A.0 LIST OF CONSULTEES

An Taisce – National Trust for Ireland	Tailors Hall	Back Lane	Dublin 8	Ireland
Bord Failte Eireann	Baggot Street Bridge	Baggot Street	Dublin 2	Ireland
Department of Arts, Heritage, Gaeltacht & the Islands	Dun Aimhirgin	43-49 Mespil Road	Dublin 4	Ireland
Northern Regional Fisheries Board	Station Road	Ballyshannon	Co Donegal	Ireland
National Roads Authority	St Martins House	Waterloo Road	Dublin 4	Ireland
Environmental Protection Agency	PO Box 300	Johnstown Castle Estate	Wexford	Co Wexford
North Western Health Board	Head Office	Manorhamilton	Co Leitrim	
Department of Communications, Marine & Natural Resources	Leeson Lane	Dublin 2	Ireland	
Department of Health and Children	Hawkins House	Dublin 2	Ireland	
Department of Enterprise, Trade and Employment	Kildare Street	Dublin 2	Ireland	
The Arts Council	70 Merrion Square	Dublin 2	Ireland	
The Heritage Council	An Comhairle Oidhreachta	Kilkenny	Ireland	
Waterways Ireland	Ashstown Gate	Navan Road	Dublin 15	Ireland
An Bord Pleanala	64 Marlborough Street	Dublin 1	Ireland	
Bord Na Mona	Main Street	Newbridge	Co Kildare	Ireland
Central Fisheries Board	Balnagowan	Mobhi Boreen	Glasnevin	Dublin 9
Coillte Teoranta	Spruce House	Leeson Street	Dublin 2	Ireland
Department of Agriculture and Food	Kildare Street	Dublin 2	Ireland	
Department of Tourism, Sport & Recreation	Kildare Street	Dublin 2	Ireland	
Department of Transport	44 Kildare Street	Dublin 2	Ireland	
Department of the Environment & Local Government	Custom House	Dublin 1	Ireland	
Duchas – The Heritage Service	6 Ely Place Upper	Dublin 2	Ireland	
Forestry Service Administration	Johnston Castle Estate	Wexford	Co Wexford	
Geological Survey of Ireland	Beggars Bush	Haddingston Road	Dublin 4	Ireland
Health Research Board	73 Lower Baggot Street	Dublin 2	Ireland	
National Monuments & Historic Properties Services	Office of Public Works	51, St Stephen's Green	Dublin 2	Ireland

North West Regional Tourism	Aras Redden	Temple Street	Sligo	Ireland
Teagasc- Head Office	Agricultural House	Kildare Street	Dublin 2	Ireland
IBEC North West Office	11/12 Mill Court	The Diamond	Donegal Town	Co Donegal
Department of Defence Irish Air Corp	Casement Aerodrome	Baldonnel	Co Dublin	Ireland
Duchas	National Parks and Wildlife Division	7 Ely Place	Dublin 2	Ireland
FAS	Training & Employment Authority	27-33 Upper Baggot Street	Dublin 4	Ireland
Enterprise Ireland	Glasnevin	Dublin 9		
Health and Safety Authority	10 Hogan Place	Dublin 2		
Institute of Occupational Safety & Health	10 Hogan Place	Dublin 2		
Irish Science and Technology Agency	Glasnevin	Dublin 9		
Meteorological Services	Climatological Division	Glasnevin Hill	Dublin 9	
National Museum of Ireland	Kildare Street	Dublin 2		
Foyle Basin Council	10 Claredon Street	Derry	BT48 7ET	
Birdwatch Ireland	Ruttledge House	8 Longford House	Monkstown	Co Dublin
Irish Farmers' Association	Irish Farm Centre	Blueball	Dublin 12	
Irish Landscape Institute	6 Merrion Square	Dublin 2		
Northern Regional Fisheries Board	Station Road	Ballyshannon	Co Donegal	

Northern Regional Fisheries Board
Bord Iascaigh Réigiúnach an Tuaisceart

Fisheries Ireland
Our Natural Heritage

29th July 2002

Our Ref: 02/168

Donegal Co. Council
30 JUL 2002
LABORATORY

Mr Donal Casey
Senior Executive Chemist
Donegal County Council
Council Laboratory
Magherenan
Letterkenny
Co. DONEGAL

PROPOSED LANDFILL SITE AT BALLYNACARRICK, BALLINTRA – ENVIRONMENTAL IMPACT ASSESSMENT

Dear Mr Casey,

The only information the Board has in relation to the site was a water sample taken on 5/5/98 180 metres downstream of the landfill. The following were the results of the analysis undertaken: -

Total Phosphorous mg/l	*0.08*
Molybdate reactive phosphorous mg/l	*0.036*
Total nitrogen mg/l	*19.485*
Total oxidised nitrogen mg/l	*1.282*

The site drains to Durnish Lake which is a cSAC and Duchas should be contacted for their observations in this particular matter.

The Board has limited information on that particular lake system regarding the fish populations, principally sea trout and some details on macro-invertebrates and macrophytes. If necessary the information can be accessed at a later stage if the consultants wish to see the data that is in-house. It is in hard format.

Yours sincerely,

HARRY LLOYD
CEO

Kirk McClure Morton P.P. RECEIVED 13 AUG 2002

F.A.O.	RECEIPT	F.A.O.	RECEIPT
P.M.			

JOB No. 523-08

The Northern Regional Fisheries Board
Station Road
Ballyshannon
Co. Donegal
T: (072) **51435**
F: (072) **51816**
E: info@nrfb.ie
northfisheries@eircom.net
nrfbglenties@eircom.net
www.nrfb.ie

ENTERPRISE
IRELAND

Glasnevin Dublin 9
Ireland

Ref: July02/5234.08

Kirk McClure Morton,
Unit A6,
The Enterprise and Business Centre,
Ballyraine,
Letterkenny,
Co. Donegal.

26th July, 2002.

Re: Ballynacarrick Landfill Site Extension – Environmental Impact Assessment

Dear Sir/Madam,

Further to a letter from Donal Casey, Senior Executive Chemist, Donegal County Council, we have no additional information other than what was already presented to Kirk McClure Morton.

Yours sincerely,

Dr. Vincent O'Malley

Kirk McClure Morton P.P. RECEIVED 31 JUL 2002

F.A.O.	RECEIPT	F.A.O.	RECEIPT
P.M.	DD		

JOB No 5234-08

Tel: +353 (0) 1 857 0000 / 608 2000
Fax: +353 (0) 1 808 2020
Web: www.enterprise-ireland.com

Dúchas
The Heritage Service

Rannóg na Niarratas Forbartha
Development Applications Section

7 Plás Ely, Baile Átha Cliath 2, Éire
7 Ely Place, Dublin 2, Ireland

Teileafón +353 1 647 3000
Facsuimhir +353 1 678 8116
Glao Áitiúil 1890 474 847
Web www.ealga.ie

Our Ref: G2002/475

Kirk McClure Morton,
Unit A6,
The Enterprise & Business Centre,
Ballyraine,
Letterkenny,
Co. Donegal.

Re: Ballynacarrick Landfill Site Extension – Environmental Impact Statement

Dear Sir/Madam,

We refer to your letter of 19 July 2002 in relation to the above. Outlined below are Dúchas The Heritage Service of the Department of the Environment and Local Government's archaeological (terrestrial) recommendations:-

Archaeological (terrestrial)

As part of the Environmental Impact Statement (EIS) it is necessary that the archaeological implications of the development be addressed in the Cultural Heritage Section.

It is therefore necessary that a suitably qualified archaeologist be employed to carry out an Archaeological Assessment of the proposed site as part of the EIS and prior to a consideration of planning permission.

The Archaeological Assessment shall include:

- Documentary and map research
- Site visits and full survey of the proposed development site
- An Archaeological Impact Assessment and Visual Amenity Impact Assessment
- Recommended mitigatory measures

The EIS should be submitted to Dúchas The Heritage Service and the relevant planning authority outlining all of the above prior to a planning decision. The developer shall be prepared to be advised further by Dúchas with regard to any archaeological requirements (these may include refusal, preservation *in situ*, monitoring, testing, and/or excavation).

In addition, the proposed development is also being examined from a nature conservation and an archaeological (underwater) perspective and our comments will be forwarded to you when they are to hand.

Yours Sincerely,

Yvonne Doolan,
Dúchas The Heritage Service,
Department of the Environment & Local Government.
9th August 2002_

Teagasc

County Advisory and Training Services

CARNAMUGGAGH,
Letterkenny, Co. Donegal.
Tel: 074-21555 Fax: 074-26659

16 September 2002

Mr. Donal Casey,
Senior Executive Chemist,
Comhairle Chontae Dhún na nGall,
County House,
Lifford,
Co. Donegal.

