012 by Aidan Daffy of BHP Laboratories with the aid of personnel provided by Limerick County Council. Three soil samples and four water samples were taken from the four trial holes excavated. A water sample was also taken from a nearby stream.

The following map illustrates the approximate location of trial holes excavated on site.

The following soil samples were taken from the trial holes and tested against the acceptance criteria for waste at inert landfills.



Sketch of Area surveyed indicating Trial Hole Locations.

TH2	Composite sample taken from a depths 0.5m-6.0m
TH3	Composite sample taken from a depths 0.5m-6.0m
TH4	Composite sample taken from a depths 0.5m-6.0m

TH5 Soil sample taken at between 4.0m and 5.0m

Water ingress into Trial Hole TH2 was noted at a depth of 4.40m. A water sample was taken from TH2 at this depth.

Water ingress into Trial Hole TH3 was noted at a depth of 2.50m. A water sample was taken from TH3 at this depth.

Water ingress into Trial Hole TH4 was noted at a depth of 3.80m. A water sample was taken from TH4 at this depth.

Water ingress into Trial Hole TH5 was noted at a depth of 1.80m. A water sample was taken from TH5 at this depth.

The soil samples were analysed to determine whether they met acceptance criteria for inert landfills as set down in Council Decision 2003/33/EC.

The water sample was tested to the requirements of SI No. 12/2001 (Water Quality Dangerous Substances Regulations 2001.

For its petition the requirements of SI No. 12/2001 (Water Quality Dangerous Substances Regulations 2001.

EPA Export 10-05-2019:03:42:30

4.0 ANALYTICAL RESULTS (SEE APPENDIX 1)

Comprehensive analysis results are presented in Appendix 1. A summary of Analytical Results is presented below.

- Material excavated from all trial holes contains a mixture of soil, aggregate and municipal waste of varying composition.
- The municipal waste is categorised as mixed municipal waste, EWC 20 03 01, according to the European Waste Catalogue and as such is acceptable at landfills for non-hazardous waste according to Council Decision 2003/33/EC Section 2.2.1.
- Leaching limit values for soils taken from all trial holes were within waste acceptance criteria for inert landfills as set down in Council Decision 2003/33/EC (Section 2.1.2.1) due to elevated dissolved organic carbon. Thus was expected due to the presence of paper and cardboard in the samples.
- Total content of organic parameters for soils taken from all trial holes were within waste acceptance criteria for ment landfills as set down in Council Decision 2003/33/EC (Section 2.1.2.2) with the exception of total organic carbon. This was expected due to the presence of paper and cardboard in the samples.
- Dangerous substance concentrations in the water sample meet the standards set down in SI No. 12/2001 'Water Quality (Dangerous Substances)
 Regulations, 2001.

The material can be classified as non-hazardous in accordance with 2003/33/EU.

5.0 INTERPRETATION

Council Decision of 19 December 2002 'on establishing criteria and procedures for the acceptance of waste at Landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC' sets out criteria for the acceptance of waste at landfills. The Acceptance criteria for Inert Landfills and Non-Hazardous Landfills are outlined in Section 2.1 and 2.2 respectively. All material observed and tested can be classified as either Municipal Waste (EWC 20 03 01) or Soil Stone Waste (EWC 17 05 04). As such the material meets waste acceptance criteria as set down in Council Decision 2003/33/EC for Landfills for Non-Hazardous Waste.

6.0 CONCLUSIONS

Intrusive site investigations revealed the presence of municipal waste at varying concentrations across the landfill area examined. There is no evidence of lining at this site, the capping layer is of very poor quality.

The waste body is largely decomposed with odour detected in two trial holes. No gas was detected using the gas monitor.

There is no evidence of measures taken to isolate the effects of landfill material, leachate or landfill gas from the surrounding environment.

7.0 RECOMMENDATIONS

Determine the hydrological flow from the site to identify potential receptors and the risks posed by the leachate run-off. Determine the composition of leachate, ground water and surface water in the vicinity of the landfill to assess leachate impact on the environment. The site has been assessed adequately. Additional monitoring and analysis is at the discretion of the client.

Determine the potential migration pathways for landfill gases and the possible receptors due to these pathways. Regular monitoring of landfill gas levels in the possible receptors, to reduce risk from landfill gas migration.

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APPENDIX 1

ANALYTICAL RESULTS

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APPENDIX 2

QUALITY CONTROL

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

1.1 Chain of Custody and Client Instruction

Every sample received at BHP laboratories is inspected by the laboratory manager Pat O'Sullivan or by site manager Paul O' Sullivan.

A client instruction is required to start analysis.

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

1.2

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

1.3 Validation

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

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

1.4 Quality Control (Skewhart) Charts

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

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

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

1.5 Inter-laboratory Testing

The CEM laboratory are members of the W.R.C Aquacheck Scheme. The Laboratory also participates in the Environmental Protection Agency's Intercalibration

Programme and is listed on the Agency's Register of Quality Approved Testing

Laboratories.

For inspection Intercalibration

For inspection In

APPENDIX 1

ANALYTICAL RESULTS

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Client:

Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102502.1

Order No.:

Date Received: 14/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP

New Road Thomondgate Limerick Ireland

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

Test	Client Reference	Units	Results	Standard Reference
	TH2 (4.4M)			
		use.		
Water Level		ottet 1158.	4.40	ISO 5667 - 11
Temperature	Consent of copyright owner require	974. 5124 °C	11	APHA - 2550 - B
pН	noses of	-	6.60	APHA - 4500 - H ⁺ - I
Conductivity	n Pure quit	μScm ⁻¹	1942	APHA - 2510 - B
Ammonia (as NH ₃ -N)	aection reference	mg/l	64.6	APHA -4500- NH ₃ -I
Nitrate (as NO ₃)	ritelito	mg/l	1.55	APHA - 4110 - B
Nitrite (as NO ₂)	FO PARE	mg/l	< 0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)	atolo	mg/l	0.35	APHA - 4110 - B
BOD	Coliser	mg/l	11	APHA - 5210 - B
COD		mg/l	158	APHA - 5220 - D
Calcium		mg/l	48.9	APHA - 3120 - B
Magnesium		mg/l	15.6	APHA - 3120 - B
Sodium		mg/l	34.51	APHA - 3120 - B
Potassium	,	mg/l	32.05	APHA - 3120 - B
Iron		ug/l	560	APHA - 3120 - B
Manganese		ug/l	206	APHA - 3120 - 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 :

Pat O'Sullivan

Issue Date: 07/03/2012

COLIMITY GOUNCIL

1 2 E F 2012

1 Invironment Section

Client:

Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

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Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP

