Eve O'Sullivan

Subject: FW: Historic Landfill at Moate
Attachments: Certificatation 2018.pdf; Post Remedial Monitoring Programme 2018.pdf; S Moran_ 2017_IGI register.pdf; Tier 3 Assessment Moate 2018.pdf

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From: Leo Buckley [mailto:Leo.Buckley@westmeathcoco.ie]
Sent: 31 August 2018 14:34
To: Magnus Amajirionwu
Cc: Ciaran Jordan
Subject: FW: Historic Landfill at Moate

Magnus,

Please find the following documentation attached relating to the Certification of Authorisation application for the former Moate Landfill site:

1. Revised Tier 3 Risk Assessment
2. Post remedial Monitoring Programme
3. Credential of the Qualified Person (Sean Moran)
4. Certification.

If you require any further details please do not hesitate to contact me.

Regards,

Leo Buckley,
Assistant Engineer | Environment | Westmeath County Council
Áras an Chontae, Mullingar, Co. Westmeath
Tel: 044 9332281
Mob: 087 1134748

From: Magnus Amajirionwu [mailto:M.Amajirionwu@epa.ie]
Sent: 28 June 2018 15:53
To: Ciaran Jordan
Cc: Mary Murray
Subject: Historic Landfill at Moate

Dear Ciaran,

I refer to the letter received by the Agency from Mr Martin Murray, Director of Services, in relation to the historic landfill at Moate. The letter conveyed amendments to the original Tier 3 risk assessment for the site.

The Agency requires an updated Tier 3 risk assessment accompanied by a letter from a qualified person in line with the Code of Practice, to be submitted for assessment.

Thanks and kind regards

Magnus

Dr. Magnus U. Amajirionwu
Scientific Officer
Office of Environmental Sustainability
Environmental Protection Agency,
Johnstown Castle, Wexford, Ireland

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Director of Services,
Environment Section,
Westmeath County
County Buildings
Mullingar,
County Westmeath

20th August 2018

Re:Risk Assessment on an historic landfill (Moate) in support of an application for a Certificate of Authorisation in accordance with Regulation 7 of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008.

Dear Director,

As a person who is qualified, trained and experienced to the standard set out in section 2.3 of *Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites* (EPA, 2007), it is my opinion that the risk assessment carried out on the closed landfill at Moate is adequate and complete.

The risk assessment complies with all of the requirements of the *Code of Practice*. The local authority and O'Callaghan Moran & Associates in carrying out the risk assessment, has followed and completed the steps set out in the *Code of Practice* and associated guidance (Matrix 1 and Matrix 2 – as published).

The following items:

- - the risk assessment,
- - the findings and conclusions of the risk assessment,
- - the remedial measures proposed
- - the monitoring proposed to be carried out to demonstrate the effectiveness of the remedial measures,

In my opinion, are, appropriate and adequate to:-

Cont'd

- identify the instances and risks of environmental pollution arising from the closed landfill to which this application refers,

- proportionately address any and all such instances and risks of environmental pollution, and

- Ensures that any future instances of environmental pollution will be detected in a timely manner.

I have advised the local authority on the following aspects of this project or have carried out or managed the following aspects of the project on behalf of the local authority:

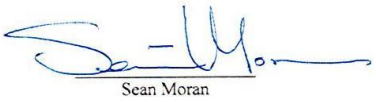
- - Tier 1 and 2 risk assessment (Yes)

- - Tier 3 risk assessment including GQRA (Yes). The additional investigations (groundwater, surface water and landfill gas monitoring) were carried out by Westmeath County Council. OCM completed the Tier 3 assessment based on the results.

- - Remedial Measures (Yes). OCM made recommendations for such works. However a detailed design has not been prepared as the works would only be required if it is decided to construct residential dwellings on land to the north of the site, or if approval is granted for the recreational use of the site.

- - Post-Remediation Monitoring Programme (Yes) OCM prepared a monitoring programme to establish the effectiveness of the remediation works once they have been completed.

-

Signed: 

Name Sean Moran (P.Geol., Eur. Geol, MSc.)>
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Post Remedial Monitoring Programme Moate Landfill.

The Tier 3 Risk Assessment Report includes recommendations for remedial works and on-going monitoring. Remedial works will only be required if it is decided to construct new dwellings on lands adjacent to the waste deposition area or if planning permission is granted for the recreational use of the site. The scope and design of the works will be based on the results of the on-going leachate and landfill gas monitoring, but may include:

- The layout of any proposed residential area should be such that the houses are the maximum practical distance from the edge of the fill area. If possible, the rear gardens should be 10 m from the edge of the fill.

- Incorporating appropriate gas protection measures, as specified in the DOE Guidance, into the building design.

- The installation of a landfill gas migration barrier north of the northern edge of the waste between it and the proposed residential area. The barrier should extend the full length of northern edge and may comprise a trench excavated to approximately 3m below ground level, with a flexible membrane liner (e.g. High Density Polyethylene) placed against the northern face and the trench backfilled with granular material.

- No buildings or enclosed spaces be constructed or provided at either the playground or civic amenity area.

- Should the planning application for use of the site as a sports pitch be considered appropriate landfill gas control measures, as specified in the DOE Guidance, must be incorporated into the design of the Dressing Rooms. These may include either active or passive systems and the decision must be based on the results of the landfill gas monitoring in new landfill gas monitoring wells installed between the edge of the waste and the building footprint and using a Risk Assessment based on CIRIA 665.

- Under no circumstances should the thickness of the existing cover layer be reduced. If the application for the development of the soccer pitch is approved the cover layer should be increased to a minimum thickness of 1m across the both the pitch and the warm up area. The surface water drains must not extend into the waste and there must be a minimum of 500mm of subsoils between the invert level of the drains and the waste to ensure that there is no connection between the drains and the waste and to minimise the infiltration of water into the waste.

To establish the effectiveness of the remedial works, landfill gas monitoring (methane, carbon dioxide and oxygen levels and flow rate) should be carried out in wells that are between any gas migration barriers that may be installed and the new residential area. If the existing monitoring wells are damaged during the remedial works, replacement wells should be installed.

The monitoring should be carried out at quarterly intervals for one year and should include Gas Flow Rate. If the monitoring identifies the presence of landfill gas at levels that present a risk to the residential areas, additional remedial works will be required. The scope of such works will depend on the monitoring results.

If the monitoring does not detected the presence of landfill gas, the frequency may be reduced to six monthly after year 1 and subsequently to annually after year 2.

Surface water monitoring should be carried out in the stream annually to confirm that the waste is not affecting water quality. The parameters should include pH, electrical conductivity, ammonia and BOD.

To: Sean Moran
O'Callaghan Moran

Date 14th July 2017

Re: Credentials in accordance with section 2.3 of *Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites* (EPA, 2007)

Dear Sean,

The Institute of Geologists of Ireland is satisfied to state that you are a person who is qualified, trained and experienced to the standard set out in section 2.3 of *Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites* (EPA, 2007) and have achieved chartered status with this professional regulatory body. Your specialisms are:

1. Environmental Geology
2. Hydrogeology

I can confirm that your place on the IGI's Register of Professionally Qualified Geoscientists / Competent Persons (*in respect of environmental risk assessment for regulated and unregulated waste disposal and contaminated land*) has been renewed. Please see www.igi.ie for current Register.

This letter of accreditation is valid until 31 December 2018.

Yours sincerely
Institute of Geologists of Ireland

_____

EurGeol Catherine Buckley PGeo
President, IGI
Catherine.buckley@arup.com

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UPDATED TIER 3 ENVIRONMENTAL RISK ASSESSMENT

FORMER MUNICIPAL LANDFILL

MOATE,

COUNTY WESTMEATH

Prepared For: -

Westmeath County Council,
County Buildings,
Mullingar,
County Westmeath

Prepared By: -

O' Callaghan Moran & Associates,
Granary House,
Rutland Street,
Cork

August 2018

O'Callaghan Moran & Associates Registration/VAT Number: 8272844U

TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

In 2007, Westmeath County Council (Council) appointed O' Callaghan Moran & Associates (OCM) to undertake an environmental assessment of a former Council operated landfill in Moate. At the time, the Council was considering development options on part of the site to the north of and outside the waste deposition area.

The objective of the assessment was to establish the nature and extent of the wastes; identify and quantify any environmental impacts associated with waste deposition; evaluate the risk presented to the proposed development, and if necessary, identify appropriate remediation measures.

OCM carried out the assessment using the guidance contained in the Code of Practice – Environmental Risk Assessment for Unregulated Waste Disposal Facilities issued by the Environmental Protection Agency in 2007. The scope, included a background information review and site walkover (Tier 1), followed by a detailed site investigation (Tier 2). .

Tier 1 involved a review of the available information to establish the site history, determine the local and regional hydrological and hydrogeological conditions and identify potential receptors. OCM subsequently conducted a walkover survey to gain an understanding of the site conditions, confirm the presence of potential receptors, develop a preliminary conceptual site model, and identify suitable locations for intrusive investigations.

The Tier 2 Investigation included:-

- Excavation of exploratory trial pits,
- Collection and analyses of waste and sub-soil samples,
- Installation of permanent leachate monitoring wells,
- Installation of permanent landfill gas and groundwater monitoring wells,
- Collection and analyses of leachate and groundwater samples,
- Landfill gas monitoring, and
- A topographic survey

The investigation was conducted in accordance with BS 10175:2001 Investigation of Potentially Contaminated Sites-Code of Practice. The works were supervised by an experienced OCM geologist, who was also responsible for all field monitoring and the collection of the waste, soil, leachate, surface water and groundwater samples. The laboratory methodologies were all ISO approved or equivalent.

The assessment concluded that the waste did not present a significant risk to either surface water or groundwater; however landfill gas did present a risk to any future development adjacent to the site.

In 2011, the Council, commissioned OCM to complete a Tier 3 Assessment based on the findings of the 2007 Tier 1 and Tier 2 assessments and additional groundwater, leachate, landfill gas and surface water monitoring conducted by Council staff between November and December 2011. In May 2012 Moate Celtic Football Club submitted a planning application to construct dressing rooms, a soccer pitch and perimeter fencing on the site.

The report described the Tier 1 and 2 investigations completed in 2007 and the additional monitoring carried out in 2011 and presents the Tier 3 Assessment, which includes for the proposed development of the site as a soccer pitch.

In 2018 the Council requested OCM to update the risk assessment and proposed remedial measures following discussions with the EPA regarding the proposed remedial measures for the site. The Moate Cletic planning permission expired in 2017 and no development proceeded on the site. However, the Council would consider future applications for the development of the site for sport/recreational use.

2. TIER 1 ASSESSMENT

2.1 Site Location

The site is located in the townland of Killeenyboylegan, on the southern outskirts of Moate, as shown on Figure 2.1. The National Grid Reference is 219161: 238151. It is accessed of the N80 Moate to Clara National Secondary Road.

2.2 Site Layout

The site occupies an area of 3.4 ha, as shown on Figure 2.2. It is bordered to the north by a stone wall, to the east by a roadway and to the west and south by hedgerows. A stream runs along the southern site boundary, with a tributary drain running along the western boundary. The original topography of the site sloped from north to south but this has been altered by the waste deposition. There is a high point near the south central part of the fill will shallow falls in all direction.

The restored areas appear to be free draining, with the exception of an area in the centre of the site where rushes were observed in the 2007 investigation. At that time there was no evidence of either any waste at the ground surface, or of vegetation die back.

2.3 Site History

It is understood that the use of the site as a landfill started sometime ca 1970 and continued up to ca 1990. It is understood that the lands were low lying and that no excavation or quarrying was carried out prior to the start of the waste deposition. An aerial photograph from 1973 (Appendix 1) shows waste deposition in a small area in the south east of the site, with the remainder of the site undisturbed. An aerial photograph from 1987 (Appendix 1) shows waste deposition in the south western section of the site, with the previously filled section reinstated to grassland.

It is understood that the site was used to dispose of household waste collected by the Council in Moate and its environs, however there is no precise information on the nature and volume of waste deposited at the site, the method of waste placement or they type of cover applied. Given the historic landuses in the area, it is likely that the majority of the waste comprised municipal household waste.

Waste deposition stopped in ca 1990, following the opening of the Ballydonagh Landfill. It is understood that the deposited waste was covered with soils. In the mid 1990's, during improvement works at the nearby Council owned wastewater treatment plant (WWTP) subsoils excavated during the construction works was placed over the waste.

In 2002, the Council conducted a preliminary intrusive site investigation to establish the northern edge of the waste deposition area. The investigation involved the excavation of trial pits and the installation of soil probes in the waste and in the adjoining northern area. The investigation identified the northern boundary of the fill area, but did not establish either the nature or depth of the waste. A copy of the report on the investigation is in Appendix 1. A playground and civic amenity area were provided on the site in 2009.

2.4 Surrounding Land use

There are houses immediately to the north and within 10 metres of the site boundary, and a farm building to the east. The lands to the south, east and west of the site are agricultural. The Council's WWTP is approximately 500m to the south.

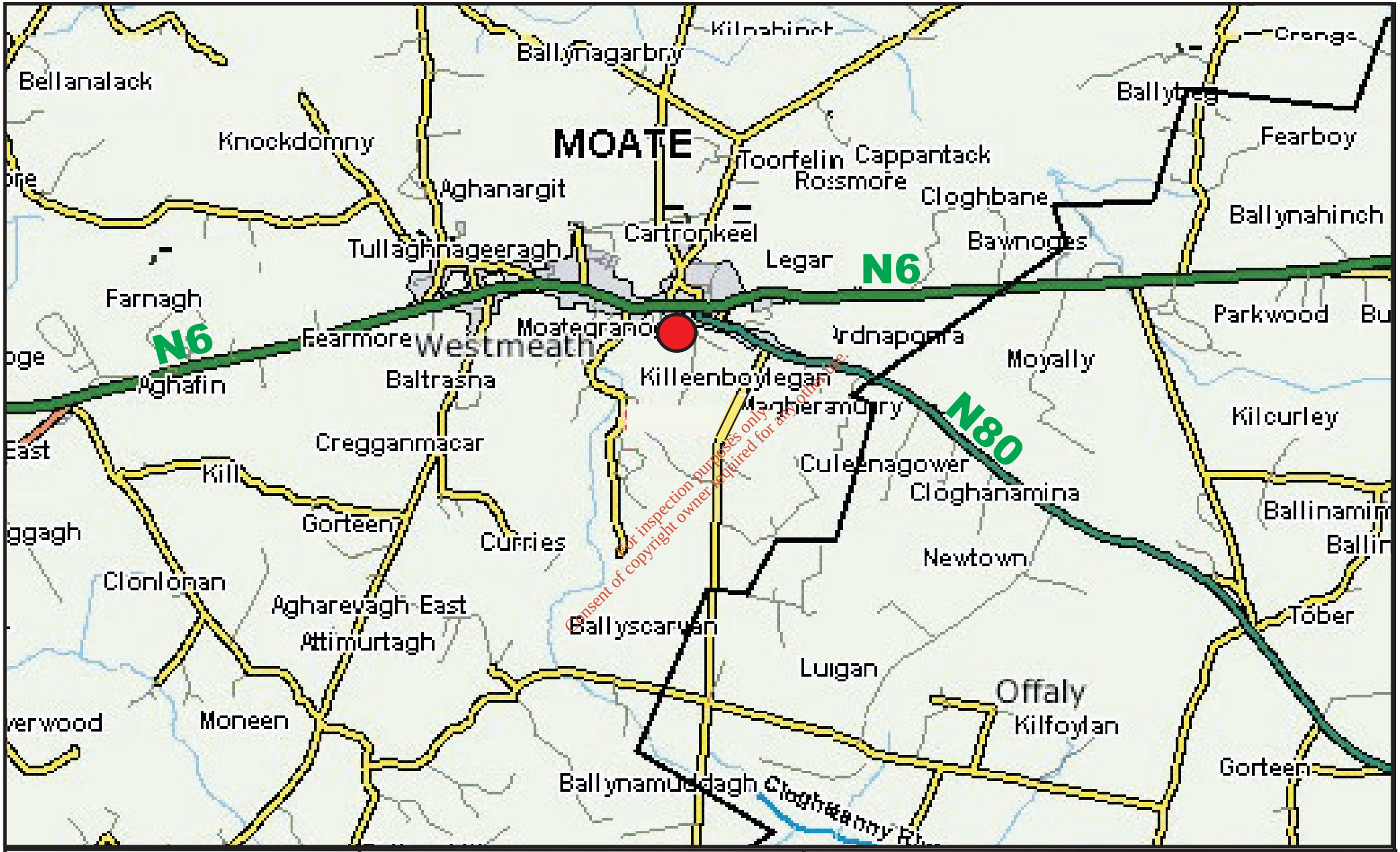
2.5 Hydrology

The fill area is domed and slopes from the centre of the site to the north, east, west and south. There is a stream along the southern site boundary. An Ordnance Survey (OS) map from 1912 (Appendix 1), shows a spring at the south eastern boundary of the site, which appears to be the source of the stream. It is probable, based on site observations, that the flow in the stream is affected by seasonal conditions.

The water level in the stream is approximately 2m below the ground level at the southern site boundary. There is an open drain running along the western site boundary, which is a tributary of the stream. The stream flows to the south and is a tributary of the Cloghatanny River, which flows to the south east to join the River Brosna.

2.6 Geology & Hydrogeology

OCM established the local geological and hydrogeological conditions from a review of databases maintained by the Geological Survey of Ireland (GSI), Teagasc and the site investigation findings. The latter are discussed in more detail in Section 3.



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CLIENT Westmeath County Council

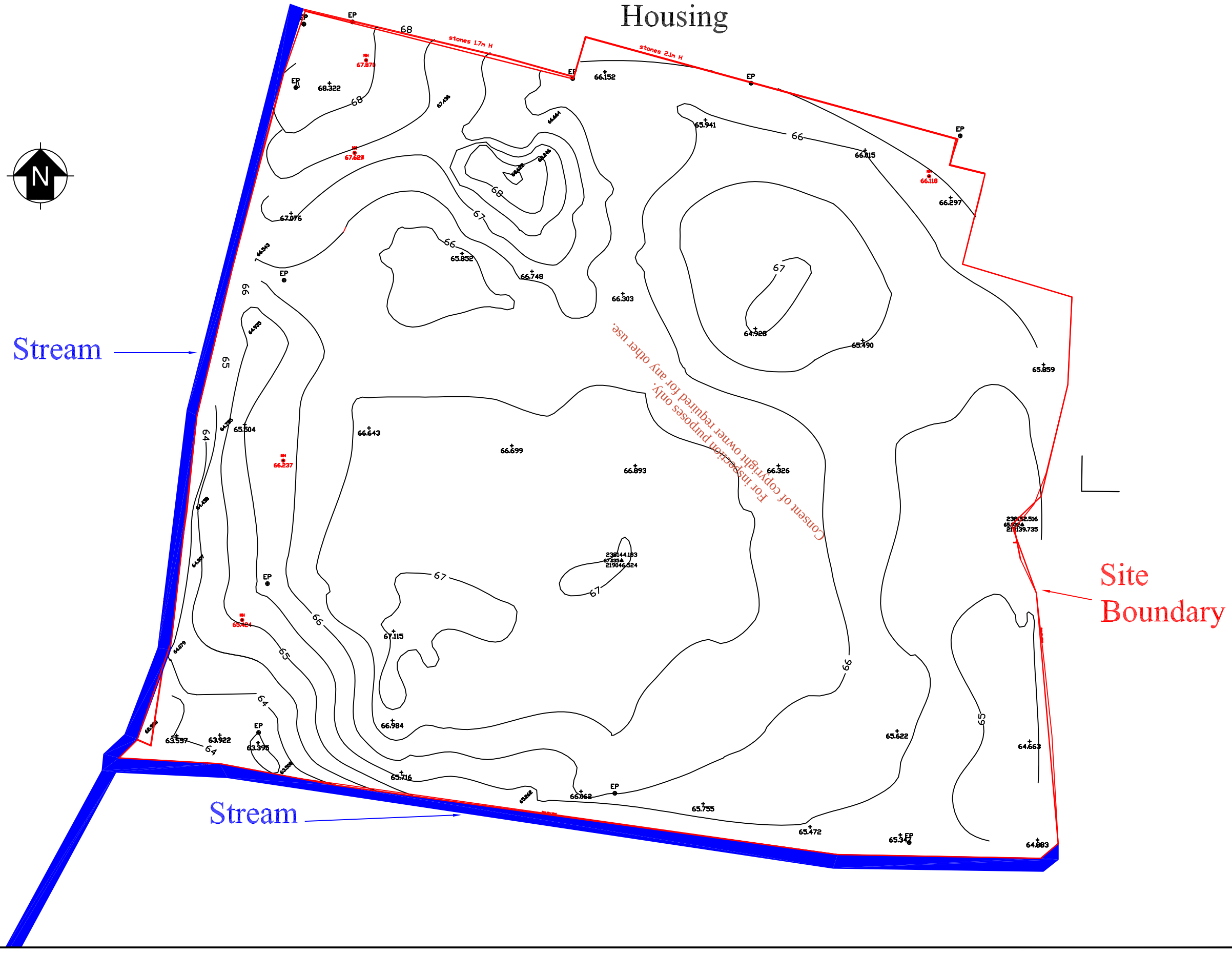
TITLE Site Location

Details
Site Location

FIGURE NUMBER 2.1

Scale
Not To Scale

Job Number:
11-045-01



NOTES

REV	DATE	DESCRIPTION	DRN	CHKD	APP
REV	DATE	DESCRIPTION	DRN	CHKD	APP

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CLIENT
Westmeath County Council

TITLE
Site Layout

SCALE	DRAWING No.	REV.
SCALE A3	2.2	

2.6.1 Soils and Subsoils

The GSI and Teagasc data bases indicate that the subsoils at the site comprise well drained limestone tills. The Teagasc maps indicate that the subsoils to the south of the site comprise gravels, overlain by cut peat.

The trial pits and boreholes installed in the 2007 investigation and which is described in Section 3 revealed that the natural subsoils over most of the site comprise dense grey gravely sand, with a proven minimum thickness of 5m. A peat layer which was encountered in the south east of the site, ranging from 0.2 to 0.4m thick, appears to be original ground.

Water was not encountered in the subsoils underlying the waste. Groundwater was encountered in the subsoils to the north of the waste, with the depth ranging from 2.7m to 4.0m below ground level (mbgl). As discussed above, the 1912 OS map shows a spring at the south eastern site boundary. This means that the water table is close to the surface in this area, which is probably the reason for the formation of the peat in this part of the site.

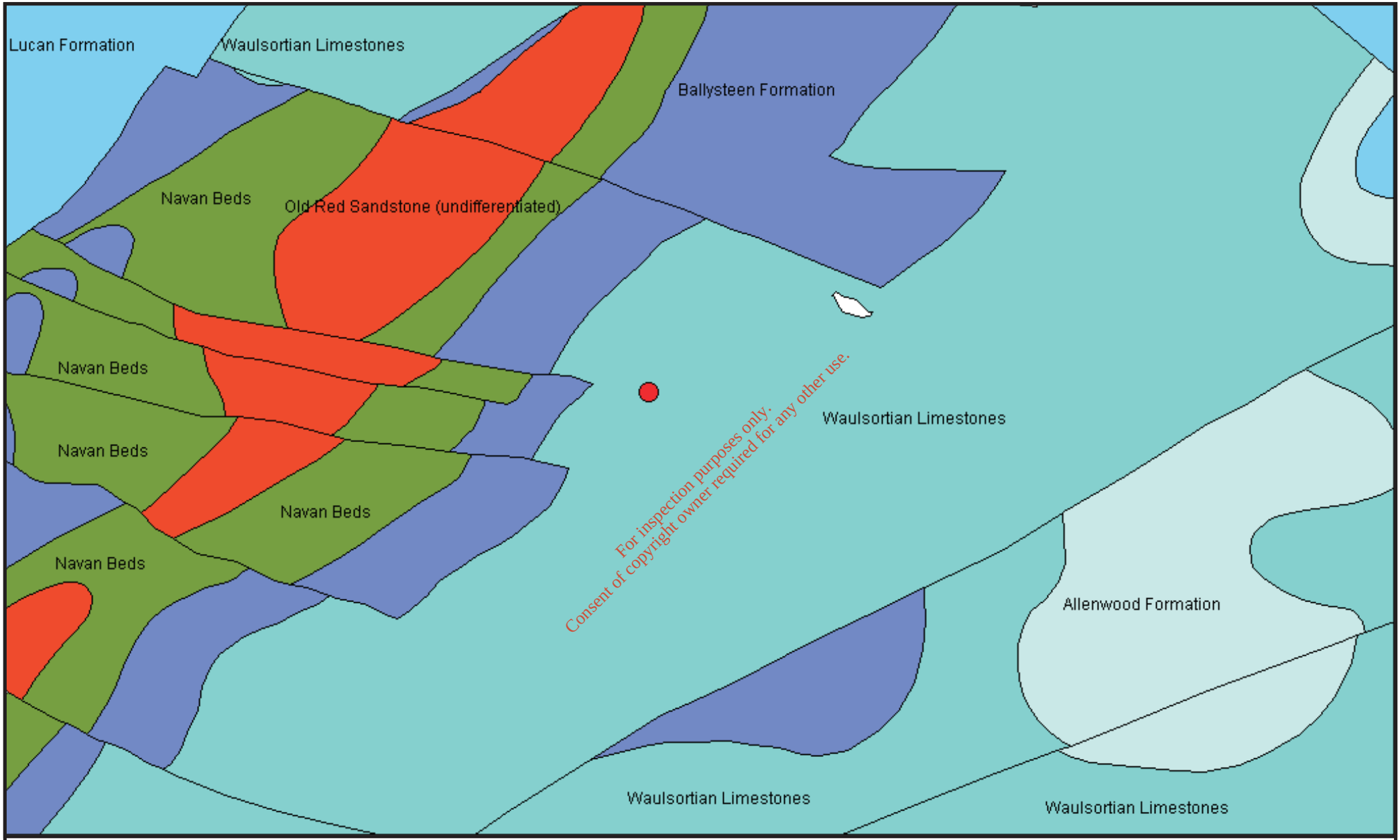
2.6.2 Bedrock

The regional geology is shown on Figure 2.3. The site is underlain by the Waulsortian Limestone Formation, which is described as a massive pale grey limestone. The formation is classified by the GSI as a locally important aquifer (**Ll**), being moderately productive only in local zones (Figure 2.4) In 2007,the bedrock aquifer vulnerability was classified by the GSI as ranging High to Low (**HL**) (Figure 2.5). Based on the topographic gradient it is estimated that groundwater flow is from north to south.

2.7 Potential Receptors

The site is located on the southern outskirts of the town. The houses approximately 10m to the north of the northern site boundary are the closest domestic residences to the site. There is a civic amenity area and children's playground inside the site boundary.

The stream on the southern site boundary, which arises from a spring and is a tributary of the Cloghatanny River, which itself is a tributary of the River Brosna. The underlying bedrock is categorised a locally important aquifer. There are no public water supplies and no record of any private wells within 1 kilometre of the site. There are no Natura 2000 sites within 1 km of the site.



