

BHP/CEM/23/A

LIMERICK COUNTY COUNCIL
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TECHNICAL REPORT

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

FAO: Finbarr Murphy



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

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LIMERICK
COUNTY COUNCIL
11 APR 2012
HK Billosky
Environment Section

For and on behalf of BHP Ltd.

Joan McCarthy
Joan McCarthy

Date Issued: 05th April 2012

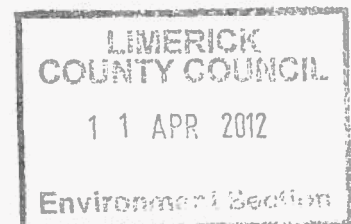
Supplement to report No. N/A

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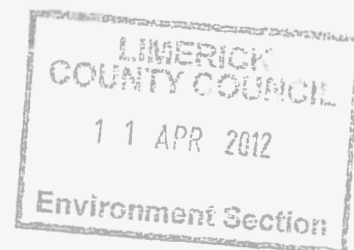
1.0 EXECUTIVE SUMMARY

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

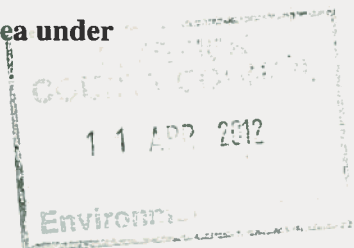
2.1 Background

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 Unlicensed 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

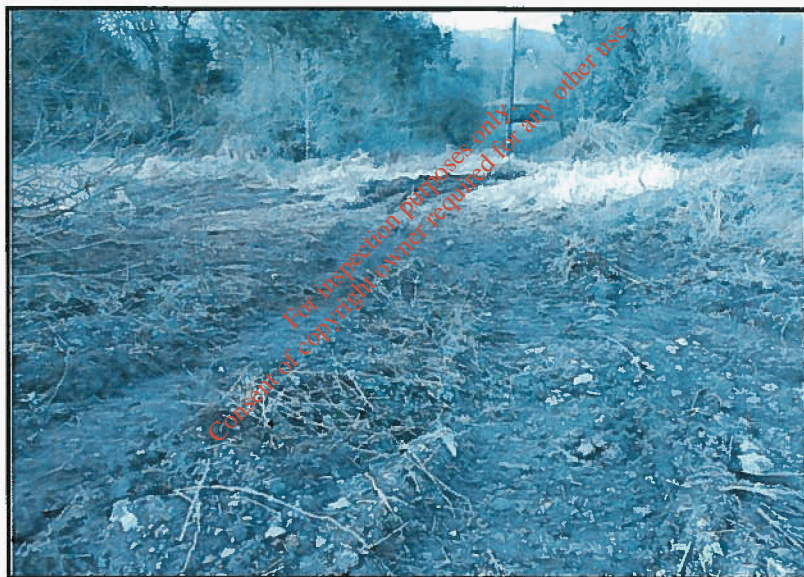


Image C of Site



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 excavation are given as follows:

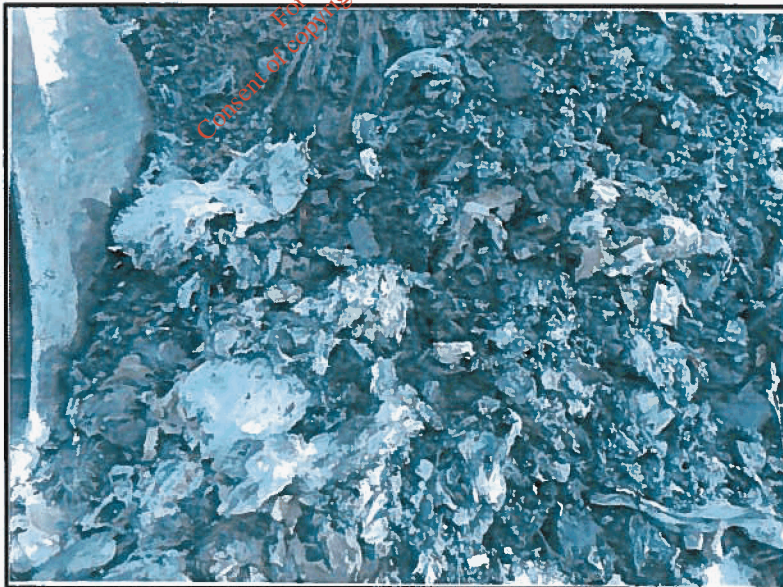
Trial Hole	Depth	Description	EWIC #
TH2	Surface to 0.50m	Clean Aggregate	-
	0.50m to 6m	Mixed municipal waste	20-03-01
TH3	Surface to 2.5m	Mixed municipal waste	20-03-01
	2.5m to 3.0m	Aggregate	-
	3.0m to 6.0m	Mixed municipal waste	-
TH4	Surface to 0.3m	Topsoil	-
	0.3m to 0.5m	Aggregate	-
	0.5m to 6m	Mixed municipal waste	20-03-01
TH5	0.3m to 4m	Mixed municipal waste	20-03-01
	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.