New Road Thomondgate Limerick Ireland

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

Test	Client Reference	Units	Results	Standard Reference
	TH2 (4.4M) For inspection purposes of the conjugate of t	,		
		150.		
Cadmium		other ug/l	<0.1	APHA - 3120 - B
Total Chromium		nly all ug/l	<1	APHA - 3120 - B
Copper	00° 148	ug/l	<1	APHA - 3120 - B
Nickel	7 Pur equi	ug/l	<1	APHA - 3120 - B
Lead	aection inet	ug/l	2	APHA - 3120 - B
Zinc	or institution	ug/l	12	APHA - 3120 - B
Arsenic	Fortyfic	ug/l	<0.9	APHA - 3120 - B
Boron	a di	ug/l	9	APHA - 3120 - B
Mercury	Conserv	ug/l	<0.2	APHA - 3120 - B
Sulphate		mg/l	6.1	APHA - 4110 - B
Chloride		mg/l	47.8	APHA - 4110 - B
Molybdate Reactive Phosphorus	s (as P)	mg/l	0.23	APHA - 4500 - P-E
Total Cyanide		mg/l	0.05	APHA - 4500-CN-C
Fluoride		mg/l	0.13	APHA - 4110 - B
	1			

Additional information:

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1 2 1 2012

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BHP

New Road Thomondgate Limerick Ireland

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

Test	Client Reference	Units	Results	Standard Reference
Atrazine Dichloromethane Simazine Toluene Tributyltin Total Xylenes	TH2 (4.4M) TH2 (4.4M) Consent of converted to the conve	offer ug/l ug/l ug/l ug/l ug/l ug/l ug/l	<1 <1 <1 <1 <0.001 <1	GC-MS GC-MS GC-MS GC-MS GC-MS GC-MS

Additional information:

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For and on behalf of BHP laboratories:

Pat O'Sullivan

Issue Date: 07/03/2012

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Client:

Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102502.2

Order No.:

Date Received: 14/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

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BHP

New Road Thomondgate Limerick Ireland

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

Test	Client Reference	Units	Results	Standard Reference
	TH3 (2.5M)	ng.		
Water Level	Consent of copyright owner required h	offer use.	2.50	ISO 5667 - 11
Temperature	Oth	C oC	11	APHA - 2550 - B
pH	oo red	-	6.48	APHA - 4500 - H ⁺ - I
Conductivity	n Put requir	μScm ⁻¹	1667	APHA - 2510 - B
Ammonia (as NH ₃ -N)	gedio net	mg/l	75.28	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)	of institution	mg/l	0.81	APHA - 4110 - B
Nitrite (as NO ₂)	COBAIL	mg/l	< 0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)	nt of C	mg/l	0.18	APHA - 4110 - B
BOD	Conser	mg/l	9	APHA - 5210 - B
COD		mg/l	437	APHA - 5220 - D
Calcium		mg/l	75.4	APHA - 3120 - B
Magnesium		mg/l	22.49	APHA - 3120 - B
Sodium		mg/l	34.56	APHA - 3120 - B
Potassium		mg/l	21.99	APHA - 3120 - B
Iron		ug/l	453	APHA - 3120 - B
Manganese		ug/l	11	APHA - 3120 - B

Additional information:

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and Wastewater 20th Edition.

For and on behalf of BHP laboratories:

Pat O'Sullivan

Issue Date: 07/03/2012

Client: Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102502.2

Order No.:

Date Received: 14/02/12 Date Completed: 05/03/12

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BHP

New Road Thomondgate Limerick

Ireland Tel +353 61 455399 Fax + 353 61 455447

E Mail bhpcem2@bhp.ie

	CI: . P. C	TT 1.	72 14	G: 1 1
Test	Client Reference	Units	Results	Standard
				Reference
	TH3 (2.5M)			
		r USE.		
Cadmium	Consent of copyright owner required for	diter ug/l	<0.1	APHA - 3120 - B
Total Chromium	Out of	ug/l	<1	APHA - 3120 - B
Copper	Joseph Joseph	ug/l	<1	APHA - 3120 - B
Nickel	an Purkequir	ug/l	<1	APHA - 3120 - B
Lead	gertion net	ug/l	2	APHA - 3120 - B
Zinc	or insight o	ug/l	12	APHA - 3120 - B
Arsenic	Copyre	ug/l	< 0.9	APHA - 3120 - B
Boron	nt of contract of the contract	ug/l	11	APHA - 3120 - B
Mercury	College	ug/l	<0.2	APHA - 3120 - B
Sulphate		mg/l	19.9	APHA - 4110 - B
Chloride		mg/l	71.7	APHA - 4110 - B
Molybdate Reactive Phosphorus (as	s P)	mg/l	0.24	APHA - 4500 - P-E
Total Cyanide		mg/l	0.119	APHA - 4500-CN-C
Fluoride		mg/l	< 0.05	APHA - 4110 - B
G.				

Additional information:

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For and on behalf of BHP laboratories:

Pat O'Sullivan

Issue Date: 07/03/2012

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

1 2 1945 7017

Client: Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102502.2

Order No.:

Date Received: 14/02/12 Date Completed: 05/03/12

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Item: See below

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BHP

New Road
Thomondgate
Limerick
Ireland

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

Γest	Client Reference	Units	Results	Standard Reference
Atrazine Dichloromethane Simazine Toluene Tributyltin Total Xylenes	TH3 (2.5M) TH3 (2.5M) For inspection purposes of the contraction of		<1 <1 <1 <1 <0.001 <1	GC-MS GC-MS GC-MS GC-MS GC-MS GC-MS

Additional information:

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For and on behalf of BHP laboratories:

Pat O'Sullivan

Issue Date: 07/03/2012

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Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102502.3

Order No.:

Date Received: 14/02/12 Date Completed: 05/03/12

Test Specification: Nil

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BHP

New Road Thomondgate Limerick Ireland

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

Test	Client Reference	Units	Results	Standard
- 100 × 100				Reference
	TH4 (3.8M)			
		use.		
Water Level		offict use.	3.80	ISO 5667 - 11
Temperature	Consent of copyright owner required to	°C °C	12.6	APHA - 2550 - B
pН	ose edit	-	6.40	APHA - 4500 - H ⁺ - B
Conductivity	2 Pur equit	μScm ⁻¹	1418	APHA - 2510 - B
Ammonia (as NH ₃ -N)	ection et	mg/l	70.73	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)	ritis dito	mg/l	0.9	APHA - 4110 - B
Nitrite (as NO ₂)	Folyhie	mg/l	< 0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)	A OF C	mg/l	0.2	APHA - 4110 - B
BOD	CONSEL	mg/l	25	APHA - 5210 - B
COD		mg/l	659	APHA - 5220 - D
Calcium		mg/l	82.4	APHA - 3120 - B
Magnesium		mg/l	21.16	APHA - 3120 - B
Sodium	•	mg/l	36.54	APHA - 3120 - B
Potassium		mg/l	41.87	APHA - 3120 - B
Iron		ug/l	652	APHA - 3120 - B
Manganese		ug/l	24	APHA - 3120 - B