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CLIENT Westmeath County Council

TITLE Local Geology

Details
Site Location

FIGURE NUMBER 2.3

Scale
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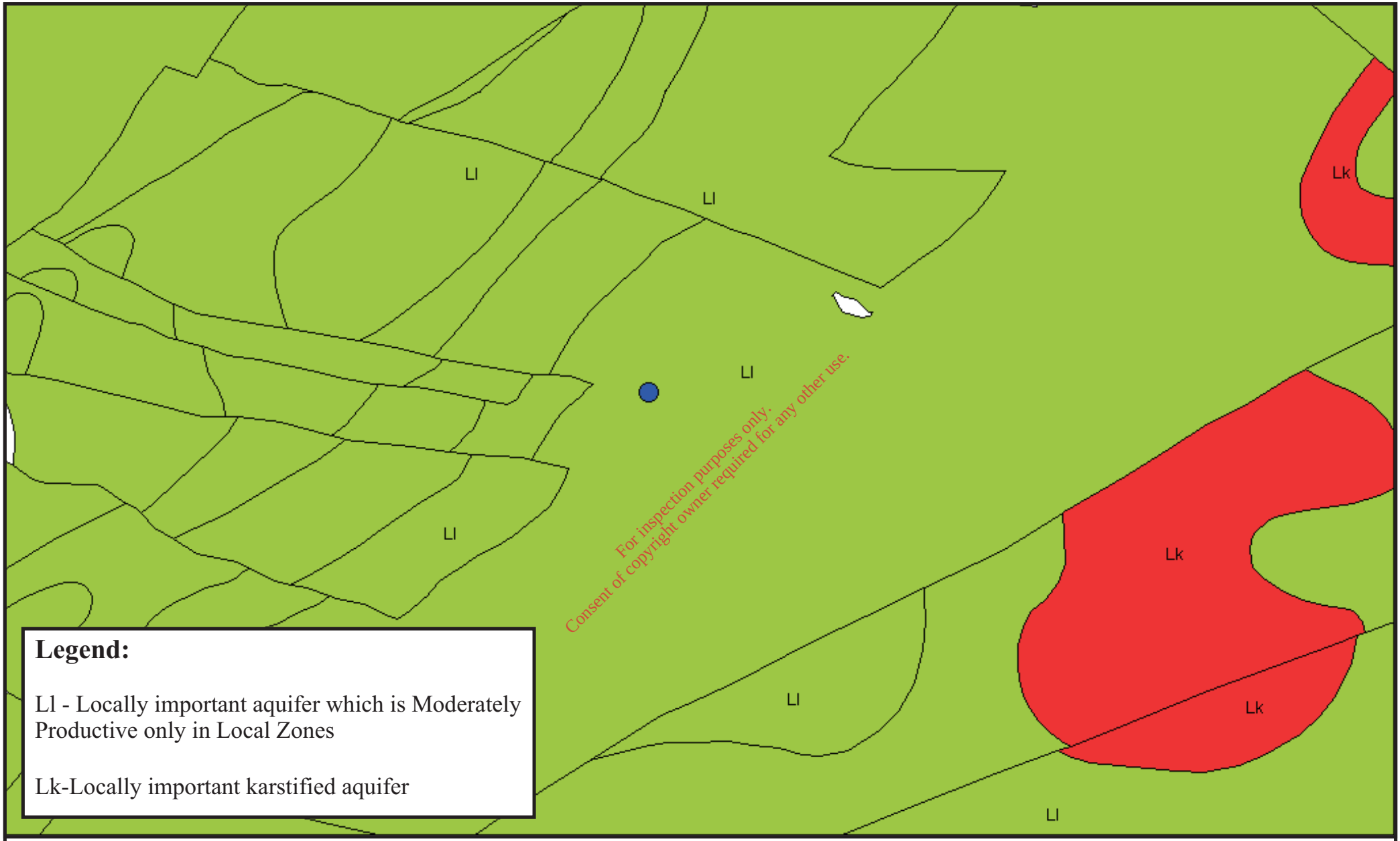
Job Number:
11-045-01



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CLIENT Westmeath County Council

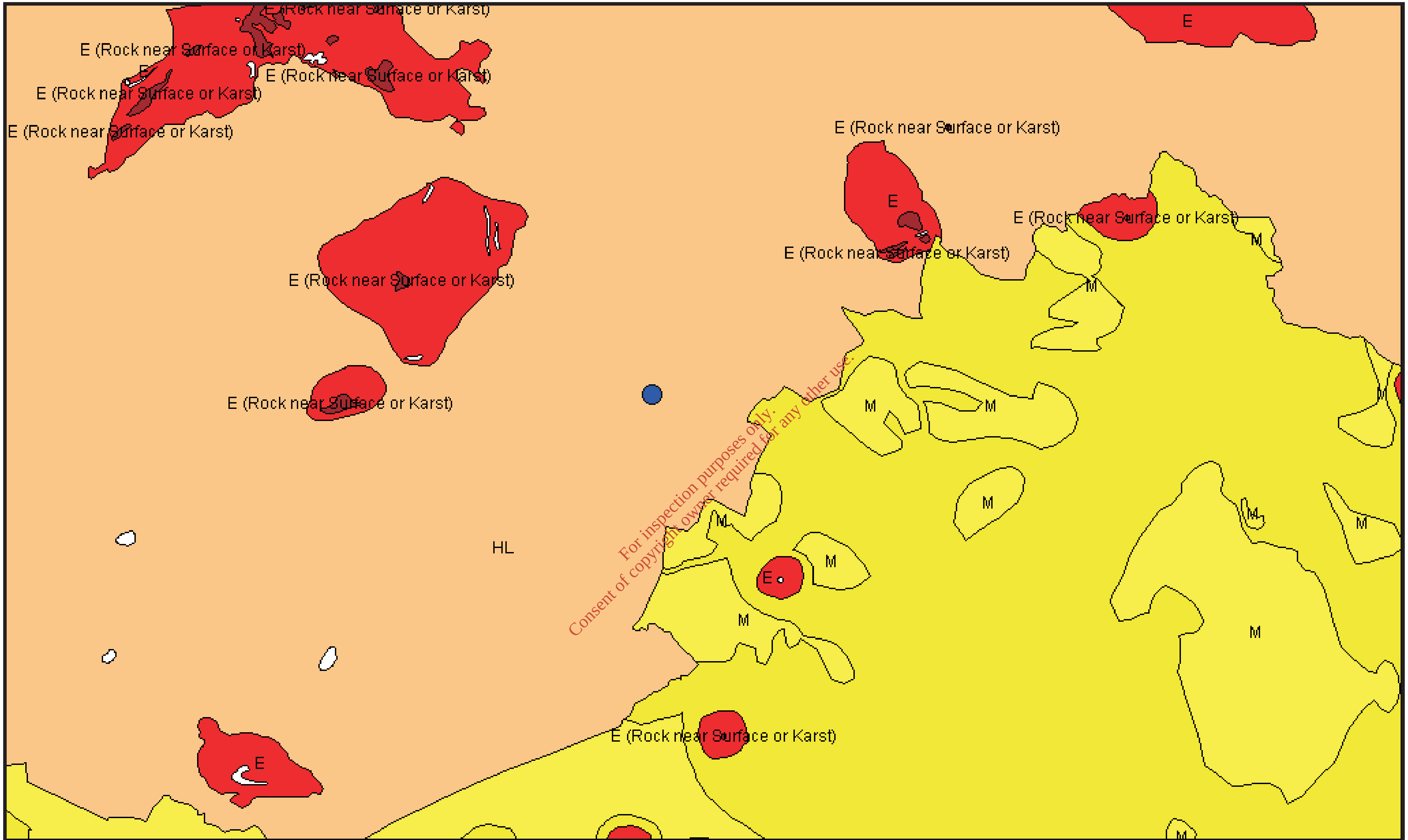
TITLE Aquifer Classification

Details
Site Location

FIGURE NUMBER 2.4

Scale
Not To Scale

Job Number:
11-045-01



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CLIENT	Westmeath County Council
TITLE	Aquifer Vulnerability
Details	Site Location
FIGURE NUMBER	2.5
Scale	Not To Scale
Job Number:	11-045-01

3. PRELIMINARY & DETAILED SITE INVESTIGATION

3.1 Objectives

The objectives of the investigations were:-

- to delineate the lateral and vertical extent of the wastes,
- to characterise the waste,
- to assess the risk of pollution to soils, surface water and groundwater, and
- to assess the risk presented by landfill gas.

3.2 Site Investigation Scope

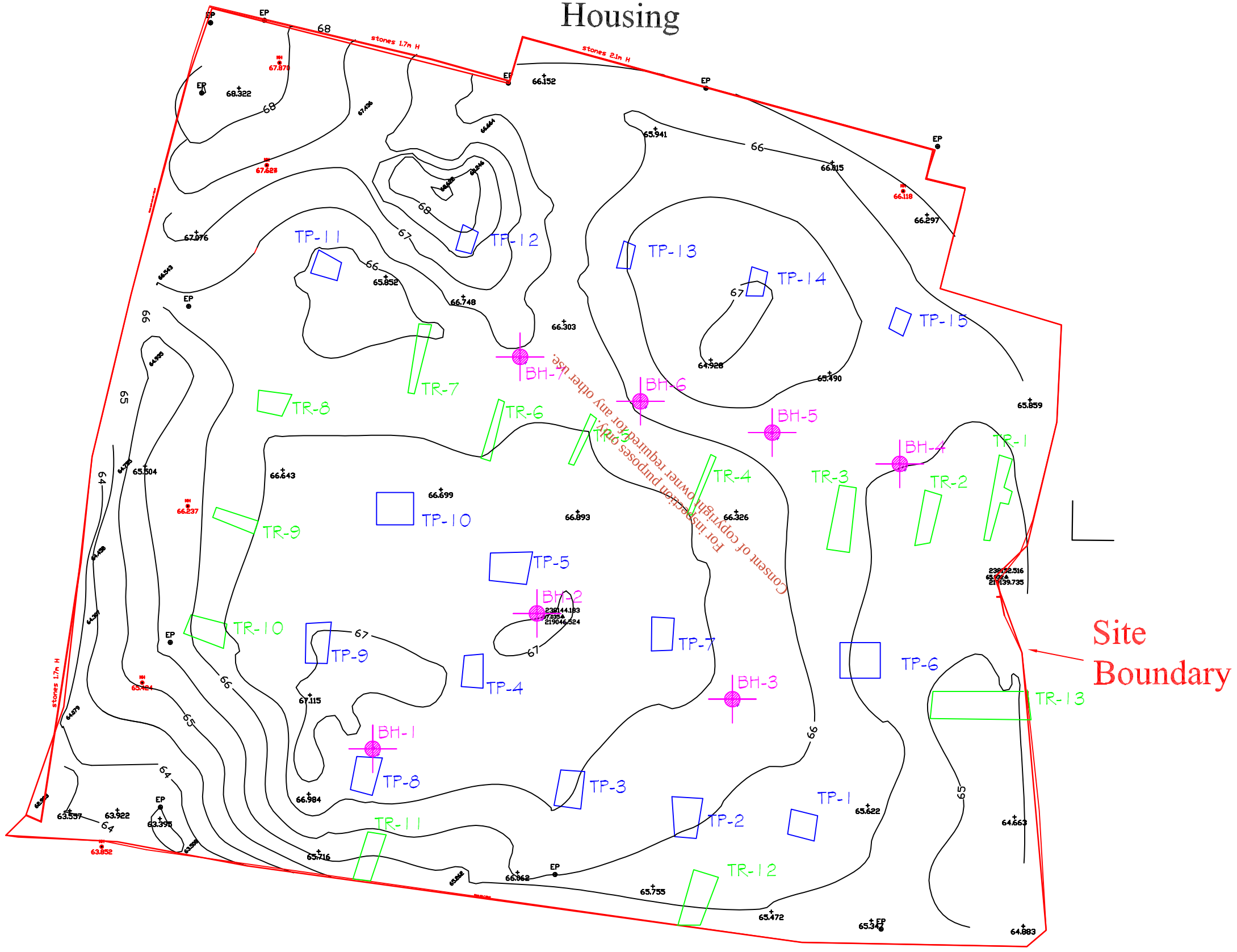
The site investigations were carried out in two stages. The Preliminary stage involved the excavation of trial pits and trenches, and the collection and testing of waste samples to establish the nature and extent of the waste. The Detailed stage comprised the installation of leachate; landfill gas and groundwater monitoring wells, the collection and analysis of leachate, groundwater and surface water samples and landfill gas monitoring.

3.3 Preliminary Investigation

The trial pit and trench excavations were carried out on the 9th and 10th May 2007 using a track mounted excavator, capable of travelling on variable terrain and with a reach of 5–7m below ground level (bgl). The locations are shown on Figure 3.1 and the works was supervised by an experienced OCM geologist.

Initially thirteen (13 No) shallow trial trenches were excavated to delineate the lateral extent of the waste. Following this, ten (10 No) pits were excavated within the waste body to determine the depth of the waste and to collect representative samples for laboratory analyses. Five (5 No) pits were excavated in the undisturbed ground north of the deposition area to establish natural ground conditions.

Housing



NOTES

Borehole Locations

TP-1 Trial Pit Location

TR-1 Trial Trench Location

REV	DATE	DESCRIPTION	DRN	CHKD	APP
REV	DATE	DESCRIPTION	DRN	CHKD	APP

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CLIENT
Westmeath County Council

TITLE
Borehole Trial Pit and Trench Locations

SCALE	DRAWING No.	REV.
SCALE A3	3.1	

3.3.1 Lateral Extent of the Waste

The first trench was positioned at the edge of the fill, as established by the Council in its 2002 investigation. The trench was opened to 0.8-1.2m mbgl. Once waste was encountered, the trench was extended north at a consistent depth until natural ground was encountered. The boundary between the waste and the undisturbed area was then marked with a wooden stake. Similar trenches were excavated along the northern, southern, eastern and western borders of the site.

The trenches confirmed that waste had been deposited up to the southern and eastern borders, but did not extend to the western or northern site boundaries. The lateral extent of the waste, which is shown on Figure 3.2, covers an area of ca 18,500m^2.

3.3.2 Vertical Extent of Waste

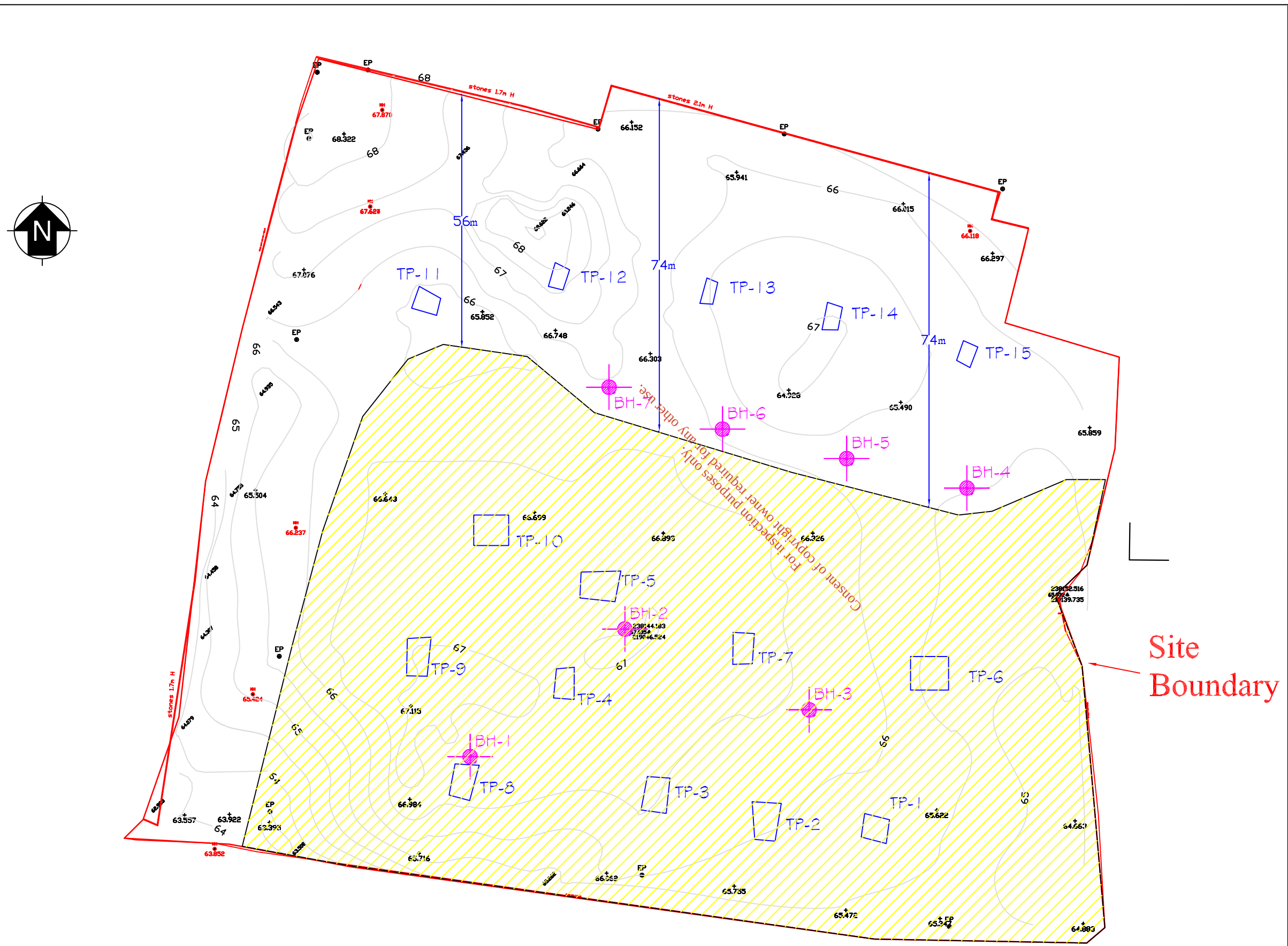
Ten (10) trial pits were excavated within the waste body (TP-1 to TP-10). The locations are shown on Figure 3.1 and the logs, which were recorded by the OCM Geologist in accordance with BS5930, are in Appendix 2.

The waste was covered by a thin layer of topsoil, which was underlain by a gravely clay, ranging from 0.2 to 1.2m across the site, being thickest in the central area. The underlying waste ranged from 2.5m in TP-4 to 4.6m in TP-8, with an average thickness of 3.3m. In the southern part of the site in the trial pits TP-1, TP-2 and TP-3 and the central section in TP-10 the waste is underlain by peat. Peat was not encountered in the rest of the site, where the waste is underlain by compact sandy gravels. Minor inflows of water were encountered in only two of the trial pits TP-1 and TP-2. Cross-sections through the waste are shown on Figure 3.3.

3.3.3 Waste Characterisation

The waste was not water saturated and comprised a mix plastic bags, glass bottles, concrete blocks, bricks, cardboard, car parts, fragments of steel, newspapers, food packaging, all of which were intermixed with a sandy clay. Photographs of the wastes are presented below.

It is assumed that the sandy clay was used as cover material when the site was operational, but no discrete layers were noted. A newspaper dated 1970 was found in TP-4 and food packaging dated 1990 was found in TP-5. There was no evidence of any significant amounts of potentially hazardous waste (e.g. oils, solvents).



NOTES

TP-1 Trial Pit Location

Extent of Waste Body

REV	DATE	DESCRIPTION	DRN	CHKD	APP
REV	DATE	DESCRIPTION	DRN	CHKD	APP

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CLIENT
Westmeath County Council

TITLE
Extent of Burried Waste

SCALE	DRAWING No.	REV.
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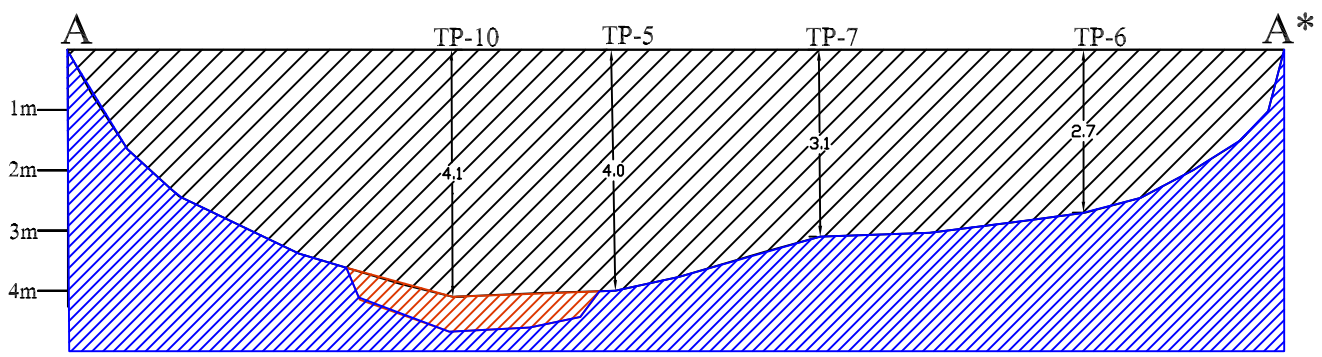

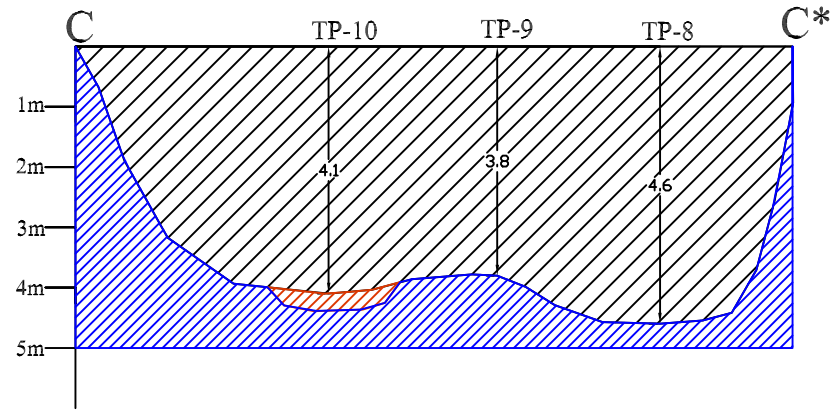

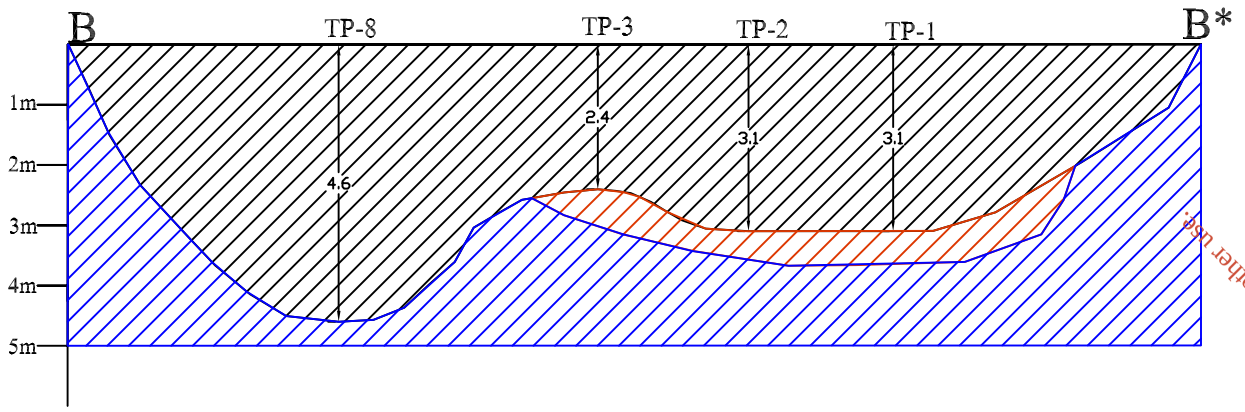

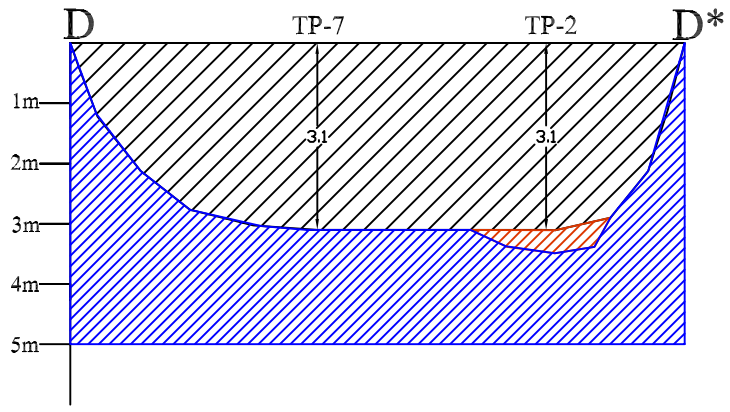

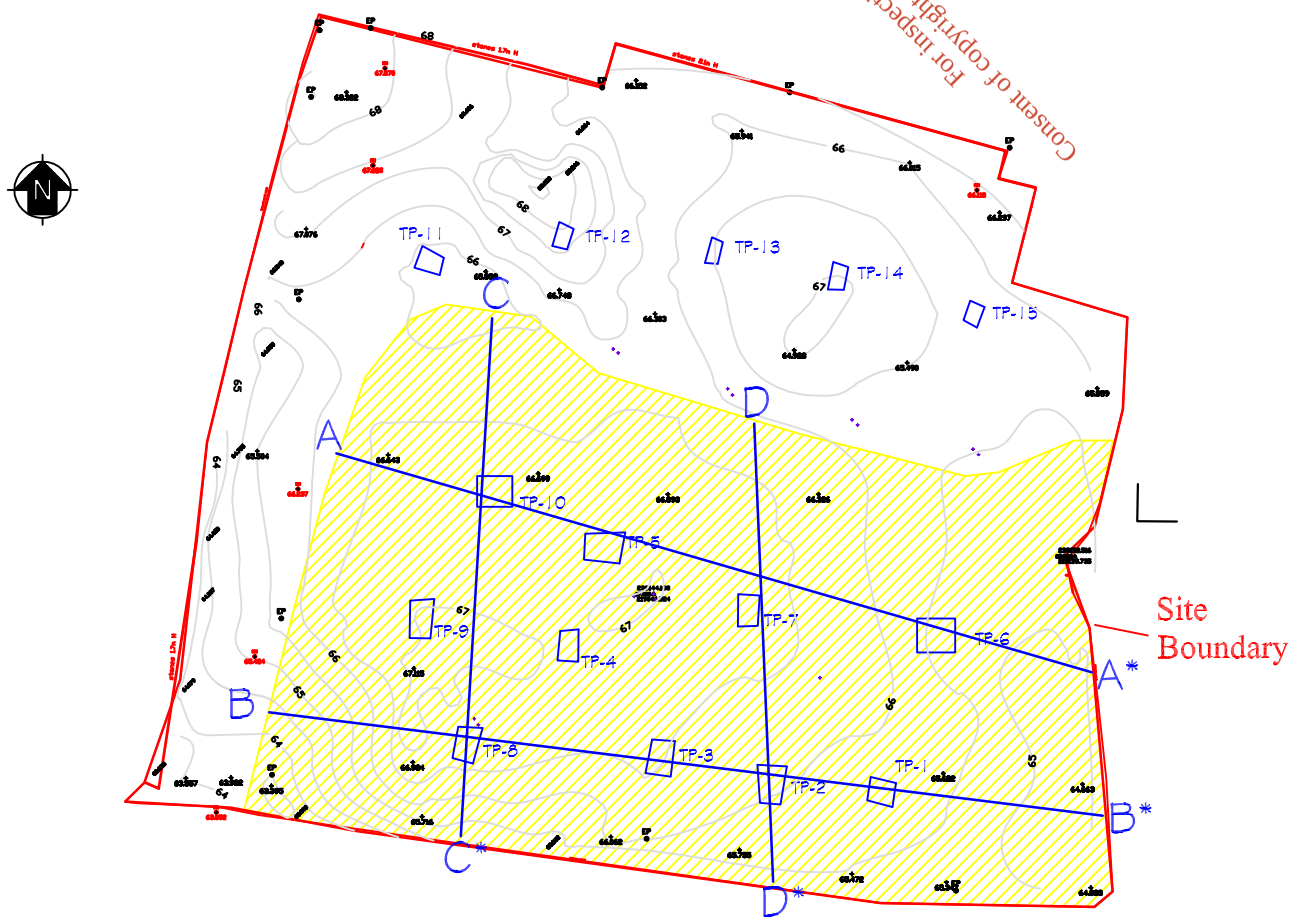

NOTES

Legend:
- Waste Material
- Peat Material
- Sands and Gravels

REV	DATE	DESCRIPTION	DRN	CHKD	APP
REV	DATE	DESCRIPTION	DRN	CHKD	APP

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CLIENT
Westmeath County Council

TITLE
Cross Sections

SCALE	DRAWING No.	REV.
SCALE A3	3.3	

Photograph No 1 Waste material encountered in TP-5

Photograph No 2 Waste material encountered in TP-6

Photograph No.3 Waste material encountered in TP-7

Photograph No 4 Waste material encountered in TP-9

3.3.4 Samples

Samples of the waste, as well as the underlying natural ground, were collected in all of the trial pits in accordance with OCM's sampling protocol, a copy of which is included in Appendix 3. The samples were field screened for the presence of volatile organic compounds (VOC) using a photo ionisation detector (PID). The PID readings are recorded in the trial pit logs. The samples were placed in laboratory prepared containers and stored in coolers prior to shipment to ALcontrol Geochem Laboratories in Blanchardstown, County Dublin.