Ref: 02/5234.08 Ballynacarrick Landfill Site Extension.

Dear Mr. Casey,

Regarding your letter of 9th July 2002, I wish to make the following comments on the proposal.

I visited the proposed site on 27/8/2002 and based on the map received the proposed works appear to be at an advanced stage (composite liner installation). As it is adjacent to and contiguous with the original site, I do not foresee any major difficulty with the operation.

I would however draw your attention to the geology of this area. It is rolling drumlin type topography over glacial drift material that is mainly limestone with a shale and sandstone mixture. Limestone is a very permeable material so the protection of groundwater should therefore be of prime concern, not forgetting other areas of concern, such as surface water pollution, unpleasant odours, traffic and the impact on neighbouring farms and dwellings.

Therefore the hydrology reports being procured should be examined in detail so that the best approach is taken.

From a farming perspective there is a general concern, especially in dairying areas, on the potential of landfill sites to attract flocks of birds such as Crows and Gulls. These birds could be instrumental in the spread of disease and dump material from farm to farm. This disease risk should be addressed in the EIS.

Yours sincerely,

John J. Cannon.
Teagasc Adviser.

C.c. Donal Carey, Director of Operations, Teagasc North.
P.J. Molloy, CAO. Co. Donegal.
Sean Regan, Farm Environment Specialist, Teagasc.

HEALTH AND SAFETY AUTHORITY

10 Hogan Place, Dublin 2, Ireland.
Telephone: 01-614 7000 Fax: 01-614 7020 Website: http://www.hsa.ie/osh

Agents for Donegal County Council
Kirk McClure Morton
Unit A6,
The Enterprise and Business Centre,
Ballyraine,
Letterkenny,
Co. Donegal

Our Reference: 02-LuP-Landfill-DCC Tuesday, August 27, 2002

Re: Proposed Landfill Site at Meenaboll– Environmental Impact Assessment & Ballynacarrick Landfill Site Extension - Environmental Impact Assessment

A Chara,

The Authority, acting as the Central Competent Authority under the EC (Control of Major Accident Hazards involving Dangerous Substances) Regulations, 2000 (SI 476 of 2000), gives technical advice to the planning authority when requested, under regulation 29(1) in relation to

(a) the siting of new establishments,
(b) modifications to an existing establishment to which Article 10 of the Directive applies, or
(c) proposed development in the vicinity of an existing establishment

The advice given is for the purposes of assessing new development only, where a precautionary approach is taken.

Based on the information provided to the Authority (re. Letter July02/5234.08 & July02/5234.50), Regulation 4(2)(e) of SI 476 of 2000 states that the Regulations do NOT apply to waste land-fill sites.

If you have any queries please contact the undersigned.

Yours sincerely

Noreen Quinn
Inspector
Process Industries Unit

Kirk McClure Morton P.P. RECEIVED 02 SEP 2002

F.A.O.	RECEIPT	F.A.O.	RECEIPT
P.M.	DOD		
BHG			

JOB No. 5234.50

Kirk McClure Morton P.P. RECEIVED SEP 002

F.A.O.	RECEIPT	F.A.O.	RECEIPT
P.M.			

JOB No.

An tSeirbhís Foraoise
An Roinn Cumarsáide,
Mara agus Acmhainní Nadúrtha
Eastát Chaisleán Bhaile Sheonach
Co. Loch Garman

FOREST SERVICE
Department of Communications,
Marine and Natural Resources
Johnstown Castle Estate
Co Wexford
Tel + 353 53 60 200
LoCall 1890 200 223
Fax 053 43834 / 5 / 6
www.dcmnr.gov.ie/forestservice

Kirk McClure
Unit A6
The Enterprise and Business Centre
Ballyraine
Letterkenny
Co. Donegal

Your Ref: July02/5234.08
Our Ref: SC4/14/73 V3

RE: Ballynacarrick Landfill Site Extension – Environmental Impact Assessment

Dear Sirs,

I refer to your letter of the 19th January 2002 requesting comments on the proposal and details of information that we may hold in relation to the site at Ballynacarrick Co. Donegal.

The Forest Service does not own land in the area and does not have any specific comments to make at this time. However a copy of the proposal has been sent to our Forestry Inspector for the area, if he has specific comments to make I will send them to you at a latter date.

Coillte Teoranta and any private land owners who may have forestry in the area should be consulted separately about the proposed development.

Forest Inventory Data is available in GIS format from the Forest Service in respect of forests planted up to mid-1997. If this information would be of use to you in deciding the preferred route please sign and return the enclosed Confidential Data Agreement to Mary O'Leary, IFIS Unit, a CD will be issued to you.

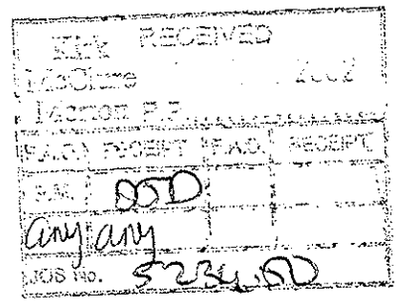
Yours sincerely,

Gerard Smullen
Forest Service
7 August 2002

Suirbhéireacht Gheolaíochta Éireann
Tor an Bhacaigh
Bóthar Hadington
Baile Átha Cliath 4

Geological Survey of Ireland
Beggars Bush
Haddington Road
Dublin 4
Tel. +353 1 6707444
Fax. +353 1 6681782
http://www.gsi.ie

Kirk McClure Morton
Unit 6A
The Enterprise and Business Centre
Ballyraine
Letterkenny
Co. Donegal



9 August 2002

Re. Ballynacarrick Landfill Site

Dear Sir,

I am writing in response to the letter of 19 July 2002 from Donegal County Council concerning the above project. The letter requested that any response should be sent to you at your Letterkenny office.

The Geological Survey of Ireland (GSI) is the national earth science agency and has datasets on Bedrock Geology, Quaternary Geology, Mineral deposits, Groundwater Resources and the Geology of the Irish Seabed area. These consist of maps, reports, and extensive databases. These latter include mineral occurrences, site investigation boreholes, mineral exploration boreholes, karst features, wells and springs.

While the proposed scope for the Environmental Impact Assessment makes reference to "landscape and visual", it does not mention the Bedrock and Quaternary Geology of the site. The GSI is of the view that these should be an integral part of the assessment process as they have considerable impacts on other aspects such as hydrogeology and ground conditions for traffic and construction.

The GSI is very anxious to enlarge the database of site investigation boreholes on a nationwide basis to provide a better service to the civil engineering sector. Therefore it would much appreciate a copy of the reports detailing the site investigations undertaken. These would then be added to the national database.

If the GSI can be of any further help please contact me.

Yours sincerely,

Dr. Ronnie Creighton, PGeo
Senior Geologist
Quaternary and Geotechnical Section

National Roads Authority
An tÚdarás um Bóithre Náisiúnta

Kirk McClure Morton
Unit A6,
The Enterprise and Business Centre,
Ballyraine,
Letterkenny,
Co. Donegal.

St. Martin's House / Waterloo Road / Dublin 4
Tel: +353 1 660 2511 / Fax: +353 1 668 0009

Date	Our Ref.	Your Ref.
29th July, 2002.	NRA1055	July02/5234.08

Re: Ballynacarrick Landfill Site Extension - Environmental Impact Assessment

Dear Sir/Madam,

I refer to a recent letter received in this office from Donegal County Council in relation to the above application for planning permission to extend a landfill site at Ballynacarrick.

In the case of this planning application the Authority will rely on Donegal County Council to abide by the national policy in relation to frontage development on national roads as outlined in Circular Letter 1/95.

In the circumstances, while it would be open to the Authority to make a submission or observation on this application under Article 34 of the Local Government Planning and Development Regulations, 1994, the Authority will not, in this case, be availing of this right.

Yours faithfully,

Amy O'Shaughnessy
Programme Division

DDP
Ack 019
5234.08

Email: info@nra.ie Web: www.nra.ie

Department of Enterprise, Trade and Employment

Roinn Fiontar Tráidálá agus Fostaíochta

Your ref: 5234.08

Kirk McClure Morton
Unit A6
The Enterprise and Business Centre
Ballyraine
Letterkenny
Co. Donegal

Dear Sirs

I refer to Mr. Donal Casey's letter of 19 July 2002 regarding an environmental impact assessment for Ballynacarrick Landfill Site Extension.

I wish to inform you that this Department has no observations on the matter.