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Thomondgate Limerick

Ireland

New Road

BHP

Analysing Testing

Consulting Calibrating

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

Test	Client Reference	Units	Results	Standard
				Reference
	TH4 (3.8M)			
		use.		
Cadmium		inet ug/l	< 0.1	APHA - 3120 - B
Total Chromium	व्योग वर्ष	ug/l	1	APHA - 3120 - B
Copper	ases ad for	ug/l	<1	APHA - 3120 - B
Nickel	Durgaline	ug/l	<1	APHA - 3120 - B
Lead	cition refre	ug/l	2	APHA - 3120 - B
Zinc	insperon	ug/l	13	APHA - 3120 - B
Arsenic	Fot high	ug/l	< 0.9	APHA - 3120 - B
Boron	of cold	ug/l	16	APHA - 3120 - B
Mercury	TH4 (3.8M) For inspection purposes only and for any companies to the control of control	ug/l	<0.2	APHA - 3120 - B
Sulphate	Co	mg/l	5.42	APHA - 4110 - B
Chloride		mg/l	47.5	APHA - 4110 - B
Molybdate Reactive Phosphorus (as	P)	mg/l	0.24	APHA - 4500 - P-E
Total Cyanide		mig/l	0.031	APHA - 4500-CN-C
Fluoride		mg/l	< 0.05	APHA - 4110 - B
	A STATE OF THE STA			

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Test	Client Reference	Units	Results	Standard Reference
Atrazine Dichloromethane Simazine Toluene Tributyltin Total Xylenes	TH4 (3.8M) For inspection purposes of convinging the direction of convinging the convincence of the convinc	officer ug/l ug/l ug/l ug/l ug/l ug/l	<1 <1 <1 <0.001 <1	GC-MS GC-MS GC-MS GC-MS GC-MS

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Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102539.1

Order No.:

Date Received: 16/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP

New Road

Thomondgate

Limerick Ireland

Tel +353 61 455399 Fax + 353 61 455447

E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
	TH5 (1.8M)			
		nge.		
Water Level	TH5 (1.8M) For its perior purposes of the decopyright owner required to the construction of copyright owner required to the c	atter M	1.80	ISO 5667 - 11
Temperature		Y; all °C	12.4	APHA - 2550 - B
pН	Oses of	· -	6.76	APHA - 4500 - H ⁺ - H
Conductivity	Durgediide	μScm ⁻¹	681	APHA - 2510 - B
Ammonia (as NH ₃ -N)	actionization	mg/l	63.75	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)	ilisopt ou	mg/l	2.66	APHA - 4110 - B
Nitrite (as NO ₂)	Fotogrifie	mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)	x of co	mg/l	0.6	APHA - 4110 - B
BOD	* Office The	mg/l	28	APHA - 5210 - B
COD		mg/l	84	APHA - 5220 - D
Calcium		mg/l	65.8	APHA - 3120 - B
Magnesium		mg/l	17.86	APHA - 3120 - B
Sodium		mg/l	39.77	APHA - 3120 - B
Potassium		mg/l	44.68	APHA - 3120 - B
Iron		ug/l	893	APHA - 3120 - B
Manganese		ug/l	406	APHA - 3120 - 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:

Pat O'Sullivan

Issue Date: 07/03/2012

Client: **Limerick County Council**

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102539.1

Order No.:

Date Received: 16/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP **New Road** Thomondgate

Limerick Ireland

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

Test	Client Reference	Units	Results	Standard Reference
-	TH5 (1.8M)	æ.		
Cadmium		of other ug/l	< 0.1	APHA - 3120 - B
Total Chromium		ug/l	<1	APHA - 3120 - B
Copper	Consent of copyright owner require	ug/l	<1	APHA - 3120 - B
Nickel	Durgoliti	ug/l	<1	APHA - 3120 - B
Lead	action refre	ug/l	3	APHA - 3120 - B
Zinc	ilisophom	ug/l	14	APHA - 3120 - B
Arsenic	For Artis	ug/l	<0.9	APHA - 3120 - B
Boron	Se Col	ug/l	8	APHA - 3120 - B
Mercury	onsent.	ug/l	<0.2	APHA - 3120 - B
Sulphate	Co	mg/l	9.63	APHA - 4110 - B
Chloride		mg/l	47.6	APHA - 4110 - B
Molybdate Reactive Phosphoru	as (as P)	mg/l	0.75	APHA - 4500 - P-E
Total Cyanide		mg/l	0.032	APHA - 4500-CN-C
Fluoride		mg/l	0.14	APHA - 4110 - 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:

Pat O'Sullivan

Issue Date: 07/03/2012

Client:

Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

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Date Received: 16/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP

New Road

Thomondgate

Limerick Ireland

ireland

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

Test	Client Reference	Units	Results	Standard Reference
	TH5 (1.8M)	يع.		
Atrazine		officer ug/l	<1	GC-MS
Dichloromethane		ug/l	<1	GC-MS
Simazine	Sep.	ug/l	<1	GC-MS
Toluene	- Duft equiff	ug/l	<1	GC-MS
Tributyltin	editor de la companya del companya del companya de la companya de	ug/l	<0.001	GC-MS
Total Xylenes	For inspection purposes for inspection owner reduite	ug/l	<1	GC-MS

Additional information:

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

For and on behalf of BHP laboratories:

Pat O'Sullivan

Issue Date: 07/03/2012

COLNTY COUNCIL

1 2 MAR 2012

Environment Section

Limerick County Council Client:

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102539.2

Order No.:

Date Received: 16/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP

New Road

Thomondgate

Limerick

Ireland

Tel +353 61 455399

Fax + 353 61 455447

E Mail bhpcem2@bhp.ie

Γest	Client Reference	Units	Results	Standard Reference
	Leonards Stream			
Vater Level	Leonards Stream	erise.	n/a	ISO 5667 - 11
Cemperature		4. of other oc	9.8	APHA - 2550 - B
oH	, ces 3	iot or -	6.68	APHA - 4500 - H ⁺ - 1
Conductivity	author litted	μScm ⁻¹	429	APHA - 2510 - B
Ammonia (as NH ₃ -N)	ation of red	mg/l	0.43	APHA -4500- NH ₃ -I
Nitrate (as NO ₃)	in Spirit Only	mg/l	0.53	APHA - 4110 - B
Nitrite (as NO ₂)	Forlyigh	mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)	, of cox	mg/l	0.12	APHA - 4110 - B
BOD	Medi	mg/l	3	APHA - 5210 - B
COD	Cor	mg/l	44	APHA - 5220 - D
Calcium		mg/l	54.2	APHA - 3120 - B
Magnesium		mg/l	16.83	APHA - 3120 - B
Sodium		mg/l	62.11	APHA - 3120 - B
otassium		mg/l	34.1	APHA - 3120 - B
ron		ug/l	<1	APHA - 3120 - B
Manganese		ug/l	759	APHA - 3120 - 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:

Pat O'Sullivan

Issue Date: 07/03/2012

TIMERICK CORPSTY COUNCIL 1 2 MAR 2012 Environment Section

Client:

Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102539.2

Order No.:

Date Received: 16/02/12 Date Completed: 05/03/12 Test Specification: Nil

Item: See below

Testing Consulting Calibrating

Analysing



BHP

New Road

Thomondgate

Limerick

Ireland

Tel +353 61 455399 Fax + 353 61 455447

E Mail bhpcem2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
	Leonards Stream For inspection purposes for inspection when require	nse.		
Cadmium	0 0 0 0	atter ug/l	< 0.1	APHA - 3120 - B
Total Chromium		ald and ug/l	<1	APHA - 3120 - B
Copper	ages of	ug/l	<1	APHA - 3120 - B
Nickel	Durgolitic	ug/l	<1	APHA - 3120 - B
Lead	ction to re	ug/l	3	APHA - 3120 - B
Zinc	:1550000	ug/l	7	APHA - 3120 - B
Arsenic	Fortyiel	ug/l	<0.9	APHA - 3120 - B
Boron	of cor.	ug/l	12	APHA - 3120 - B
Mercury	nsent.	ug/l	< 0.2	APHA - 3120 - B
Sulphate	Cor	mg/l	10.43	APHA - 4110 - B
Chloride		mg/l	51.27	APHA - 4110 - B
Molybdate Reactive Phosphorus (a	s P)	mg/l	0.15	APHA - 4500 - P-E
Total Cyanide		mg/l	0.015	APHA - 4500-CN-C
Fluoride		mg/l	0.12	APHA - 4110 - 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:

Pat O'Sullivan

Issue Date: 07/03/2012

1 2 MAR 2012

constructions.

Seviroament Section

Client:

Limerick County Council

Aras an Chontae

Dorradoyle Co.Limerick

FTAO: Finbarr Murphy

BHP Ref. No.: 102539.2

Order No.:

Date Received: 16/02/12 Date Completed: 05/03/12

Test Specification: Nil

Item: See below

Analysing Testing Consulting Calibrating



BHP

New Road

Thomondgate Limerick

Ireland

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

Test	Client Reference	Units	Results	Standard Reference
Atrazine Dichloromethane Simazine Toluene Tributyltin Total Xylenes	Leonards Stream Leonards Stream Earlingtedion purposes only as a consent of congression of con	ug/l ug/l ug/l ug/l ug/l ug/l ug/l	<1 <1 <1 <1 <0.001 <1	GC-MS GC-MS GC-MS GC-MS GC-MS GC-MS

Additional information:

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

For and on behalf of BHP laboratories:

Issue Date: 07/03/2012

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

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1 2 MAR 3912

Chemical Analysis Report for Limerick County Council

Address:

Churchtown, Adare, Co.Limerick

(Sheet 1 of 4)

Description:_____L/S = 2 l/kg ______

Sample: TH2

Leachate analysis

Parameter	Results (mg/kg dry substance)						Limit values L/S = 2 l/kg mg/kg dry substance	Analysis method / technique
BHP Reference	102503.1					Method		
						Detection		
Product Description	Waste sample				, USC	Limits		
Arsenic As	0.002				other	0.002	0.1	ICP-MS
Barium Ba	0.012				H. My	0.01	7	ICP-MS
Cadmium Cd	< 0.001				fot	0.001	0.03	ICP-MS
Chromium total Cr	0.04			2 Pitrocities	,	0.001	0.2	ICP-MS
Copper Cu	0.49			Pilifedir		0.001	0.9	ICP-MS
Mercury Hg	<0.0002			inei.		0.001	0.003	ICP-MS
Molybdenum Mo	0.012			074		0.002	0.3	ICP-MS
Nickel Ni	0.18		coi in			0.001	0.2	ICP-MS
Lead Pb	0.024		CODY			0.001	0.2	ICP-MS
Antimony Sb	<0.001		O			0.001	0.02	ICP-MS
Selenium Se	0.004	25	ill.			0.002	0.06	ICP-MS
Zinc Zn	0.21	Co				0.002	2	ICP-MS
Chloride	18.8					0.1	550	I.C
Fluoride	0.74					0.2	4	I.C
Sulphate	254					0.1	560	I.C
Dissolved Organic Carbon	108					1	240	Photometric
Fotal Dissolved Solids	378					1	2500	Gravimetric
Phenol Index	0.008					0.001	0.5	Photometric

Signed for and on behalf of BHP Laboratories Ltd.

Chemical Analysis Report for Limerick County Council

Address: Churchtown, Adare, Co.Limerick

(Sheet 2 of 4) Description: L/S = 10 l/kg Sample: TH2 Leachate analysis

Parameter	Results (mg/kg dry substance)						Limit values L/S = 10 l/kg mg/kg dry substance	Analysis method / technique
BHP Reference	102503.1					Method		
Product Description	Waste sample					Detection Climits		ŀ
Arsenic As	<0.001				thet	0.002	0.5	ICP-MS
Barium Ba	0.004				14. 23	0.01	20	ICP-MS
Cadmium Cd	0.001	-		G	of or all	0.001	0.04	ICP-MS
Chromium total Cr	0.002			205.4	, 5	0.001	0.5	ICP-MS
Copper Cu	0.027			Pilipositi		0.001	2	ICP-MS
Mercury Hg	<0.0002			tion set		0.001	0.01	ICP-MS
Molybdenum Mo	0.001			e out		0.002	0.5	ICP-MS
Nickel Ni	0.004		cot in	of the		0.001	0.4	ICP-MS
Lead Pb	0.011		1,00%			0.001	0.5	ICP-MS
Antimony Sb	< 0.001		9			0.001	0.06	ICP-MS
Selenium Se	0.001		Sent			0.002	0.1	ICP-MS
Zinc Zn	0.014	(OR			0.002	4	ICP-MS
Chloride	2.49					0.1	800	I.C
Fluoride	0.16					0.2	10	I.C
Sulphate	24.7					0.1	1000	I.C
Dissolved Organic Carbon	120					1	500	Photometric
Fotal Dissolved Solids	1012					1	4000	Gravimetric
Phenol Index	0.012					0.001	1	Photometric
	-							

Signed for and on behalf of BHP Laboratories Ltd.