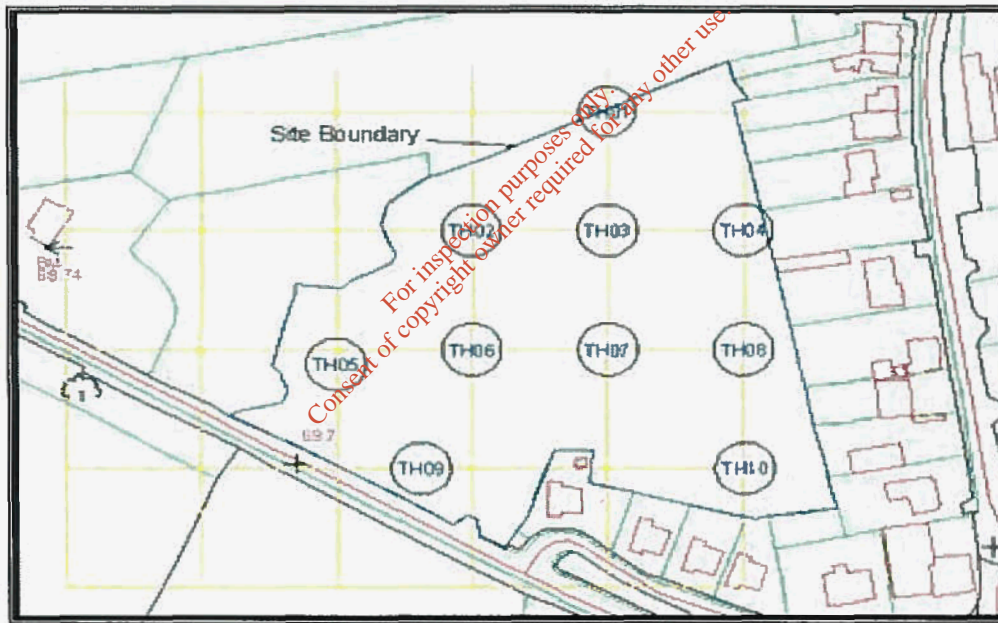
Photograph of excavated material from TH3

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).

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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. This 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 inert 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

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.

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APPENDIX 1

ANALYTICAL RESULTS

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TEST REPORT

Analysing
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Client: Limerick County Council
Aras an Chontae
Dorradoyle
Co.Limerick

BHP Ref. No.: 102502.1
Order No.:
Date Received: 14/02/12
Date Completed: 05/03/12
Test Specification: Nil
Item :See below

BHP
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Tel +353 61 455399
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FTAO: Finbarr Murphy


Test	Client Reference	Units	Results	Standard Reference
	TH2 (4.4M)			
Water Level		M	4.40	ISO 5667 - 11
Temperature		°C	11	APHA - 2550 - B
pH		-	6.60	APHA - 4500 - H ⁺ - B
Conductivity		µScm ⁻¹	1942	APHA - 2510 - B
Ammonia (as NH ₃ -N)		mg/l	64.6	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)		mg/l	1.55	APHA - 4110 - B
Nitrite (as NO ₂)		mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/l	0.35	APHA - 4110 - B
BOD		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

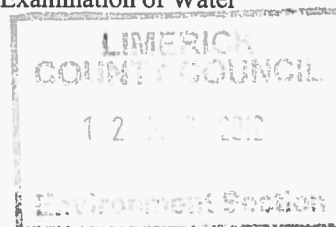
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Additional information :

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For and on behalf of BHP laboratories :


Pat O'Sullivan
Issue Date : 07/03/2012



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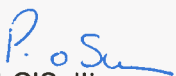
Test	Client Reference	Units	Results	Standard Reference
	TH2 (4.4M)			
Cadmium		ug/l	<0.1	APHA - 3120 - B
Total Chromium		ug/l	<1	APHA - 3120 - B
Copper		ug/l	<1	APHA - 3120 - B
Nickel		ug/l	<1	APHA - 3120 - B
Lead		ug/l	2	APHA - 3120 - B
Zinc		ug/l	12	APHA - 3120 - B
Arsenic		ug/l	<0.9	APHA - 3120 - B
Boron		ug/l	9	APHA - 3120 - B
Mercury		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 (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

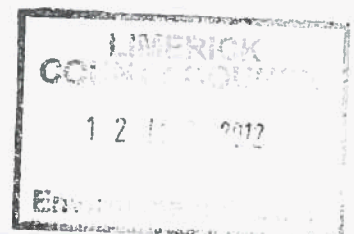
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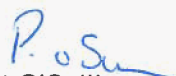
Test	Client Reference	Units	Results	Standard Reference
	TH2 (4.4M)			
Atrazine		ug/l	<1	GC-MS
Dichloromethane		ug/l	<1	GC-MS
Simazine		ug/l	<1	GC-MS
Toluene		ug/l	<1	GC-MS
Tributyltin		ug/l	<0.001	GC-MS
Total Xylenes		ug/l	<1	GC-MS

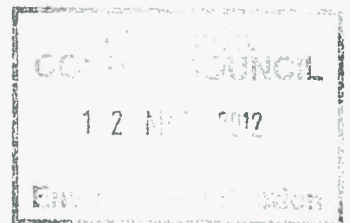
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FTAO: Finbarr Murphy

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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E Mail bhpccm2@bhp.ie


Test	Client Reference	Units	Results	Standard Reference
	TH3 (2.5M)			
Water Level		M	2.50	ISO 5667 - 11
Temperature		°C	11	APHA - 2550 - B
pH		-	6.48	APHA - 4500 - H ⁺ - B
Conductivity		µScm ⁻¹	1667	APHA - 2510 - B
Ammonia (as NH ₃ -N)		mg/l	75.28	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)		mg/l	0.81	APHA - 4110 - B
Nitrite (as NO ₂)		mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/l	0.18	APHA - 4110 - B
BOD		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

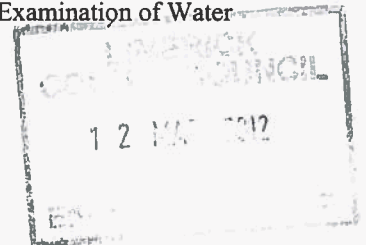
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Fax + 353 61 455447
E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
	TH3 (2.5M)			
Cadmium		ug/l	<0.1	APHA - 3120 - B
Total Chromium		ug/l	<1	APHA - 3120 - B
Copper		ug/l	<1	APHA - 3120 - B
Nickel		ug/l	<1	APHA - 3120 - B
Lead		ug/l	2	APHA - 3120 - B
Zinc		ug/l	12	APHA - 3120 - B
Arsenic		ug/l	<0.9	APHA - 3120 - B
Boron		ug/l	11	APHA - 3120 - B
Mercury		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 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