Yours sincerely

M. Ryan

Margaret Ryan
Environment Section
24 July 2002

Kildare Street, Dublin 2, Ireland
Tel: 353 1 631 2121 Fax: 353 1 631 2827 www.entemp.ie
Lo-Call telephone service (if calling from outside (01) area) - 1890 220222

ENVIRONMENTAL PROTECTION AGENCY
An Ghníomhaireacht um Chaomhnú Comhshaoil

PO Box 3000
Johnstown Castle Estate
County Wexford
Ireland

Tel.: +353 53 60600
Fax: +353 53 60699

Bosca Poist 3000
Eastát Chaisleán Bhaile Sheáin
Contae Loch Garman
Éire

Email: info@epa.ie
Website: www.epa.ie

Kirk McClure Morton
Unit A6, The Enterprise and Business Centre
Ballyraine
Letterkenny
Co. Donegal.

Date 2nd October 2002 Our ref. 04-13-04-01 Your ref.

Re: Ballynacarrick Landfill Site Extension – Environmental Impact Assessment

Dear Sir/Madam:

I acknowledge your letter to the Agency regarding the above development.

I would draw your attention to two documents the EPA have published on the preparation of Environmental Impact Statements: 'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, 1995' and more recently, 'Guidelines on the Information to be Contained in Environmental Impact Statements, 2002'. These guidelines set out the issues that the Agency consider need to be addressed in the preparation of an EIS and, where necessary, in the subsequent development.

In relation to the specific project, I refer you to section 3 of the Advice notes which provide guidance on the topics which would usually be addressed when preparing an EIS for developments of a specific project class. The Advice Notes are currently under revision due to recent legislative changes in EIA law; further details on this can be obtained from the EPA website.

In relation to possible constraints, I would draw your attention to our list of publications and the register of EPA licensed activities on our website, www.epa.ie. General water and air quality information can be obtained from the relevant EPA publications. The EPA has also published a number of manuals relating to landfill operation, design and maintenance, which may also be of some assistance. These publications are available from our publications office (tel. 01-2680100).

Yours sincerely

Avril Boland

Avril Boland
Environmental Management and Planning

Environment Section
Department of Agriculture and Food
Johnstown Castle,
Co. Wexford

Your ref No 02/5234.08

Re :- Ballynacarrick Landfill Site Extension _ Environment Impact Assessment

Att.: - Kirk Mc Clure Morton
Unit A6, the Enterprise and Business Center.
Ballyraine,
Letterkenny,
Co. Donegal

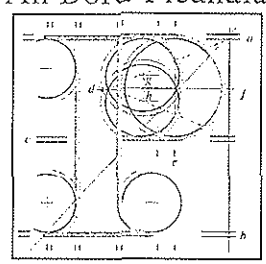
Dear Sir/Madam

I refer to correspondence received from Mr. Donal Casey, Senior Executive Chemist in Donegal Co. Council requesting this Departments observations on the above proposal . The Department of Agriculture and Food has no comment to offer on this issue at this time . However, we will contact you should any matters relevant to this department arise.

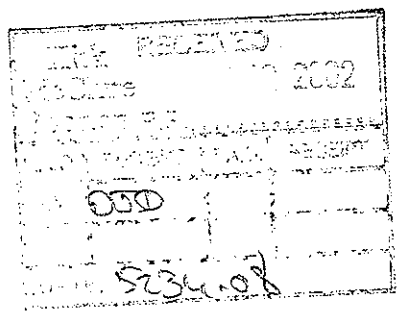
Michael Mac Carthy
September 30, 2002

Our Ref:PL 05.ES2010
P.A.Reg.Ref:
Your Ref:

An Bord Pleanála



Donal Casey
Senior Executive Chemist
County House
Lifford
Co Donegal



30th July 2002

Re: Ballynacarrick Landfill Site Exetention

Dear Sir,

An Bord Pleanála has received your letter dated 19th of July, 2002 in relation to the above proposed development. I wish to advise you that the Board's only preliminary function in respect of local authority development proposals which are to be the subject of a formal application for approval under Section 175 of the Planning and Development Act, 2000 is the formal scoping process set out at article 117 of the Planning and Development Regulations, 2001. It is not open to the Board to provide informal comments or feedback in respect of such proposed developments. You should also note that the statutory procedures and statutory time limits applicable to such formal scoping requests and to which the Board is subject are those set out at article 95 of the 2001 Regulations (this includes formal notification to prescribed bodies as appropriate).

Having regard to the foregoing and the contents of your letter the Board does not consider that a formal scoping request under the said article 117 has been made to it and accordingly it does not propose to further respond to your letter.

However please be advised that it is of course open to you to submit a formal scoping request in accordance with the 2001 Regulations if the Local Authority so wishes. Any such request should indicate that it is a formal scoping request under article 117 and contain all the information specified at article 95 . It should also be endorsed by the County Manager or Secretary or the relevant Director of Services as appropriate.

Please contact the undersigned if you require any further information.

Siobhan White
Executive Officer

64 Sráid Maoilbhríde.
Baile Átha Cliath 1.

Tel: (01) 858 8100
LoCall: 1890 275 175
Fax: (01) 872 2684
Web.http//www.pleanala.ie
email:bord@pleanala.ie

64 Marlborough Street,
Dublin 1.

Cill Chainnigh, Éire
Teileafón: 056 70777
Faics: 056 70788
Idirnáisiúnta: +353 56 70777
E-mail: heritage@heritagecouncil.com
Web Site: http://www.heritagecouncil.ie

An Chomhairle Oidhreachta

The Heritage Council

Kilkenny, Ireland
Telephone: 056 70777
Fax: 056 70788
International: +353 56 70777
E-mail: heritage@heritagecouncil.com
Web Site: http://www.heritagecouncil.ie

24 September 2002.

Kirk McClure Morton
Unit A6, The Enterprise and Business Centre
Ballyraine
Letterkenny
Co. Donegal

Re: Ballynacarrick Landfill Site Extension – Environmental Impact Assessment

Dear Sir/Madam,

I refer to a letter received from Mr. Donal Casey, Senior Executive Chemist, Donegal County Council, in relation to the preparation of an Environmental Impact Statement for the above site, and requesting that we respond with any comments directly to you.

The Heritage Council is a prescribed body under Article 122 of the Local Government (Planning and Development) Regulations, 1994-1999, in relation to Environmental Impact Statements. However, due to its restricted resources, the Council has had to adopt a limited role in the planning process, as outlined in the Council's *Policy Paper on the Role of the Heritage Council in the Planning Process*. This, together with the fact that the Council's primary role is one of policy advice, means that it does not generally comment on individual development proposals. Therefore, the following comments on the scope and content of EISs in relation to heritage assets are of a general nature, and are not based upon an investigation of the site in question. The Council recommends that you contact Dúchas – The Heritage Service, Ely Court, 7 Ely Place, Dublin 2, Tel: 01 647 3000, for specific information relating to any heritage assets which may be present in the study area.

The Heritage Council recommends that all relevant aspects of heritage should be included in a comprehensive and integrated way. Therefore, the sources of information, consultees, designations and records, likely impacts and assessment techniques should be recorded for each of the following areas, where appropriate:

Topic	Heritage Interests
Archaeology	Monuments Archaeological objects Heritage objects
Built and designed heritage	Architectural heritage Heritage gardens and parks Inland waterways Wrecks
Natural systems, earth heritage and biodiversity	Flora Fauna Wildlife habitats and ecosystems Geology Natural systems and processes Water
Landscape and amenity	Landscapes Seascapes Visual amenity

Each stage of the project (e.g. survey work, pre-construction works, construction stage, post-construction monitoring, operational and maintenance stages) should be assessed in relation to the above.

I hope the above is of use to you in your work.

Yours sincerely,

Paddy Mathews
Planning Officer

B.0 CONSULTATION REPORT

B.1 A public consultation exercise was undertaken as part of the EIA process in order to take on board any concerns that local residents have in relation to the proposed extension to the landfill at Ballynacarrick. This took the form of a public open day held on 4th December 2002 in St Brigid's Community Centre, Ballintra. The event was advertised in the local press in week beginning 25th November 2002. At the event Council Officers and representatives from Kirk McClure Morton were present to answer any queries that may have arisen in relation to the Project.

B.2 The Community and Enterprise Division of Donegal County Council were available at the consultation events to record the comments of the public. The summary below is an extracted from the Community and Enterprise Division Report of the consultation exercise.

COMMUNITY AND ENTERPRISE REPORT

Introduction and Context

B.3 The Community and Enterprise division has been developing its role within council over the last number of months. This role is additional to the existing role of the division in providing executive support to the County Development Board (and its structures) in the implementation of An Straiteis.

B.4 One function which Community and Enterprise is in a position to perform in a Donegal County Council context is that of assistance with public consultation. This is by virtue of the expertise and previous experience of personnel in the division, and also due to the fact that the division, through the Project Officers and Community and Enterprise Development Officers, has developed considerable links with the community at area level.