Chemical Analysis Report for Limerick County Council

Address:

Churchtown, Adare, Co.Limerick

(Sheet 3 of 4)

Description:_____L/S = 0.1 l/kg C0 (Percolation) _____

Sample: TH2

Leachate analysis

Parameter		Results (mg/l)					Limit values L/S = 0.1 l/kg mg/l	Analysis method / technique
BHP Reference	102503.1					Method		
						Detection		- 1
Product Description	Waste sample					Limits		
Arsenic As	0.002			<u> </u>	other	0.002	0.06	ICP-MS
Barium Ba	0.012			<u> </u>	M. M.	0.01	4	ICP-MS
Cadmium Cd	0.006			ي و د	Offor	0.001	0.02	ICP-MS
Chromium total Cr	0.011			Pitrons	200	0.001	0.1	ICP-MS
Copper Cu	0.096			Dill'edit		0.001	0.6	ICP-MS
Mercury Hg	< 0.002			diorner,		0.001	0.002	ICP-MS
Molybdenum Mo	0.002			\$0,0g		0.002	0.2	ICP-MS
Nickel Ni	0.027		ÇOT Î	i gji		0.001	0.12	ICP-MS
Lead Pb	0.032		ुर्ल	7.		0.001	0.15	ICP-MS
Antimony Sb	< 0.001		O.			0.001	0.1	ICP-MS
Selenium Se	0.001		asent.			0.002	0.04	ICP-MS
Zinc Zn	0.039		Cor			0.002	1.2	ICP-MS
Chloride	16.7					0.1	460	I.C
Fluoride	0.52					0.2	2.5	I.C
Sulphate	224.7					0.1	1500	I.C
Dissolved Organic Carbon	510					1	160	Photometric
Total Dissolved Solids							-	Gravimetric
Phenol Index	0.124					0.001	0.3	Photometric

Signed for and on behalf of BHP Laboratories Ltd.

Address: Churchtown, Adare, Co.Limerick

(Sheet 4 of 4) Description: Organic Parameters Sample: TH2

Solid analysis

Parameter		Resu (mg/kg)	lts					Limit values mg/kg	Analysis method / technique
BHP Reference	102503.1						Method		
						_	Detection	1	
Product Description	Waste sample						Limits		
Total Organic Carbon	75000					other	0.1	30000	Photometric
BTEX	< 0.01					Many	0.01	6	GC-FID
PCBs (7 cogeners)	< 0.001					offor	0.001	1	GC-MS
Mineral Oil (C10 to C40)	<0.1				4005 is	eg	0.1	500	GC-FID
PAHs (16)	< 0.005				Scilor de de de la cilor de la		0.005	-	GC-MS
					cionet				
					5,00				
				ÇOI'S	(2)				
				COD.					
				O.					
				asent					
				Ç					
							_		

Address: Churchtown, Adare, Co.Limerick

(Sheet 1 of 4) Description: L/S = 2 1/kg Sample: TH3 Leachate analysis

Parameter	(mg/	Results /kg dry substance)					Limit values L/S = 2 l/kg mg/kg dry substance	Analysis method / technique
BHP Reference	102503.2					Method		
n				 	. 158	Detection		
Product Description	Waste sample			 	atherite	Limits	0.1	ICP-MS
Arsenic As	<0.001		_	 	Office	0.002	0.1	
Barium Ba	0.024				H. My	0.01		ICP-MS
Cadmium Cd	< 0.001			<u>_</u>	(oi	0.001	0.03	ICP-MS
Chromium total Cr	0.07			Pitrogitie		0.001	0.2	ICP-MS
Copper Cu	0.31			Spr. Ode		0.001	0.9	ICP-MS
Mercury Hg	<0.0002			ction net?		0.001	0.003	ICP-MS
Molybdenum Mo	0.008			C OW		0.002	0.3	ICP-MS
Nickel Ni	0.039		FOI 18	Syr-		0.001	0.2	ICP-MS
Lead Pb	0.024		1,063			0.001	0.2	ICP-MS
Antimony Sb	<0.001		, of			0.001	0.02	ICP-MS
Selenium Se	0.002		aseit.			0.002	0.06	ICP-MS
Zinc Zn	0.16	C	OF			0.002	2	ICP-MS
Chloride	98			· · · · · · · · · · · · · · · · · · ·		0.1	550	I.C
Fluoride	0.68					0.2	4	I.C
Sulphate	101					0.1	560	I.C
Dissolved Organic Carbon	82					1	240	Photometric
Total Dissolved Solids	458					1	2500	Gravimetric
Phenol Index	0.122					0.001	0.5	Photometric

Address:

Churchtown, Adare, Co.Limerick

(Sheet 2 of 4)

Description:_____L/S = 10 l/kg _____

Sample: TH3

Leachate analysis

Parameter	(m _i	Results g/kg dry substance)		100			Limit values L/S = 10 l/kg mg/kg dry substance	Analysis method / technique
BHP Reference	102503.2					Method		
Design Design design						Detection	-	
Product Description	Waste sample				ather	Limits	0.5	ICP-MS
Arsenic As	<0.001		 			0.002	0.5	
Barium Ba	0.006			<u> </u>	My any	0.01		ICP-MS
Cadmium Cd	0.001		<u> </u>		offor	0.001	0.04	ICP-MS
Chromium total Cr	0.012		 _	1005	ల్	0.001	0.5	ICP-MS
Copper Cu	0.18			Puli edir		0.001	2	ICP-MS
Mercury Hg	<0.0002			chorner		0.001	0.01	ICP-MS
Molybdenum Mo	0.002			So Other		0.002	0.5	ICP-MS
Nickel Ni	0.019		FOI 18	of the		0.001	0.4	ICP-MS
Lead Pb	0.009		1,063			0.001	0.5	ICP-MS
Antimony Sb	< 0.001		, 8			0.001	0.06	ICP-MS
Selenium Se	0.001		sen			0.002	0.1	ICP-MS
Zinc Zn	0.024		COR			0.002	4	ICP-MS
Chloride	10.7					0.1	800	I.C
Fluoride	0.15					0.2	10	I.C
Sulphate	127					0.1	1000	I.C
Dissolved Organic Carbon	270					1	500	Photometric
Total Dissolved Solids	880					1	4000	Gravimetric
Phenol Index	0.036					0.001	1	Photometric

Signed for and on behalf of BHP Laboratories Ltd.

Address: Churchtown, Adare, Co.Limerick

(Sheet 3 of 4) Description:____L/S = 0.1 l/kg C0 (Percolation) _____ Sample: TH3 Leachate analysis

Parameter		Results (mg/l)					Limit values L/S = 0.1 l/kg mg/l	Analysis method / technique	
BHP Reference	102503.2					Method			
Product Description	Waste sample					Detection Limits			
Arsenic As	0.001				thei	0.002	0.06	ICP-MS	
Barium Ba	0.036				77. U.J.	0.01	4	ICP-MS	
Cadmium Cd	0.006			-	off of all	0.001	0.02	ICP-MS	
Chromium total Cr	0.018			205.4	60,	0.001	0.1	ICP-MS	
Copper Cu	0.049			Dilledill		0.001	0.6	ICP-MS	
Mercury Hg	<0.002			ation per 1		0.001	0.002	ICP-MS	
Molybdenum Mo	0.003		<u> </u>	S OTH		0.002	0.2	ICP-MS	
Nickel Ni	0.054		cotile	Sp.		0.001	0.12	ICP-MS	
Lead Pb	0.036		1009			0.001	0.15	ICP-MS	
Antimony Sb	< 0.001		20			0.001	0.1	ICP-MS	
Selenium Se	0.001		Sente			0.002	0.04	ICP-MS	
Zinc Zn	0.022		OF.			0.002	1.2	ICP-MS	
Chloride	231					0.1	460	I.C	
Fluoride	0.25					0.2	2.5	I.C	
Sulphate	459					0.1	1500	I.C	
Dissolved Organic Carbon	670					1	160	Photometric	
Total Dissolved Solids							<u>.</u>	Gravimetric	
Phenol Index	0.212					0.001	0.3	Photometric	