3.3.5 Laboratory Analysis

Based on the field observations and field screening, which indicated that waste was generally consistent across the site, it was decided to analyse a total of 7 waste samples and 4 samples of the underlying subsoils. Depending on the results, additional samples would be tested.

The samples were analysed for the full suite of parameters specified in the Annex to EU Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC. The Annex, which is commonly known as the Landfill Waste Acceptance Criteria (WAC), sets threshold limits for a range of inorganic and organic parameters that characterise a waste as suitable for disposal to an inert, non-hazardous or hazardous waste landfill.

The solid samples were tested for Total Organic Carbon (TOC), BTEX (benzene, toluene, ethylbenzene and xylene) Polychlorinated biphenyls (PCB), Mineral Oil and Polycyclic Aromatic Hydrocarbons (PAH). Leachate generated from the samples was tested for arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc, chloride, fluoride, soluble sulphate, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

The analytical methodologies were all ISO/CEN approved or equivalent and the method detection limits were all below the relevant WAC values.

3.3.6 Results

The complete laboratory test report is included in Appendix 3 and the results are presented in Table 3.1. The Table includes the WAC values for Inert and Non-Hazardous wastes. The Decision does not specify limits for PAH, as this is left to the individual member states. The Agency has set a limit of 100mg/kg in a Waste Licence for an inert landfill, and this has been used as a guideline.

With the exception of antimony, fluoride, sulphate, Total Dissolved Solids (TDS) and Total Organic Carbon (TOC) all of the parameters were below the Inert WAC values. All of the parameters were significantly below the Non-Hazardous WAC values.

Table 3.1 Soil Results

Location	TP-2	TP-2	TP-3	TP-3	TP-4	TP-4	TP-6	TP-8	TP-8	TP-9	TP-10	INERT LANDFILL	NON-HAZ LANDFILL
Depth	**1.5-2.0m**	**3.2-3.5m**	**0.5-1.0m**	**2.4-2.6m**	**1.0-1.5m**	**2.6-2.8m**	**1.0-1.5m**	**1.0-1.58m**	**4.7-4.9**	**0.8-1.3m**	**1.0-1.5m**	**L/S = 10*l/kg***	**L/S = 10*l/kg***
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Arsenic	<0.01	<0.01	0.02	<0.01	0.02	<0.01	0.02	0.02	0.01	0.03	0.02	0.5	2
Barium	2.41	4.74	2.86	1.89	3.36	<0.01	2.31	3.5	2.6	2.47	3	20	100
Cadmium	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.04	1
Chromium	0.02	<0.01	0.02	<0.01	0.03	<0.01	0.02	0.03	0.02	0.03	0.02	0.5	10
Copper	0.08	0.05	0.06	0.09	0.17	<0.01	0.15	0.14	0.06	0.24	0.09	2	50
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.01	0.2
Molybdenum	0.07	0.01	0.14	0.02	0.29	0.02	0.04	0.18	0.13	0.21	0.13	0.5	10
Nickel	0.06	0.03	0.03	<0.01	0.05	<0.01	0.02	0.07	0.03	0.06	0.04	0.4	10
Lead	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.5	10
Antimony	0.03	0.02	0.07	0.04	0.08	<0.01	0.01	0.03	0.05	0.02	0.02	0.06	0.7
Selenium	0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.1	0.5
Zinc	0.69	3.26	0.98	0.32	1.16	0.31	0.42	1.67	0.94	0.56	0.4	4	50
Chloride	20	58	32	22	72	25	23	31	99	36	32	800	15,00
Fluoride	<1	<1	<1	2	<1	3	2	<1	3	2	<1	2	150
Sulphate	8,446	4,644	1,486	158	1,438	64	299	3,747	849	306	494	1,000	20,000
Phenols	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1	NE
Dissolved Organic Carbon	30	153	48	<20	134	<20	75	97	70	155	38	500	800
Total Dissolved Solids	12,511	5,361	3,377	520	3,725	350	2,000	6,146	2,312	1,750	1,684	4,000	60,000
Total Organic Carbon*	1.8	27.1	3.7	0.4	3.3	<0.2	1.5	3.1	0.6	1.3	1.2	0.03	NE
BTEX	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.033	<0.01	6	NE
PCBs	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	NE
Mineral Oil	<1	<1	<1	<1	<1	<1	<1	<1	<1	125	<1	500	NE
PAH (6)	<1.6	<1.6	<1.6	<1.6	3.8	<1.6	<1.6	<1.6	<1.6	<1.6	6.2	-	NE
PAH (16)	1.231	<1	0.453	<1	6.488	<1	0.415	2.891	1.036	1.63	10.19	-	NE
PAH (17).	1.265	<1	0.467	<1	6.547	<1	0.427	2.982	1.049	1.667	10.452	Murphy's 100mg/kg	NE

3.3.7 Area North of the Waste

Five (5) pits (TP-11 to TP-15) were excavated in natural ground the area to the north of the waste. Waste was not uncovered in any of the pits and the subsoils comprised natural sands and gravels with occasional cobbles. A moderate groundwater inflow was encountered in one trial pit (TP-14), at a depth of 1.6 mbgl.

3.4 Detailed Investigation

The second stage involved the installation of three combined leachate and landfill gas monitoring wells inside the body of the waste, four combined groundwater and landfill gas wells outside the waste, the collection and analysis of groundwater, surface water and leachate samples and landfill gas monitoring.

The wells were installed between 28th May and 1st June 2007 at the locations shown on Figure 3.1, using a rotary percussive drilling rig. The wells are labelled as BH-1 to BH-7 on the drawing. The drilling and well construction was supervised by an OCM geologist. The drilling logs and well construction details are in Appendix 2.

3.4.1 Leachate/Landfill Gas Wells

Three (No.3) wells MW-1 to MW-3 were installed in the waste body to monitor leachate and landfill gas. Based on the findings of the trial pits, which did not identify either the presence of significant volumes of leachate or a significant low permeability layer beneath the waste, the borings were extended through the waste. The objective was to confirm the thickness of the waste and to establish if there was an underlying unsaturated zone. Groundwater/leachate was not encountered during the drilling.

3.4.2 Landfill Gas/Groundwater Wells

Based on the topography and the local surface water drainage pattern, the direction of groundwater flow was expected to be from the north to the south. As the waste extended up to the southern site boundary, it was not possible to install a groundwater monitoring well within the site and immediately down gradient of the waste. Based on the findings of the Preliminary Investigation and the installation of the wells within the waste body which found no evidence of the presence of a significant amount of leachate, it was decided that the installation of side gradient wells to the east and west of the site was not required.

The wells (MW4 to MW-7), were positioned to the north of the fill area and were intended to primarily allow the monitoring of landfill gas and also establish upgradient groundwater

quality. The wells extended to a depth of 5m bgl, which is below the base of the waste. Groundwater was encountered in all the borings at between 2.6 and 4m below ground level.

3.4.3 Well Construction

The monitoring wells were constructed using uPVC 50 mm diameter standpipes, which were slotted from the base of the hole to 1.0m bgl. A gravel filter pack was inserted in the annular space between the boring and the standpipe to a level of 0.5 m above the slotted section of the standpipe. As the waste extended up to the southern site boundary, it was not possible to install a groundwater monitoring well within the site and immediately down gradient of the waste.

The annular space above the gravel filter was filled with a bentonite seal. The solid section of the well pipe was brought above the ground level and all fitted with landfill gas caps and valves to allow landfill gas monitoring. A steel protective well casing, set in a concrete base, was placed around the standpipe.

3.5 Leachate

No significant inflow of leachate was noted during the drilling of the boreholes and installation of the well pipes. Following installation, the wells were monitored on three occasions (1st, 15th and 28th June 2007) to establish if leachate was present. MW-1 and MW-2 were dry on all three occasions, but liquid was present in MW-3. The total depth of leachate measured in the MW-3 was 1.1m.

Leachate samples were collected from MW-3 on the 15th June 2007 using a disposable polyethylene baler. During sampling there was a noticeable drop in the leachate level in the well. The sample was placed in laboratory prepared containers and stored in a cooler and consigned to the ALcontrol laboratory.

3.5.1 Laboratory Analysis

The sample was analysed for leachate indicators and a range of organic and inorganic parameters, including a number of List I and II substances referred to in the EU Directives on Dangerous Substances (76/464/EEC) and Groundwater (80/68/EC) as amended, which comprised pH, electrical conductivity, dissolved oxygen, alkalinity, ammonia, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total oxidised nitrogen (TON), orthophosphate, chloride, fluoride and metals (arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc). The analytical methodologies were all ISO/CEN approved or equivalent and the method detection limits were all below the relevant thresholds.

3.5.2 Laboratory Results

The full laboratory test report is in Appendix 3 and the results are presented in Table 3.2. For comparative purposes the tables include the ranges (weak to strong) for the individual substances typically found in leachate, which are derived from the EPA's Landfill Design Manual.

Table 3.2 Leachate Results June 2077

Parameter	MW-3	EPA Landfill Design Manual Range
pH	7.33	6.8 - 8.2
Conductivity (mS/cm)	1.584	5,990 - 19,300
COD	4,063	622 - 8,000
Dissolved Oxygen (mg/l)	4	-
Total Alkalinity as $CaCO_3$ (mg/l)	614	3,000 - 9,130
Ammoniacal Nitrogen as N (mg/l)	4	283 - 2,040
Biological Oxygen Demand (mg/l)	11	110 - 1,900
Orthophosphate as PO_4 (mg/l)	0.03	-
Chloride (mg/l)	22	570 - 4,710
Fluoride (mg/l)	<0.1	-
Total Oxidised Nitrogen as N (mg/l)	<0.3	-
Arsenic (mg/l)	<0.001	<0.001 - 6.7
Dissolved Boron (mg/l)	0.501	-
Dissolved Cadmium (mg/l)	<0.0004	<0.010 -0.08
Dissolved Chromium (mg/l)	0.007	-
Dissolved Copper (mg/l)	<0.001	0.020 - 0.620
Mercury (mg/l)	<0.00005	<0.0001 - 0.0008
Nickel (mg/l)	0.008	<0.030 - 0.6
Zinc (mg/l)	0.017	<0.030 - 6.7
Selenium (mg/l)	0.002	-
Lead (mg/l)	<0.001	<0.040 - 1.9
Cyanide (mg/l)	<0.00005	-

The results indicate a very low strength leachate. All of the parameters, with the exception of COD, were either close to or below the lower end of the EPA range. This is consistent with an aged, predominantly non-hazardous waste mass that has undergone significant biodegradation.

3.6 Groundwater

A sample of the groundwater was collected from MW-6 on the 15th June 2007 to establish the upgradient groundwater quality. The sample was collected in accordance with OCM's sampling protocol, which is included in Appendix 3.

After completion of groundwater level measurements, the well was purged to remove the stagnant water in the well and surrounding gravel pack. Purging is required to ensure that the groundwater sample collected is representative of the formation and not the stagnant water in the monitoring well or surrounding gravel filter. The samples were placed in laboratory prepared containers, stored in a cooler, and sent for analyses to ALcontrol.

3.6.1 Laboratory Analysis

The sample was analysed for a range of organic and inorganic parameters that included indicators of general water quality and leachate contamination: electrical conductivity, dissolved oxygen, pH, ammonia, chemical oxygen demand (COD), cyanide and alkalinity, total hardness, BOD, total suspended solids, chloride, fluoride, nitrate, orthophosphate, TON, and metals (arsenic, boron, cadmium, chromium, copper, lead, nickel, selenium, zinc and mercury).

The analytical methodologies were all ISO/CEN approved or equivalent and, with the exception of ammoniacal nitrogen the method detection limits were all below the relevant comparative values.

3.6.2 Laboratory Results

The full laboratory test report is in Appendix 3 and the results are presented in Table 3.3.

Table 3.3 Groundwater Results June 2007

Parameter	MW-6	IGV values	GTV
pH	7.63	<6.5 and <9.5	-
Conductivity (mS/cm)	0.757	1	800-1,875
COD	437	-	-
Dissolved Oxygen (mg/l)	4.8	No abnormal change	-
Total Alkalinity as $CaCO_3$ (mg/l)	260	No abnormal change	-
Ammoniacal Nitrogen as N (mg/l)	<0.2	0.15	0.065-0.175
BOD (mg/l)	3	-	-
Orthophosphate as PO_4 (mg/l)	0.05	0.03	-
Chloride (mg/l)	29	30	24-187.5
Fluoride (mg/l)	0.2	1	-
Total Oxidised Nitrogen as N (mg/l)	3.9	No abnormal change	-
Arsenic (mg/l)	<0.001	0.01	0.0075
Dissolved Boron (mg/l)	0.05	1	0.075
Dissolved Cadmium (mg/l)	<0.0004	0.005	0.00375
Dissolved Chromium (mg/l)	0.003	0.03	0.0375
Dissolved Copper (mg/l)	<0.001	0.03	1.5
Mercury (mg/l)	<0.00005	0.001	0.00075
Nickel (mg/l)	0.005	0.02	0.015
Zinc (mg/l)	0.01	0.1	-

Selenium (mg/l)	0.002	-	-
Lead (mg/l)	<0.001	0.01	0.01875
Cyanide (mg/l)	<0.00005	0.1	0.0375

The tables include, for comparative purposes, the Interim Guideline Values (IGV) published by the EPA and the Groundwater Threshold Values (GTV) set out in the European Communities Environmental Objectives (Groundwater) Regulations (S.I. 9 of 2010). GTVs have only been established for core indicator parameters. With the exception of ortho-phosphate, all of the parameters were below the relevant IGVs and GTV. A GTV has not been specified for phosphate.

3.7 Surface Water

The stream at the southern site boundary is approximately 2 m below the southern edge of the waste. OCM did not observe any drains from the site entering either the stream or its tributary along the western boundary.

Given the assumed direction of groundwater flow from north to south and the fact that the source of the stream is a spring at the south-eastern site boundary, there is the potential for leachate to enter the stream either via contaminated groundwater, or seepage through the stream banks.

The flow in the stream is from east to west. Surface water samples were taken in the stream at two locations (SW-1 and SW-2) on the 15th June 2007. The locations are shown on Figure 3.1. SW-1 was at the south eastern site boundary and is upstream of the fill area. SW-2 was at the south western site boundary, downstream of the fill area and the confluence with the tributary drain.

The samples were collected in accordance with OCM sampling protocols, a copy of which is in Appendix 3 and were placed in laboratory prepared containers and stored in a cooler. The samples were sent for analyses to ALcontrol

3.7.1 Laboratory Analysis

The samples were analysed for a range of organic and inorganic parameters that included indicators of general water quality and leachate contamination: pH, electrical conductivity, dissolved oxygen, ammonia, hardness, COD, BOD, orthophosphate, nitrate, total suspended solids and chloride. The analytical methodologies were all ISO/CEN approved or equivalent and with the exception of ammoniacal nitrogen the method detection limits were all below the relevant comparative values.

3.7.2 Laboratory Results

The laboratory test report is in Appendix 3 and the results are summarised in Table 3.4. The Table includes, for comparative purposes, the environmental quality standards (EQS) set out in the Surface Water Environmental Objectives (Surface Water) Regulations 2009 (SI 272 of 2009).

Table 3.4 Surface Water Results June 2007

Parameter	SW-1	SW-2	EQS
pH	7.59	8.19	-
Conductivity (mS/cm)	0.847	0.711	-
COD	46	17	-
Dissolved Oxygen (mg/l)	6.2	6.1	-
Ammoniacal Nitrogen as N (mg/l)	<0.2	<0.2	0.065 – 0.14
Total Hardness (mg/l)	394	374	-
Total Suspended Solids (mg/l)	60	<10	-
Biochemical Oxygen Demand (mg/l)	4	5	1.5-2.6
Nitrate as NO_3 (mg/l)	19.2	8.9	-
Orthophosphate as PO_4 (mg/l)	<0.03	0.06	0.035 – 0.075*
Chloride (mg/l)	29	17	-

*Limit for phosphorus

All of the parameters, with the exception of the BOD, were below the relevant EQS. There was a decrease in the COD, nitrate, chloride and suspended solids levels between the upstream and down stream sites. The water quality at SW-2 was good, with no evidence of leachate contamination.

3.8 Landfill Gas

Landfill gas monitoring was conducted in all seven monitoring wells on 1st June, 15th June and 28th June 2007. The monitoring included the measurement of methane, carbon dioxide, oxygen and atmospheric pressure using a Gas Data LSMx gas analyser. The meter was calibrated before use. The detection limit was 0.1% for methane, carbon dioxide and oxygen.

The monitoring results are presented in Table 3.5. The table includes guideline limits from the Department of the Environment (DOE) publication on the 'Protection of New Buildings and Occupants from Landfill Gas' (1994). The guidelines stipulate that, where carbon dioxide or methane are present in a landfill at 0.5% v/v and 1% v/v respectively, then housing should not be erected within 50 m of the landfill and private gardens should not be allowed within 10 m.

3.8.1 Wells in the Waste

Persistent elevated methane (7.9%) and carbon dioxide (10%) were detected in MW-1 in all three monitoring events. Methane was also detected above in MW-2 on one occasion, but was not detected in MW-3. The carbon dioxide levels in both MW-2 and MW-3 persistently exceeded the DOE limit.

3.8.2 Wells Outside the Waste

Methane was not detected in MW-4 to MW-7. Carbon dioxide was detected on all three monitoring occasions. In two instances the levels exceeded the DOE limit. The variation in the carbon dioxide levels may have been due to atmospheric pressure differences over the monitoring period.

Table 3.5 Landfill Gas Monitoring Data: June 2007

Location	Methane (%)			Carbon Dioxide (%)			Oxygen$_2$ (%)			Barometric Pressure (mb)		
	1st June 2007	15th June 2007	28th June 2007	1st June 2007	15th June 2007	28th June 2007	1st June 2007	15th June 2007	28th June 2007	1st June 2007	15th June 2007	28th June 2007
MW-1	**2.7**	**7.9**	**7.6**	**4.9**	**8.1**	**10.0**	1.4	0.9	0.8	1012	999	1001
MW-2	0.4	0.0	**1.3**	**6.6**	**4.4**	**9.8**	2.4	10.1	2.1	1012	999	1001
MW-3	0.0	0.0	0.0	**2.3**	**6.4**	**6.7**	18.3	14.0	13.2	1012	999	1001
MW-4	*	0.0	0.0	*	**4.2**	**4.5**	*	9.5	8.0	*	999	1001
MW-5	0.0	0.0	0.0	0.6	**2.3**	**4.4**	20.3	8.9	7.8	1012	999	1001
MW-6	0.0	0.0	0.0	0.7	**3.1**	**4.2**	20.3	8.8	9.7	1012	999	1001
MW-7	0.0	0.0	0.0	1.0	**3.6**	**2.4**	20.3	12.3	16.1	1012	999	1001
DOE limits	0.5	0.5	0.5	1.0	1.0	1.0	-	-	-	-	-	-

- DOE limit not established
* Measurement not taken due to a gas cap fault

4. CONCEPTUAL SITE MODEL & RISK ASSESSMENT

4.1 Conceptual Site Model

A conceptual site model (CSM) was developed using the guidance presented in the EPA Code of Practice and based on the findings of the Stage 1 and 2 investigations. The CSM, which is depicted in Figure 4.1, formed the basis for the completion of the risk assessment.

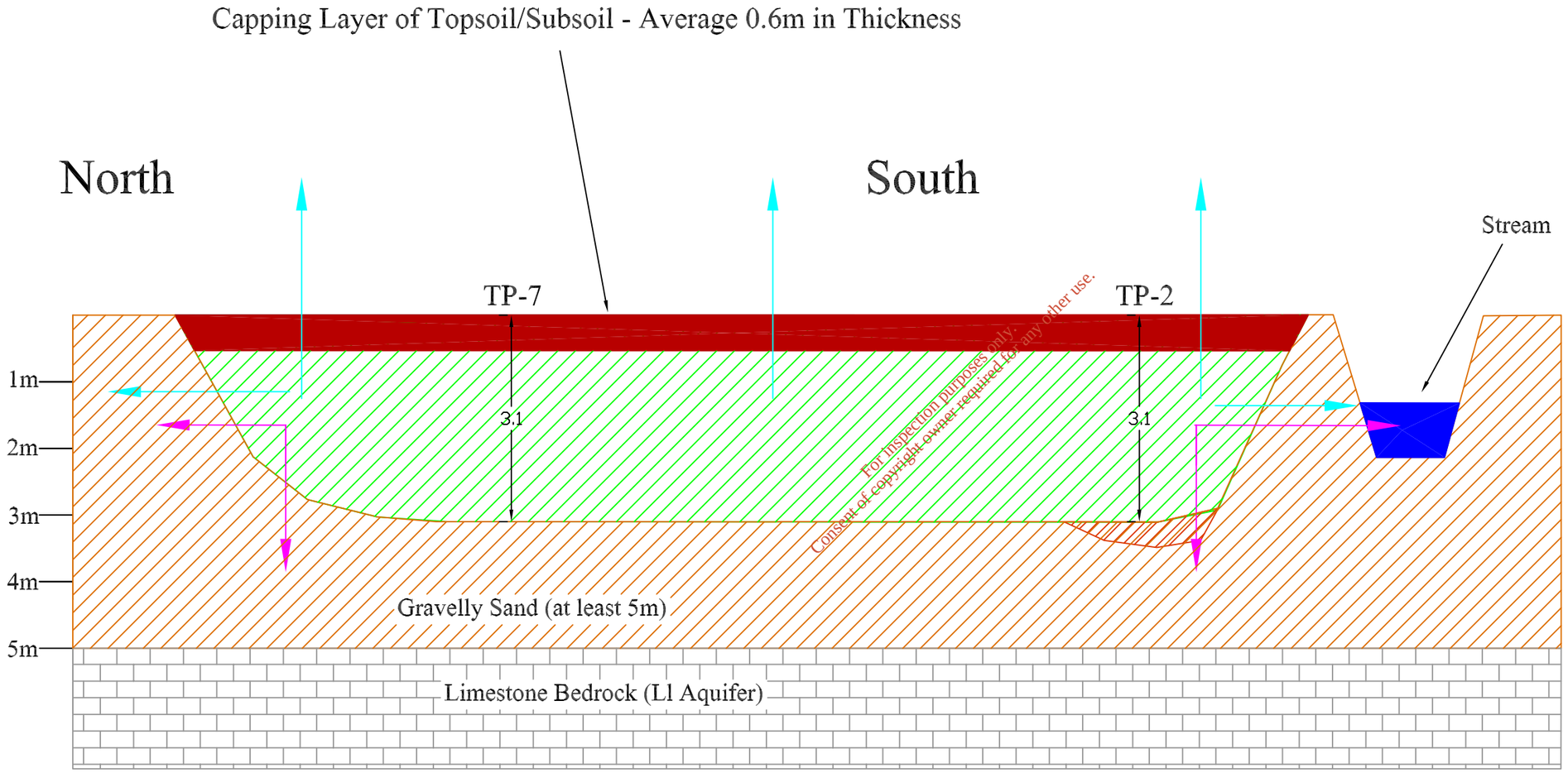
It appears that the original ground comprised peat overlying gravels. At some time peat and possibly part of underlying gravel were excavated from across the most of the waste deposition area. In the northern and central areas, it appears that the waste was placed directly on the gravels, while in the south the waste was placed on the peat. The average thickness of the waste is 3.3m. It is likely that the level of the fill in the south of the site is approximately 1m higher than the original ground level.

The waste has been covered with thin layer of topsoil, which is underlain by a gravely clay, ranging from 0.2 to 1.2m across the site, being thickest in the central area

The gravels underlying the waste are water bearing but are not considered to be a significant aquifer. The depth to the underlying bedrock aquifer, which is Waulsortian Limestone Formation, is not known but the GIS vulnerability classification is (H/L). Based on the precautionary principle, it is assumed that the vulnerability across the entire site is H. The bedrock aquifer is classed as a local important aquifer (L/l)

The source of the stream along the southern site boundary appears to be a spring that rises to the east of the site and flows to the west. A field drain along the western boundary confluences with the stream to the south west of the site. There were no drains within the site that connect to either the boundary stream or drain.

There are occupied residences approximately 80m from the northern edge of the waste area. In 2007, it was proposed to construct new residential dwellings within 50 m of the edge of the waste.



NOTES

Legend:

- Waste
- Peat
- Sands and Gravels
- Bedrock
- Capping Layer of Topsoil/Subsoil

- Leachate
- Landfill Gas

REV	DATE	DESCRIPTION	DRN	CHKD	APP
REV	DATE	DESCRIPTION	DRN	CHKD	APP

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CLIENT
Westmeath County Council

TITLE
North South Cross Section

SCALE	DRAWING No.	REV.
NTS	4.1	

4.2 Risk Assessment

Source/Hazards

Waste Types

The waste encountered comprised plastic bags, glass bottles, concrete blocks, bricks, cardboard, car parts, fragments of steel, newspapers, food packaging all of which were supported by a sandy clay matrix. There was no evidence of food or putrescible waste. The nature of waste observed is typical of household waste that has been buried for more than 15 years and which has undergone considerable biodegradation.

The testing of representative samples recovered from trial pits TP-2, TP-3, TP-4 and TP-8 established that a number of parameters exceeded the Inert WAC (sulphates and total dissolved solids). These levels are probably associated with the deposition of Construction & Demolition Waste (e.g. gypsum plasterboard). The testing confirmed the field observations that the waste comprises well degraded municipal waste, the bulk of which can be classified as inert.

Waste Area

The southern and eastern extent of the waste is defined by the site boundaries. The western edge is approximately 28m from the western site boundary. The northern edge is approximately 65m from the northern site boundary. The investigation proved the thickness of the waste ranged from 2.5 to 4.6m, with an average thickness of 3.3m. It is estimated, based on the proven lateral and vertical extent of the waste, that there is approximately 61,000m^3 of waste at the site.

Leachate

Leachate was encountered in two of the trial pits and one of the monitoring wells installed in the waste body. Only small inflows were noted in the two trial pits (TP-1 and TP-2) and small volumes recorded in the monitoring well (MW-3). The trial pits are located in the southern area of the site, where the waste is underlain by peat. It is considered that the peat inhibits the downward percolation of any infiltrating rainwater; while in other areas, where the peat is absent, it can percolate freely to the underlying subsoils.

The analytical results indicate that that the leachate is very low strength with the exception of COD. This is consistent with both the field observations and the analyses of the waste samples.