B.5 In this context, Community and Enterprise were asked to assist the Environmental Services team named overleaf in approaching a public consultation/information exercise on the subject of Donegal County Council elected members' decision that a planning application be developed for the extension of the Ballynacarrick landfill site, to include overall upgrading of the existing facility.

Approach to the Exercise

B.6 The exercise itself was approached through drawing together a team consisting of Donegal County Council officers as named overleaf (County Chemist, Environmental Awareness Officer, Recycling Officer, Community and Enterprise Development Officer for the Donegal Area, Water and Sanitary Services Area Manager (Donegal), and the technical consultants for the project, Kirk McClure Morton.

B.7 The exercise took place in the form of an information day: all personnel involved in the exercise attended at Ballintra Community Centre on 4th December 2002, from 1pm until 8pm. Each officer brought information and materials for dissemination, and the displays included not only plans for the proposed work on the landfill site, but also general information about recycling and Council recycling policy/activities, and about the Community, Culture and Enterprise Directorate. All personnel were available to answer specific questions and individual members of the public were referred to whoever was best able to answer their query if a detailed one.

Issues Arising from Consultation and Implications of these

B.8 *Note on respondents*:

The number of people who attended in the course of the day at Ballintra Community Centre was not large, but represented most of the local residents i.e. people living adjacent to the dump or on access roads to the dump. In attendance were residents and landowners/farmers using fields in the area.

B.9 A response form had been prepared which asked respondents to indicate the following:

B.10 What is your interest in this proposal? Are you from:

- Access Road leading to the site
- Ballintra Area
- Ballyshannon and Donegal Town Area
- Other

B.11 Respondents were also asked to give comments under the following issue-based headings:

- Traffic
- Wildlife
- Noise
- Management of the Site
- Water Quality
- Others

Issue	Comments/Concerns
Traffic	▪ On access roads, heavy and slow-moving vehicles going to and from the site are a nuisance factor. There is a need for passing bays. ▪ Preferable that lorries would not use the Bog Road. They are causing a public nuisance. ▪ People queueing outside Diver's house to get into the dump- this is a nuisance factor for one family resident directly adjacent to the dump.
Wildlife	
Noise	
Site Management	▪ There would be a need for different bins and skips because there will be a need to control what is actually going into the dump.
Water Quality	▪ Concern about the ongoing impact of the dump on water quality for local residents. ▪ Some private and public water supplies are located in the drainage path from the site (i.e. seawards). This is a limestone area.
Others	▪ **Maintenance of the Bog Road is a concern**. There is a drain on the bog road which needs to be piped. The roads section should be made aware of this. This development is a priority for one section of Donegal County Council, therefore there must be a co-ordinated response from other sections of the council to supporting this development. ▪ **Bog Road** is unsuitable for use for access to the site. It has repeatedly been in a dangerous state. Repairs cannot be sustained because once the road is fit to use after repairs it is assaulted by lorry use again. Even if the Bog Road is improved, this will be shortlived unless lorries are prohibited from using it for access. The other road should be improved as an incentive. The Bog Road is currently used as the quickest route to the dump.

	▪ **Road is too narrow**, needs to be widened. Residents have to use it every day. There is a nuisance factor on the road. ▪ **Upgrade the Rockhill road** instead of using the Bog Road. ▪ **The smell from the site is often unacceptable.** ▪ **The shortest way out of the dump is the Bog Road**, which is in bad condition. This should not be used by heavy vehicles. It should be fixed up and used by cars only. ▪ **Waste coming in from Sligo** is something that people know was happening in the past and which they don't want. ▪ **Pests:** Flies hibernating in the attic of a resident, birds picking at the site and dropping debris into resident's garden. Organic waste attracts pests. ▪ **Visual impact of site.** ▪ **Devaluation of property** – unable to sell, compelled to stay. ▪ Dump should not be sited around farmland because of its effects on the farmland. ▪ Seagulls contaminating grazing ▪ Effect on Cattle ▪ Summertime and harvest time can raise problems because of birds in the vicinity. ▪ Having to raise issues with the site two or three times a year.

Preferences with Regard to Management of the Site

B.12 It should be noted that there was little enthusiasm or positive uptake of the notion of people becoming involved in a structure to manage or monitor the site. Those living close to the site were under the impression that it would eventually be closed and have reacted with dismay to the news that it is now proposed to upgrade and expand the facility. Those living far enough away from it not to experience direct nuisances and stress from pest infestation etc seemed to be mainly concerned with the issue of traffic coming to and from the site.

B.13 For those experiencing more regular nuisances, particularly with regard to pest infestation, it was acknowledged that some form of pro-active monitoring of the site and side-effects from the site would be preferable. The main point, made in response to the question as to what people would prefer to see in terms of being involved in or having more contact regarding the management of the site, was that there should be some mechanism in place whereby:

a) It is not left up to residents to go and complain about something when it becomes an active problem
b) There is no exertion or inconvenience to the resident
c) A mechanism whereby people can raise issues without any anxiety about offending the management of the site.

Analysis

B.14 *Issues of Concern*

It would appear from the issues raised that there is a certain amount of resignation to the idea that the dump will be upgraded and expanded. There is a high awareness of the impact on the Bog Road of constant traffic, and a direct expectation, expressed more than once, that Donegal County Council should actively seek to discourage travel by HGVs on the Bog Road.

B.15 Water quality appears to be an ongoing concern of residents.

B.16 The nature of the waste actually going in to the site is a concern. That this should be minimised and controlled is recognised by local residents, by way of controlling the numbers of birds and vermin.

Management and Monitoring of the Site

B.17 It will be necessary for council to consider ways of keeping residents officially informed as to control of conditions on the site. It should not be left as something that will only happen if residents become actively involved themselves: this is a Council facility taking waste for the southern half of the county and as such is Council's responsibility. It is felt that there is very little to be gained by residents from participating in a structure- whereas they feel they would benefit from a pro-active reporting system to them, and a demonstration of ongoing work on the site to address issues of concern which arise from time to time. Credibility of the reporting will be key. The issue of confidentiality with regard to complaints should also be dealt with- perhaps through another conduit than direct contact with on-site management.

B.18 In addition to the public Consultation day held in Ballintra meetings were held with the following groups to discuss the proposed extension.

Duchas (Parks and Wildlife)	9th September 2002 and 18th October 2002
Ballyshannon Town Commission	5th November 2002
Donegal Town Electroal Committee	8th November 2002
Leaflet Drops	2nd October 2002
EPA	15th November 2002
Donegal County Council (Planning)	2nd December 2002
Donegal County Council (Roads)	21st November 2002

Donegal Waste Collectors	13th November 2002
IBEC	
Special Policy Committee (Environment)	
Bundoran Urban Council	
Standing Committee on Water Pollution	

C.0 MINUTES OF MEETING

APPENDIX C.1

MINUTES OF MEETING

MINUTES OF MEETING OF GENERAL PURPOSES COMMITTEE HELD IN THE COUNTY HOUSE, LIFFORD ON 11th FEBRUARY 2002

G/08/02 MEMBERS PRESENT

Clr. P. Kelly, Cathaoirleach; Clrs. D. Alcorn, N. Blaney, A. Bonner, E. Bonner, J. Boyle, S. Campbell, F. Conaghan, G. Crawford, A. Doherty, P. Doherty, R. Donaghey, T. Gildea, J. Harte, C. Keaveney, P. Kennedy, D. Larkin, S. Maloney, S. McEniff, N. McGinley, P. McGowan, B. McGuinness, D. McHugh, J. McHugh, T. Pringle, J. J. Reid, J. Sheridan and T. Slowey.

G/09/02 OFFICIALS IN ATTENDANCE

Mr. Michael. McLoone, Co. Manager, Mr. Liam Kelly, Assistant Co. Manager, Mr. Sean Sheridan, Director of Corporate Services, Mr. Jim Holohan, Director of Water/Environment/ Emergency Services, Mr. John McLaughlin, Director of Roads & Transportation, Mr. Francie Coyle, Director of Planning & Economic Development, Mr. Eunan Sweeney, Co. Secretary, Mr. Donal Casey, Senior Executive Chemist, Ms. Catherine Hannon, Recycling/ Waste Reduction Officer, Ms. Mary Hannigan, Staff Officer.

G/32/02 WASTE MANAGEMENT PLAN – PROGRESS REPORT ON IMPLEMENTATION OF ACTION PLAN :

- Short term - objectives
- Medium term -objectives
- Long term- objectives.