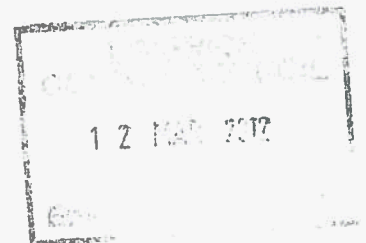
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Fax + 353 61 455447
E Mail bhpcem2@bhp.ie


Test	Client Reference	Units	Results	Standard Reference
	TH3 (2.5M)			
Atrazine		ug/l	<1	GC-MS
Dichloromethane		ug/l	<1	GC-MS
Simazine		ug/l	<1	GC-MS
Toluene		ug/l	<1	GC-MS
Tributyltin		ug/l	<0.001	GC-MS
Total Xylenes		ug/l	<1	GC-MS

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Client: Limerick County Council
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FTAO: Finbarr Murphy

BHP Ref. No.: 102502.3
Order No.:
Date Received: 14/02/12
Date Completed: 05/03/12
Test Specification: Nil
Item :See below

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E Mail bhpccm2@bhp.ie

Test	Client Reference	Units	Results	Standard Reference
	TH4 (3.8M)			
Water Level		M	3.80	ISO 5667 - 11
Temperature		°C	12.6	APHA - 2550 - B
pH		-	6.40	APHA - 4500 - H ⁺ - B
Conductivity		µScm ⁻¹	1418	APHA - 2510 - B
Ammonia (as NH ₃ -N)		mg/l	70.73	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)		mg/l	0.9	APHA - 4110 - B
Nitrite (as NO ₂)		mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/l	0.2	APHA - 4110 - B
BOD		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

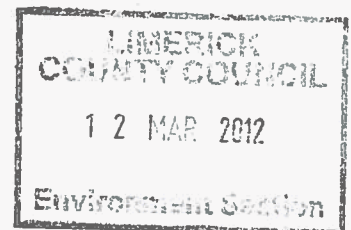
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Additional information :

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For and on behalf of BHP laboratories :


Pat O'Sullivan
Issue Date : 07/03/2012



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TEST REPORT

Analysing
Testing
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Calibrating



Client: Limerick County Council
Aras an Chontae
Dorradoyle
Co.Limerick

BHP Ref. No.: 102502.3
Order No.:
Date Received: 14/02/12
Date Completed: 05/03/12
Test Specification: Nil
Item :See below

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

FTAO: Finbarr Murphy


Test	Client Reference	Units	Results	Standard Reference
	TH4 (3.8M)			
Cadmium		ug/l	<0.1	APHA - 3120 - B
Total Chromium		ug/l	1	APHA - 3120 - B
Copper		ug/l	<1	APHA - 3120 - B
Nickel		ug/l	<1	APHA - 3120 - B
Lead		ug/l	2	APHA - 3120 - B
Zinc		ug/l	13	APHA - 3120 - B
Arsenic		ug/l	<0.9	APHA - 3120 - B
Boron		ug/l	16	APHA - 3120 - B
Mercury		ug/l	<0.2	APHA - 3120 - B
Sulphate		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		mg/l	0.031	APHA - 4500-CN-C
Fluoride		mg/l	<0.05	APHA - 4110 - B

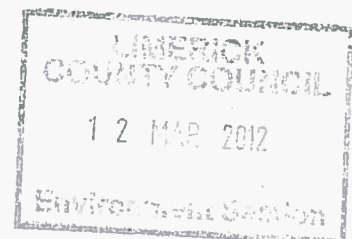
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Aras an Chontae
Dorradoyle
Co.Limerick

BHP Ref. No.: 102502.3
Order No.:
Date Received: 14/02/12
Date Completed: 05/03/12
Test Specification: Nil
Item :See below

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

FTAO: Finbarr Murphy

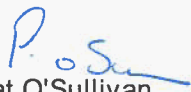
Test	Client Reference	Units	Results	Standard Reference
	TH4 (3.8M)			
Atrazine		ug/l	<1	GC-MS
Dichloromethane		ug/l	<1	GC-MS
Simazine		ug/l	<1	GC-MS
Toluene		ug/l	<1	GC-MS
Tributyltin		ug/l	<0.001	GC-MS
Total Xylenes		ug/l	<1	GC-MS

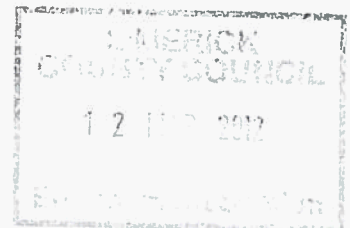
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Client: Limerick County Council
Aras an Chontae
Dorradoyle
Co.Limerick

BHP Ref. No.: 102539.1
Order No.:
Date Received: 16/02/12
Date Completed: 05/03/12
Test Specification: Nil
Item :See below

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Tel +353 61 455399
Fax + 353 61 455447
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FTAO: Finbarr Murphy

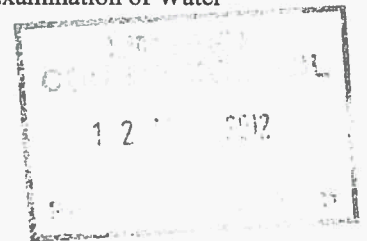
Test	Client Reference	Units	Results	Standard Reference
	TH5 (1.8M)			
Water Level		M	1.80	ISO 5667 - 11
Temperature		°C	12.4	APHA - 2550 - B
pH		-	6.76	APHA - 4500 - H ⁺ - B
Conductivity		µScm ⁻¹	681	APHA - 2510 - B
Ammonia (as NH ₃ -N)		mg/l	63.75	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)		mg/l	2.66	APHA - 4110 - B
Nitrite (as NO ₂)		mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/l	0.6	APHA - 4110 - B
BOD		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