Landfill Gas

The landfill gas monitoring has established that the waste is a source of landfill gas. The gas levels measured indicate that the waste is in the final stages of landfill gas generation, with relatively low methane and carbon dioxide concentrations. This is consistent with the type of waste observed, its age and relatively shallow thickness.

The site investigation did not identify the presence of discrete layers of daily cover material placed over the waste, with the exception of the final cover. It is probable that when the site was operational daily cover was not regularly applied. This would have encouraged the aerobic breakdown of the organic content and, where anaerobic conditions occurred it would have allowed landfill gas to vent freely to atmosphere.

The subsoils placed over the waste following closure comprise a gravely clay that has a relatively low permeability and will inhibit vertical gas movement, particularly in the central area of the site where the cover is >1m. This gives rise to the potential for lateral landfill gas migration from the waste body. Elevated carbon dioxide was detected in the wells outside the waste body indicating the likely lateral movement of landfill gas to the north.

4.3 Pathways

4.3.1 Leachate Migration Pathways

Groundwater Vulnerability

The GSI maps indicate that the aquifer vulnerability of the area occupied by the site ranges from High to Low. The subsoils beneath the waste range from peat in the south to sand and gravel in the central and northern areas. A 0.4m thickness of peat and 1m unsaturated thickness of sandy gravels was proven by the boreholes installed in the waste. The boreholes to the north of the fill proved a thickness of 5 m of sands and gravels. In the absence of a confirmed depth to bedrock, a High vulnerability has been assumed.

The waste is not water saturated and water/leachate was only encountered in those areas where that waste is underlain by peat. It appears that the placement of the low permeability subsoil cover, which is graded to fall away from the central area of the site, has significantly reduced infiltration of rain water to the waste.

When the site was operational it is probable that incident rainfall infiltrated the waste to generate a leachate, which then percolated down into the underlying unsaturated zone where the peat layer was absent. Here, it would have been subject to attenuation before entering the groundwater.

The sample of the underlying peat in TP-2 has concentrations of sulphate, TDS and TOC that exceed the Inert WAC values. The sulphates and TDS are likely associated with the high levels of sulphate detected in the overlying waste at this location and which most probably leached out before the waste was covered. The elevated TOC is probably associated with the peat and not the waste. The peat itself, given its compressed nature, is likely to inhibit the downward movement of the leachate into the underlying subsoils.

The samples from the natural ground in the other trial pits did not identify any impacts on the subsoils, indicating that any contaminants have probably already migrated downwards. It is probable that the majority of the soluble/mobile substances in the waste have already leached out. This is supported by the results of the leach testing of the waste samples, which indicates that the majority of the waste is essentially inert.

Groundwater Flow Regime

In the southern areas of the site, where peat is present, there is the potential for lateral downgradient movement of leachate towards the southern site boundary.

4.3.2 Landfill Gas Pathways

The unsaturated sands and gravels beneath the waste in the central and northern areas and in the adjoining unfilled areas of the site are gas permeable and are a potential pathway for the migration of landfill gas.

4.4 Receptors

4.4.1 Leachate Migration Receptors

Human Presence

There is no record of any groundwater wells in the vicinity of the site. However, given the proximity of houses the precautionary principle was applied and, for the purposes of risk scoring, it is assumed that there is a private well within 250m of the waste.

Aquifer Category

The bedrock aquifer is classified as locally important (LI).

Surface Water Bodies

There is a stream along the southern site boundary and a tributary drain on the western boundary. There is no apparent direct connection (e.g. drains from the waste body) for leachate to enter the surrounding surface water system. Monitoring conducted in the stream did not identify any impacts associated with the landfill.

4.5 Landfill Gas Receptors

Human Presence

There are occupied residences approximately 80m from the northern edge of the waste area. In 2007, it was the intention to construct new residential dwellings within 50 m of the edge of the waste and this was factored into the risk assessment.

4.6 Risk Assessment

The Code of Practice provides a scoring matrix where points are assigned, based on a source-pathway-receptor (SPR) model, to assess risk. The points for the individual parameters are derived from tables in the Code of Practice. The scores are normalised to 1 -100.

High risk sites are those with a score greater than or equal to 70 for any one SPR. Moderate risk are sites scoring between 40 -70. Low risk sites, which are considered not to pose a significant risk to the environment or human health, are those with a score less than or equal to 40.

The maximum score for any single SPR is 70, and is associated with the Landfill Gas to on-site and off site receptors and Surface Water SPR. It should be noted that there are no on-site receptors.

Table 1a LEACHATE: Source/hazard Scoring Matrix			
Waste Type	Waste Footprint (ha)		
	≤1ha	>1≤5ha	>5ha
C&D	0.5	1	1.5
Municipal	5	7	10
Industrial	5	7	10
Pre 1977 sites	1	2	3

1a =	**7**

Table 1b LANDFILL GAS: Source/hazard Scoring Matrix			
Waste Type	Waste Footprint (ha)		
	≤1ha	>1≤5ha	>5ha
C&D	0.5	0.75	1
Municipal	5	7	10
Industrial	3	5	7
Pre 1977 sites	0.5	0.75	1

1b=	**7**

Table 2a LEACHATE MIGRATION: Pathways	
Groundwater Vulnerability (Vertical Pathway)	Points
Extreme Vulnerability	3
High Vulnerability	2
Moderate Vulnerability	1
Low Vulnerability	0.5
High – Low Vulnerability	2

2a=	**2**

Table 2b LEACHATE MIGRATION: Pathways	
Groundwater Flow Regime (Horizontal Pathway)	Points
Karstified Groundwater Bodies (Rk)	5
Productive Fissured Bedrock Groundwater Bodies (Rf & Lm)	3
Gravel Groundwater Bodies (Rg & Lg)	2
Poorly Productive Bedrock Groundwater Bodies (Ll, Pl, Pu)	1

2b =	**1**

Table 2cLEACHATE MIGRATION: Pathways	
Surface Water Drainage (Surface Water Pathway)	Points
Is there direct connection between drainage ditches associated with the waste body and adjacent surface water body? Yes	2
If no direct connection.	0

2c =	**2**

Table 2d LANDFILL GAS: Pathways (assuming receptor within 250m of source)	
Landfill Gas Lateral Migration Potential	Points
Sand and Gravel, Made ground, urban, karst	3
Bedrock	2
All other Tills (including limestone, sandstone etc – moderate permeability)	1.5
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

2d =	**3**

Table 2e LANDFILL GAS: Pathways (assuming receptor above source)	
Landfill Gas Lateral Migration Potential	Points
Sand and Gravel, Made ground, urban, karst	5
Bedrock	3
All other Tills (including limestone, sandstone etc – moderate permeability)	2
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

*No receptor above waste body

2e =	**5**

Table 3a LEACHATE MIGRATION: Receptors	
Human Presence (presence of a house indicates potential private wells)	Points
On or within 50m of the waste body	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km	1
Greater than 1km of the waste body	0

3a =	2

Table 3b LEACHATE MIGRATION: Receptors	
Protected Areas (SWDTE & GWDTE)	Points
Within 50m of the waste body	3
Greater than 50m but less than250m of the waste body	2
Greater than 250m but less than 1km of the waste body	1
Greater than 1km of the waste body	0
Undesignated sites within 50m of the waste body	1
Undesignated sites greater than 50m but less than250m of the waste body	0.5
Undesignated sites greater than 250m of the waste body	0

3b =	0

Table 3c LEACHATE MIGRATION: Receptors	
Aquifer Category (resource potential)	Points
Regionally Important Aquifers (Rk, Rf, Rg)	5
Locally Important Aquifers (Ll, Lm, Lg)	3
Poor Aquifer (Pl, Pu)	1

3c =	3

Table 3d LEACHATE MIGRATION: Receptors	
Public Water Supplies (other than private wells)	Points
Within 100m of the site boundary	7
Greater than 100m but less than 300m or within the in inner SPA for GW supplies	5
Greater than 300m but less than 1km or within outer SPA for GW supplies	3
Greater than 1km (karst aquifer)	3
Greater than 1km (no karst)	0

3d =	0

Table 3e LEACHATE MIGRATION: Receptors	
Surface Water Bodies	Points
Within 50 of the site boundary	3
Greater than 50m but les than 250m of the site boundary	2
Greater than 250m but less than 1km	1
Greater than 1km	0

3e =	3

Table 3f LANDFILL GAS: Receptors	
Human Presence	Points
On site or within 50m of site boundary	5
Greater than 50 but less than 150m of site	3
Greater than 150m but less than 250m of the site	1
Greater than 250m of the site	0.5

3f =	5

Risk Equation	SPR Values	Maximum Score	Linkages	Normalised Scores
SPR 1 = 1a x (2a + 2b + 2c) x 3e	105	300	Leachate →Surface Water	35.00%
SPR 2 = 1a x (2a + 2b + 2c) x 3b	0	300	Leachate →SWDTE	0.00%
SPR 3 = 1a x (2a + 2b) x 3a	42	240	Leachate → human presence	17.50%
SPR 4 = 1a x (2a + 2b) x 3b	0	240	Leachate → GWDTE	0.00%
SPR 5 = 1a x (2a + 2b) x 3c	63	400	Leachate → aquifer	15.75%
SPR 6 = 1a x (2a + 2b) x 3d	0	560	Leachate → surface water	0.00%
SPR 7 = 1a x (2a + 2b) x 3e	63	240	Leachate → SWDTE	26.25%
SPR 8 = 1a x 2c x 3e	42	60	Leachate → surface water	**70.00%**
SPR 9 = 1a x 2c x 3b	0	60	Leachate → SWDTE	0.00%
SPR 10 = 1b x 2d x 3f	105	150	Landfill Gas → human presence	**70.00%**
SPR 11 = 1b x 2e x 3f	175	250	Landfill Gas → human presence	**70.00%**

Risk Classification	Score Range
High Risk (Class A)	**Greater than or equal to 70% for any individual SPR linkage**
Moderate Risk (Class B)	**Between 40% and 70% for any individual SPR linkage**
Low Risk (Class C)	**Less than or equal to 40% for any individual SPR linkage**

Overall Score	**70%**
Overall Risk	**High Risk (Class A)**

Note: The table presents the Tier 2 risk rating for this site. SPR1- 9 relate to Leachate Risk. SPR10 & 11 relate to Landfill Gas. The migration pathways are colour coded as follows:

Groundwater & Surface Water	Groundwater only	Surface water only	Lateral & Vertical

Calculator		SPR Values	Maximum Score	Normalised Score
SPR1	1a x (2a + 2b + 2c) x 3e	105	300	35.00%
SPR2	1a x (2a + 2b + 2c) x 3b	0	300	0.00%
SPR3	1a x (2a + 2b) x 3a	42	240	17.50%
SPR4	1a x (2a + 2b) x 3b	0	240	0.00%
SPR5	1a x (2a + 2b) x 3c	63	400	15.75%
SPR6	1a x (2a + 2b) x 3d	0	560	0.00%
SPR7	1a x (2a + 2b) x 3e	63	240	26.25%
SPR8	1a x 2c x 3e	42	60	**70.00%**
SPR9	1a x 2c x 3b	0	60	0.00%
SPR10*	1b x 2d x 3f	105	150	**70.00%**
SPR11	1b x 2e x 3f	175	250	**70.00%**
Overall Risk Score		200		**70.00%**
***SPR 10 is not applicable as there is no receptor above the source				**A**

Risk Classification	Range of Risk Scores
Highest Risk (Class A)	**Greater than or equal to70 for any individual SPR linkage**
Moderate Risk (Class B)	**40-70 for any individual SPR linkage**
Lowest Risk (Class C)	**Less than 40 for any individual SPR linkage**

5. ADDITIONAL INVESTIGATIONS

The additional investigations completed by the Council in 2011 included the collection of groundwater, surface water and leachate samples and the monitoring of landfill gas within the on site landfill gas wells.

5.1 Leachate Sampling

Leachate samples were collected from MW-1 and MW-2 on the 1st December 2011 using a disposable polyethylene baler. There was insufficient liquid in MW-3, which was the well sampled in the 2007 investigation, to collect a sample. During sampling there was a noticeable drop in the leachate level in the wells. The samples were placed in laboratory prepared containers, stored in a cooler and consigned to the ALcontrol laboratory.

5.1.1 Laboratory Analysis

The samples was analysed for leachate indicators and a range of organic referred to in the EU Directives on Dangerous Substances (76/464/EEC) and Groundwater (80/68/EC) as amended. The analyses included total suspended solids, alkalinity, BOD, ammoniacal nitrogen, COD, electrical conductivity, pH, chloride and total hardness. The analytical methodologies were all ISO/CEN approved or equivalent and the method detection limits were all below the relevant thresholds.

5.1.2 Laboratory Results

The full laboratory test report is in Appendix 3 and the results are summarised in Tables 5.1. Included in the Table, for comparative purposes, are the ranges (weak to strong) for the individual substances typically found in leachate, which are derived from the EPA's Landfill Design Manual.

Table 5.1 Leachate Results December 2011

Parameter	MW-1	MW-2	EPA Landfill Design Manual Range
pH	7.79	7.15	6.8 - 8.2
Conductivity (mS/cm)	2.92	0.902	5.990 – 19.3
COD	169	49.7	622 - 8,000
Total Suspended Solids (mg/l)	54	422	-
Total Alkalinity as $CaCO_3$ (mg/l)	1,470	635	3,000 - 9,130
Ammoniacal Nitrogen as N (mg/l)	84	3.03	283 - 2,040
Biological Oxygen Demand (mg/l)	<4	<2	110 - 1,900
Hardness (mg/l)	932	546	-
Chloride (mg/l)	233	10.2	570 - 4,710

The results indicate a low strength leachate, with all parameters either at the lower end or less than the EPA range. The COD was significantly lower than that recorded in 2007.

5.2 Groundwater Sampling

A groundwater sample was collected from MW-7 on the 1st December 2011 using a disposable polyethylene baler. The sample was placed in laboratory prepared containers, stored in a cooler and consigned to the ALcontrol laboratory.

5.2.1 Laboratory Analysis

The sample was analysed for total suspended solids, alkalinity, BOD, ammoniacal nitrogen COD, electrical conductivity, pH, chloride and total hardness. The analytical methodologies were all ISO/CEN approved or equivalent and with the exception of ammonium the method detection limits were all below the relevant thresholds.

5.2.2 Laboratory Results

The full laboratory test report is in Appendix 3 and the results are summarised in Table 5.2. The tables include for comparative purposes the relevant IGV and GTVs.

Table 5.1 Groundwater Results December 2011

Parameter	MW-7	IGV values	GTV
pH	7.48	<6.5 and <9.5	-
Conductivity (mS/cm)	0.715	1	800-1,875
COD	14.7	-	-
Total Hardness (mg/l)	402	200	-
Total Alkalinity as $CaCO_3$ (mg/l)	375	No abnormal change	-
Ammoniacal Nitrogen as N (mg/l)	<0.2	0.15	0.065-0.175

BOD (mg/l)	<2	-	-
Total Suspended Solids (mg/l)	72.5	-	-
Chloride (mg/l)	28.5	30	24-187.5
Fluoride (mg/l)		1	-

With the exception of hardness, all of the parameters were below the relevant IGV and GTV and the water is generally of good quality. The hardness is likely to be naturally occurring.

5.3 Surface Water

Surface water samples were taken in the stream at SW-1 and SW-2 on the 1st December 2011. SW-1. The samples were collected and placed in laboratory prepared containers and stored in a cooler and sent to the ALcontrol Laboratory.

5.3.1 Laboratory Analysis

The samples were analysed for total suspended solids, alkalinity, BOD, ammoniacal nitrogen COD, electrical conductivity, pH, chloride and total hardness. The analytical methodologies were all ISO/CEN approved or equivalent and with the exception of ammonium the method detection limits were all below the relevant thresholds.

5.3.2 Laboratory Results

The laboratory test report is in Appendix 3 and the results are summarised in Table 5.3. The Table includes, for comparative purposes, the relevant EQS

Table 5.3 Surface Water Results December 2011

Parameter	SW-1	SW-2	EQS
pH	7.8	8.14	-
Conductivity (mS/cm)	0.712	0.793	-
COD	10.2	7.71	-
Alkalinity (mg/l)	365	405	-
Ammoniacal Nitrogen as N (mg/l)	<0.2	<0.2	0.065 – 0.14
Total Hardness (mg/l)	409	442	-
Total Suspended Solids (mg/l)	2	<2	-
Biochemical Oxygen Demand (mg/l)	<2	<2	1.5-2.6
Chloride (mg/l)	30.3	33	-

*Limit for phosphorus

There was a slight increase in pH, conductivity, alkalinity, hardness and chloride between the upstream and downstream locations. The water quality is good and there is no evidence of leachate contamination.

5.4 Landfill Gas

Landfill gas monitoring was conducted in all seven monitoring wells on the 15th November, 1st December and the 16th December 2011. Monitoring was undertaken in six of the seven wells in 2018. MW-4 was inaccessible in 2018. The programme included the measurement of methane, carbon dioxide, oxygen and atmospheric pressure using a Gas Data LSMx gas analyser. The meter was calibrated before use. The detection limit is 0.1% for methane, carbon dioxide and oxygen. The monitoring results are presented in Table 5.4 and 5.5. The tables cludes the DOE guideline limits

5.4.1 Wells in the Waste

In 2011 elevated methane levels were detected in MW-1 in all three events, on two occasions in MW-2 and once at Mw-3. Elevated carbon dioxide levels were recorded in MW-1 in all three events and on two occasions in MW-2 and MW-3

Carbon dioxide levels exceeded the DOE limit in all of the wells.

In 2018 the methane was only detected in MW-1 and 2 and the levels in these wells are gradually declining.

Carbon dioxide levels have also declined significantly but remains above the DOE limit in all of the wells.

5.4.2 Wells Outside the Waste

In 2011 Methane was recorded at 0.1% in MW-4, and MW- 7 on one occasion; however this was at the instrument detection level. Elevated carbon dioxide levels were recorded in MW-6 and MW-7 on all three occasions and once in MW-5.

In 2018 No methane was detected in any of the wells outside the waste body. Carbon dioxide levels continue to decline compared to 2011 but remain above the DOE limits in these wells.

Table 5.4 Landfill Gas Monitoring Data: November - December 2011

	Methane (%)			Carbon Dioxide (%)			Oxygen (%)		
	15th November 2011	1st December 2011	16th December 2011	15th November 2011	1st December 2011	16th December 2011	15th November 2011	1st December 2011	16th December 2011
MW-1	**10.6**	**10.7**	**3.3**	**14.8**	**14.2**	**3.5**	0.0	0.0	15.4
MW-2	**8.3**	**6.6**	0.3	**12.6**	**9.2**	0.4	0.6	6.4	19.5
MW-3	0	0	0.1	**3.8**	**2.8**	0.1	18.2	18.0	19.7
MW-4	0	0	0.1	0.0	0.1	0.1	20.8	20.1	19.4
MW-5	0	0	0	**8.0**	0.4	0.6	9.6	19.6	17.9
MW-6	0	0	0	**5.2**	**8.1**	**2.3**	12.2	7.3	14.3
MW-7	0.1	0	0	**5.3**	**2.8**	**3.2**	12.1	16.9	14.1
DOE limits	0.5	0.5	0.5	1.0	1.0	1.0	-	-	-

- DOE limit not established
* Measurement not taken due to a gas cap fault

Table 5.4 Landfill Gas Monitoring Data: November - December 2011

	Methane (%)			Carbon Dioxide (%)			Oxygen (%)		
	15th November 2011	1st December 2011	16th December 2011	15th November 2011	1st December 2011	16th December 2011	15th November 2011	1st December 2011	16th December 2011
MW-1	**10.6**	**10.7**	**3.3**	**14.8**	**14.2**	**3.5**	0.0	0.0	15.4
MW-2	**8.3**	**6.6**	0.3	**12.6**	**9.2**	0.4	0.6	6.4	19.5
MW-3	0	0	0.1	**3.8**	**2.8**	0.1	18.2	18.0	19.7
MW-4	0	0	0.1	0.0	0.1	0.1	20.8	20.1	19.4
MW-5	0	0	0	**8.0**	0.4	0.6	9.6	19.6	17.9
MW-6	0	0	0	**5.2**	**8.1**	**2.3**	12.2	7.3	14.3
MW-7	0.1	0	0	**5.3**	**2.8**	**3.2**	12.1	16.9	14.1
DOE limits	0.5	0.5	0.5	1.0	1.0	1.0	-	-	-

- DOE limit not established
* Measurement not taken due to a gas cap fault

Table 5.5 Landfill Gas Monitoring Results 2018

	Methane							Carbon Dioxide							Oxygen						
Date	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7
20/02/2018	0	**1.2**	0	NA	0	0	0	0	**4.5**	0.2	NA	**2.9**	**2.8**	0	21.9	5	21.7	NA	15.4	14.4	21
05/04/2018	**3.5**	**1.4**	0.0	NA	0.0	0.0	0.0	**10.3**	**7.3**	**7.3**	NA	**3.8**	**3.4**	**2.8**	0.1	1.1	11.1	NA	13.9	14.9	14.3
12/04/2018	**3.8**	**1.7**	0.0	NA	0.0	0.0	0.0	**9.4**	**5.8**	0.1	NA	**3.9**	**3.4**	**3.0**	1.2	4.0	20.8	NA	12.8	14.4	13.6
16/04/2018	**3.8**	**2.2**	0.0	NA	0.0	0.0	0.0	**10.5**	**7.5**	**7.4**	NA	**4.2**	**3.6**	**2.7**	0.1	0.4	10.1	NA	12.3	14.0	15.8
26/04/2018	**2.6**	**2.2**	0.0	NA	0.0	0.0	0.0	**7.6**	**6.5**	0.9	NA	**4.6**	**3.6**	**3.0**	6.1	2.6	19.3	NA	12.5	14.0	15.5
01/05/2018	**3.5**	**2.4**	0.0	NA	0.0	0.0	0.0	0.0	**7.7**	**4.8**	NA	**4.9**	**3.0**	**3.1**	1.5	0.5	13.8	NA	12.3	14.9	15.1
10/05/2018	**3.1**	**2.3**	0.0	NA	0.0	0.0	0.0	**8.0**	**7.3**	**7.8**	NA	0.0	**3.3**	**3.1**	4.8	0.5	6.7	NA	20.7	14.4	15.0
17/05/2018	**3.1**	**1.3**	0.0	NA	0.0	0.0	0.0	**7.6**	**4.7**	**2.0**	NA	**4.6**	**3.5**	**3.3**	5.0	7.2	16.8	NA	13.0	14.1	14.6
24/05/2018	**3.2**	0.0	0.0	NA	0.0	0.0	0.0	**7.4**	1.1	0.0	NA	**4.5**	**3.6**	**3.3**	5.6	16.9	20.3	NA	12.9	13.3	14.7
30/05/2018	**3.2**	0.6	0.0	NA	0.0	0.0	0.0	**7.5**	**2.5**	**4.9**	NA	**4.6**	**3.7**	**3.7**	5.3	13.6	12.9	NA	11.8	11.5	13.2
06/06/2018	**2.8**	**1.1**	0.0	NA	0.0	0.0	0.0	**7.3**	**4.6**	0.0	NA	**4.3**	**3.9**	**3.6**	5.5	8.0	19.7	NA	11.3	10.0	13.2
14/06/2018	**1.9**	0.0	0.0	NA	0.0	0.0	0.0	**7.5**	0.0	**8.3**	NA	**2.7**	**4.5**	**3.6**	7.1	20.7	11.1	NA	15.8	11.8	15.5
21/06/2018	**1.5**	0.8	0.0	NA	0.0	0.0	0.0	**7.6**	**5.7**	0.3	NA	**4.6**	**3.9**	**3.5**	5.7	6.0	20.0	NA	14.1	14.6	14.7
28/06/2018	0.0	0.0	0.0	NA	0.0	0.0	0.0	**2.7**	0.0	0	NA	**4.3**	**4.7**	**3.9**	13.9	19.9	19.9	NA	14.3	11.9	12.6
05/07/2018	0	0	0	NA	0	0	0	**2.4**	0.6	**1.6**	NA	**5.6**	**3.2**	**4.2**	15.9	18.9	19.3	NA	9.4	14.8	12.2
12/07/2018	0.4	0.0	0.0	NA	0.0	0.0	0.0	**5.7**	0.5	**5.8**	NA	**6.1**	**3.2**	0.4	8.7	19.0	16.1	NA	8.7	15.3	20.1
19/07/2018	0.0	0.0	0.0	NA	0.0	0.0	0.0	**3.5**	**5.8**	**5.9**	NA	**5.5**	**3.3**	0.1	12.0	9.0	14.3	NA	9.7	15.3	20.0
26/07/2018	0.0	0.0	0.0	NA	0.0	0.0	0.0	**4.8**	0.1	**7.1**	NA	**2.9**	**5.4**	**3.6**	8.8	20.3	11.1	NA	15.5	11.7	15.9
02/08/2018	0.2	0.1	0.0	NA	0.0	0.0	0.0	**3.5**	**2.2**	**3.8**	NA	**3.2**	**4.1**	**4.1**	13.1	15.5	13.3	NA	10.3	12.1	12.8
09/08/2018	0.4	0.1	0.0	NA	0.0	0.0	0.0	**4.8**	**4.9**	**2.5**	NA	**3.7**	**4.8**	**4.8**	9.1	10.3	16.0	NA	12.4	11.3	10.3
14/08/2018	0.0	0.1	0.1	NA	0.0	0.0	0.0	**2.5**	**3.2**	**1.8**	NA	**4.3**	**5.5**	**5.6**	14.8	12.0	15.8	NA	13.0	10.5	9.5
DOE Limit %	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-

Denotes - DOE limit not established
NA denotes Not Accessible

6. TIER 3 ASSESSMENT

6.1 Site Layout

There has been a change in the landuse since the completion of the Tier 2 Assessment in 2007, with the provision of a playground and civic amenity area in 2009 and the use of a portion of the site to store road planings.

The construction of the playground involved the placement of 600mm of Clause 804 aggregate on a geotextile layer which was then covered with approximately 324m^2 of soft asphalt. The hard core extends beyond the asphalted area. The playground is surrounded by a 1.2m high railing. (Photograph No 5). Drainage from the play area is directed to the stream along the southern boundary. .

Photograph No 5 Looking South: Playground in eastern part of the site

The area to the south of the playground is used to temporarily store road planings (Photograph No 6).

Photograph No 6 Looking North Road Planings

The civic amenity bring centre is to the north of the playground and contains bottle, aluminium cans and clothes banks (Photograph No 7). The proposed location of the Moate Football Club Dressing Rooms is immediately to the south west of the bring centre, with the pitch further to the south.

Photograph No 7 Looking South West**:** Bring Centre & Southern Part of the Site

The remainder of the site, is covered in grass and used for animal grazing (Photograph No 8).

Photograph No 8 Livestock in the Northern Unfilled Area.

6.2 Revised CSM

The data obtained from the additional investigations and the changes to the landuse at the site were used to refine the Tier 2 CSM.

It appears that the original ground comprised peat overlying gravels. At some time peat and possibly part of the underlying gravels were excavated from across the most of the waste deposition area. In the northern and central areas, it appears that the waste was placed directly on the gravels, while in the south the waste was placed on the peat. The average thickness of the waste is 3.3m. It is likely that the level of the fill in the south of the site is approximately 1m higher than the original ground level.