The Committee considered the report, circulated with the agenda, in relation to the above. Mr. Jim Holohan, Director of Water/Environment/Emergency Services, Mr. Donal Casey, Senior Executive Chemist and advised the Committee that a number of decisions relating to waste management now required the approval of the members. The Council was then presented with options for new landfill sites. Mr. Donal Casey, Senior Executive then gave an informative presentation in relation to same. During his presentation, Mr.Casey gave a detailed analysis of the preferred options for proposed new landfill sites in the county, as follows :

- In the Inishowen Electoral Area, a suitable site had been identified at the back of Scalp Mountain.
- In the Donegal Electoral Area, the recommended option was to extend the existing Ballintra site.

- In the Milford Electoral Area, a site had been identified on the Letterkenny to Fintown road at Meenaboll, which Mr. Casey stated was extremely suitable. The site actually bordered the Milford and Glenties Electoral Areas, but was officially located in the Milford Area.

Mr. Casey advised that a suitable site had not yet been identified for West Donegal, but that investigation would continue in order to provide a solution for the West of the county.
Following some discussion, the Committee recommended approval to the following :

- On the proposal of Clr. Kennedy, seconded by Clr. E. Bonner, the Committee recommended that the existing landfill site at Ballinacarrick, Ballintra, be extended, and that the Council proceed with planning and design work for same.
- On the proposal of Clr. Maloney, seconded by Clr. Blaney, the Committee recommended that the Council proceed with preliminary planning and design work for the Meenaboll site.
- On the proposal of Clr. Slowey, seconded by Clr. McGinley, the Committee recommended that the Council undertake a preliminary assessment of the site at Scalp Mountain.
- On the proposal of Clr. Maloney, seconded by Clr. Conaghan the Committee recommended that the Council continue its participation in the North West Region Cross Border Group, and to maintain under review the implications of a North West Regional Strategy for the Donegal Waste Management Plan.

A lengthy discussion followed, wherein Mr. Casey and Mr. Holohan responded to queries from the Committee in relation to the proposed landfill sites and the implementation of the Waste Management Plan in general. The main points arising from the discussion were as follows:

- Clr. McGinley recommended that a 25-mile radius "cap" be placed on acceptance of waste at any landfill i.e. waste should only be accepted from locations within a 25-mile radius of the site.
- Clr. J. McHugh expressed concern at the condition of the roads leading into the proposed site at Meenaboll, and he recommended that funding be sought to upgrade same.
- Clr. D. Mc Hugh stated that he believed the burden of having a landfill in an area should be evenly carried throughout the county, and that no one region should be over-burdened, which Clr.D McHugh believed would be the case if these landfill sites are not advanced simultaneously.
- The Committee requested that all other aspects of the Waste Management Plan be progressed, in tandem with the provision of the landfill sites, with specific reference to recycling and the elimination of illegal dumping.
- Members requested that the possibility of the Council acquiring mobile recycling units, similar to those used in other local authorities, be investigated.

- Members of the Inishowen Electoral Area expressed their concern in relation to problems being experienced at the Civic Amenity Site in Carndonagh. Members referred to increases in the charges at the site, which members had not been informed about and which had created many problems. Mr. J. Holohan advised that charges at the site in Carndonagh were brought to the same level as charges imposed by private collectors, in order to avoid competition between the Council and private collectors. However, Mr. Holohan advised that if members were not in agreement with this strategy, the matter could be reviewed. Members referred to other problems at the Carndonagh Civic Amenity Site, e.g. signage. Mr. J. Holohan agreed to investigate all issues raised.
- Clr. Conaghan expressed concern at the estimated cost of €350,000 per site for preliminary design and planning work for the proposed new landfill sites, as stated in the report from Mr. J. Holohan, which had been circulated with the agenda.He recommended that relevant officials revert to members as soon as possible after preliminary investigations, and that costs be kept to a minimum.

Following some further discussion, it was agreed that members of the Glenties and Milford Electoral Areas would visit the proposed landfill site at Meenaboll with the relevant officials, after which the matter would be discussed at the Electoral Area Committee Meetings, before entering the public domain.

APPENDIX C.2

PRESENTATION

Landfill Site Selection

Donegal County Council

Landfill Site Selection

- The process of site selection of new landfills must begin with establishing what criteria are to be used in the selection process.
- The EPA has produced Draft Site Selection guidelines on how the site selection process should be carried out and what criteria should be involved These Guidelines are the basis for the approach now being taken by Donegal County Council.
- The Guidelines set out a decision making pathway the first stage of which is the formation of a constraint study

A Constraint Study effectively sets out to establish areas of the County where the development of a landfill is less likely to occur than others

- It does not exclude any such areas but establishes a series of preferences.

Landfill Site Selection

PHASED APPROACH

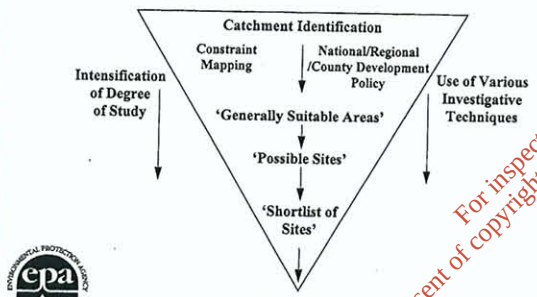


Figure 6.1

Introduction to Constraints on Landfill Site Selection

There are many factors that act as constraints on the decision making in landfill site selection

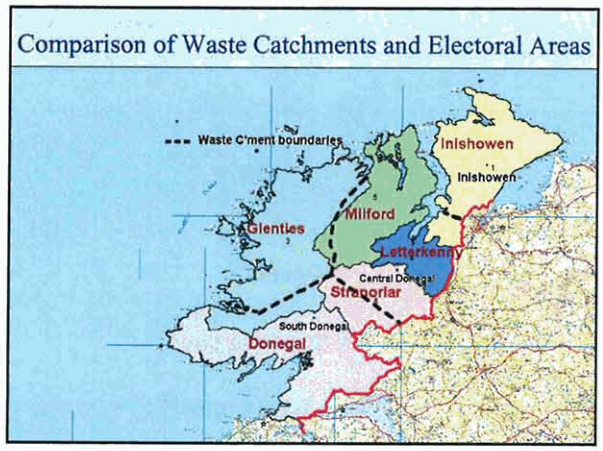
- They can be broadly divided into two main categories.
- The first can be associated with the decisions we make as a society in which we seek to develop a lifestyle that is both sustainable and sustaining to us as individual members of that society. Issues such as NHA and SAC designated areas are in this category
- The second relates more directly to the physical world and environment we find ourselves living in.

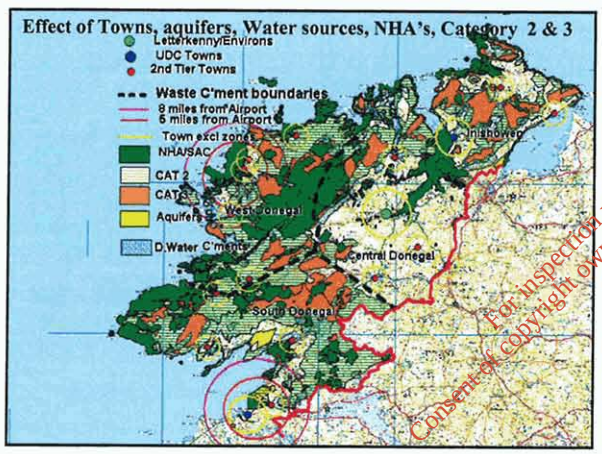
Introduction to Constraints on Landfill Site Selection

- NHA /SAC
- Category 3 County development plan
- Category 2 County development plan
- Category 1 County development plan
- Proximity to developments
- Water catchments
- Aquifers
- Airports
- Monuments/Sacred sites
- Protected species of Flora/Fauna
- Coastal Areas
- Roads
- Electricity
- Public acceptance

Landfill Site Selection

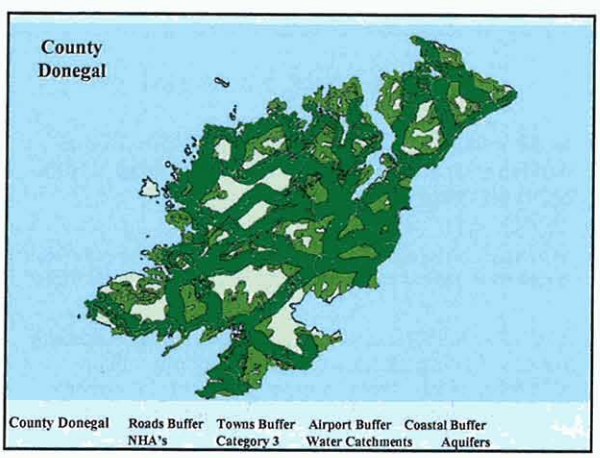
- In the waste management plan it was also decided to develop regional landfills as opposed to 1 large landfill or "superdump"
- We must therefore look at the County and see how best it can be divided into regions each served by a landfill.
- The following map shows a first approximation to such regions. The final borders between regions will be blurred in reality but it is expected that they will not differ significantly from those displayed on the next map.