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Item :See below

BHP
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E Mail bhpcem2@bhp.ie

FTAO: Finbarr Murphy

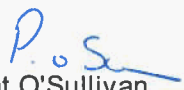
Test	Client Reference	Units	Results	Standard Reference
	TH5 (1.8M)			
Cadmium		ug/l	<0.1	APHA - 3120 - B
Total Chromium		ug/l	<1	APHA - 3120 - B
Copper		ug/l	<1	APHA - 3120 - B
Nickel		ug/l	<1	APHA - 3120 - B
Lead		ug/l	3	APHA - 3120 - B
Zinc		ug/l	14	APHA - 3120 - B
Arsenic		ug/l	<0.9	APHA - 3120 - B
Boron		ug/l	8	APHA - 3120 - B
Mercury		ug/l	<0.2	APHA - 3120 - B
Sulphate		mg/l	9.63	APHA - 4110 - B
Chloride		mg/l	47.6	APHA - 4110 - B
Molybdate Reactive Phosphorus (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

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Client: Limerick County Council
Aras an Chontae
Dorradoyle
Co.Limerick

BHP Ref. No.: 102539.1
Order No.:
Date Received: 16/02/12
Date Completed: 05/03/12
Test Specification: Nil
Item :See below

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

FTAO: Finbarr Murphy

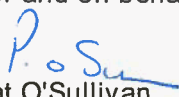
Test	Client Reference	Units	Results	Standard Reference
	TH5 (1.8M)			
Atrazine		ug/l	<1	GC-MS
Dichloromethane		ug/l	<1	GC-MS
Simazine		ug/l	<1	GC-MS
Toluene		ug/l	<1	GC-MS
Tributyltin		ug/l	<0.001	GC-MS
Total Xylenes		ug/l	<1	GC-MS

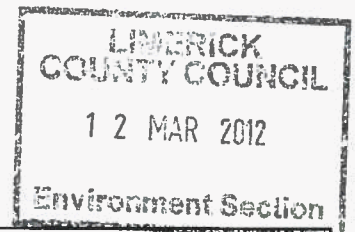
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Client: Limerick County Council
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Co.Limerick

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

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

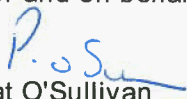
Test	Client Reference	Units	Results	Standard Reference
Water Level	Leonards Stream	M	n/a	ISO 5667 - 11
Temperature		°C	9.8	APHA - 2550 - B
pH		-	6.68	APHA - 4500 - H ⁺ - B
Conductivity		µScm ⁻¹	429	APHA - 2510 - B
Ammonia (as NH ₃ -N)		mg/l	0.43	APHA -4500- NH ₃ -D
Nitrate (as NO ₃)		mg/l	0.53	APHA - 4110 - B
Nitrite (as NO ₂)		mg/l	<0.1	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/l	0.12	APHA - 4110 - B
BOD		mg/l	3	APHA - 5210 - B
COD		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
Potassium		mg/l	34.1	APHA - 3120 - B
Iron		ug/l	<1	APHA - 3120 - B
Manganese		ug/l	759	APHA - 3120 - B

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BHP Ref. No.: 102539.2
Order No.:
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Date Completed: 05/03/12
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E Mail bhpcem2@bhp.ie

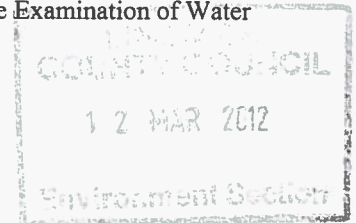
Test	Client Reference	Units	Results	Standard Reference
	Leonards Stream			
Cadmium	Consent of copyright owner required for any other use. For inspection purposes only.	ug/l	<0.1	APHA - 3120 - B
Total Chromium		ug/l	<1	APHA - 3120 - B
Copper		ug/l	<1	APHA - 3120 - B
Nickel		ug/l	<1	APHA - 3120 - B
Lead		ug/l	3	APHA - 3120 - B
Zinc		ug/l	7	APHA - 3120 - B
Arsenic		ug/l	<0.9	APHA - 3120 - B
Boron		ug/l	12	APHA - 3120 - B
Mercury		ug/l	<0.2	APHA - 3120 - B
Sulphate		mg/l	10.43	APHA - 4110 - B
Chloride		mg/l	51.27	APHA - 4110 - B
Molybdate Reactive Phosphorus (as 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

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For and on behalf of BHP laboratories :


Pat O'Sullivan
Issue Date : 07/03/2012



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Analysing
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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


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

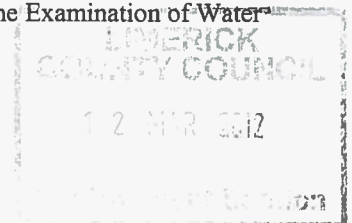
Test	Client Reference	Units	Results	Standard Reference
	Leonards Stream			
Atrazine	Consent of copyright owner required for any other use. For inspection purposes only.	ug/l	<1	GC-MS
Dichloromethane		ug/l	<1	GC-MS
Simazine		ug/l	<1	GC-MS
Toluene		ug/l	<1	GC-MS
Tributyltin		ug/l	<0.001	GC-MS
Total Xylenes		ug/l	<1	GC-MS

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Chemical Analysis Report for Limerick County Council

Client:

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
	102503.1					Method Detection Limits		
BHP Reference								
Product Description	Waste sample							
Arsenic As	0.002					0.002	0.1	ICP-MS
Barium Ba	0.012					0.01	7	ICP-MS
Cadmium Cd	<0.001					0.001	0.03	ICP-MS
Chromium total Cr	0.04					0.001	0.2	ICP-MS
Copper Cu	0.49					0.001	0.9	ICP-MS
Mercury Hg	<0.0002					0.001	0.003	ICP-MS
Molybdenum Mo	0.012					0.002	0.3	ICP-MS
Nickel Ni	0.18					0.001	0.2	ICP-MS
Lead Pb	0.024					0.001	0.2	ICP-MS
Antimony Sb	<0.001					0.001	0.02	ICP-MS
Selenium Se	0.004					0.002	0.06	ICP-MS
Zinc Zn	0.21					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
Total Dissolved Solids	378					1	2500	Gravimetric
Phenol Index	0.008					0.001	0.5	Photometric

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Chemical Analysis Report for Limerick County Council

Client:

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 Detection		
Product Description	Waste sample					Limits		
Arsenic As	<0.001					0.002	0.5	ICP-MS
Barium Ba	0.004					0.01	20	ICP-MS
Cadmium Cd	0.001					0.001	0.04	ICP-MS
Chromium total Cr	0.002					0.001	0.5	ICP-MS
Copper Cu	0.027					0.001	2	ICP-MS
Mercury Hg	<0.0002					0.001	0.01	ICP-MS
Molybdenum Mo	0.001					0.002	0.5	ICP-MS
Nickel Ni	0.004					0.001	0.4	ICP-MS
Lead Pb	0.011					0.001	0.5	ICP-MS
Antimony Sb	<0.001					0.001	0.06	ICP-MS
Selenium Se	0.001					0.002	0.1	ICP-MS
Zinc Zn	0.014					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
Total Dissolved Solids	1012					1	4000	Gravimetric
Phenol Index	0.012					0.001	1	Photometric

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Chemical Analysis Report for Limerick County Council

Client:

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		
Product Description	Waste sample					Detection		
						Limits		
Arsenic As	0.002					0.002	0.06 ICP-MS	
Barium Ba	0.012					0.01	4 ICP-MS	
Cadmium Cd	0.006					0.001	0.02 ICP-MS	
Chromium total Cr	0.011					0.001	0.1 ICP-MS	
Copper Cu	0.096					0.001	0.6 ICP-MS	
Mercury Hg	<0.002					0.001	0.002 ICP-MS	
Molybdenum Mo	0.002					0.002	0.2 ICP-MS	
Nickel Ni	0.027					0.001	0.12 ICP-MS	
Lead Pb	0.032					0.001	0.15 ICP-MS	
Antimony Sb	<0.001					0.001	0.1 ICP-MS	
Selenium Se	0.001					0.002	0.04 ICP-MS	
Zinc Zn	0.039					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	

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Chemical Analysis Report for Limerick County Council

Client:

Address: Churchtown, Adare, Co.Limerick

(Sheet 1 of 4)

Description: _____ L/S = 2 l/kg _____

Sample: TH3

Leachate analysis

Parameter	Results (mg/kg dry substance)					Method Detection Limits	Limit values L/S = 2 l/kg mg/kg dry substance	Analysis method / technique
	102503.2							
BHP Reference								
Product Description	Waste sample							
Arsenic As	<0.001				0.002	0.1	ICP-MS	
Barium Ba	0.024				0.01	7	ICP-MS	
Cadmium Cd	<0.001				0.001	0.03	ICP-MS	
Chromium total Cr	0.07				0.001	0.2	ICP-MS	
Copper Cu	0.31				0.001	0.9	ICP-MS	
Mercury Hg	<0.0002				0.001	0.003	ICP-MS	
Molybdenum Mo	0.008				0.002	0.3	ICP-MS	
Nickel Ni	0.039				0.001	0.2	ICP-MS	
Lead Pb	0.024				0.001	0.2	ICP-MS	
Antimony Sb	<0.001				0.001	0.02	ICP-MS	
Selenium Se	0.002				0.002	0.06	ICP-MS	
Zinc Zn	0.16				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	

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BHP Chemical Analysis Report for Limerick County Council

Client:

Address: Churchtown, Adare, Co.Limerick

(Sheet 2 of 4)

Description: _____ L/S = 10 l/kg _____

Sample: TH3

Leachate analysis

Parameter	Results (mg/kg dry substance)						Limit values L/S = 10 l/kg mg/kg dry substance	Analysis method / technique
	102503.2					Method		
BHP Reference						Detection		
Product Description	Waste sample					Limits		
Arsenic As	<0.001					0.002	0.5	ICP-MS
Barium Ba	0.006					0.01	20	ICP-MS
Cadmium Cd	0.001					0.001	0.04	ICP-MS
Chromium total Cr	0.012					0.001	0.5	ICP-MS
Copper Cu	0.18					0.001	2	ICP-MS
Mercury Hg	<0.0002					0.001	0.01	ICP-MS
Molybdenum Mo	0.002					0.002	0.5	ICP-MS
Nickel Ni	0.019					0.001	0.4	ICP-MS
Lead Pb	0.009					0.001	0.5	ICP-MS
Antimony Sb	<0.001					0.001	0.06	ICP-MS
Selenium Se	0.001					0.002	0.1	ICP-MS
Zinc Zn	0.024					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

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Signed for and on behalf of BHP Laboratories Ltd.