The waste has been covered with thin layer of topsoil, which is underlain by a gravely clay, ranging from 0.2 to 1.2m across the site, being thickest in the central area

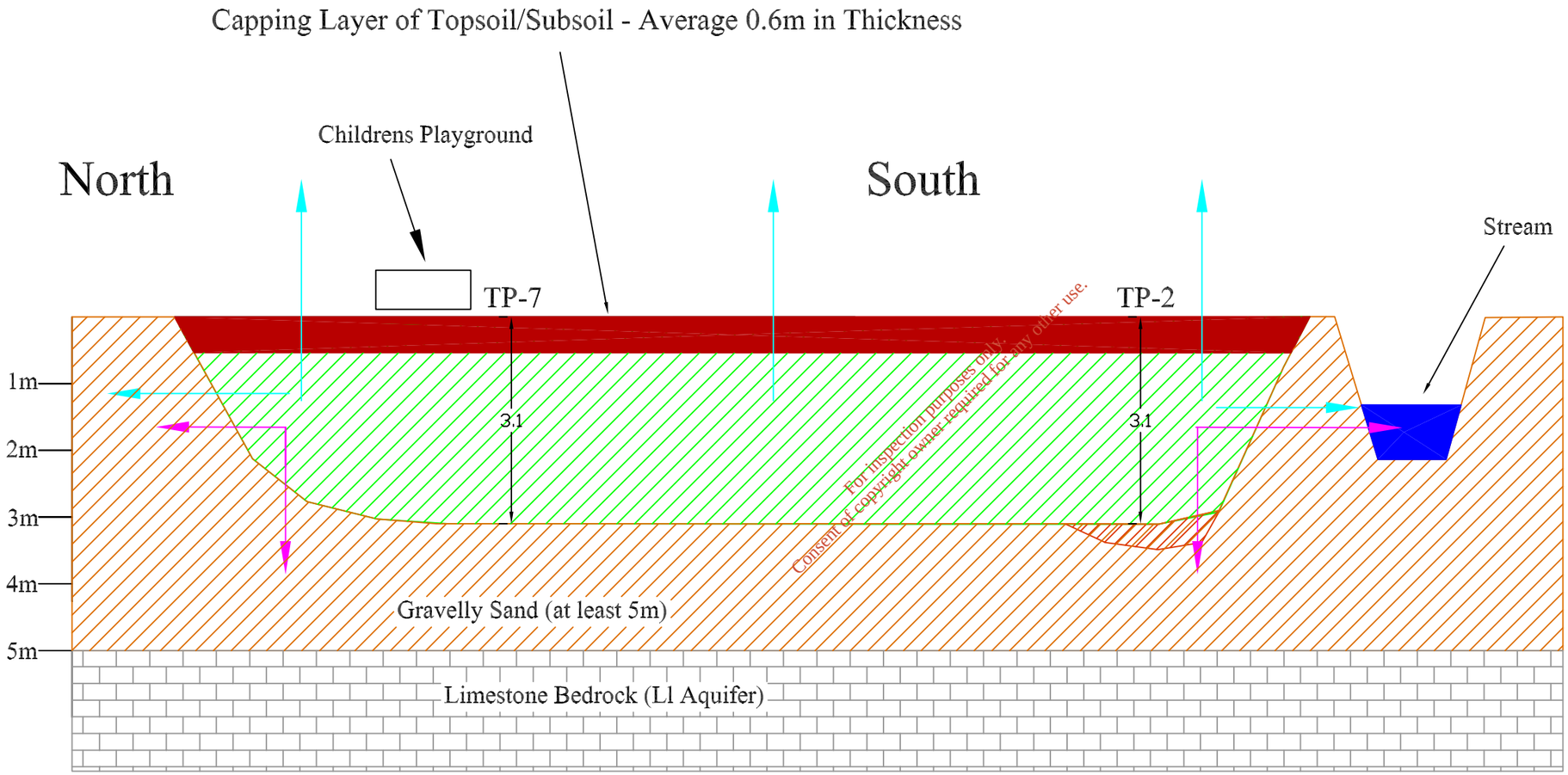
The gravels underlying the waste are water bearing but do not constitute a significant aquifer. Since 2007, the aquifer vulnerability rating has been revised from H/L to M by the GSI. The bedrock aquifer (Waulsortian Limestone Formation) is classed as a local important aquifer (Ll).

The source of the stream along the southern site boundary appears to be a spring that rises to the east of the site and flows to the west. A field drain along the western boundary confluences with the stream to the south west of the site. Surface water run off from the play ground is piped to the stream along the southern site boundary. It is understood that the drainage pipes are not laid in the waste. However, although there is no evidence of any direct drainage link between the waste deposition area and the stream along the southern site boundary, it is prudent to assume that this is the case.

There are occupied residences approximately 80m from the northern edge of the waste area. In 2007, it had been proposed to construct new residential dwellings within 50 m of the edge of the waste, but this development has not occurred. There is a children's playground and civic amenity area in the eastern part of the waste deposition area. Although there are no enclosed areas in either the playground or the civic amenity area, these are considered to be on-site receptors for landfill gas.

The planning application by Moate Football Club included the construction of a Dressing Room in an area immediately adjoining the north eastern edge of the fill area and the development of a pitch and warm up area on the southern and central parts of the waste deposition area. The planning permission for the site expired in 2017 and the site remains undeveloped.

The revised CSM is depicted in Figure 6.1. It does not take into consideration the proposed soccer pitch and Dressing Rooms as the planning application has expired. However the Council remains open to proposals for reuse of the site for Sport or recreational purposes and as such this type of use is included in the revised risk assessment.



NOTES

Legend:

- Waste
- Peat
- Sands and Gravels
- Bedrock
- Capping Layer of Topsoil/Subsoil
- Leachate
- Landfill Gas

REV	DATE	DESCRIPTION	DRN	CHKD	APP
REV	DATE	DESCRIPTION	DRN	CHKD	APP

O' Callaghan Moran & Associates.
Granary House, Rutland Street,
Cork, Ireland.
Tel. (021) 4321521 Fax. (021) 4321522
email : info@ocallaghanmoran.com

CLIENT
Westmeath County Council

TITLE
North South Cross Section

SCALE	DRAWING No.	REV.
SCALE	6.1	

6.3 Revised Risk Assessment

The revised risk scores are presented below

Table 1a LEACHATE: Source/hazard Scoring Matrix			
Waste Type	Waste Footprint (ha)		
	≤1ha	>1≤5ha	>5ha
C&D	0.5	1	1.5
Municipal	5	7	10
Industrial	5	7	10
Pre 1977 sites	1	2	3

1a =	**7**

Table 1b LANDFILL GAS: Source/hazard Scoring Matrix			
Waste Type	Waste Footprint (ha)		
	≤1ha	>1≤5ha	>5ha
C&D	0.5	0.75	1
Municipal	5	7	10
Industrial	3	5	7
Pre 1977 sites	0.5	0.75	1

1b=	**7**

Table 2a LEACHATE MIGRATION: Pathways	
Groundwater Vulnerability (Vertical Pathway)	Points
Extreme Vulnerability	3
High Vulnerability	2
Moderate Vulnerability	1
Low Vulnerability	0.5
High – Low Vulnerability	2

2a=	**1**

Table 2b LEACHATE MIGRATION: Pathways	
Groundwater Flow Regime (Horizontal Pathway)	Points
Karstified Groundwater Bodies (Rk)	5
Productive Fissured Bedrock Groundwater Bodies (Rf & Lm)	3
Gravel Groundwater Bodies (Rg & Lg)	2
Poorly Productive Bedrock Groundwater Bodies (Ll, Pl, Pu)	1

2b =	**1**

Table 2cLEACHATE MIGRATION: Pathways	
Surface Water Drainage (Surface Water Pathway)	Points
Is there direct connection between drainage ditches associated with the waste body and adjacent surface water body? Yes	2
If no direct connection.	0

2c =	2

Table 2d LANDFILL GAS: Pathways (assuming receptor within 250m of source)	
Landfill Gas Lateral Migration Potential	Points
Sand and Gravel, Made ground, urban, karst	3
Bedrock	2
All other Tills (including limestone, sandstone etc – moderate permeability)	1.5
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

*No receptor within 250m

2d =	3

Table 2e LANDFILL GAS: Pathways (assuming receptor above source)	
Landfill Gas Lateral Migration Potential	Points
Sand and Gravel, Made ground, urban, karst	5
Bedrock	3
All other Tills (including limestone, sandstone etc – moderate permeability)	2
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

2e =	5

Table 3a LEACHATE MIGRATION: Receptors	
Human Presence (presence of a house indicates potential private wells)	Points
On or within 50m of the waste body	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km	1
Greater than 1km of the waste body	0

3a =	2

Table 3b LEACHATE MIGRATION: Receptors	
Protected Areas (SWDTE & GWDTE)	Points
Within 50m of the waste body	3
Greater than 50m but less than250m of the waste body	2
Greater than 250m but less than 1km of the waste body	1
Greater than 1km of the waste body	0
Undesignated sites within 50m of the waste body	1
Undesignated sites greater than 50m but less than250m of the waste body	0.5
Undesignated sites greater than 250m of the waste body	0

3b =	0

Table 3c LEACHATE MIGRATION: Receptors	
Aquifer Category (resource potential)	Points
Regionally Important Aquifers (Rk, Rf, Rg)	5
Locally Important Aquifers (Ll, Lm, Lg)	3
Poor Aquifer (Pl, Pu)	1

3c =	3

Table 3d LEACHATE MIGRATION: Receptors	
Public Water Supplies (other than private wells)	Points
Within 100m of the site boundary	7
Greater than 100m but less than 300m or within the in inner SPA for GW supplies	5
Greater than 300m but less than 1km or within outer SPA for GW supplies	3
Greater than 1km (karst aquifer)	3
Greater than 1km (no karst)	0

3d =	0

Table 3e LEACHATE MIGRATION: Receptors	
Surface Water Bodies	Points
Within 50 of the site boundary	3
Greater than 50m but les than 250m of the site boundary	2
Greater than 250m but less than 1km	1
Greater than 1km	0

3e =	3

Table 3f LANDFILL GAS: Receptors	
Human Presence	Points
On site or within 50m of site boundary	5
Greater than 50 but less than 150m of site	3
Greater than 150m but less than 250m of the site	1
Greater than 250m of the site	0.5

3f =	5

Risk Equation	SPR Values	Maximum Score	Linkages	Normalised Scores
SPR 1 = 1a x (2a + 2b + 2c) x 3e	84	300	Leachate →Surface Water	28.00%
SPR 2 = 1a x (2a + 2b + 2c) x 3b	0	300	Leachate →SWDTE	0.00%
SPR 3 = 1a x (2a + 2b) x 3a	28	240	Leachate → human presence	11.66%
SPR 4 = 1a x (2a + 2b) x 3b	0	240	Leachate → GWDTE	0.00%
SPR 5 = 1a x (2a + 2b) x 3c	42	400	Leachate → aquifer	10.50%
SPR 6 = 1a x (2a + 2b) x 3d	0	560	Leachate → surface water	0.00%
SPR 7 = 1a x (2a + 2b) x 3e	42	240	Leachate → SWDTE	17.5%
SPR 8 = 1a x 2c x 3e	42	60	Leachate → surface water	**70.00%**
SPR 9 = 1a x 2c x 3b	0	60	Leachate → SWDTE	0.00%
SPR 10 = 1b x 2d x 3f	105	150	Landfill Gas → human presence	**70.00%**
SPR 11 = 1b x 2e x 3f	175	250	Landfill Gas → human presence	**70.00%**

Risk Classification	Score Range
High Risk (Class A)	**Greater than or equal to 70% for any individual SPR linkage**
Moderate Risk (Class B)	**Between 40% and 70% for any individual SPR linkage**
Low Risk (Class C)	**Less than or equal to 40% for any individual SPR linkage**

Overall Score	**70%**
Overall Risk	**High Risk (Class A)**

Note: The table presents the Tier 3 risk rating for this site. SPR1- 9 relate to Leachate Risk. SPR10 & 11 relate to Landfill Gas Risk. The migration pathways are colour coded as follows:

Groundwater & Surface Water	Groundwater only	Surface water only	Lateral & Vertical

Calculator		SPR Values	Maximum Score	Normalised Score
SPR1	1a x (2a + 2b + 2c) x 3e	105	300	35.00%
SPR2	1a x (2a + 2b + 2c) x 3b	0	300	0.00%
SPR3	1a x (2a + 2b) x 3a	42	240	17.50%
SPR4	1a x (2a + 2b) x 3b	0	240	0.00%
SPR5	1a x (2a + 2b) x 3c	63	400	15.75%
SPR6	1a x (2a + 2b) x 3d	0	560	0.00%
SPR7	1a x (2a + 2b) x 3e	63	240	26.25%
SPR8	1a x 2c x 3e	42	60	**70.00%**
SPR9	1a x 2c x 3b	0	60	0.00%
SPR10	1b x 2d x 3f	105	150	**70.00%**
SPR11	1b x 2e x 3f	175	250	**70.00%**
Overall Risk Score		200		**70.00%**
				A

Risk Classification	Range of Risk Scores
Highest Risk (Class A)	**Greater than or equal to70 for any individual SPR linkage**
Moderate Risk (Class B)	**40-70 for any individual SPR linkage**
Lowest Risk (Class C)	**Less than 40 for any individual SPR linkage**

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Leachate

The leachate risk to surface water is based on the precautionary assumption, given the proximity of the waste to the stream and the presence of surface water drains in the children's play area, that there is a direct pathway between the waste and the stream along the southern boundary. It must be emphasised that there is no evidence that such a direct pathway exists and the surface water monitoring carried out in 2007 and 2011 did not identify any impact on water quality in the stream.

The planning application by Moate Football Club has expired.

Landfill Gas

Given the distance to the existing residences from the edge of the fill area (>80m) and the measured gas concentrations, it is considered that landfill gas generated by the waste does not present a risk to these dwellings. However, the gas does present a risk to future residential development in the undisturbed northern part of the site. It also presents a risk to the children's playground and civic amenity area although, at present, the risk to users of both the playground and civic amenity area is negligible, given the absence of enclosed spaces in which landfill gases can accumulate.

The gas levels measured in the waste and in the external monitoring wells exceed the limits set in the DOE Guidance on the Protection of Buildings and Occupants from Landfill Gas. Although the volumes of gas being generated will decline over time, as the residual organic matter is depleted, the levels currently being generated require the implementation of remedial measures if the proposed residential development within 50m of the site proceeds or if the site is developed in the future for sport or recreational uses.

Human Health

The monitoring data indicates that the waste does not present a significant environmental risk to either surface water, or groundwater. At present there is direct pathway by which the waste could impact on human health. The construction of the playground involved the placement of 600mm of aggregate at the ground surface both inside and adjoining the playground and asphalting the play area. This minimises the exposure to the waste for example by children digging.

7.2 Recommendations

Leachate

Surface water monitoring should be carried out in the stream annually to confirm that the waste is not affecting water quality. The parameters should include pH, electrical conductivity, ammonia and BOD

For any future development use on the landfill under no circumstances should the thickness of the existing cover layer be reduced. If an application for sports pitch development is approved OCM recommends that the following conditions should be applied;

- The cover layer should be increased to a minimum thickness of 1m across the both the pitch and the warm up area. Details of the type of cover materials and the method of placement must be submitted to and approved by Council in advance of the works being carried out.

- No surface water drainage should be permitted into the waste and there must be a minimum of 500mm of subsoils between the invert level of the drains and the waste to ensure that there is no connection between the drains and the waste and to minimise the infiltration of water into the waste.

Landfill Gas

It is recommended that the landfill gas monitoring wells be maintained and used for long term monitoring purposes. Monitoring should be carried out at 6 monthly intervals to confirm that the gas levels within the waste body remain at levels that do not present a risk to the existing dwellings.

It is recommended that no buildings or enclosed spaces be either constructed, or provided at the playground or civic amenity area.

Should a planning application for use of the site as a sports pitch be approved OCM considers that it should be a condition of such permission that appropriate landfill gas control measures, as specified in the DOE Guidance, be incorporated into the design of the Dressing Rooms

Any future assessment of development risk from landfill gas should be based on CIRIA 665 Ground Gas Risk Assessment.

Should it be decided to proceed with the development of residential areas to the north of the waste deposition area, gas control measures should be provided. Subject to the results of the landfill gas monitoring, these may include;

- The layout of any proposed residential area should be such that the houses are the maximum practical distance from the edge of the fill area. If possible, the rear gardens should be 10 m from the edge of the fill.

- Incorporating appropriate gas protection measures, as specified in the DOE Guidance, into the building design.

- The installation of a landfill gas migration barrier north of the northern edge of the waste between it and the proposed residential area. The barrier should extend the full length of northern edge and may comprise a trench excavated to approximately 3m below ground level, with a flexible membrane liner (e.g. High Density Polyethylene) placed against the northern face and the trench backfilled with granular material.

Human Health

Should an application to develop a sports pitch be considered in the future, OCM considers that it should be a condition of the permission that a minimum depth of 1m of cover material be provided beneath those parts of the pitch and warm up area that are above the waste. The objective is to minimise the risk of future exposure of the waste.

APPENDIX 1

Background Information

Kath original to file 3/99
copy to David Muldoon – prepare rough layout for houses on the uncontaminated area of this site for discussion purposes.
[signature] 7 NOV 02

WESTMEATH COUNTY COUNCIL

GEOTECHNICAL UNIT

(Tel. (044) 49037 & Fax 044 - 45763)

[illegible]
23 AUG 2002

Mr Ciaran Jordan S.E.E.
Housing Section.
Co Buildings.
Mullingar.

[illegible]/08/02

Re: [illegible] Lands Killeen Boylegan Moate..

Dear Ciaran,

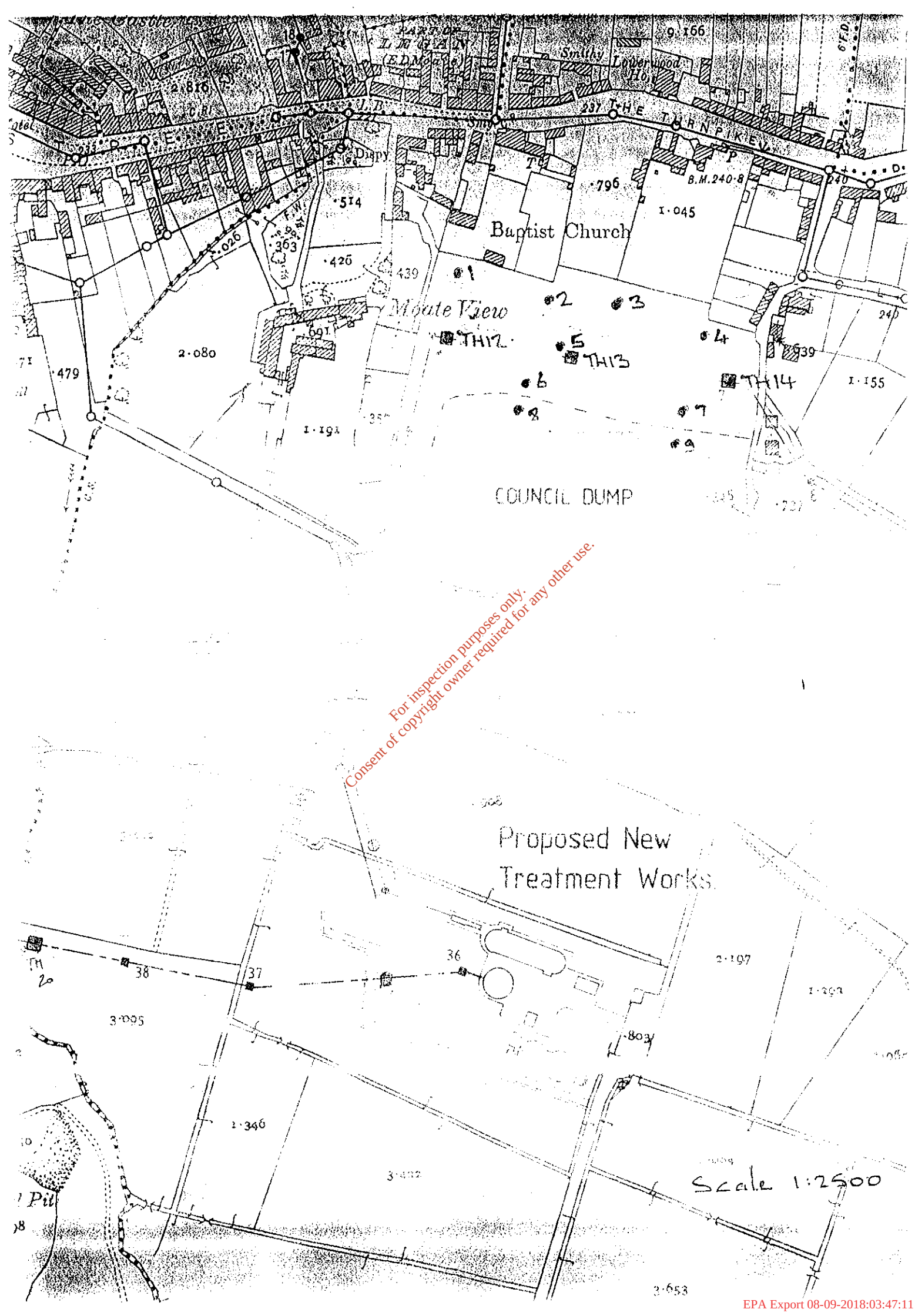
Please find enclosed results for above work as requested. 9 no Probes were carried out across the site. Enclosed also 3 no Trial Pit logs carried in 1991.
The boundary of the old dump is shown on attached location map see probes 8 and 9
The results show that the uncontaminited area of the site is suitable for housing.
A main sewer runs along the the western and northern boundary of the site.

If you have any queries regarding this matter please contact me at the above number.

Yours Sincerely ,

[signature]

Denis Cronin,
Sen Executive Technician.
Soils Laboratory.



WESTMEATH COUNTY COUNCIL

J P HEARN. BE C.Eng. F.I.E.I.
COUNTY ENGINEER
MULLINGAR

T.H.
12

Appendix	
Job No.	
Made By	D.Cronin
Date Made	6.2.91

RECORD OF TRIAL PIT

MOATE SEWERAGE SCHEME

DAILY PROGRESS	DEPTH TO WATER		SAMPLE OR TESTS DEPTH FROM	DEPTH TO	TYPE	LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m		Ground Level
29/30 JAN 9							0.20		TOPSOIL
							0.40		Brown gravelly CLAY
									Fine to coarse GRAVEL and COBBLES
							2.80		TRIAL PIT COMPLETE

REMARKS
No Water encountered
Trench stable

METHOD OF EXCAVATION
Cat 50

TRIAL PIT 12

WESTMEATH COUNTY COUNCIL

J.P. HEARN. B.E. C.Eng. F.I.E.I.
COUNTY ENGINEER
MULLINGAR

T.H 13

RECORD OF TRIAL PIT

MOATE SEWERAGE SCHEME

Appendix
Job No.
Made By D.Cronin
Date Made 6.2.91

DAILY PROGRESS	DEPTH TO WATER		SAMPLE OR TESTS DEPTH FROM	SAMPLE OR TESTS DEPTH TO	SAMPLE OR TESTS TYPE	LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m		Ground Level
29/30 JAN 91							0.20		TOPSOIL
									Brown gravelly CLAY
									Fine to coarse GRAVEL and COBBLES
							2.70		TRIAL PIT COMPLETE

REMARKS No Water encountered
Trench stable

METHOD OF EXCAVATION
Cat 50
Tracked

TRIAL PIT 13

WESTMEATH COUNTY COUNCIL

J P HEARN. B.E. C.Eng. F.I.E.I.
COUNTY ENGINEER
MULLINGAR

T.H
14

Appendix
Job No.
Made By D.Cronin
Date Made 6.2.91

RECORD OF TRIAL PIT

MOATE SEWERAGE SCHEME

DAILY PROGRESS	DEPTH TO WATER		SAMPLE OR TESTS DEPTH FROM	TO	TYPE	LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m		Ground Level
29/30 JAN 91							0.20		TOPSOIL
									Brown gravelly CLAY
	1.20						1.10		Fine to coarse GRAVEL and COBBLES
							2.30		TRIAL PIT COMPLETE

REMARKS

Water pouring in at 1 2m
Trench unstable
Rose to 1.2 below Ground Level in 45 mins

METHOD OF EXCAVATION

Cat 100
Tracked

TRIAL PIT 14

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	1

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.30	Brown Gravelly Silty CLAY & Cobbles
		1.50	Sand & Gravel Cobbles & Boulders
		3.00	
			Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	2

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.20	
		3.00	Sand & Gravel Cobbles & Boulders
			Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	3

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.30	Brown Gravelly Silty CLAY & Cobbles
		2.20	Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	4

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.30	Brown Gravelly Silty CLAY & Cobbles
		1.30	Boulder
		1.30	Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	5

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.40	Silty Sandy GRAVEL Cobbles & Boulders
		2.20	Boulder
		2.20	Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	6

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.30	Brown Gravelly Silty CLAY & Cobbles
		2.00	Sand & Gravel Cobbles & Boulders
		3.00	
			Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	7

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Topsoil
		0.30	Brown Gravelly Silty CLAY & Cobbles
		1.50	Grey Gravelly Silty CLAY Cobbles & Boulders
		2.20	
			Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	8

Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Clay (Fill)
		0.40	Rubbish Tip
		1.50	Obstruction
		1.50	Probe Complete

Remarks:

Clients Initials:

Made By: N. Egerton

WESTMEATH COUNTY COUNCIL
SOILS LABORATORY
Mechanical Probe. Cobra 30mm

Client: *Westmeath Co. Council*
Project: *Moate Housing (Old Dump)*
Date: *19/08/02*

Probe No.	9

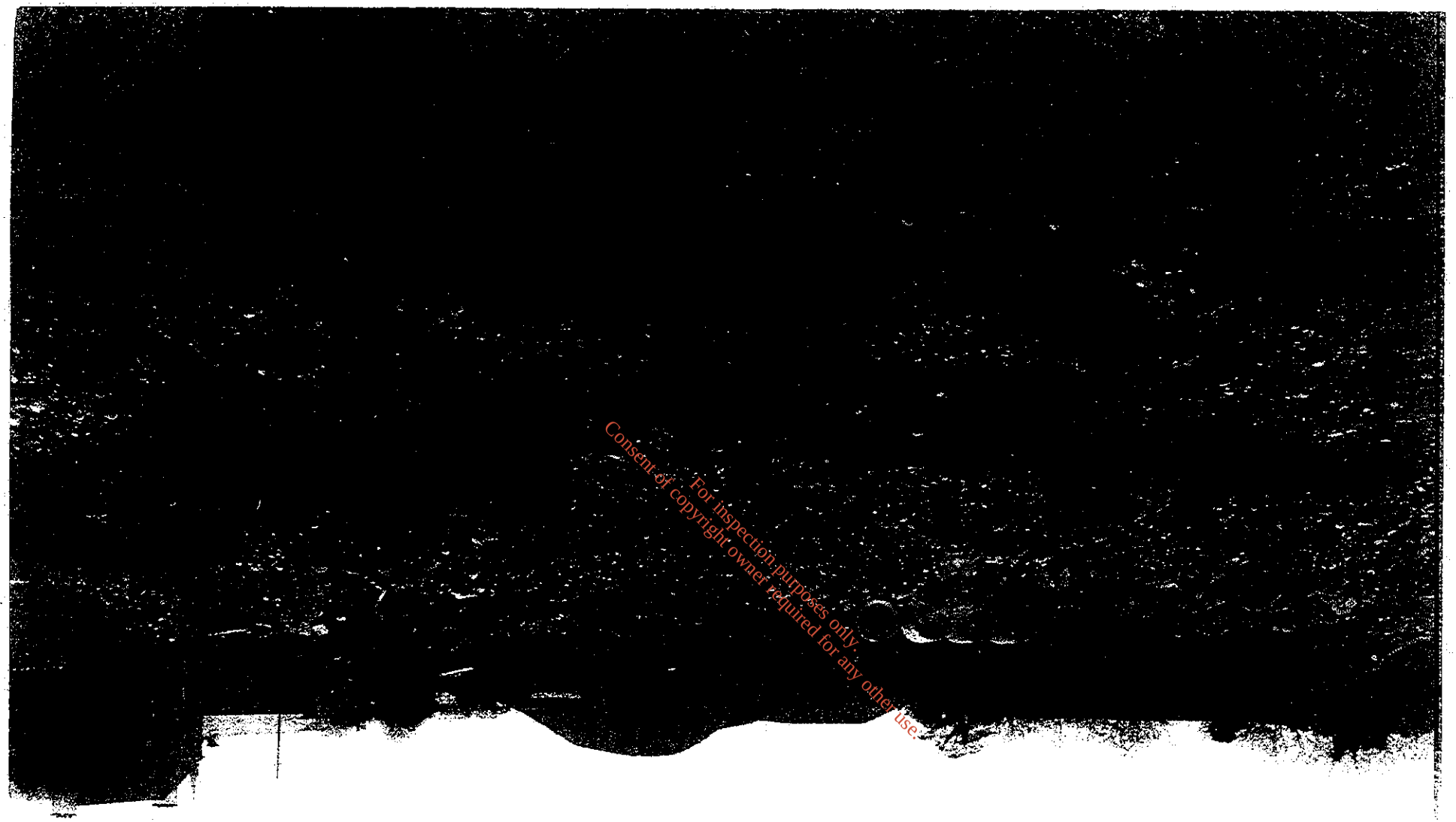
Sample Depth (m)	Water Depth (m)	Depth of Strata (m)	Description of Strata
		G.L.	Clay (Fill)
		0.30	Rubbish Tip
		1.00	Sand & Gravel Cobbles & Boulders
		2.00	Probe Complete