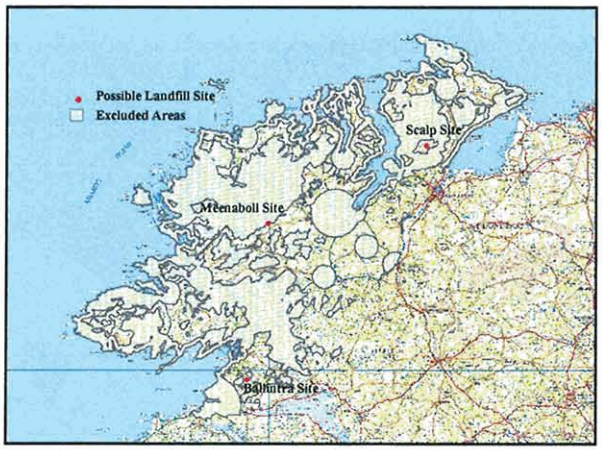


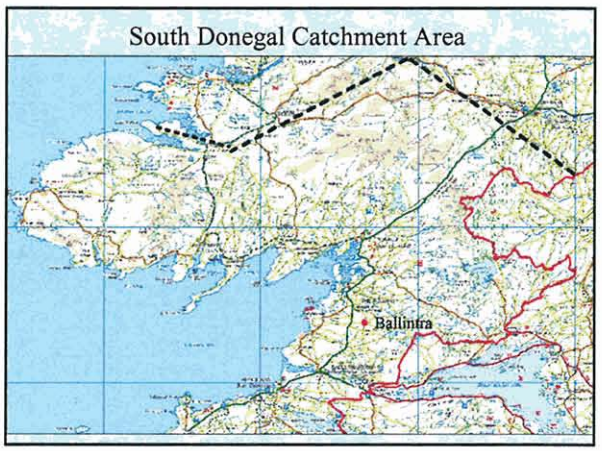
Introduction to Constraints on Landfill Site Selection

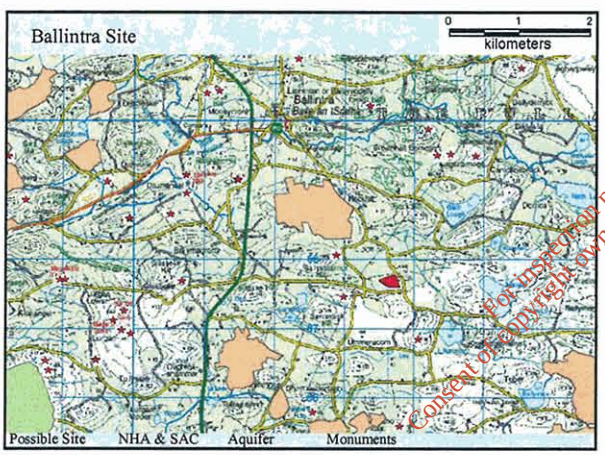
- Using the GIS techniques the following slides show how the various stages of the GIS based selection process contributes to the decision making process itself.
- Buffer zones around particular features are applied where it is both desirable and not so desirable to site landfills.
- The next slide shows how the application of the buffer zone technique indicate the desired locations for landfill site development within County Donegal.

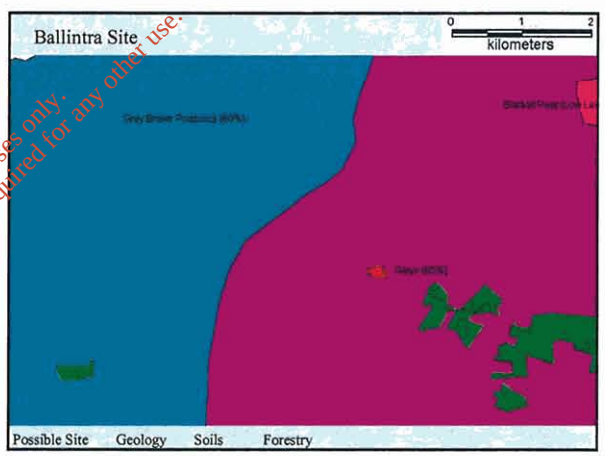


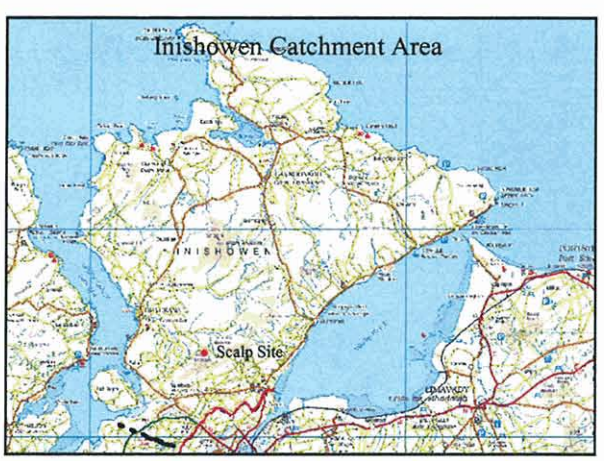
When we take a more detailed look at the constraints set out in the previous slides, and include other factors such as housing, population dispersion, access, and ground availability, the following areas are emerging as possibly suitable for the new generation of landfills in County Donegal