Address: Churchtown, Adare, Co.Limerick

(Sheet 4 of 4) Description: Organic Parameters Sample: TH3

Solid analysis

Parameter		Results (mg/kg)					<u>.</u> .	Limit values mg/kg	Analysis method / technique
BHP Reference	102503.1						Method]	
Product Description	Waste sample						Detection Limits	1	
Total Organic Carbon	92500					ather	0.1	30000	Photometric
BTEX	< 0.01					17. W.	0.01	6	GC-FID
PCBs (7 cogeners)	< 0.001				25	of soil	0.001	1	GC-MS
Mineral Oil (C10 to C40)	<0.1				. ~ · ∧	<i>y</i>	0.1	500	GC-FID
PAHs (16)	< 0.005				Pilitedia		0.005	-	GC-MS
					io, set				
				(4)	6, 0g				
				201 X	65				
				CODY					
				ot a				<u></u>	
				Seit					
				700					
-									

Address: Churchtown, Adare, Co.Limerick

(Sheet 1 of 4) Description:____L/S = 2 l/kg ____ Sample: TH4 Leachate analysis

Parameter	(mg/k	Results og dry substance)					Limit values L/S = 2 l/kg mg/kg dry substance	Analysis method / technique
BHP Reference	102503.3					Method Detection		
					. 1150	Limits	i	
Product Description	Waste sample				athert	0.002	0.1	ICP-MS
Arsenic As	<0.001				14. ally offi	0.002	7	ICP-MS
Barium Ba	0.036			O	Koi ou .	0.001	0.03	ICP-MS
Cadmium Cd	<0.001			2005 itel	<u> </u>	0.001	0.03	ICP-MS
Chromium total Cr	0.019			2 Diffeolities		0.001	0.9	ICP-MS
Copper Cu	0.3			ction net seu		0.001	0.003	ICP-MS
Mercury Hg	<0.0002			ction net		0.001	0.3	ICP-MS
Molybdenum Mo	0.012			CT CO		0.002	0.2	ICP-MS
Nickel Ni	0.043		GOT TO			0.001	0.2	ICP-MS
Lead Pb	0.021		, cols,			0.001	0.02	ICP-MS
Antimony Sb	<0.001		ett of C				0.02	ICP-MS
Selenium Se	0.001		ζ ^γ			0.002	2	ICP-MS
Zinc Zn	0.11					0.002		I.C
Chloride	80					0.1	550	I.C
Fluoride	0.62					0.2	4	I.C
Sulphate	208					0.1	560	
Dissolved Organic Carbon	360					l	240	Photometric Cravimatria
Total Dissolved Solids	1010					1	2500	Gravimetric
Phenol Index	0.245					0.001	0.5	Photometric
								

Address:

Churchtown, Adare, Co.Limerick

(Sheet 2 of 4)

Description:_____L/S = 10 l/kg _____

Sample: TH4

Leachate analysis

Parameter	(mg/l	Results kg dry substance)	_				Limit values L/S = 10 l/kg mg/kg dry substance	Analysis method / technique
BHP Reference	102503.3					Method Detection		
Product Description	Waste sample					Limits		1000 1100
Arsenic As	<0.001				other	0.002	0.5	ICP-MS
Barium Ba	0.014				M. My	0.01	20	ICP-MS
Cadmium Cd	0.011			دع	Office	0.001	0.04	ICP-MS
Chromium total Cr	0.008			1005 is	20	0.001	0.5	ICP-MS
Copper Cu	0.21			2 Pil redd		0.001	2	ICP-MS
Mercury Hg	<0.0002			ctioniei		0.001	0.01	ICP-MS
Molybdenum Mo	0.001		. مو	S ONL		0.002	0.5	ICP-MS
Nickel Ni	0.008		COLIN	66		0.001	0.4	ICP-MS
Lead Pb	0.006		, %,			0.001	0.5	ICP-MS
Antimony Sb	<0.001		, of			0.001	0.06	ICP-MS
Selenium Se	0.001		asett of Co			0.002	0.1	ICP-MS
Zinc Zn	0.036		9			0.002	4	ICP-MS
Chloride	19.1					0.1	800	I.C
Fluoride	0.6					0.2	10	I.C
	19.1					0.1	1000	I.C
Sulphate Carbon	180					1	500	Photometric
Dissolved Organic Carbon Total Dissolved Solids	568					1	4000	Gravimetric
	0.048					0.001	1	Photometric
Phenol Index	U.U40							

Signed for and on behalf of BHP Laboratories Ltd.

Address:

Churchtown, Adare, Co.Limerick

(Sheet 3 of 4)

Description:_____L/S = 0.1 l/kg C0 (Percolation) _____

Sample: TH4

Leachate analysis

Parameter		Results (mg/l)					Limit values L/S = 0.1 l/kg mg/l	Analysis method / technique	
BHP Reference	102503.3					Method]		
						Detection			
Product Description	Waste sample			<u> </u>		Limits			
Arsenic As	0.002				other	0.002	0.06	ICP-MS	
Barium Ba	0.041				77. Jay	0.01	4	ICP-MS	
Cadmium Cd	0.007			29	for	0.001	0.02	ICP-MS	
Chromium total Cr	0.032			Pirogses	<u> </u>	0.001	0.1	ICP-MS	
Copper Cu	0.049			Pilitedin	L	0.001	0.6	ICP-MS	
Mercury Hg	< 0.002			ion set		0.001	0.002	ICP-MS	
Molybdenum Mo	0.001			S ON -		0.002	0.2	ICP-MS	
Nickel Ni	0.054		- COT TO	S. C.		0.001	0.12	ICP-MS	
Lead Pb	0.031					0.001	0.15	ICP-MS	
Antimony Sb	< 0.001		O.			0.001	0.1	ICP-MS	
Selenium Se	0.001		Sent			0.002	0.04	ICP-MS	
Zinc Zn	0.029		O			0.002	1.2	ICP-MS	
Chloride	229					0.1	460	I.C	
Fluoride	0.43					0.2	2.5	I.C	
Sulphate	295					0.1	1500	I.C	
Dissolved Organic Carbon	610					11	160	Photometric	
Total Dissolved Solids							-	Gravimetric	
Phenol Index	0.185					0.001	0.3	Photometric	

Signed for and on behalf of BHP Laboratories Ltd.