Remarks:

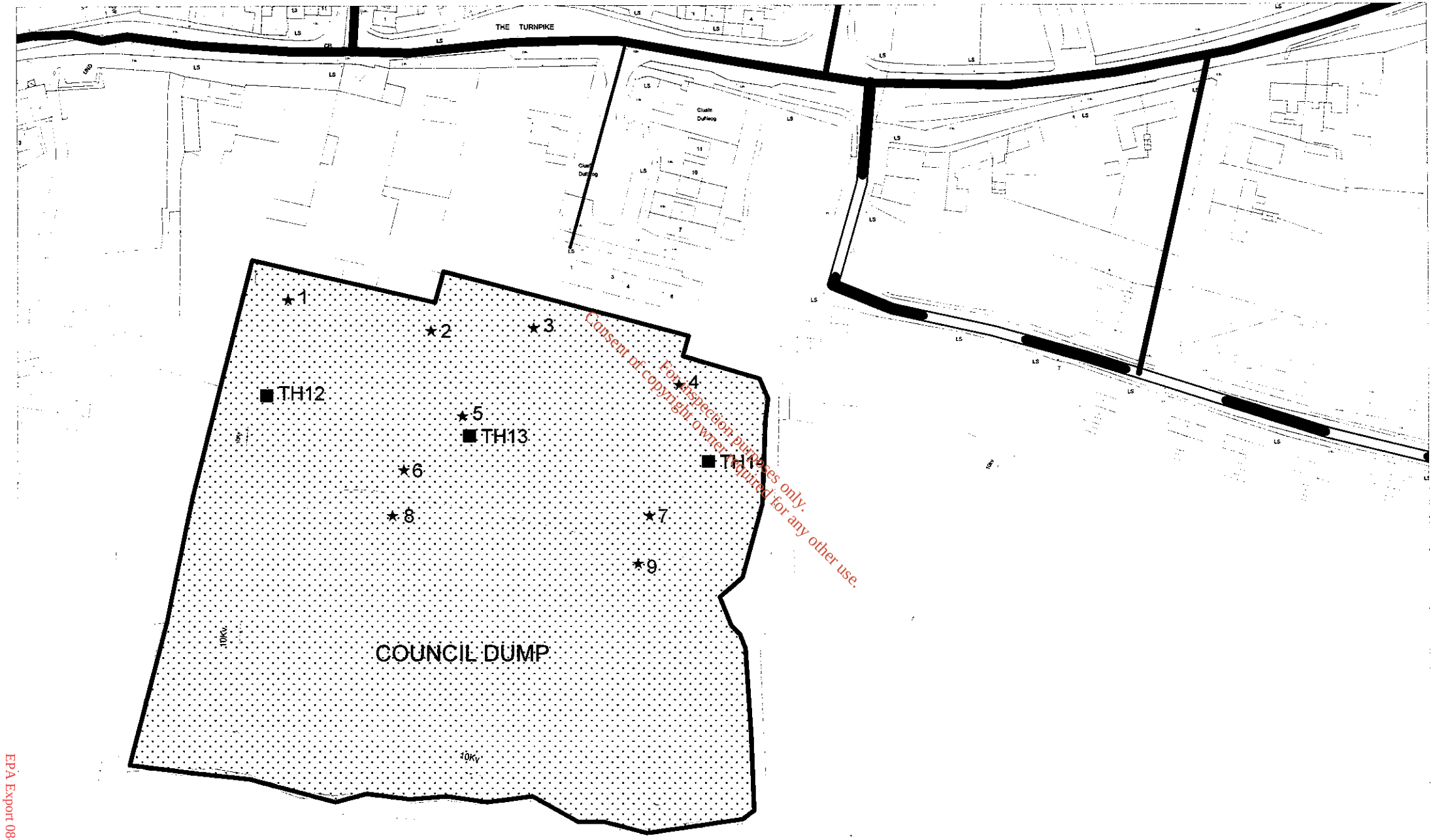
Clients Initials:

Made By: N. Egerton

M1



M4



APPENDIX 2

Site Investigation Logs

TRIAL PIT LOG

CONTRACT: Westmeath County Council

LOCATION NO. TP-1

LOCATION: Moate

DATE: 09/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles.	1m		PID Soil	0ppm 1-1.5m
Slight inflow of water at 3.1mgl.	2m 3m			
Brown peaty material. Material dry.			Soil PID	3.2-3.6m 0ppm
	4m 5m 6m 7m			

Comments:

TRIAL PIT LOG

CONTRACT: Westmeath County Council

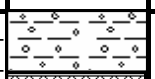
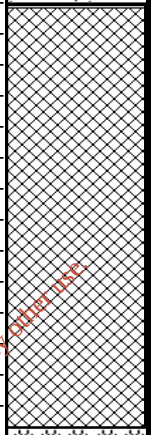
LOCATION NO. TP-2

LOCATION: Moate

DATE: 09/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles.	1m		PID Soil	0ppm 1.5-2m
Slight inflow of water at 3.1mgl.	2m 3m			
Brown peaty material. Material dry.			Soil PID	3.2-3.5m 0ppm
	4m 5m 6m 7m			

Comments:

TRIAL PIT LOG

CONTRACT: Westmeath County Council

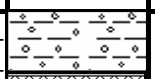
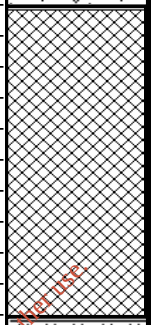
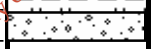
LOCATION NO. TP-3

LOCATION: Moate

DATE: 09/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles, fragments of a car chassis.	1m 2m		Soil PID	0.5-1m 0ppm
Brown peat			Soil PID	2.4-2.6m 0ppm
Grey Gravelly Sand	3m 4m 5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

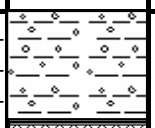
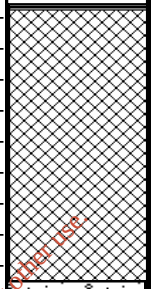
LOCATION NO. TP-4

LOCATION: Moate

DATE: 09/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles. Newspaper dated 1970 encountered.	1m 2m		Soil PID	1-1.5m 0ppm
Grey Sand and Gravel.	3m		PID Soil	0ppm 2.6-2.8m
	4m 5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

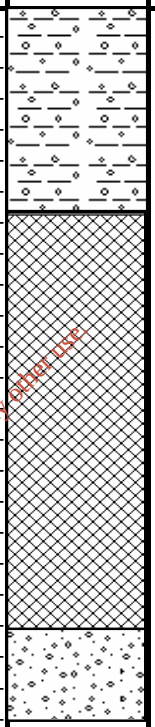
LOCATION NO. TP-5

LOCATION: Moate

DATE: 09/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)		Soil PID	1.5-2m 0ppm
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles, anti freeze canister noted. Food packaging with best before date of 1990. Large fragments of timber noted.	1m 2m 3m 4m			
Grey Sand and Gravel.	5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

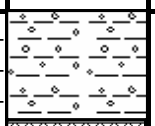
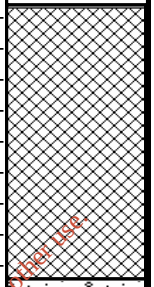
LOCATION NO. TP-6

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles.	1m 2m		Soil PID	1-1.5m 0ppm
Grey Sand and Gravel.	3m		PID Soil	0ppm 2.5-2.6m
	4m 5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

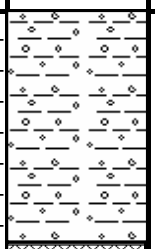
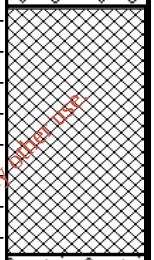
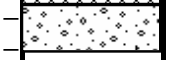
LOCATION NO. TP-7

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)		Soil PID	1.5-2m 0ppm
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles.	1m 2m 3m			
Grey Sand and Gravel.			Soil PID	3.1-3.3 0ppm
	4m 5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

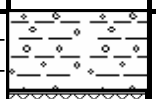
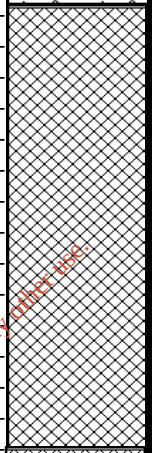
LOCATION NO. TP-8

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles.	1m 2m 3m 4m		Soil PID	1-1.5m 0ppm
Grey Sand and Gravel.	5m		Soil PID	4.7-4.9 0ppm
	6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

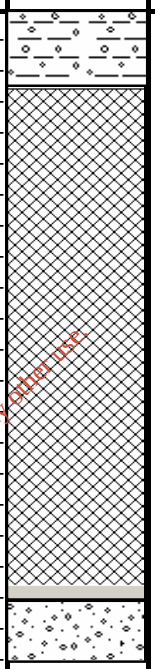
LOCATION NO. TP-9

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles. Fragments of concrete bonded asbestos roof sheeting between 0.7m and 1.5m.	1m 2m 3m		Soil PID	0.8-1.3m 0ppm
Grey Sand and Gravel.	4m		PID Soil	0ppm 4-4.2m
	5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

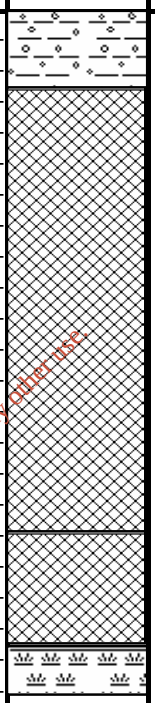
LOCATION NO. TP-10

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material comprising plastic bags, rigid plastics fragments of steel, concrete blocks, glass bottles, paper, cardboard, detergent bottles.	1m		Soil PID	1-1.5 0ppm
	2m			
	3m			
Slight inflow of water at 4.1m.	4m		PID Soil	0ppm 4.1-4.3m
Brown Peat.				
	5m			
	6m			
	7m			

Comments:

TRIAL PIT LOG

CONTRACT: Westmeath County Council

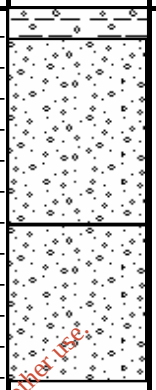
LOCATION NO. TP-11

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil.	Metres (m)			
Firm brown sandy gravelly Clay.	1m			
Firm grey Sand and Gravel.	2m			
	3m			
	4m			
	5m			
	6m			
	7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

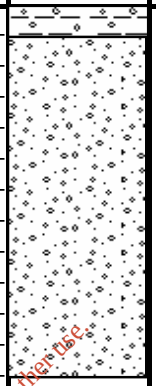
LOCATION NO. TP-12

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil.	Metres (m)			
Sand and Gravels with minor amounts of clay.	1m 2m			
	3m 4m 5m 6m 7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

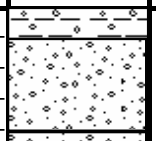
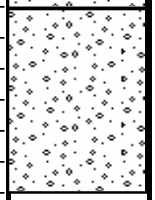
LOCATION NO. TP-13

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil.	Metres (m)			
Firm slightly sandy gravelly Clay.				
Brown sandy Gravels with occasional cobbles.	1m			
	2m			
	3m			
	4m			
	5m			
	6m			
	7m			

Comments:
No groundwater encountered.

TRIAL PIT LOG

CONTRACT: Westmeath County Council

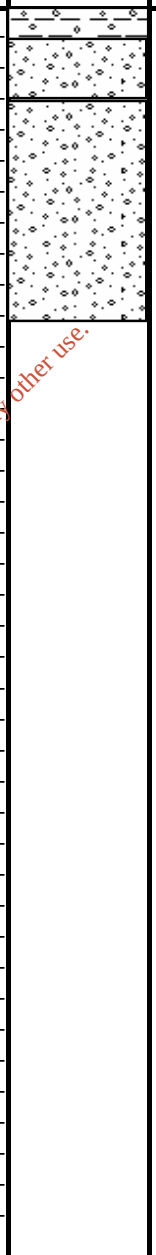
LOCATION NO. TP-14

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil.	Metres (m)			
Firm sandy gravelly Clay.				
Clayey Sand and Gravel with cobbles and small boulders. Groundwater inflow at 1.6m.	1m 2m 3m 4m 5m 6m 7m			

Comments:

TRIAL PIT LOG

CONTRACT: Westmeath County Council

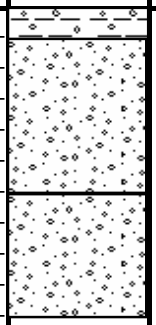
LOCATION NO. TP-15

LOCATION: Moate

DATE: 10/05/2007

GRID REFERENCE:

METHOD OF EXCAVATION: 21tonne Track Mounted Excavator

DESCRIPTION	TRIAL PIT DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil.	Metres (m)			
Firm sandy gravelly Clay.	1m			
Sand and Gravels with cobbles.	2m			
	3m			
	4m			
	5m			
	6m			
	7m			

Comments:

BOREHOLE LOG

CONTRACT: Westmeath County Council

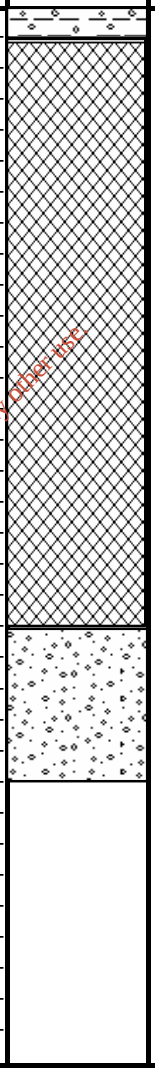
LOCATION NO. BH-1

LOCATION: Moate

DATE: 28/05/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material	1m 2m 3m 4m			
Grey limestone gravel	5m			
Borehole terminated at 5m	6m			

Construction Details

50mm Slotted Standpipe: 1-5mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

BOREHOLE LOG

CONTRACT: Westmeath County Council

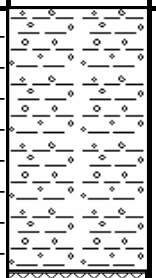
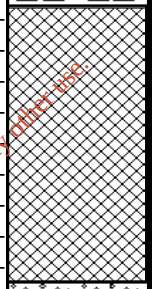
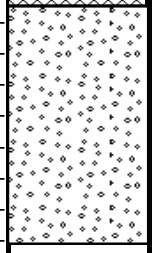
LOCATION NO. BH-2

LOCATION: Moate

DATE: 29/05/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material	1m 2m			
Grey gravel	3m 4m			
Borehole terminated at 5m	5m 6m			

Construction Details

50mm Slotted Standpipe: 1-5mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

BOREHOLE LOG

CONTRACT: Westmeath County Council

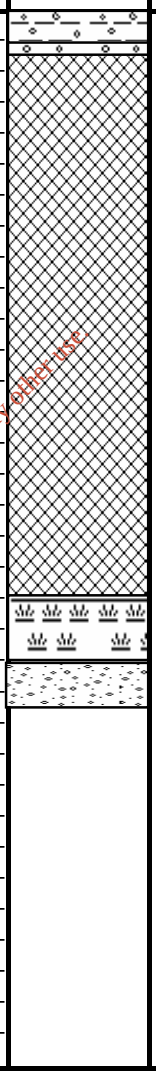
LOCATION NO. BH-3

LOCATION: Moate

DATE: 29/05/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Sandy gravelly Clay	Metres (m)			
Waste material	1m 2m 3m			
Peat	4m			
Brown slightly gravelly sand				
Termionation of hole at 4.5m bgl	5m 6m			

Construction Details

50mm Slotted Standpipe: 1-4.55mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

BOREHOLE LOG

CONTRACT: Westmeath County Council

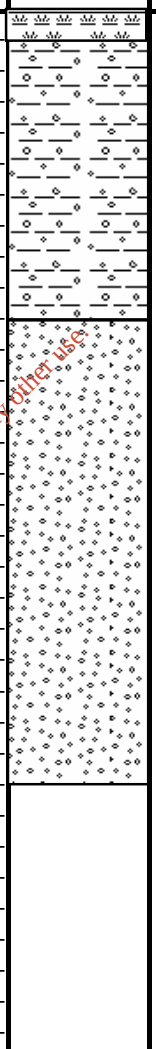
LOCATION NO. BH-4

LOCATION: Moate

DATE: 30/05/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil	Metres (m)			
Brown gravelly clay	1m			
Grey gravel	2m			
Dense grey gravel and water strike at 3.8m	3m			
Borehole terminated at 5m	4m			
Water strike at 3.6m	5m			
	6m			

Construction Details

50mm Slotted Standpipe: 1-5mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

BOREHOLE LOG

CONTRACT: Westmeath County Council

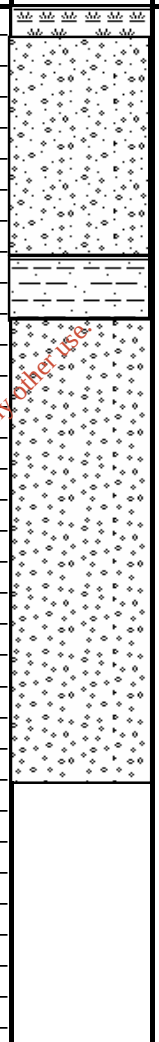
LOCATION NO. BH-5

LOCATION: Moate

DATE: 30/05/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil	Metres (m)			
Brown clayey sand and gravel	1m			
Brown slightly sandy clay	2m			
Grey gravel Water Strike at 2.6m				
Dense grey gravel and water strike	3m 4m 5m			
Borehole terminated at 5m	6m			

Construction Details

50mm Slotted Standpipe: 1-5mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

BOREHOLE LOG

CONTRACT: Westmeath County Council

LOCATION NO. BH-6

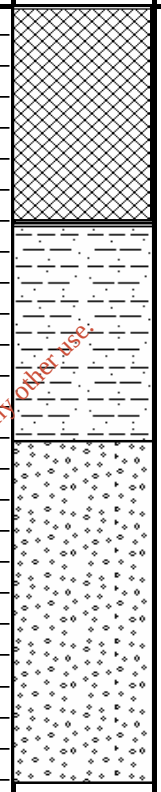
LOCATION: Moate

DATE: 31/05/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Gravel fill material	Metres (m)			
Brown sandy clay	1m 2m			
Sandy gravel Water strike at 3m	3m 4m			
Borehole terminated at 5m	5m 6m			



Construction Details

50mm Slotted Standpipe: 1-5mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

BOREHOLE LOG

CONTRACT: Westmeath County Council

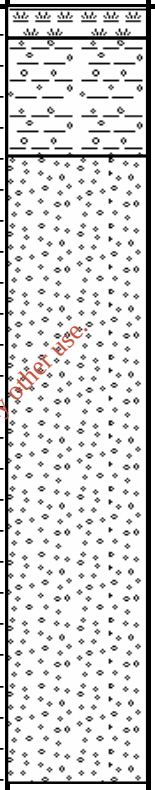
LOCATION NO. BH-7

LOCATION: Moate

DATE: 01/06/2007

GRID REFERENCE:

DRILLING METHOD: Rotary Percussion

DESCRIPTION	BOREHOLE DEPTH (m)	SYMBOLIC LOG	SAMPLE TYPE	DEPTH (m)/ Reading (ppm)
Topsoil	Metres (m)			
Brown clayey sand and gravel	1m			
Grey gravel				
Brown sandy gravel	2m			
Grey gravel Water strike at 2.8m	3m			
	4m			
	5m			
Borehole terminated at 5m	6m			

Construction Details

50mm Slotted Standpipe: 1-5mbgl
Solid Standpipe: 0mbgl - 1mbgl
Gravel filter pack: 0.5 - 5mbgl
Bentonite: 0mbgl-0.5mbgl

APPENDIX 3

Sampling Protocols & Laboratory Results

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: O'Callaghan Moran Associates (Cork)

Granary House
Rutland Street
Cork
Ireland

Attention: Barry Sexton

Date: 31 May, 2007

Our Reference: 07-B03175/01

Your Reference: 07-045-01

Location: Moate

A total of 19 samples was received for analysis on Friday, 11 May 2007 and authorised on Thursday, 31 May 2007. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Ken Scally

Lorraine Mc Namara

Ken Scally
General Manager, Ireland

Lorraine McNamara
Laboratory Technical Manager

Compiled By

Norah O'Connor

Norah O'Connor

UKAS TESTING
1291
GROUP

Printed at 10:08 on 05/06/2007

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B03175/01 **Sample Type: SOIL**

Client: O'Callaghan Moran Associates (Cork) Location: Moate

Date of Receipt: 11/05/2007 Client Contact: Barry Sexton

Client Ref: 07-045-01

Detection Method				CEN 10:1 Leach	CV AA	ELTRA	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS
UKAS Accredited [Testing Laboratory] No. 1291						✓	✓	✓		✓		✓					
ALcontrol Reference	Sample Identity	Other ID	P / V	CEN 10:1 Leachate Test	Dissolved Mercury Low Level in CEN 10:1 Leachate	Total Organic Carbon**	PRO & BTEX	Mineral Oil by GC	Coronene	PAH EPA (16)	PAH Total (17) GCMS (Solid)	PAH Total (6) GCMS <1.6mg/kg (Solid)	PCB 7 Congeners	Natural Moisture Content	Total Dissolved Solids Gravimetric CEN 10:1	Total Phenols by HPLC in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach
07-B03175-S0004-A01	TP-1	1-1.5M	Plastic tub	On Hold													
07-B03175-S0004-A02	TP-1	1-1.5M	Amber Jar	On Hold													
07-B03175-S0004-A03	TP-1	1-1.5M	Volatile Vial	On Hold													
07-B03175-S0005-A01	TP-1	3.2-3.6M	Plastic tub	On Hold													
07-B03175-S0005-A02	TP-1	3.2-3.6M	Amber Jar	On Hold													
07-B03175-S0005-A03	TP-1	3.2-3.6M	Volatile Vial	On Hold													
07-B03175-S0006-A01	TP-2	1.5-2M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0006-A03	TP-2	1.5-2M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X
07-B03175-S0006-A17	TP-2	1.5-2M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0007-A01	TP-2	3.2-3.5M	Plastic tub	On Hold													
07-B03175-S0007-A02	TP-2	3.2-3.5M	Amber Jar	On Hold													
07-B03175-S0007-A03	TP-2	3.2-3.5M	Volatile Vial	On Hold													
07-B03175-S0008-A01	TP-3	0.5-1M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0008-A03	TP-3	0.5-1M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X
07-B03175-S0008-A17	TP-3	0.5-1M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0009-A01	TP-3	2.4-2.6M	Plastic tub	On Hold													
07-B03175-S0009-A02	TP-3	2.4-2.6M	Amber Jar	On Hold													
07-B03175-S0009-A03	TP-3	2.4-2.6M	Volatile Vial	On Hold													
07-B03175-S0010-A01	TP-4	1-1.5M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0010-A03	TP-4	1-1.5M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland
Test Schedule

Ref Number: 07-B03175/01
Client: O'Callaghan Moran Associates (Cork)
Date of Receipt: 11/05/2007

Sample Type: SOIL
Location: Moate
Client Contact: Barry Sexton
Client Ref: 07-045-01

Detection Method				CEN 10:1 Leach	CV AA	ELTRA	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS
UKAS Accredited [Testing Laboratory] No. 1291						✓	✓	✓		✓		✓					
ALcontrol Reference	Sample Identity	Other ID	P / V	CEN 10:1 Leachate Test	Dissolved Mercury Low Level in CEN 10:1 Leachate	Total Organic Carbon**	PRO & BTEX	Mineral Oil by GC	Coronene	PAH EPA (16)	PAH Total (17) GCMS (Solid)	PAH Total (6) GCMS <1.6mg/kg (Solid)	PCB 7 Congeners	Natural Moisture Content	Total Dissolved Solids Gravimetric CEN 10:1	Total Phenols by HPLC in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach
07-B03175-S0010-A17	TP-4	1-1.5M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0011-A01	TP-4	2.6-2.8M	Plastic tub	On Hold													
07-B03175-S0011-A02	TP-4	2.6-2.8M	Amber Jar	On Hold													
07-B03175-S0011-A03	TP-4	2.6-2.8M	Volatile Vial	On Hold													
07-B03175-S0012-A01	TP-5	1.5-2M	Plastic tub	On Hold													
07-B03175-S0012-A02	TP-5	1.5-2M	Amber Jar	On Hold													
07-B03175-S0012-A03	TP-5	1.5-2M	Volatile Vial	On Hold													
07-B03175-S0013-A01	TP-6	1-1.5M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0013-A03	TP-6	1-1.5M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X
07-B03175-S0013-A17	TP-6	1-1.5M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0014-A01	TP-6	2.5-2.6M	Plastic tub	On Hold													
07-B03175-S0014-A02	TP-6	2.5-2.6M	Amber Jar	On Hold													
07-B03175-S0014-A03	TP-6	2.5-2.6M	Volatile Vial	On Hold													
07-B03175-S0015-A01	TP-7	1.5-2M	Plastic tub	On Hold													
07-B03175-S0015-A02	TP-7	1.5-2M	Amber Jar	On Hold													
07-B03175-S0015-A03	TP-7	1.5-2M	Volatile Vial	On Hold													
07-B03175-S0016-A01	TP-7	3.1-3.3M	Plastic tub	On Hold													
07-B03175-S0016-A02	TP-7	3.1-3.3M	Amber Jar	On Hold													
07-B03175-S0016-A03	TP-7	3.1-3.3M	Volatile Vial	On Hold													
07-B03175-S0017-A01	TP-8	1-1.5M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B03175/01 **Sample Type: SOIL**