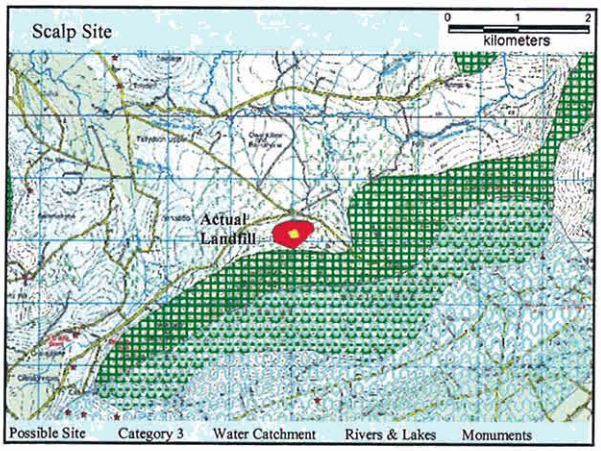


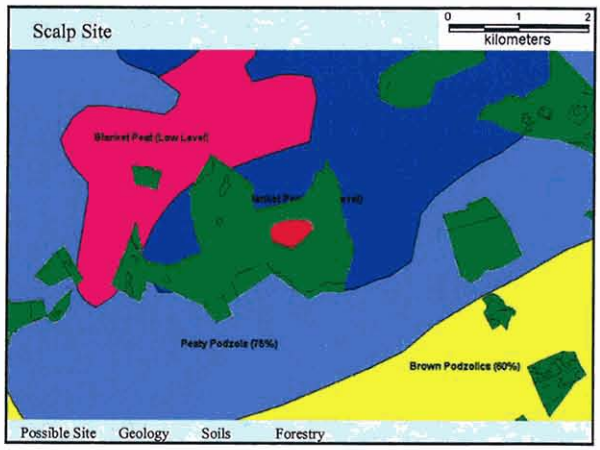


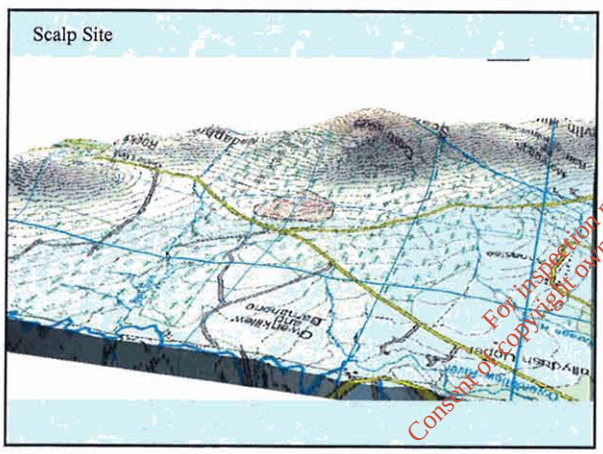


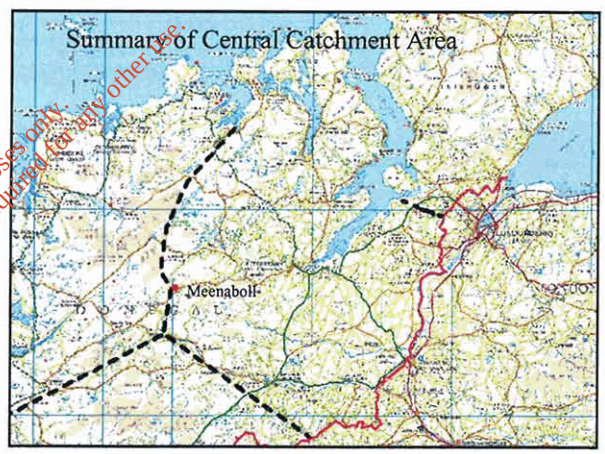


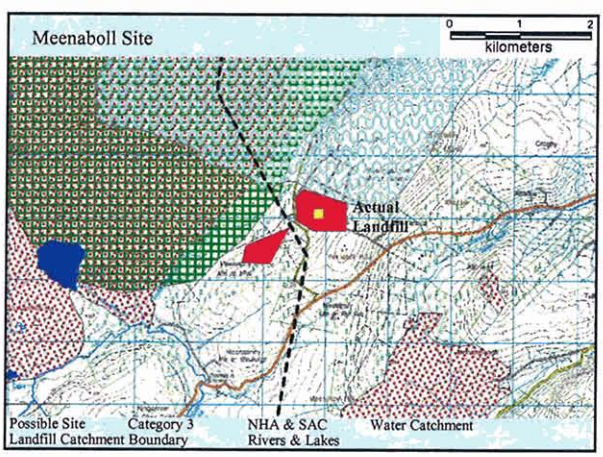


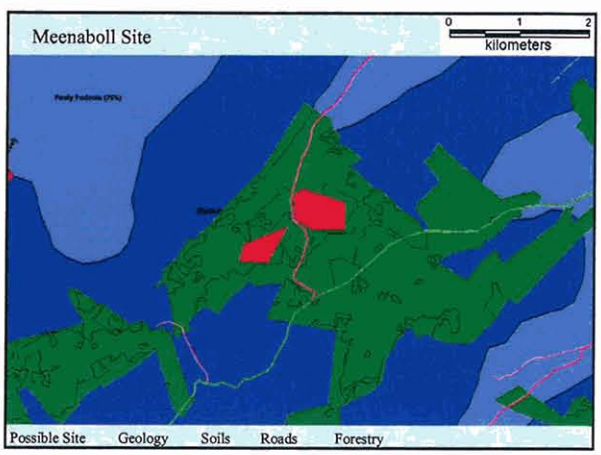












Meenaboll Site

Summary

- Carry out planning and design work for:
- Ballinacarrick
- Meenabol
- Carry out preliminary planning for:
- Scalp site
- Continue investigation and seek alternatives for West Donegal.
- Maintain contact with North West Regional Cross Border Group

D.0 MONITORING

PROPOSED MONITORING PROGRAMME

Parameter	Frequency	Determinand
Surface water	Weekly Quarterly Annually	Visual NH_4-N, BOD, COD, Cl, DO, EC, pH, TSS, Temp Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, K, SO_4, Na, Alk, Tot.Phos, TON, Zn
Groundwater	Monthly Quarterly Annually	Groundwater level, NH_4-N , EC, pH, Temp, K Visual, Cl, DO, Na, TON, TOC, Phenols B, Cd, Ca, Cr, Cu, Cn, F, Fe, Pb, Mg, Mn, Hg, SO_4 Alk, Tot.Phos, Residue on evaporation, Zn, FC, TC. List I & II substances
Landfill gas Piezometers	Monthly	CH_4, CO_2, O_2, AP
Leachate levels	Weekly	
Leachate Composition	Monthly Quarterly Annually	Level Visual, NH_4-N , BOD, COD, Cl, EC, pH, Temp, Fe, K Na, TON B, Cd, Ca, Cr, Cu, Cn, F, , Pb, Mg, Mn, Hg, SO_4 Alk, Tot.Phos, Zn, FC, TC. List I & II substances
Meteorological Data	Daily	Precipitation, Temp, Wind, Evaporation, Humidity, Atmospheric Pressure
Other parameters	Annually	Settlement

E.0 GEOLOGY

APPENDIX E.1

TRIAL PIT LOGS

TRIAL PIT No.: 1	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.2	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.7	Loose, pale greyish brown, gravelly, very silty, fine to coarse SAND containing cobbles [GLACIAL]
2.1	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
4.5	END OF TRIAL PIT

Comments:

- Slight flow of groundwater struck at 1.7m running conditions developing in sand layer
- Material excavation below water table affected by liquifaction
- Localised sidewall collapse below 1.7m when excavation 2.1m deep

TRIAL PIT No.: 2	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT containing decaying tree trunks and roots [RECENT]
1.5	Flaggy angular COBBLES and BOULDERS in a matrix of fine to coarse gravel [FIELD DRAIN?]
1.8	Loose, pale greyish brown, gravelly, very silty, fine to coarse SAND containing cobbles [GLACIAL]
1.9	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
2.5	Strong, pale grey, fine to coarse macro-crystalline, slightly to moderately weathered, schistose PSAMMITE with close to medium spaced joints [DALRADIAN]
2.7	END OF TRIAL PIT (REFUSAL)

Comments:

- Slight flow of groundwater struck at 1.8m
- Rock excavation by mechanical ripping very difficult producing 100mm to 300mm tabular blocks of material

TRIAL PIT No.: 3	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.7	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
0.9	Strong, pale grey, fine to coarse macro-crystalline, slightly to moderately weathered, schistose PSAMMITE with close to medium spaced joints [DALRADIAN]
1.1	END OF TRIAL PIT (REFUSAL)

Comments:

- Slight flow of groundwater struck at 0.7m
- Rock excavation by mechanical ripping very difficult producing 100mm to 300mm tabular blocks of material

TRIAL PIT No.: 4	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.2	Very strong, pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
0.2	END OF TRIAL PIT (REFUSAL)

Comments:

- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 5	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.2	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
0.3	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
0.35	END OF TRIAL PIT (REFUSAL)

Comments:

- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 6	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT containing decaying tree trunks and roots [RECENT]
0.9	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.2	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
1.2 to 1.7	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
0.35	END OF TRIAL PIT (REFUSAL)

Comments:

- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.
- Pit dry and stable on completion

TRIAL PIT No.: 7	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT containing decaying tree trunks and roots [RECENT]
0.9	Very soft, bluish grey, slightly sandy, organic, silty CLAY with bands of greyish brown, silty peat [RECENT]
3.6	END OF TRIAL PIT (COLLAPSED)

Comments:

- Slight flow of groundwater struck at 0.7m depth
- Pit collapsed below ground surface when 3.6m deep

TRIAL PIT No.: 8	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.7	Flaggy angular COBBLES and BOULDERS in a matrix of silty peat [FIELD DRAIN?]
1.3	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
1.3	END OF TRIAL PIT (REFUSAL)

Comments:

- Slight flow of groundwater struck at 0.7m
- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 9	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.9	Flaggy angular COBBLES and BOULDERS in a matrix of silty peat [FIELD DRAIN?]
1.1	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
2.3	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
2.7	END OF TRIAL PIT (REFUSAL)

Comments:

- Slight flow of groundwater struck at 0.9m
- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 10	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.5	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.1	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
1.7	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
1.9	END OF TRIAL PIT (REFUSAL)

Comments:

- Slight flow of groundwater struck at 0.5m
- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 11	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.4	Flaggy angular COBBLES and BOULDERS [WEATHERED ROCK?]
1.7	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
1.9	END OF TRIAL PIT (REFUSAL)

Comments:

- Pit dry and stable on completion
- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 12	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.3	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.1	Firm to stiff, in patches soft, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
1.7	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
1.9	END OF TRIAL PIT (REFUSAL)

Comments:

- Pit dry and stable on completion
- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 13	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
1.2	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.4	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
2.0	Medium dense, pale brownish grey, gravelly, very silty, fine to medium SAND containing cobbles [GLACIAL]
2.4	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
2.45	END OF TRIAL PIT (REFUSAL)

Comments:

- Seepage to slight flow of groundwater struck at 1.2m depth
- Rock excavation by mechanical ripping not effective. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 14	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT containing decaying tree trunks and roots [RECENT]
0.7	Flaggy angular COBBLES and BOULDERS in a matrix of silty peat [FIELD DRAIN?]
1.7	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
2.6	Flaggy angular COBBLES and BOULDERS [WEATHERED ROCK?]
2.8	Very strong, Pale greyish brown to grey, fine to coarse grained, slightly weathered GRITSTONE with medium to widely spaced joints [CARBONIFEROUS BASAL CLASTICS]
2.8	END OF TRIAL PIT (REFUSAL)

Comments:

- Seepage to slight flow of groundwater struck at 1.5m depth
- Rock excavation by mechanical ripping not effective below 2.8m. Hydraulic breaking or blasting likely to be required.