Chemical Analysis Report for Limerick County Council

Client:

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		
Arsenic As	0.001					0.002	0.06	ICP-MS
Barium Ba	0.036					0.01	4	ICP-MS
Cadmium Cd	0.006					0.001	0.02	ICP-MS
Chromium total Cr	0.018					0.001	0.1	ICP-MS
Copper Cu	0.049					0.001	0.6	ICP-MS
Mercury Hg	<0.002					0.001	0.002	ICP-MS
Molybdenum Mo	0.003					0.002	0.2	ICP-MS
Nickel Ni	0.054					0.001	0.12	ICP-MS
Lead Pb	0.036					0.001	0.15	ICP-MS
Antimony Sb	<0.001					0.001	0.1	ICP-MS
Selenium Se	0.001					0.002	0.04	ICP-MS
Zinc Zn	0.022					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							-	Gravimetric
Phenol Index	0.212					0.001	0.3	Photometric

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Chemical Analysis Report for Limerick County Council

Client:

Address: Churchtown, Adare, Co.Limerick

(Sheet 4 of 4)

Description: _____ Organic Parameters _____ Sample: TH3

Solid analysis

Parameter	Results (mg/kg)						Limit values mg/kg	Analysis method / technique
	102503.1							
BHP Reference								
						Method		
						Detection		
Product Description	Waste sample					Limits		
Total Organic Carbon	92500					0.1	30000	Photometric
BTEX	<0.01					0.01	6	GC-FID
PCBs (7 congeners)	<0.001					0.001	1	GC-MS
Mineral Oil (C10 to C40)	<0.1					0.1	500	GC-FID
PAHs (16)	<0.005					0.005	-	GC-MS

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BHP Chemical Analysis Report for Limerick County Council

Client:

Address: Churchtown, Adare, Co.Limerick

(Sheet 1 of 4)

Description: _____ L/S = 2 l/kg _____

Sample: TH4

Leachate analysis

Parameter	Results (mg/kg dry substance)				Limit values L/S = 2 l/kg mg/kg dry substance	Analysis method / technique
	102503.3					
BHP Reference						
Product Description	Waste sample					
Arsenic As	<0.001				0.002	ICP-MS
Barium Ba	0.036				0.01	ICP-MS
Cadmium Cd	<0.001				0.001	ICP-MS
Chromium total Cr	0.019				0.001	ICP-MS
Copper Cu	0.3				0.001	ICP-MS
Mercury Hg	<0.0002				0.001	ICP-MS
Molybdenum Mo	0.012				0.002	ICP-MS
Nickel Ni	0.043				0.001	ICP-MS
Lead Pb	0.021				0.001	ICP-MS
Antimony Sb	<0.001				0.001	ICP-MS
Selenium Se	0.001				0.002	ICP-MS
Zinc Zn	0.11				0.002	ICP-MS
Chloride	80				0.1	I.C
Fluoride	0.62				0.2	I.C
Sulphate	208				0.1	I.C
Dissolved Organic Carbon	360				1	Photometric
Total Dissolved Solids	1010				1	Gravimetric
Phenol Index	0.245				0.001	Photometric

Signed for and on behalf of BHP Laboratories Ltd.



Chemical Analysis Report for Limerick County Council

Client:

Address: Churchtown, Adare, Co.Limerick

(Sheet 2 of 4)

Description: _____ L/S = 10 l/kg _____

Sample: TH4

Leachate analysis

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

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Chemical Analysis Report for Limerick County Council

Client:

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
	102503.3					Method Detection Limits		
BHP Reference								
Product Description	Waste sample							
Arsenic As	0.002					0.002	0.06	ICP-MS
Barium Ba	0.041					0.01	4	ICP-MS
Cadmium Cd	0.007					0.001	0.02	ICP-MS
Chromium total Cr	0.032					0.001	0.1	ICP-MS
Copper Cu	0.049					0.001	0.6	ICP-MS
Mercury Hg	<0.002					0.001	0.002	ICP-MS
Molybdenum Mo	0.001					0.002	0.2	ICP-MS
Nickel Ni	0.054					0.001	0.12	ICP-MS
Lead Pb	0.031					0.001	0.15	ICP-MS
Antimony Sb	<0.001					0.001	0.1	ICP-MS
Selenium Se	0.001					0.002	0.04	ICP-MS
Zinc Zn	0.029					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					1	160	Photometric
Total Dissolved Solids							-	Gravimetric
Phenol Index	0.185					0.001	0.3	Photometric

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Signed for and on behalf of BHP Laboratories Ltd.

BHP Chemical Analysis Report for Limerick County Council

Client:

Address: Churchtown, Adare, Co.Limerick

(Sheet 4 of 4)

Description: _____ Organic Parameters _____ Sample: TH4

Solid analysis

Parameter	Results (mg/kg)					Limit values mg/kg	Analysis method / technique	
BHP Reference	102503.3							
Product Description	Waste sample				Method			
					Detection			
Total Organic Carbon	111200				Limits	0.1	30000	Photometric
BTEX	<0.01					0.01	6	GC-FID
PCBs (7 congeners)	<0.001					0.001	1	GC-MS
Mineral Oil (C10 to C40)	<0.1					0.1	500	GC-FID
PAHs (16)	<0.005					0.005	-	GC-MS

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Signed for and on behalf of BHP Laboratories Ltd.



TEST REPORT

Analysing
Testing
Consulting
Calibration

Client: Limerick County Council
County Hall
Dooradoyle
Co. Limerick

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



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

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

Client Reference: Newcastlewest Landfill Site.

Sampling Certificate Provided: Yes

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

Client Sample Ref.:	:	Sample 1 1
Sample No.	:	1
Date Sampled	:	Not stated
Source	:	Not stated
Location	:	Base of landfill
% Retained on 425µm test sieve	:	9
Method of Test	:	BS 1377:Part 2:1990:Cl.4 & 5
Sample Preparation	:	Wet Sieving
Deviation from Test Method	:	None

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Results:

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

Remarks:

Nil

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.