Client: O'Callaghan Moran Associates (Cork) Location: Moate

Date of Receipt: 11/05/2007 Client Contact: Barry Sexton

Client Ref: 07-045-01

Detection Method				CEN 10:1 Leach	CV AA	ELTRA	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS
UKAS Accredited [Testing Laboratory] No. 1291						✓	✓	✓		✓		✓					
ALcontrol Reference	Sample Identity	Other ID	P / V	CEN 10:1 Leachate Test	Dissolved Mercury Low Level in CEN 10:1 Leachate	Total Organic Carbon**	PRO & BTEX	Mineral Oil by GC	Coronene	PAH EPA (16)	PAH Total (17) GCMS (Solid)	PAH Total (6) GCMS <1.6mg/kg (Solid)	PCB 7 Congeners	Natural Moisture Content	Total Dissolved Solids Gravimetric CEN 10:1	Total Phenols by HPLC in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach
07-B03175-S0017-A03	TP-8	1-1.5M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X
07-B03175-S0017-A17	TP-8	1-1.5M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0018-A01	TP-8	4.7-4.9M	Plastic tub	On Hold													
07-B03175-S0018-A02	TP-8	4.7-4.9M	Amber Jar	On Hold													
07-B03175-S0018-A03	TP-8	4.7-4.9M	Volatile Vial	On Hold													
07-B03175-S0019-A01	TP-9	0.8-1.3M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0019-A03	TP-9	0.8-1.3M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X
07-B03175-S0019-A17	TP-9	0.8-1.3M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0020-A01	TP-9	4-4.2M	Plastic tub	On Hold													
07-B03175-S0020-A02	TP-9	4-4.2M	Amber Jar	On Hold													
07-B03175-S0020-A03	TP-9	4-4.2M	Volatile Vial	On Hold													
07-B03175-S0021-A01	TP-10	1-1.5M	Plastic tub	-	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0021-A03	TP-10	1-1.5M	Amber Jar	X	X	-	-	X	X	X	X	X	X	X	X	2	X
07-B03175-S0021-A17	TP-10	1-1.5M	Volatile Vial	-	-	-	X	-	-	-	-	-	-	-	-	-	-
07-B03175-S0022-A01	TP-10	4.1-4.3M	Plastic tub	On Hold													
07-B03175-S0022-A02	TP-10	4.1-4.3M	Amber Jar	On Hold													
07-B03175-S0022-A03	TP-10	4.1-4.3M	Volatile Vial	On Hold													

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B03175/01 **Sample Type: SOIL**

Client: O'Callaghan Moran Associates (Cork) Location: Moate

Date of Receipt: 11/05/2007 Client Contact: Barry Sexton

Client Ref: 07-045-01

Detection Method				ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓													
ALcontrol Reference	Sample Identity	Other ID	P / V	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate
07-B03175-S0004-A01	TP-1	1-1.5M	Plastic tub	On Hold													
07-B03175-S0004-A02	TP-1	1-1.5M	Amber Jar	On Hold													
07-B03175-S0004-A03	TP-1	1-1.5M	Volatile Vial	On Hold													
07-B03175-S0005-A01	TP-1	3.2-3.6M	Plastic tub	On Hold													
07-B03175-S0005-A02	TP-1	3.2-3.6M	Amber Jar	On Hold													
07-B03175-S0005-A03	TP-1	3.2-3.6M	Volatile Vial	On Hold													
07-B03175-S0006-A01	TP-2	1.5-2M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0006-A03	TP-2	1.5-2M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B03175-S0006-A17	TP-2	1.5-2M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0007-A01	TP-2	3.2-3.5M	Plastic tub	On Hold													
07-B03175-S0007-A02	TP-2	3.2-3.5M	Amber Jar	On Hold													
07-B03175-S0007-A03	TP-2	3.2-3.5M	Volatile Vial	On Hold													
07-B03175-S0008-A01	TP-3	0.5-1M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0008-A03	TP-3	0.5-1M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B03175-S0008-A17	TP-3	0.5-1M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0009-A01	TP-3	2.4-2.6M	Plastic tub	On Hold													
07-B03175-S0009-A02	TP-3	2.4-2.6M	Amber Jar	On Hold													
07-B03175-S0009-A03	TP-3	2.4-2.6M	Volatile Vial	On Hold													
07-B03175-S0010-A01	TP-4	1-1.5M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0010-A03	TP-4	1-1.5M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B03175/01 **Sample Type: SOIL**

Client: O'Callaghan Moran Associates (Cork) Location: Moate

Date of Receipt: 11/05/2007 Client Contact: Barry Sexton

Client Ref: 07-045-01

Detection Method				ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓													
ALcontrol Reference	Sample Identity	Other ID	P / V	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate
07-B03175-S0010-A17	TP-4	1-1.5M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0011-A01	TP-4	2.6-2.8M	Plastic tub	On Hold													
07-B03175-S0011-A02	TP-4	2.6-2.8M	Amber Jar	On Hold													
07-B03175-S0011-A03	TP-4	2.6-2.8M	Volatile Vial	On Hold													
07-B03175-S0012-A01	TP-5	1.5-2M	Plastic tub	On Hold													
07-B03175-S0012-A02	TP-5	1.5-2M	Amber Jar	On Hold													
07-B03175-S0012-A03	TP-5	1.5-2M	Volatile Vial	On Hold													
07-B03175-S0013-A01	TP-6	1-1.5M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0013-A03	TP-6	1-1.5M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B03175-S0013-A17	TP-6	1-1.5M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0014-A01	TP-6	2.5-2.6M	Plastic tub	On Hold													
07-B03175-S0014-A02	TP-6	2.5-2.6M	Amber Jar	On Hold													
07-B03175-S0014-A03	TP-6	2.5-2.6M	Volatile Vial	On Hold													
07-B03175-S0015-A01	TP-7	1.5-2M	Plastic tub	On Hold													
07-B03175-S0015-A02	TP-7	1.5-2M	Amber Jar	On Hold													
07-B03175-S0015-A03	TP-7	1.5-2M	Volatile Vial	On Hold													
07-B03175-S0016-A01	TP-7	3.1-3.3M	Plastic tub	On Hold													
07-B03175-S0016-A02	TP-7	3.1-3.3M	Amber Jar	On Hold													
07-B03175-S0016-A03	TP-7	3.1-3.3M	Volatile Vial	On Hold													
07-B03175-S0017-A01	TP-8	1-1.5M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B03175/01 **Sample Type: SOIL**

Client: O'Callaghan Moran Associates (Cork) Location: Moate

Date of Receipt: 11/05/2007 Client Contact: Barry Sexton

Client Ref: 07-045-01

Detection Method				ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓													
ALcontrol Reference	Sample Identity	Other ID	P / V	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate
07-B03175-S0017-A03	TP-8	1-1.5M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B03175-S0017-A17	TP-8	1-1.5M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0018-A01	TP-8	4.7-4.9M	Plastic tub	On Hold													
07-B03175-S0018-A02	TP-8	4.7-4.9M	Amber Jar	On Hold													
07-B03175-S0018-A03	TP-8	4.7-4.9M	Volatile Vial	On Hold													
07-B03175-S0019-A01	TP-9	0.8-1.3M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0019-A03	TP-9	0.8-1.3M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B03175-S0019-A17	TP-9	0.8-1.3M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0020-A01	TP-9	4-4.2M	Plastic tub	On Hold													
07-B03175-S0020-A02	TP-9	4-4.2M	Amber Jar	On Hold													
07-B03175-S0020-A03	TP-9	4-4.2M	Volatile Vial	On Hold													
07-B03175-S0021-A01	TP-10	1-1.5M	Plastic tub	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0021-A03	TP-10	1-1.5M	Amber Jar	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07-B03175-S0021-A17	TP-10	1-1.5M	Volatile Vial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0022-A01	TP-10	4.1-4.3M	Plastic tub	On Hold													
07-B03175-S0022-A02	TP-10	4.1-4.3M	Amber Jar	On Hold													
07-B03175-S0022-A03	TP-10	4.1-4.3M	Volatile Vial	On Hold													

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: **07-B03175/01** **Sample Type:** **SOIL**
Client: O'Callaghan Moran Associates (Cork) Location: Moate
Date of Receipt: 11/05/2007 Client Contact: Barry Sexton
Client Ref: 07-045-01

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	CEN 10:1 Leach	CEN 10:1 Leachate Test	7
X	CV AA	Dissolved Mercury Low Level in CEN 10:1 Leachate	7
X	ELTRA	Total Organic Carbon**	7
X	GC	PRO & BTEX	7
X	GC FID/CALC	Mineral Oil by GC	7
X	GCMS	Coronene	7
X	GCMS	PAH EPA (16)	7
X	GCMS	PAH Total (17) GCMS (Solid)	7
X	GCMS	PAH Total (6) GCMS <1.6mg/kg (Solid)	7
X	GCMS	PCB 7 Congeners	7
X	GRAVIMETRIC	Natural Moisture Content	7
X	GRAVIMETRIC	Total Dissolved Solids Gravimetric CEN 10:1	7
X	ICP MS	Dissolved Antimony Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Arsenic Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Barium Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Cadmium Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Chromium Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Copper Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Lead Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Molybdenum Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Nickel Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Selenium Low CEN 10:1 Leach	7
X	ICP MS	Dissolved Zinc Low CEN 10:1 Leach	7
X	IR	Dissolved Organic Carbon in CEN 10:1 Leachate	7
X	KONE	Chloride in CEN 10:1 Leachate	7
X	KONE	Fluoride in CEN 10:1 Leachate	7
X	KONE	Sulphate in CEN 10:1 Leachate	7
2	HPLC	Total Phenols by HPLC in CEN 10:1 Leachate	7

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B03175/01

Client: O'Callaghan Moran Associates (Cork)

Date of Receipt: 11/05/2007

(of first sample)

Sample Type: SOIL

Location: Moate

Client Contact: Barry Sexton

Client Ref: 07-045-01

	Detection Method	CV AA	ELTRA	GC	GC	GC	GC	GC	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS
	Method Detection Limit	<0.0005mg/kg	<0.2%	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<1mg/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg
UKAS Accredited [Testing Laboratory] No. 1291			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	Dissolved Mercury Low CEN 10:1 Leachate	Total Organic Carbon**	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Benzene	Toluene	Ethylbenzene	Total Xylene	Mineral Oil by GC	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
			mg/kg	%	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
07-B03175-S0004	TP-1	1-1.5M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0005	TP-1	3.2-3.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0006	TP-2	1.5-2M	<0.0005	1.8	<10	<10	<10	10	<10	<10	<1	6	10	17	3	18	8
07-B03175-S0007	TP-2	3.2-3.5M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0008	TP-3	0.5-1M	<0.0005	3.7	<10	<10	<10	<10	<10	<10	<1	8	6	26	9	13	4
07-B03175-S0009	TP-3	2.4-2.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0010	TP-4	1-1.5M	<0.0005	3.3	<10	<10	<10	<10	<10	<10	<1	68	32	43	77	127	47
07-B03175-S0011	TP-4	2.6-2.8M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0012	TP-5	1.5-2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0013	TP-6	1-1.5M	<0.0005	1.5	<10	<10	<10	<10	<10	<10	<1	5	7	20	3	11	4
07-B03175-S0014	TP-6	2.5-2.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0015	TP-7	1.5-2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0016	TP-7	3.1-3.3M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0017	TP-8	1-1.5M	<0.0005	3.1	<10	<10	<10	<10	<10	<10	<1	30	31	36	25	85	32
07-B03175-S0018	TP-8	4.7-4.9M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0019	TP-9	0.8-1.3M	<0.0005	1.3	55	<10	<10	<10	11	22	125	67	23	73	73	137	34
07-B03175-S0020	TP-9	4-4.2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0021	TP-10	1-1.5M	<0.0005	1.2	<10	<10	<10	<10	<10	<10	<1	27	37	44	50	212	109
07-B03175-S0022	TP-10	4.1-4.3M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

Printed at 10:08 on 05/06/2007

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B03175/01

Client: O'Callaghan Moran Associates (Cork)

Date of Receipt: 11/05/2007

(of first sample)

Sample Type: SOIL

Location: Moate

Client Contact: Barry Sexton

Client Ref: 07-045-01

	Detection Method	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS
	Method Detection Limit	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1.6mg/kg	<1ug/kg	<1ug/kg	<1 ug/kg	<1ug/kg
UKAS Accredited [Testing Laboratory] No. 1291		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			
ALcontrol Reference	Sample Identity	Other ID	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)+Benzo(k) fluoranthene	Benzo(a)pyrene	Indeno(123cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	Coronene	Total 6 PAHs	Total 16 EPA PAHs	Total 17 PAHs	PCB Congener 28	PCB Congener 52
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg
07-B03175-S0004	TP-1	1-1.5M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0005	TP-1	3.2-3.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0006	TP-2	1.5-2M	73	73	369	93	252	127	106	52	25	34	<1.6	1231	1265	<1	<1
07-B03175-S0007	TP-2	3.2-3.5M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0008	TP-3	0.5-1M	28	26	47	48	100	60	42	21	14	14	<1.6	453	467	<1	<1
07-B03175-S0009	TP-3	2.4-2.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0010	TP-4	1-1.5M	506	445	878	667	1616	824	671	249	135	159	3.8	6488	6547	<1	<1
07-B03175-S0011	TP-4	2.6-2.8M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0012	TP-5	1.5-2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0013	TP-6	1-1.5M	33	31	56	43	94	52	35	13	8	12	<1.6	415	427	<1	<1
07-B03175-S0014	TP-6	2.5-2.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0015	TP-7	1.5-2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0016	TP-7	3.1-3.3M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0017	TP-8	1-1.5M	242	203	396	290	727	335	248	120	90	91	<1.6	2891	2982	<1	<1
07-B03175-S0018	TP-8	4.7-4.9M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0019	TP-9	0.8-1.3M	81	71	333	111	294	130	119	55	29	37	<1.6	1630	1667	<1	<1
07-B03175-S0020	TP-9	4-4.2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0021	TP-10	1-1.5M	845	808	1241	956	2687	1436	898	551	288	262	6.2	10190	10452	<1	<1
07-B03175-S0022	TP-10	4.1-4.3M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B03175/01

Client: O'Callaghan Moran Associates (Cork)

Date of Receipt: 11/05/2007

(of first sample)

Sample Type: SOIL

Location: Moate

Client Contact: Barry Sexton

Client Ref: 07-045-01

	Detection Method	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS
	Method Detection Limit	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<0.1%	<350mg/kg	<0.1mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.004mg/kg	<0.01mg/kg	<0.01mg/kg
UKAS Accredited [Testing Laboratory] No. 1291												✓				
ALcontrol Reference	Sample Identity	Other ID	PCB Congener 101	PCB Congener 118	PCB Congener 153	PCB Congener 138	PCB Congener 180	PCB Total of 7 Congeners	Natural Moisture Content	Total Dissolved Solids in CEN 10:1 Leachate	Total Phenols in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
07-B03175-S0004	TP-1	1-1.5M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0005	TP-1	3.2-3.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0006	TP-2	1.5-2M	<1	<1	<1	<1	<1	<1	20.5	12511	<0.1	0.03	<0.01	2.41	<0.004	0.02	0.08
07-B03175-S0007	TP-2	3.2-3.5M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0008	TP-3	0.5-1M	<1	<1	<1	<1	<1	<1	31.3	3377	<0.1	0.07	0.02	2.86	<0.004	0.02	0.06
07-B03175-S0009	TP-3	2.4-2.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0010	TP-4	1-1.5M	<1	<1	<1	<1	<1	<1	27.4	3725	<0.1	0.08	0.02	3.36	<0.004	0.03	0.17
07-B03175-S0011	TP-4	2.6-2.8M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0012	TP-5	1.5-2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0013	TP-6	1-1.5M	<1	<1	<1	<1	<1	<1	25.3	2000	<0.1	0.01	0.02	2.31	<0.004	0.02	0.15
07-B03175-S0014	TP-6	2.5-2.6M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0015	TP-7	1.5-2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0016	TP-7	3.1-3.3M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0017	TP-8	1-1.5M	<1	<1	<1	<1	<1	<1	65.7	6146	<0.1	0.03	0.02	3.50	<0.004	0.03	0.14
07-B03175-S0018	TP-8	4.7-4.9M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0019	TP-9	0.8-1.3M	<1	<1	<1	<1	<1	<1	33.9	1750	<0.1	0.02	0.03	2.47	<0.004	0.03	0.24
07-B03175-S0020	TP-9	4-4.2M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B03175-S0021	TP-10	1-1.5M	<1	<1	<1	<1	<1	<1	20.4	1684	<0.1	0.02	0.02	3.00	<0.004	0.02	0.09
07-B03175-S0022	TP-10	4.1-4.3M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim

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ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B03175/01

Client: O'Callaghan Moran Associates (Cork)

Date of Receipt: 11/05/2007

(of first sample)

Sample Type: SOIL

Location: Moate

Client Contact: Barry Sexton

Client Ref: 07-045-01

	Detection Method	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE						
	Method Detection Limit	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<20mg/kg	<10mg/kg	<1mg/kg	<30mg/kg						
UKAS Accredited [Testing Laboratory] No. 1291																
ALcontrol Reference	Sample Identity	Other ID	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate						
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg						
07-B03175-S0004	TP-1	1-1.5M	-	-	-	-	-	-	-	-	-						
07-B03175-S0005	TP-1	3.2-3.6M	-	-	-	-	-	-	-	-	-						
07-B03175-S0006	TP-2	1.5-2M	<0.01	0.07	0.06	0.01	0.69	30	20	<1	8446						
07-B03175-S0007	TP-2	3.2-3.5M	-	-	-	-	-	-	-	-	-						
07-B03175-S0008	TP-3	0.5-1M	<0.01	0.14	0.03	0.03	0.98	48	32	<1	1486						
07-B03175-S0009	TP-3	2.4-2.6M	-	-	-	-	-	-	-	-	-						
07-B03175-S0010	TP-4	1-1.5M	0.01	0.29	0.05	<0.01	1.16	134	72	<1	1438						
07-B03175-S0011	TP-4	2.6-2.8M	-	-	-	-	-	-	-	-	-						
07-B03175-S0012	TP-5	1.5-2M	-	-	-	-	-	-	-	-	-						
07-B03175-S0013	TP-6	1-1.5M	<0.01	0.04	0.02	<0.01	0.42	75	23	2	299						
07-B03175-S0014	TP-6	2.5-2.6M	-	-	-	-	-	-	-	-	-						
07-B03175-S0015	TP-7	1.5-2M	-	-	-	-	-	-	-	-	-						
07-B03175-S0016	TP-7	3.1-3.3M	-	-	-	-	-	-	-	-	-						
07-B03175-S0017	TP-8	1-1.5M	0.01	0.18	0.07	0.01	1.67	97	31	<1	3747						
07-B03175-S0018	TP-8	4.7-4.9M	-	-	-	-	-	-	-	-	-						
07-B03175-S0019	TP-9	0.8-1.3M	0.01	0.21	0.06	<0.01	0.56	155	36	2	306						
07-B03175-S0020	TP-9	4-4.2M	-	-	-	-	-	-	-	-	-						
07-B03175-S0021	TP-10	1-1.5M	<0.01	0.13	0.04	<0.01	0.40	38	32	1	494						
07-B03175-S0022	TP-10	4.1-4.3M	-	-	-	-	-	-	-	-	-						

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, SVOC, DRO, PAH, PCB, TPH CWG ,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: O'Callaghan Moran Associates (Cork)

Granary House
Rutland Street
Cork
Ireland

Attention: Michael Watson

Date: 29 June, 2007

Our Reference: 07-B04004/01

Your Reference: 7045

Location:

A total of 7 samples was received for analysis on Friday, 15 June 2007 and authorised on Friday, 29 June 2007. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Ken Scally
General Manager, Ireland

Lorraine McNamara
Laboratory Technical Manager

Compiled By

Cormac Lacey

UKAS TESTING
1291
GROUP

Printed at 11:59 on 02/07/2007

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B04004/01 **Sample Type: WATER**

Client: O'Callaghan Moran Associates (Cork) Location:

Date of Receipt: 15/06/2007 Client Contact: Michael Watson

Client Ref: 7045

Detection Method				5 DAY ATU	CV AA	GRAVIMETRIC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	P / V	BOD Unfiltered	Dissolved Mercury Low Level	Total Suspended Solids	Total Hardness (ICP MS)	Dissolved Arsenic Low Level	Dissolved Boron Low Level	Dissolved Cadmium Low Level	Dissolved Chromium Low Level	Dissolved Copper Low Level	Dissolved Lead Low Level	Dissolved Nickel Low Level	Dissolved Selenium Low Level	Dissolved Zinc Low Level	Chloride
07-B04004-S0001-A01	SW UP	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0001-A02	SW UP	UNKNOWN	Plastic Bottle	X	-	X	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0001-A10	SW UP	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	X
07-B04004-S0001-A14	SW UP	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0002-A01	SW Down	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0002-A02	SW Down	UNKNOWN	Plastic Bottle	X	-	X	X	-	-	-	-	-	-	-	-	-	-
07-B04004-S0002-A10	SW Down	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	X
07-B04004-S0002-A14	SW Down	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0003-A01	MW 3	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0003-A02	MW 3	UNKNOWN	Plastic Bottle	X	X	-	-	X	X	X	X	X	X	X	X	X	-
07-B04004-S0003-A12	MW 3	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0003-A14	MW 3	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	X
07-B04004-S0004-A01	MW 4	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0004-A02	MW 4	UNKNOWN	Plastic Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0004-A12	MW 4	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0004-A18	MW 4	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0005-A01	MW 5	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0005-A02	MW 5	UNKNOWN	Plastic Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0005-A12	MW 5	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0005-A14	MW 5	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B04004/01 **Sample Type: WATER**

Client: O'Callaghan Moran Associates (Cork) Location:

Date of Receipt: 15/06/2007 Client Contact: Michael Watson

Client Ref: 7045

Detection Method				5 DAY ATU	CV AA	GRAVIMETRIC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	KONE
UKAS Accredited [Testing Laboratory] No. 1291				✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	P / V	BOD Unfiltered	Dissolved Mercury Low Level	Total Suspended Solids	Total Hardness (ICP MS)	Dissolved Arsenic Low Level	Dissolved Boron Low Level	Dissolved Cadmium Low Level	Dissolved Chromium Low Level	Dissolved Copper Low Level	Dissolved Lead Low Level	Dissolved Nickel Low Level	Dissolved Selenium Low Level	Dissolved Zinc Low Level	Chloride
07-B04004-S0006-A01	MW 6	UNKNOWN	Glass Bottle	-	X	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0006-A04	MW 6	UNKNOWN	Plastic Bottle	X	-	-		X	X	X	X	X	X	X	X	X	-
07-B04004-S0006-A12	MW 6	UNKNOWN	100ml Plastic Anion Bottle	-	-	-		-	-	-	-	-	-	-	-	-	X
07-B04004-S0006-A18	MW 6	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0007-A01	MW 7	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0007-A02	MW 7	UNKNOWN	Plastic Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0007-A12	MW 7	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0007-A14	MW 7	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B04004/01 **Sample Type: WATER**

Client: O'Callaghan Moran Associates (Cork) Location:

Date of Receipt: 15/06/2007 Client Contact: Michael Watson

Client Ref: 7045

Detection Method				KONE	KONE	KONE	KONE	KONE	METER	METER	METER	SPECTRO	SPECTRO	SPECTRO	TITRATION		
UKAS Accredited [Testing Laboratory] No. 1291					✓	✓	✓	✓	✓		✓	✓	✓		✓		
ALcontrol Reference	Sample Identity	Other ID	P / V	Fluoride	Nitrate as NO3	ortho Phosphate	Sulphate	Total Oxidised Nitrogen	Conductivity	Dissolved Oxygen	pH (Liquid)	Ammoniacal Nitrogen	COD Unfiltered	Total Cyanide	Alkalinity		
07-B04004-S0001-A01	SW UP	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0001-A02	SW UP	UNKNOWN	Plastic Bottle	-	-	-		-	X	X	X	-	X	-	-		
07-B04004-S0001-A10	SW UP	UNKNOWN	100ml Plastic Anion Bottle	-	X	X		-	-	-	-	-	-	-	-		
07-B04004-S0001-A14	SW UP	UNKNOWN	Plastic Bottle + H2SO4	-	-	-		-	-	-	-	X	-	-	-		
07-B04004-S0002-A01	SW Down	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0002-A02	SW Down	UNKNOWN	Plastic Bottle	-	-	-	-		X	X	X	-	X	-	-		
07-B04004-S0002-A10	SW Down	UNKNOWN	100ml Plastic Anion Bottle	-	X	X	-		-	-	-	-	-	-	-		
07-B04004-S0002-A14	SW Down	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-		-	-	-	X	-	-	-		
07-B04004-S0003-A01	MW 3	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0003-A02	MW 3	UNKNOWN	Plastic Bottle	-	-	-	-	-	X	X	X	-	X	X	X		
07-B04004-S0003-A12	MW 3	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	X	-	-	-		
07-B04004-S0003-A14	MW 3	UNKNOWN	100ml Plastic Anion Bottle	X	-	X	X	X	-	-	-	-	-	-	-		
07-B04004-S0004-A01	MW 4	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0004-A02	MW 4	UNKNOWN	Plastic Bottle	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0004-A12	MW 4	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0004-A18	MW 4	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0005-A01	MW 5	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0005-A02	MW 5	UNKNOWN	Plastic Bottle	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0005-A12	MW 5	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0005-A14	MW 5	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-		

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B04004/01 **Sample Type: WATER**

Client: O'Callaghan Moran Associates (Cork) Location:

Date of Receipt: 15/06/2007 Client Contact: Michael Watson

Client Ref: 7045

Detection Method				KONE	KONE	KONE	KONE	KONE	METER	METER	METER	SPECTRO	SPECTRO	SPECTRO	TITRATION		
UKAS Accredited [Testing Laboratory] No. 1291					✓	✓	✓	✓	✓		✓	✓	✓		✓		
ALcontrol Reference	Sample Identity	Other ID	P / V	Fluoride	Nitrate as NO3	ortho Phosphate	Sulphate	Total Oxidised Nitrogen	Conductivity	Dissolved Oxygen	pH (Liquid)	Ammoniacal Nitrogen	COD Unfiltered	Total Cyanide	Alkalinity		
07-B04004-S0006-A01	MW 6	UNKNOWN	Glass Bottle	-	-	-	-	-	-	-	-	-	-	X	-		
07-B04004-S0006-A04	MW 6	UNKNOWN	Plastic Bottle	-	-	-		-	X	X	X	-	X	-	X		
07-B04004-S0006-A12	MW 6	UNKNOWN	100ml Plastic Anion Bottle	X	-	X	X	X	-	-	-	-	-	-	-		
07-B04004-S0006-A18	MW 6	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	X	-	-	-		
07-B04004-S0007-A01	MW 7	UNKNOWN	Glass Bottle	On Hold													
07-B04004-S0007-A02	MW 7	UNKNOWN	Plastic Bottle	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0007-A12	MW 7	UNKNOWN	Plastic Bottle + H2SO4	-	-	-	-	-	-	-	-	-	-	-	-		
07-B04004-S0007-A14	MW 7	UNKNOWN	100ml Plastic Anion Bottle	-	-	-	-	-	-	-	-	-	-	-	-		

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: **07-B04004/01** **Sample Type:** **WATER**

Client: O'Callaghan Moran Associates (Cork) Location:

Date of Receipt: 15/06/2007 Client Contact: Michael Watson

Client Ref: 7045

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	5 DAY ATU	BOD Unfiltered	4
X	CV AA	Dissolved Mercury Low Level	2
X	GRAVIMETRIC	Total Suspended Solids	2
X	ICP MS	Total Hardness (ICP MS)	2
X	ICP MS	Dissolved Arsenic Low Level	2
X	ICP MS	Dissolved Boron Low Level	2
X	ICP MS	Dissolved Cadmium Low Level	2
X	ICP MS	Dissolved Chromium Low Level	2
X	ICP MS	Dissolved Copper Low Level	2
X	ICP MS	Dissolved Lead Low Level	2
X	ICP MS	Dissolved Nickel Low Level	2
X	ICP MS	Dissolved Selenium Low Level	2
X	ICP MS	Dissolved Zinc Low Level	2
X	KONE	Chloride	4
X	KONE	Fluoride	2
X	KONE	Nitrate as NO3	2
X	KONE	ortho Phosphate	4
X	KONE	Sulphate	2
X	KONE	Total Oxidised Nitrogen	2
X	METER	Conductivity	4
X	METER	Dissolved Oxygen	4
X	METER	pH (Liquid)	4
X	SPECTRO	Ammoniacal Nitrogen	4
X	SPECTRO	COD Unfiltered	4
X	SPECTRO	Total Cyanide	2
X	TITRATION	Alkalinity	2