Churchtown, Adare, Co.Limerick Solid analysis (Sheet 4 of 4) Description:_ _Organic Parameters ____ Sample: TH4

Parameter		Resu (mg/kg)	llts					Limit values mg/kg	Analysis method / technique
BHP Reference	102503.3						Method]	
Product Description	Waste sample		-				Detection Limits	1	
Total Organic Carbon	111200					ther	0.1	30000	Photometric
BTEX	<0.01					27. JULY	0.01	6	GC-FID
PCBs (7 cogeners)	< 0.001					fots	0.001	1	GC-MS
Mineral Oil (C10 to C40)	<0.1				Piliposite	3	0.1_	500	GC-FID
PAHs (16)	< 0.005				Pilitedia		0.005	-	GC-MS
					tion set				
				25	C ON -				
					S. C.				
				FOR THE					
				O. C.					
				a setti					
				Or					
							_		

Signed for and on behalf of BHP Laboratories Ltd.

Address:



Client: Limerick County Council

County Hall Dooradoyle Co. Limerick

F.T.A.O.: Mr. Finbarr Murphy

Client Reference: Newcastlewest Landfill Site.

Sampling Certificate Provided: Yes

BHP Ref. No.: 12/02/199
Order No: 400217322
Date Received: 17/02/2012
Date Tested: 06/03/2012

Test Specification: Customer Item: Clay Liner material

Analysing Testing Consulting Calibration

|3|-|||

BHP New road Thomondgate Limerick Ireland

Tel +353 61 455399 Fax +353 61 455447

E Mail

seamusoconnell@bhp.ie

DETERMINATION OF PLASTICITY INDEX TO BS 1377:PART 2:1990

Client Sample Ref.: : Sample 1 1

Sample No.

Date Sampled
Source
Location

Not stated
Not stated
Not stated
Base of landfill

% Retained on 425 µm test sieve : 9

Method of Test : BS 1377:Part 2:1990:Cl.4 & 5

Sample Preparation : Wet Sieving
Deviation from Test Method : None

Results:

Liquid Limit : 40
Plastic Limit : 19
Plasticity Index : 21

Remarks:

Nil

Laboratory Technical manager

For and On Behalf of BHP Laboratories Issue Date: 8th March 2012

Test results relate to the samples, as supplied. This test report shall not be duplicated, except in full and only with the permission of the test laboratory. Sampling details where supplied are held on file.



Analysing **Testing** Consulting Calibration

Client:

Limerick County Council

BHP Ref. No.: County Hall Order No.:

Dooradoyle Co. Limerick Date Received:

12/02/199 400217322

Date Tested: 27/02/2012

17/02/2012

Test Specification: Customer spec

New road Thomondgate Limerick

F.T.A.O.:

Mr. Finbarr Murphy

Item: Clay Liner material

Ireland

Client Reference:

Newcastlewest Landfill Site.

Tel +353 61 455399 Fax +353 61 455447

Sampling Certificate Provided:

No

E Mail

BS 1377:Part 2:1990

hhnoon?@hhn ja

BHP Reference	12/02/199	-		CLIENT REFERENCE
Client Reference				
Sieve Size	% Passing	% Passing	% Passing	Customer Ref
(mm)			_	Clay liner
125	100	: =	tion purposes only any c	1
100	100			Source:
75	100			Base of Landfill
63	100			he
50	100		यात्र आर्थ	
37.5	100		ces of for	
28	97		1705 ited	
20	97		n Pilitedit	
14	97		citor net	
10	96	. 250	Kom	
6.3	95	COT IT!		†
5.0	95	COST		
3.35	95	X OT .		
2.00	94	nsent	l.	
1.18	93	Cor		
600μm	92	.3		
425μm	91		<u></u>	
300µm	90	16		
212μm	90			
150µm	89			
63µт	87		ļ.	
20μm	78			
бμт	64			
2μm	52			

Remarks:

Details of any material not representative of the bulk sample found: None found.

Laboratory Technical Manager

For and On Behalf of BHP Laboratories

Issue Date:

8th March 2012

Test results relate to the samples as supplied. This test report shall not be duplicated in full without the permission of the test laboratory. Sampling details where supplied are held on file.

PARTICLE SIZE DISTRIBUTION

Client:

Limerick County Council

Client Reference:

Newcastlewest Landfill Site.

Date Received:

17/02/12

Location:

Base of landfill

BHP Ref.:

12/02/199

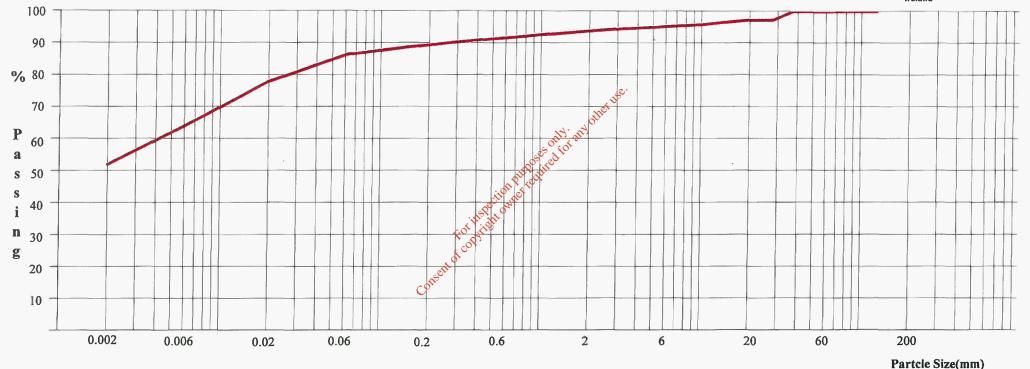
F.T.A.O.: Date Tested: Mr. Finbarr Murphy 27/02/2012

Material Spec:

Customer spec

Analysing Testing Consulting Calibrating

BHP New Road Thomondgate Limerick Ireland



ÇLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
WA		Silt			Sand			Gravel			

Laboratory Technical Manager

For and On Behalf of BHP Laboratories Ltd

Test results relate to the samples, as supplied. This test report shall not be duplicated in full without the permission of the test laboratory. Sampling details where supplied are held on file.

Issue Date: 8th March 2012



BHP Ref. No.:

Date Received:

Date Tested:

Test Spec.:

Item:

Order No:

Limerick County Council County Hall Dooradoyle Co. Limerick.

Mr. Finbarr Murphy

Client Reference:

Client:

F.T.A.O.:

Newcastlewest Landfill Site.

Sampling Certificate Provided:

No

Analysing Testing Consulting Calibration

BHP New road Thomondgate Limerick Ireland

Tel +353 61 455399 Fax +353 61 455447

E Mail

seamusoconnell@bhp.ie

.1990 DETERMINATION OF MOISTURE CONTENT

Sample No.