TEST REPORT

Analysing
Testing
Consulting
Calibration

BHP
BHP
New road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax +353 61 455447
E Mail
bhpcor2@bhp.ie

Client: Limerick County Council
County Hall
Dooradoyle
Co. Limerick

BHP Ref. No.: 12/02/199
Order No.: 400217322
Date Received: 17/02/2012
Date Tested: 27/02/2012
Test Specification: Customer spec
Item: Clay Liner material

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

Client Reference: Newcastlewest Landfill Site.

Sampling Certificate Provided: No
BS 1377:Part 2:1990

BHP Reference	12/02/199			CLIENT REFERENCE
Client Reference				Customer Ref Clay liner
Sieve Size (mm)	% Passing	% Passing	% Passing	
125	100			Source: Base of Landfill
100	100			
75	100			
63	100			
50	100			
37.5	100			
28	97			
20	97			
14	97			
10	96			
6.3	95			
5.0	95			
3.35	95			
2.00	94			
1.18	93			
600µm	92			
425µm	91			
300µm	90			
212µm	90			
150µm	89			
63µm	87			
20µm	78			
6µm	64			
2µm	52			

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Remarks:

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

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 in full without the permission of the test laboratory.

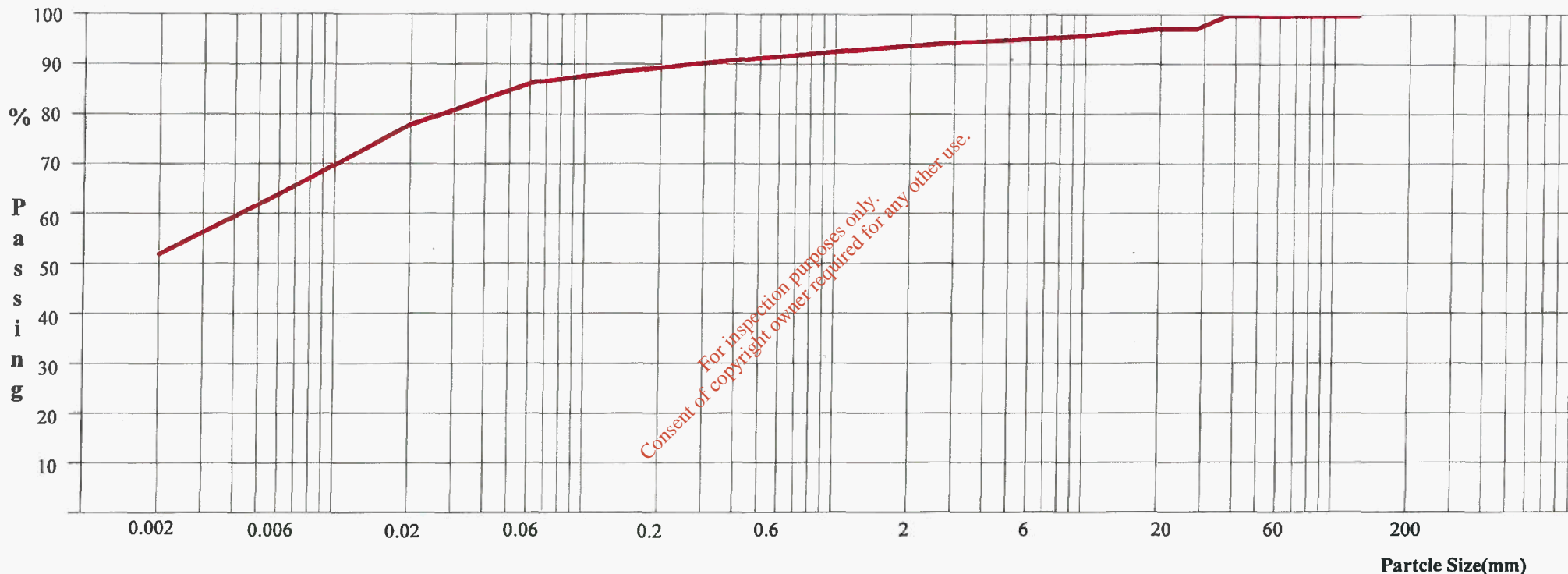
Sampling details where supplied are held on file.

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.: Mr. Finbarr Murphy
Date Tested: 27/02/2012
Material Spec: Customer spec

Analysing
 Testing
 Consulting
 Calibrating
BHP
 BHP
 New Road
 Thomondgate
 Limerick
 Ireland



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

(Signature)
 Seamus O'Connell

Laboratory Technical Manager
 For and On Behalf of BHP Laboratories Ltd

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.



TEST REPORT

Analysing
Testing
Consulting
Calibration



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

Client: Limerick County Council
County Hall
Dooradoyle
Co. Limerick.

BHP Ref. No.: 12/02/199
Order No.: 400217322
Date Received: 17/02/2012
Date Tested: 22/02/2011
Test Spec.: Customer spec
Item : Clay liner material

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

Client Reference: Newcastlewest Landfill Site.

Sampling Certificate Provided: No

DETERMINATION OF MOISTURE CONTENT TO BS 1377:PART 2:1990

Sample No.	:	1
Time Sampled	:	Not stated
Date Sampled	:	Not stated
Stated Source	:	Not stated
Location	:	Base of landfill
Method of Test	:	Definitive oven drying

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Results:

Moisture Content : 22.2%

Remarks:

Nil

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.

TEST REPORT

Analysing
Testing
Consulting
Calibration



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

Client: Limerick County Council
County Hall
Dooradoyle
Co. Limerick
Co. Clare

BHP Ref. No.: 12/02/199
Order No: 400217322
Date Received: 17/02/2012
Date Tested: 05/04/2012
Test Spec.: customer spec
Item : Clay liner sample

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

Client Ref: Newcastlewest Landfill site.