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B04004/01

Sample Type: WATER

Client: O'Callaghan Moran Associates (Cork)

Location:

Date of Receipt: 15/06/2007

(of first sample)

Client Contact: Michael Watson

Client Ref: 7045

	Detection Method	5 DAY ATU	CV AA	GRAVIMETRIC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	KONE	KONE
	Method Detection Limit	<2mg/l	<0.05ug/l	<10mg/l	<1mg/l	<1ug/l	<3ug/l	<0.4ug/l	<1ug/l	<1ug/l	<1ug/l	<1ug/l	<1ug/l	<1ug/l	<1mg/l	<0.1mg/l
UKAS Accredited [Testing Laboratory] No. 1291		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

ALcontrol Reference	Sample Identity	Other ID	BOD Unfiltered	Dissolved Mercury Low Level	Total Suspended Solids	Total Hardness	Dissolved Arsenic Low Level	Dissolved Boron Low Level	Dissolved Cadmium Low Level	Dissolved Chromium Low Level	Dissolved Copper Low Level	Dissolved Lead Low Level	Dissolved Nickel Low Level	Dissolved Selenium Low Level	Dissolved Zinc Low Level	Chloride	Fluoride
			mg/l	ug/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l
07-B04004-S0001	SW UP	UNKNOWN	4	-	60	394	-	-	-	-	-	-	-	-	-	29	-
07-B04004-S0002	SW Down	UNKNOWN	5	-	<10	374	-	-	-	-	-	-	-	-	-	17	-
07-B04004-S0003	MW 3	UNKNOWN	11	<0.05	-	-	<1	501	<0.4	7	<1	<1	8	2	17	22	<0.1
07-B04004-S0004	MW 4	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0005	MW 5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-B04004-S0006	MW 6	UNKNOWN	3	<0.05	-	-	<1	50	<0.4	3	<1	<1	2	2	10	29	0.2
07-B04004-S0007	MW 7	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Cormac Lacey

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B04004/01

Client: O'Callaghan Moran Associates (Cork)

Date of Receipt: 15/06/2007

(of first sample)

Sample Type: WATER

Location:

Client Contact: Michael Watson

Client Ref: 7045

	Detection Method	KONE	KONE	KONE	KONE	METER	METER	METER	SPECTRO	SPECTRO	SPECTRO	TITRATION	TITRATION	TITRATION	TITRATION	
	Method Detection Limit	<3mg/l	<0.03mg/l	<0.3mg/l	<0.3mg/l	<0.014mS/cm	<0.1mg/l	napH Units	<0.05mg/l	<0.2mg/l	<15mg/l	<1mg/l	<1mg/l	<1mg/l	<1mg/l	
UKAS Accredited [Testing Laboratory] No. 1291		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	
ALcontrol Reference	Sample Identity	Other ID	Sulphate	ortho Phosphate as PO4	Nitrate as NO3	Total Oxidised Nitrogen as N	Conductivity (at 25 deg. C)	Dissolved Oxygen	pH	Total Cyanide	Ammoniacal Nitrogen as N	COD Unfiltered	Bicarbonate Alk. as CaCO3	Carbonate Alk. as CaCO3	Hydroxide Alkalinity as CaCO3	Total Alkalinity as CaCO3	
			mg/l	mg/l	mg/l	mg/l	mS/cm	mg/l	pH Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
07-B04004-S0001	SW UP	UNKNOWN	-	<0.03	19.2	-	0.844	6.2	7.59	-	<0.2	46	-	-	-	-	
07-B04004-S0002	SW Down	UNKNOWN	-	0.06	8.9	-	0.711	6.1	8.19	-	<0.2	17	-	-	-	-	
07-B04004-S0003	MW 3	UNKNOWN	164	0.03	-	<0.3	1.584	4.0	7.33	<0.05	3.7	4063	614	<1	<1	614	
07-B04004-S0004	MW 4	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
07-B04004-S0005	MW 5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
07-B04004-S0006	MW 6	UNKNOWN	27	0.05	-	3.9	0.757	4.8	7.63	<0.05	<0.2	437	260	<1	<1	260	
07-B04004-S0007	MW 7	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Cormac Lacey

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, SVOC, DRO, PAH, PCB, TPH CWG ,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

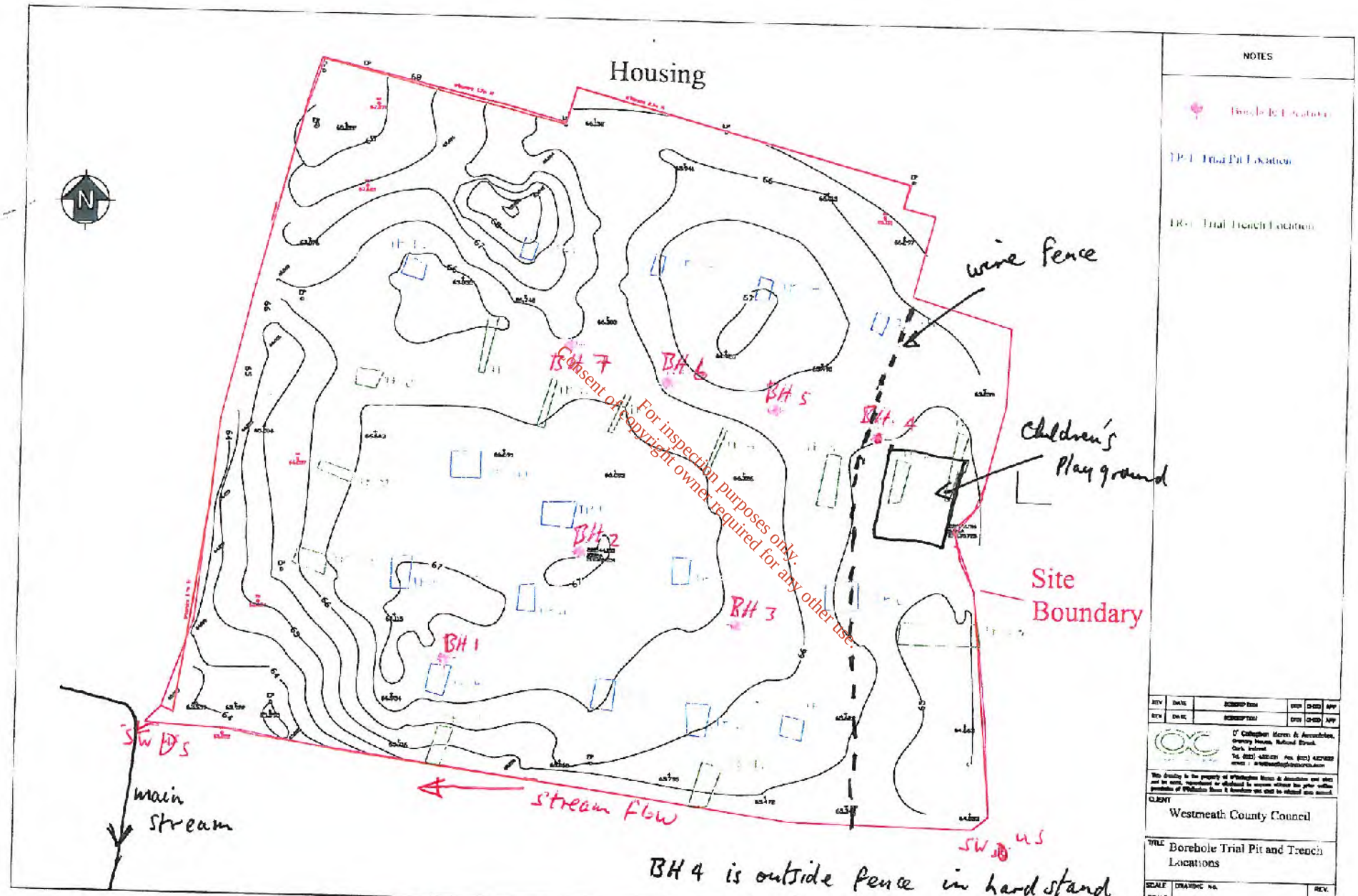
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005



ALcontrol Laboratories

Unit 18A
Rosemount Business Park
Ballycoolin
Dublin 11
Tel : (0035) 3188 29893

Westmeath County Council
Environment Section
County Buildings
Mullingar
Westmeath
Co. Westmeath

Attention: Darran Killian

CERTIFICATE OF ANALYSIS

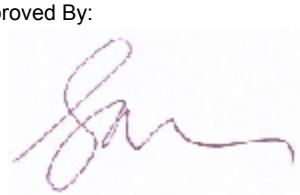
Date:	12 December 2011
Customer:	D_WESTMCC_WMT
Sample Delivery Group (SDG):	111203-38
Your Reference:	
Location:	Moate Landfill
Report No:	163286

We received 5 samples on Friday December 02, 2011 and 5 of these samples were scheduled for analysis which was completed on Monday December 12, 2011. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	111203-38	**Location:**	Moate Landfill	**Order Number:**	400213971
Job:	D_WESTMCC_WMT-31	**Customer:**	Westmeath County Council	**Report Number:**	163286
Client Reference:		**Attention:**	Darran Killian	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
4812734	1			01/12/2011
4812736	2			01/12/2011
4812737	7			01/12/2011
4812740	SW D/S			01/12/2011
4812739	SW U/S			01/12/2011

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	111203-38	**Location:**	Moate Landfill	**Order Number:**	400213971
Job:	D_WESTMCC_WMT-31	**Customer:**	Westmeath County Council	**Report Number:**	163286
Client Reference:		**Attention:**	Darran Killian	**Superseded Report:**	

LIQUID

Results Legend

X **Test**

N **No Determination Possible**

			4812740	4812739	4812734	4812736	4812737
Lab Sample No(s)							
Customer Sample Reference			SW D/S	SW U/S	1	2	7
AGS Reference							
Depth (m)							
Container			1plastic (ALE221)	1plastic (ALE221)	1plastic (ALE221)	1plastic (ALE221)	1plastic (ALE221)
Alkalinity as CaCO3	All	NDPs: 0 Tests: 5	X	X	X	X	X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 5	X	X	X	X	X
Anions by Kone (w)	All	NDPs: 0 Tests: 5	X	X	X	X	X
BOD True Total	All	NDPs: 0 Tests: 5	X	X	X	X	X
COD Unfiltered	All	NDPs: 0 Tests: 5	X	X	X	X	X
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 5	X	X	X	X	X
Metals by iCap-OES Dissolved (W)	All	NDPs: 0 Tests: 5	X	X	X	X	X
pH Value	All	NDPs: 0 Tests: 5	X	X	X	X	X
Suspended Solids	All	NDPs: 0 Tests: 5	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	111203-38	**Location:**	Moate Landfill	**Order Number:**	400213971
Job:	D_WESTMCC_WMT-31	**Customer:**	Westmeath County Council	**Report Number:**	163286
Client Reference:		**Attention:**	Darran Killian	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Deviating sample.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	1	2	7	SW D/S	SW U/S
			Depth (m)	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	01/12/2011	01/12/2011	01/12/2011	01/12/2011	01/12/2011
			Date Received	02/12/2011	02/12/2011	02/12/2011	02/12/2011	02/12/2011
			SDG Ref	111203-38	111203-38	111203-38	111203-38	111203-38
			Lab Sample No.(s)	4812734	4812736	4812737	4812740	4812739
			AGS Reference					
Suspended solids, Total	<2 mg/l	TM022		54 #	422 #	72.5 #	<2 #	2 #
Alkalinity, Total as CaCO3	<2 mg/l	TM043		1470 #	635 #	375 #	405 #	365 #
BOD, unfiltered	<1 mg/l	TM045		<4 #	<2 #	<2 #	<2 #	<2 #
Ammoniacal Nitrogen as NH3	<0.2 mg/l	TM099		84 #	3.03 #	<0.2 #	<0.2 #	<0.2 #
COD, unfiltered	<7 mg/l	TM107		169 #	49.7 #	14.7 #	7.71 #	10.2 #
Conductivity @ 20 deg.C	<0.005 mS/cm	TM120		2.92 #	0.902 #	0.715 #	0.793 #	0.712 #
Chloride	<2 mg/l	TM184		233 #	10.2 #	28.5 #	33 #	30.3 #
Hardness, Total as CaCO3	<1 mg/l	TM228		932 #	546 #	402 #	442 #	409 #
pH	<1 pH Units	TM256		7.79 #	7.15 #	7.48 #	8.14 #	7.8 #

CERTIFICATE OF ANALYSIS

SDG:	111203-38	**Location:**	Moate Landfill	**Order Number:**	400213971
Job:	D_WESTMCC_WMT-31	**Customer:**	Westmeath County Council	**Report Number:**	163286
Client Reference:		**Attention:**	Darran Killian	**Superseded Report:**	

Table of Results - Appendix

REPORT KEY

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10-7

NDP	No Determination Possible	#	ISO 17025 Accredited	*	Subcontracted Test	M	MCERTS Accredited
NFD	No Fibres Detected	PFD	Possible Fibres Detected	»	Result previously reported (Incremental reports only)	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
TM022	Method 2540D, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part120 1981;BS EN 872	Determination of total suspended solids in waters		
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples		
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids		
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit		
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	111203-38	**Location:**	Moate Landfill	**Order Number:**	400213971
Job:	D_WESTMCC_WMT-31	**Customer:**	Westmeath County Council	**Report Number:**	163286
Client Reference:		**Attention:**	Darran Killian	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	4812734	4812736	4812737	4812740	4812739
Customer Sample Ref.	1	2	7	SW D/S	SW U/S
AGS Ref.					
Depth					
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Alkalinity as CaCO3	05-Dec-2011	05-Dec-2011	05-Dec-2011	05-Dec-2011	05-Dec-2011
Ammoniacal Nitrogen	06-Dec-2011	06-Dec-2011	06-Dec-2011	10-Dec-2011	10-Dec-2011
Anions by Kone (w)	10-Dec-2011	12-Dec-2011	10-Dec-2011	12-Dec-2011	12-Dec-2011
BOD True Total	08-Dec-2011	08-Dec-2011	08-Dec-2011	08-Dec-2011	08-Dec-2011
COD Unfiltered	04-Dec-2011	04-Dec-2011	04-Dec-2011	04-Dec-2011	04-Dec-2011
Conductivity (at 20 deg.C)	06-Dec-2011	06-Dec-2011	06-Dec-2011	05-Dec-2011	05-Dec-2011
Metals by iCap-OES Dissolved (W)	07-Dec-2011	07-Dec-2011	07-Dec-2011	06-Dec-2011	06-Dec-2011
pH Value	07-Dec-2011	07-Dec-2011	07-Dec-2011	06-Dec-2011	09-Dec-2011
Suspended Solids	05-Dec-2011	06-Dec-2011	05-Dec-2011	06-Dec-2011	06-Dec-2011

SDG:	111203-38	**Location:**	Moate Landfill	**Order Number:**	400213971
Job:	D_WESTMCC_WMT-31	**Customer:**	Westmeath County Council	**Report Number:**	163286
Client Reference:		**Attention:**	Darran Killian	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA Leach tests, flash point, ammonium as NH4 by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be screened in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. Is an asbestos fibre type is found it will be reported as detected (for each fibre type found). If asbestos is present either as asbestos containing material or loose fibres no further analysis will be undertaken. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample -similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials -whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute themajor part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 -C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB TOT/PCB CON	D&C	HEXANE:ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE:ACETONE	MICROWAVE TM218.	GC-MS
C8-C40 (C8-C40) EZ FLASH	WET	HEXANE:ACETONE	SHAKER	GC-EZ
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE:ACETONE	SHAKER	GC-EZ
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM:ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM	LIQUID/LIQUID SHAKE	GC MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC MS
PHENOLS MS	DCM	SOLID PHASE EXTRACTION	GC MS
TPH by INFRARED (IR)	TCE	LIQUID/LIQUID SHAKE	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID SHAKE	HPLC
GLYCOLS	NONE	DIRECT INJECTION	GC MS

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

STANDARD OPERATING PROCEDURE

SOIL SAMPLING

The soil sampling technique described below will be followed to ensure that soil samples are representative of the environment which they are intended to characterise.

1.0 SAMPLING

(A) Locate the soil sampling station in accordance with the workplan which will specify the number and type of samples to be taken. Place a wooden stake into the ground one metre from the sample location and record sample location on the stake.

(B) Record the location in the field logbook and, if possible, photograph the location.

(C) Collect soil samples from the depth specified in the workplan and record the depth in the field notebook. Describe the colour and texture of each sample and record in notebook.

(D) Wear appropriate level of protection when taking samples (gloves, safety glasses, hard hat etc.) as specified in the workplan. Collect soil samples as specified in the workplan using decontaminated stainless steel trowel, soil corer, or similar device. Collect discrete soil samples from each station.

(E) If required by the workplan, composite discreet soil samples by placing equal volumes of soil into the container and mixing thoroughly to a homogenous mixture. Samples may be hand picked, if necessary, to remove larger materials, such as leaves, sticks, gravel, rocks etc., if specified in the workplan. Record in notebook the nature of any materials removed from soil samples.

(F) Deposit each soil sampled into a (clean, pre-washed) container. At the time of collection, the sample bottle will be filled to the top with soil sample.

(G) Fill out labels with waterproof ink and attach to the sample container. The following information will be recorded on each sample label: -

Client/Site Name
Date Collected
Time Collected
Analysis
Preservative
Sample Identification Number

STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLING

The primary objective of groundwater sampling is to evaluate whether the potential contaminant sources at a site have impacted the quality of the groundwater in the underlying aquifer. The additional objective is to measure hydraulic gradient, or slope, of the water table in the shallow aquifer in an effort to evaluate the direction of groundwater flow.

The purpose of this procedure is to ensure that representative samples of groundwater are collected and documented using consistent methods to ensure sample integrity.

1.0 SAMPLING PROCEDURES

1.1 Well Operating and Purging Procedures

All groundwater sampling will be conducted after the installed and developed wells have been allowed to equilibrate for at least 2 to 3 days. A Field Data Sheet for Well Sampling will be completed for each well.

Groundwater sampling teams will use to following procedure for approaching, opening, purging and sampling all wells unless directed otherwise by the workplan.

1) Prior to placing any equipment into the well, decontaminate the sampling equipment according to standard decontamination protocol.

2) Approach the well with a working FID/PID , a well key, and a depth-to-water meter.

3) Unlock and open the well cap just enough to insert the probe of the OVA or HNu. Take and record a reading. A decision to upgrade PPE may be necessary based on the FID/PID readings in the breathing zone.

4) Where practical, the surface water column will be visually examined for the presence of hydrocarbons, if present or suspected, the thickness of the hydrocarbon layer will be measured using an oil/water interface probe prior to taking the depth-to-water measurement.

5) Insert the water level probe into the well and measure and record the static water level to the nearest 0.01 m with respect to the established survey point on top of the well casing.

6) Decontaminate the water level probe with DDI water (Do not rinse with any solvents unless product was encountered).

7) Calculate and record the minimum volume of water to be purged according to the following conversion factors: -

1 well volume	=	water column in metres x litres/linear metre
2 inch casing	=	2.0 LPM
4 inch casing	=	8.1 LPM
6 inch casing	=	18.2 LPM
8 inch casing	=	32.4 LPM

8) Purge the well of at least 3 casing volumes by pumping or bailing with a decontaminated submersible pump or PVC bailer equipped with a bottom filling check valve (if the purge volume is low, generally less than 100 litres, the sampling team might find it more efficient to purge with a bailer than a pump). Use a graduated bucket to track the amount of water removed from the well. Periodically determine the pH, temperature and specific conductance of the purged water. Continue purging until the well has been completely evacuated or until the pH and specific conductance measurements have stabilised for at least one well volume. Wells that become dewatered prior to producing three casing volumes will be sampled as soon as practical once they recover sufficiently.

9) Dispose of purge water collected in the graduated bucket by dumping onto the ground at a distance of 50 to 60 metres from the vicinity of the well. If the water is known or suspected to be significantly contaminated, it may be necessary to store the purge water in a secure container, such as a drum, pending proper disposal.

10) Be aware and record any unusual occurrence during purging such as cascading (a shallow water entry zone that trickles into the borehole).

1.2 Field Parameter Measurement

Measurements of field parameters of pH, temperature and electrical conductivity are collected and organic vapour screening is conducted while the well is purged. To facilitate the collection of basic field parameters, the field team needs to: -

- Purge three well volumes of water from the well and measure field parameters for each well volume removed.

- Collection of water samples should take place after stabilisation of the following parameters: -

  - Temperature $^{+}$/- 1^{o}C
  - pH (meter or paper) $^{+}$/- 0.2 units
  - Specific conductivity $^{+}$/- 5%

- If the aforementioned parameters do not stabilise within three purge volumes, the well will be purged up to a maximum of six borehole volumes unless two consecutive sets of stabilised parameters are obtained.

- Note any observations in the field logbook.

1.3 Collection of Water Samples

All samples or chemical analysis will be placed in laboratory prepared bottles. The types of sample containers and preservative required for each type of analysis are described in the workplan. If required, preservatives will be placed in the sample containers prior to collecting the samples.

The following procedure will be used to sample a well: -

1) After the well has been purged and allowed to recover, sample the well using a properly decontaminated or dedicated disposable bailer. Gently lower the bailer into the water column. Allow the bailer to sink and fill with a minimum of surface disturbance.

2) Slowly raise the bailer out of the well. Do not allow the bailer line to contact the ground, either by coiling it on a clean plastic sheet or by looping it from arm to arm as the line is extracted from the well.

3) Samples will be collected for VOCs analysis immediately after purging is complete and before other samples are collected. Pour the samples slowly into the laboratory prepared 40 ml glass vial. Overfill each vial slightly to eliminate air bubbles, a convex meniscus should be present at the top of the vial. Ensure that the Teflon liner of the septum cap is facing inward and that no bubbles are entrapped. After capping securely, turn bottle upside-down, tap it against your other hand, and observe sample water for bubbles. If bubbles are observed, remove the cap, overfill the vial and reseal. Repeat this step for each vial until the samples with no bubbles are obtained.

4) Place a label on the container and enter the following information: -

   Client/Site Name
   Date Collected
   Time Collected
   Analysis
   Preservative
   Sample Identification Number

5) Record pertinent information in the field logbook and on the Field Data Sheet for Well Sampling. Complete chain-of-custody form.

6) Place custody seals on the container caps. As soon as possible, place sample containers in a cooler with bagged ice and maintain at 4^{o}C until extraction. Surround the bottles with vermiculite.

7) Obtain the semi-volatile compound/pesticides/PCBs sample(s) by transferring the water to a laboratory prepared 1000 ml amber glass bottle with Teflon-lined cap. Fill the bottle to the bottom of the neck and follow steps 4, 5 and 6 above.

8) Dissolved metals (if necessary) requires the team to filter the sample water through a .45 micron filter. The water is collected in a 1 litre, unpreserved, plastic or glass bottle with HNO_3 preservative. Filtering must be done within 15 minutes of sample collection.

9) Obtain the total metals sample by directly transferring the water from the bailer into a laboratory prepared 1000 ml plastic or glass bottle with HNO_3 preservative.

10) Be sure the pH of the metals sampled is less than 2 by pouring off an aliquot in a clean jar and testing for pH using litmus paper. Dispose of this water and rinse the jar.

11) Collect and prepare Field QA/QC samples in accordance with separate SOP.

12) Be sure to record all data required on the Field Data Sheet or Well Sampling and appropriate entries into the field logbook.

13) Secure the well cap and replace the locking cover.

14) Decontaminate all sampling equipment according to procedure.

15) Decontaminate submersible pumps as follows: -

Scrub pump and cord in a tub of Liquinox and potable water
Pump at least 80 litres of soapy water through pump
Rinse with potable water
Pump at least 80 litres of rinse water through the pump
Rinse with D1 water before lowering pump into the next well.

END.

(H) Decontaminate sampling equipment as described below unless otherwise specified in the site workplan. When using stainless steel sampling equipment: -

- wash with non-phosphate detergent in potable water,
- rinse sequentially in potable water, methanol, acetone, methanol and D1 water and;
- allow to air dry in a containment free area.

(I) Wrap the decontaminated sampling equipment in aluminium foil which has been decontaminated in accordance with Section H.

2.0 FIELD DOCUMENTATION

Record sample information in the field notebook. Provide a complete description of the sample location, and a photograph, if necessary. Describe the soil appearance, especially if the presence of oil or an odour is noted. Document the sample bottle lot numbers in the field notebook. Record weather conditions at the time of sampling. The Field Team Leader will initial the logbook entries for correctness.

3.0 FIELD QA/QC SAMPLES

See the separate SOP on Field QA/QC samples for appropriateness and preparation of D1 Water Field Blanks, Cross-contamination Field Blanks, Trip Blanks and Field Duplicate Samples.

4.0 PACKAGING AND TRANSPORT

Check to be sure that all necessary information is on the sample container label. Complete the chain-of custody form. Package, label and transport the samples to the testing laboratory in accordance with requirements for packing, shipping and labelling environmental samples.

END.

STANDARD OPERATING PROCEDURE

LANDFILL GAS MONITORING

The primary objective of landfill gas monitoring is to assess if gas generation would be likely to give rise to a risk to human health or to the environment. It also helps determine trends in gas generation and migration and evaluates the effectiveness of any in-situ gas control measures. The purpose of this procedure is to ensure that representative measurements of landfill gas are collected using appropriate safety procedures.

1.0 SAMPLING PROCEDURES

All landfill gas monitoring equipment used will be certified intrinsically safe. All landfill gas monitoring equipment shall be regularly calibrated and serviced according to the manufacturer's specification.

The following procedure will be used for monitoring of landfill gas levels in all monitoring boreholes, unless directed otherwise.

1) On arrival at the site, test the equipment in accordance with manufacturer's recommendations and record the ambient gas concentrations, atmospheric pressure and temperature in a field notebook. This ensures the gas analyser chamber is purged prior to monitoring. Record the wind speed and direction and other weather conditions.

2) Unlock the borehole cover. Examine the appearance of the standpipe, cap and gas valve and note any damage or changes since previous recordings. Record any visible (steam), audible or olfactory signs of gas migration. Record the ground conditions (e.g. dry, wet, frozen, compacted, loose etc). If signs of gas migration are noted, measurement of gas concentrations should be made around the standpipe to ensure there are no dangerous accumulations of gas.

3) If the standpipe is fitted with a gas valve, switch on the gas analyser and securely connect the gas analyser inlet port to the gas sample valve via the inlet tube. Open the gas valve and switch on the analyser pump. Run the pump for sufficient time to remove a representative sample from the borehole. Turn the pump off.

4) Record methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) peaks and steady concentrations.

5) Record atmospheric pressure (mb) and temperature (°C).

6) When measurements are completed, the gas sample valve must be closed and the analyser disconnected.

7) A measurement of the depth to water in the borehole should be undertaken after completion of all gas measurements. Insert the water level probe into the well and measure and record the static water level to the nearest 0.01 m with respect to the established survey point on top of the well casing.

8) Be sure to record all data required in the field log book.

9) Secure the well cap and replace the locking cover.

10) Briefly run the pump on the gas analyser to purge the analyser chamber with ambient air before proceeding to the next monitoring location.

END.