Time Sampled Date Sampled Stated Source Location

Method of Test

Results:

Moisture Content

Not stated Not stated Not stated

12/02/199

400217322

17/02/2012

22/02/2011

Customer spec

Clay liner material

Base of landfill

Definitive oven drying

Issue Date: 8th March 2012

22.2%

Remarks:

Nil

Laboratory Technical Manager

For and On Behalf of BHP Laboratories

Test results relate to the samples, as supplied. This test report shall not be duplicated, except in full and only with the permission of the test laboratory. Sampling details where supplied are held on file.

Client:

Limerick County Council

County Hall Dooradoyle Co. Limerick

Co. Clare

F.T.A.O.:

Mr. Finbar Murphy

Client Ref:

Newcastlewest Landfill site.

Sampling Certificate Provided: No

TEST REPORT

BHP Ref. No.: Order No: Date Received: Date Tested:

Test Spec.: Item:

12/02/199 400217322

17/02/2012 05/04/2012 customer spec

Clay liner sample

Analysing Testing Consulting Calibration

New Road Thomondgate Limerick Ireland

Tel +353 61 455399 Fax +353 61 455447

E Mail

seamusoconnell@bhp.ie

DETERMINATION OF THE COEFFICIENT OF PERMEABILITY UNDER CONSTANT HEAD CONDITIONS IN A TRIAXIAL CELL IN ACCORDANCE WITH Consent of copyright owner required for as BS 1377:PART 6 :1990: CLAUSE 6

Sample Ref. Method of Test

Clay liner - brown silty clay BS 1377:Part 6:1990

Results:

Sample Condition

Remoulded

Method of Remoulding

2.5kg Rammer

Specimen Details

Moisture Content

Initial

Final

Diameter Height

101mm 99mm 24.0% 2.040

N/A 24.0% 2.130

N/A

Bulk Density (Mg/m³) Dry Density (Mg/m³)

1.640

1.720

Form No.:BHP/MTI/1012 1.1 27/9/6

BHP Ref. No.:

M12/02/199

Saturation Stage: Performed in accordance with Clause 5.4.3.

Initial pore pressure coeficient, B

0.86

Final pore pressure coeficient, B

0.96

Duration of stage

9 days

Consolidation Stage

Effective pressure

100 kPa

Duration of stage

3 days

Permeability Stage

Pressure difference across specimen (kPa)

Mean effective stress (kPa)

Duration of stage

Coefficient of Permeability (k_v) at 20°C

 $1.0 \times 10^{-10} \text{ m/s}$

Remarks:

Laboratory Technical Manager

For and On Behalf of BHP Laboratories

This test was subcontracted to an approved supplier.

Test results relate to the samples, as supplied. This test report shall not be duplicated, except in full and only with the permission of the test laboratory. Sampling details where supplied are held on file.

Page 2 of 2

Issue Date: 30th April 2012



Analysing Testing Consulting Calibration

|3|-I|>

Client:

Limerick County Council

County Hall

Dooradoyle Co. Limerick BHP Ref. No.: Order No.:

Order No.:
Date Received:
Date Tested:

Date Tested: 2
Test Spec: C
Item: C

28/02/2012 Customer Spec Capping material

12/02/198

400217322

17/02/2012

BHP New road Thomondgate Limerick

Tel +353 61 455399 Fax +353 61 455447

E Mail

Ireland

seamusoconnell@bhp.ie

F.T.A.O.:

Mr. Finbar Murphy

Client Ref:

Newcastlewest Landfill **Provided**: No

Sampling Certificate Provided:

IS EN 933-1: 1998 Cl. 7 (Particle Size Distribution)

BHP Reference	12/02/198			SPECIFICATION LIMITS
Client Reference	capping material			
Sieve Size	% Passing	% Passing	% Passing	
(mm)				
500	100			
125	100			
80	100			128.
63	100		3	set -
45	85		14.040	
40	81		es official	
31.5	67		ction furfice so distributed for any of	
20	49		Durk Chir	
16	41		ation serie	
. 14	37	- 20	COMPL	Not Applicable
12.5	35	or in		
10	29	tio DAI		
8	25	" of co		
6.3	22	sent		
4	18	Cont		
2.80	17		1	
2	15			
1	13			
500μm	11			
425μm	10			그리 없고 현 그렇게 생각하셨다면서 되었다.
250μm	9			
125µm	8			
63µm	7.0			

Remarks:

Details of any material not representative of the bulk sample found: None found.

The sample, as supplied is finer than a Cl. 505 Filter Drain material but typical of a Cl. 6F1/6F2 capping material as defined in the Specification for Road Works.

Seamus O'Connell

Laboratory Technical Manager

For and On Behalf of BHP Laboratories

Issue Date:

8th March 2012

Test results relate to the samples as supplied. This test report shall not be duplicated, except in full and only with the permission of the test laboratory. Sampling details where supplied are held on file.

PARTICLE SIZE DISTRIBUTION

Analysing Testing Consulting Calibrating

Client: Client Reference: Date Received:

Limerick County Council

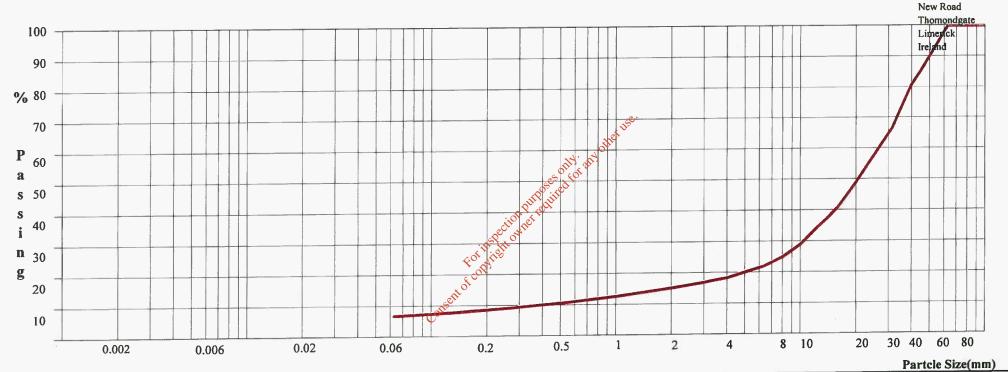
BHP Ref.: **F.T.A.O.**: capping material 17/02/12

12/02/198

Mr. Finbar Murphy

28/02/2012 Date Tested:

3-112 BHP



Boulders Medium Coarse Cobbles Coarse Fine Medium Fine Medium Coarse Fine Gravel Sand Silt

Seamus O Connell Laboratory Technical Manager

For and On Behalf of BHP Laboratories Ltd

Test results relate to the samples, as supplied. This test report shall not be duplicated in full without the permission of the test laboratory. Sampling details where supplied are held on file.

Issue Date: 8th March 2012