Sampling Certificate Provided: No

DETERMINATION OF THE COEFFICIENT OF PERMEABILITY UNDER CONSTANT HEAD CONDITIONS IN A TRIAXIAL CELL IN ACCORDANCE WITH BS 1377:PART 6 :1990: CLAUSE 6

Sample Ref. : Clay liner - brown silty clay
Method of Test : BS 1377:Part 6:1990

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Results:

Sample Condition	:	Remoulded	
Method of Remoulding	:	2.5kg Rammer	
Specimen Details	:	Initial	Final
Diameter	:	101mm	N/A
Height	:	99mm	N/A
Moisture Content	:	24.0%	24.0%
Bulk Density (Mg/m ³)	:	2.040	2.130
Dry Density (Mg/m ³)	:	1.640	1.720

BHP Ref. No.: M12/02/199

Saturation Stage: Performed in accordance with Clause 5.4.3.

Initial pore pressure coefficient, B : 0.86
Final pore pressure coefficient, 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) : 20
Mean effective stress (kPa) : 90
Duration of stage : 2 days

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Coefficient of Permeability (k_v) at 20°C = 1.0×10^{-10} m/s

Remarks:

Nil



Seamus O'Connell

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.

Issue Date: 30th April 2012



TEST REPORT

Analysing
Testing
Consulting
Calibration



Client: Limerick County Council
County Hall
Dooradoyle
Co. Limerick

BHP Ref. No.: 12/02/198
Order No.: 400217322
Date Received: 17/02/2012
Date Tested: 28/02/2012
Test Spec: Customer Spec
Item: Capping material

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

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

Client Ref: Newcastlewest Landfill
Sampling Certificate Provided: No
IS EN 933-1 : 1998 Cl. 7 (Particle Size Distribution)

BHP Reference	12/02/198			SPECIFICATION LIMITS
Client Reference	capping material			Not Applicable
Sieve Size (mm)	% Passing	% Passing	% Passing	
500	100			
125	100			
80	100			
63	100			
45	85			
40	81			
31.5	67			
20	49			
16	41			
14	37			
12.5	35			
10	29			
8	25			
6.3	22			
4	18			
2.80	17			
2	15			
1	13			
500µm	11			
425µm	10			
250µm	9			
125µm	8			
63µm	7.0			

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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.

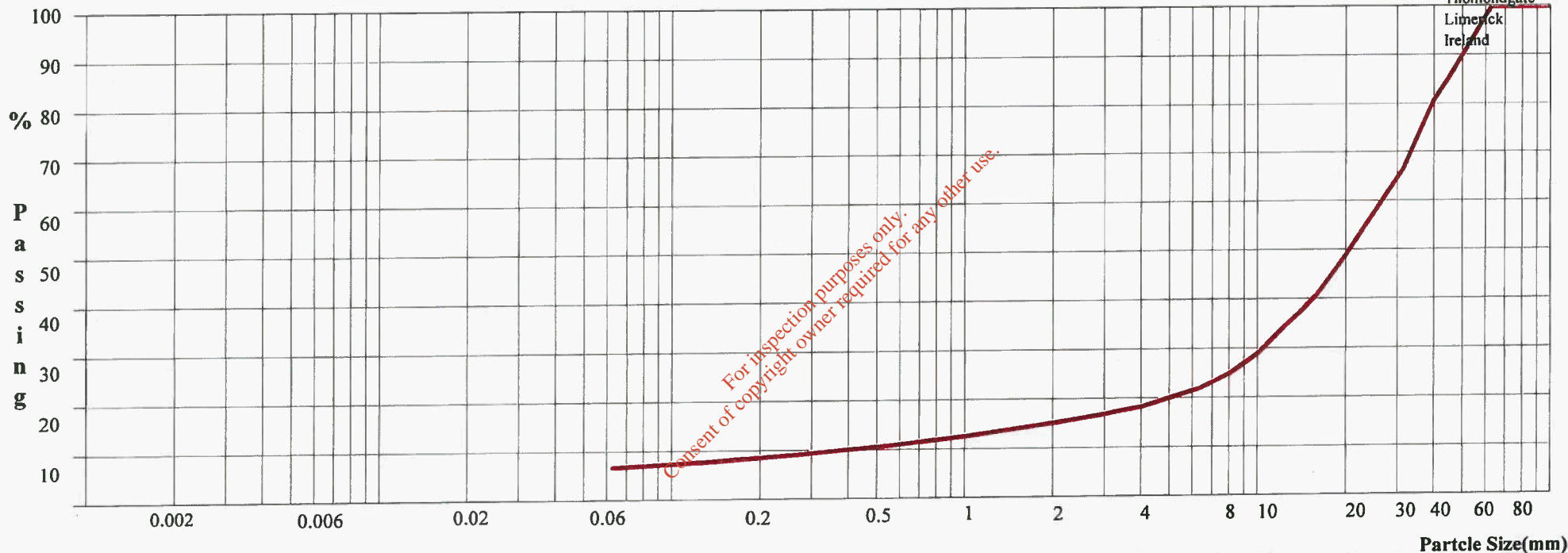
PARTICLE SIZE DISTRIBUTION

Analysing
Testing
Consulting
Calibrating

Client: Limerick County Council
Client Reference: capping material
Date Received: 17/02/12

BHP Ref.: 12/02/198
F.T.A.O.: Mr. Finbar Murphy
Date Tested: 28/02/2012

BHP
BHP
New Road
Thomondgate
Limerick
Ireland



Particle Size(mm)											
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		Silt			Sand			Gravel			

(Handwritten signature)
Seamus O'Connell

Laboratory Technical Manager
For and On Behalf of BHP Laboratories Ltd

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.