TRIAL PIT No.: 15	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.7	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.6	Loose, pale greyish brown, gravelly, very silty, fine to coarse SAND containing cobbles [GLACIAL]
2.4	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
4.1	END OF TRIAL PIT

Comments:

- Seepage of groundwater struck at 2.4m depth
- Pit sidewalls collapsing between 1.6m and 2.4m depth when excavation 3.0m deep

TRIAL PIT No.: 16	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.2	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles and boulders [GLACIAL]
1.6	Loose, pale greyish brown, gravelly, very silty, fine to coarse SAND containing cobbles [GLACIAL]
2.5	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
3.5	END OF TRIAL PIT

Comments:

- Pit sidewall collapse between 1.6m and 2.5m depth when excavation 3.0m deep

TRIAL PIT No.: 17	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.2	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles and occasional boulders [GLACIAL]
1.9	Loose, pale greyish brown, gravelly, very silty, fine to coarse SAND containing cobbles [GLACIAL]
2.5	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
4.0	END OF TRIAL PIT

Comments:

- Localised slight flow of groundwater struck at 1.9m
- Material excavation below water table affected by liquifaction
- Pit sidewall collapse between 1.5m and 2.5m depth when excavation 3.5m deep

TRIAL PIT No.: 18	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.5	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles [GLACIAL]
1.3	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
3.5	END OF TRIAL PIT

Comments:

- Seepage of groundwater struck at 1.3m
- Pit sidewall collapse between 1.3m and 2.5m when excavation 3.4m deep

TRIAL PIT No.: 19	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.6	Loose, pale greyish brown, gravelly, very sandy SILT containing cobbles and occasional boulders [GLACIAL]
0.9	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
2.9	Strong, dark grey, fine grained, slightly to moderately weathered shaley LIMESTONE with close to medium spaced joints [CARBONIFEROUS BALLYSHANNON FORMATION]
3.1	END OF TRIAL PIT (REFUSAL)

Comments:

- Seepage to slight flow of groundwater struck at 0.9m depth
- Pit sidewall collapse between 0.6m and 2.0m depth when excavation 2.9m deep
- Rock excavation by mechanical ripping very difficult.

TRIAL PIT No.: 20	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.7	Flaggy angular COBBLES and BOULDERS in a matrix of silty peat [FIELD DRAIN?]
0.9	Firm to stiff, becoming very stiff, grey, gravelly, very sandy, fissured, very clayey SILT containing cobbles and occasional boulders [GLACIAL]
2.5	Strong, dark grey, fine grained, slightly to moderately weathered shaley LIMESTONE with close to medium spaced joints [CARBONIFEROUS BALLYSHANNON FORMATION]
2.7	END OF TRIAL PIT (REFUSAL)
Comments: • Pit dry and stable on completion • Rock excavation by mechanical ripping very difficult.	

TRIAL PIT No.: 21	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.4	Flaggy angular COBBLES and BOULDERS [WEATHERED ROCK]
0.7	Strong, dark grey, fine grained, slightly to moderately weathered shaley LIMESTONE with close to medium spaced joints [CARBONIFEROUS BALLYSHANNON FORMATION]
0.8	END OF TRIAL PIT (REFUSAL)

Comments:

- Pit dry and stable on completion
- Rock excavation by mechanical ripping very difficult.

TRIAL PIT No.: 22	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.3	Flaggy angular COBBLES and BOULDERS [WEATHERED ROCK]
1.0	Strong, dark grey, fine grained, slightly to moderately weathered shaley LIMESTONE with close to medium spaced joints [CARBONIFEROUS BALLYSHANNON FORMATION]
1.1	END OF TRIAL PIT (REFUSAL)

Comments:

- Pit dry and stable on completion
- Rock excavation by mechanical ripping very difficult.

TRIAL PIT No.: 23	
Depth (m)	**Stratum Description**
0.0	Very soft, dark brown to black, amorphous, silty PEAT [RECENT]
0.7	Flaggy angular COBBLES and BOULDERS [WEATHERED ROCK?]
1.4	Strong, dark grey, fine grained, slightly to moderately weathered shaley LIMESTONE with close to medium spaced joints [CARBONIFEROUS BALLYSHANNON FORMATION]
1.8	END OF TRIAL PIT (REFUSAL)

Comments:

- Slight flow of groundwater struck at 1.0m depth
- Pit stable on completion.
- Rock excavation by mechanical ripping difficult.

APPENDIX E.2

BOREHOLE LOGS AND

ASSOCIATED TEST RESULTS

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, CO. DONEGAL			Borehole Number: GW1
Method: Shell & Auger	Dates: 27/10/99 - 27/10/99	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
Hole Diameters	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	Sample	Test	Water Level *	Daily Progress
Soft brown subamorphous and fibrous PEAT	(1.20) 1.20						Water struck at 1.20m.	
Stiff very friable grey gravelly sandy silty CLAY containing occasional cobbles and boulders	(2.80) 4.00							
[illegible]ng grey PSAMMATIC SCHIST (LOUGH DERG GROUP)	(11.00) 15.00							27/10/99
END OF BOREHOLE 15.0m.								

Remarks

Installed 50mm standpipe to 15.0m.
Slotted from 15.0m to 6.0m with gravel pack.
Gravel from 6.0 to 5.0m.
Bentonite seal from 5.0 to 0.0m.
Upright lockable cover fitted.

SAMPLE / TEST KEY

J	Disturbed Sample
B	Bulk Sample
U	Undisturbed Core Sample
P	Piston Sample
V	Field Vane Test
W	Water Sample
SPT	Standard Penetration Test
CPT	Cone Penetration Test
( )	Penetration < 300mm

Scale: 1:100 | Logged By: DC

Figure No.: 3509.GW1

Borehole Number: GW1

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, CO. DONEGAL			Borehole Number: GW2
Boring Method: Shell & Auger	Dates: 27/10/99 - 27/10/99	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
Hole Diameters:	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD):

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	Samples / Tests: Sample	Samples / Tests: Test	Water Level	Daily Progress
Soft brown subamorphous and fibrous PEAT	(0.30) 0.30							
Strong grey slightly weathered PSAMMITIC SCHIST	(14.70)							
	15.00							27/10/99
END OF BOREHOLE 15.0m.								

Remarks

Installed 50mm standpipe to 15.0m.
Slotted from 15.0m to 6.0m with gravel pack.
Gravel from 6.0 to 3.0m.
Bentonite seal from 3.0 to 0.0m.
Upright lockable cover fitted.

SAMPLE / TEST KEY

J	Disturbed Sample
B	Bulk Sample
U	Undisturbed Core Sample
P	Piston Sample
V	Field Vane Test
W	Water Sample
SPT	Standard Penetration Test
CPT	Cone Penetration Test
( )	Penetration < 300mm

Scale: 1:100 | Logged By: DC

Figure No.: 3509.GW2

Borehole Number: GW2

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, CO. DONEGAL			Borehole Number: GW3
Boring Method: ell & Auger	Dates: 28/10/99 - 28/10/99	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
Hole Diameters	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	Sample	Test	Water Level	Daily Progress
Soft brown subamorphous and fibrous PEAT	(1.50) 1.50							
Firm to stiff grey very friable fine sandy gravelly silty CLAY containing occasional cobbles and boulders	(1.00) 2.50						Water struck at 2.50m.	
Moderately weak grey badly broken and fractured PSAMMITIC SCHIST	(1.30) 3.80							
Strong grey slightly weathered PSAMMITIC SCHIST	(11.20) 15.00							28/10/99
END OF BOREHOLE 15.0m.								

Remarks
Slotted from 15.0 to 2.5m with gravel pack.
Bentonite seal from 2.5 to 0.0m.
Upright lockable cover fitted.

SAMPLE / TEST KEY
- J Disturbed Sample
- B Bulk Sample
- U Undisturbed Core Sample
- P Piston Sample
- V Field Vane Test
- W Water Sample
- SPT Standard Penetration Test
- CPT Cone Penetration Test
- ( ) Penetration < 300mm

Scale	Logged By
1:100	DC

Figure No. 3509.GW3

Borehole Number: GW3

Glover Site Investigations Ltd

Site	BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL
Borehole Number	BH1
Machine	: ATLAS COPCO
Flush	: WATER
Bit Size	: 86.00mm
Method	: ROTARY CORING
Dates	24/07/02 - 25/07/02
Client	DONEGAL COUNTY COUNCIL
Sheet	1/1
Location	AS PLAN
Engineer	KIRK McCLURE MORTON
Ground Level (mOD)	92.60

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
Peaty TOPSOIL	(0.30) 0.30		92.30	0.40						
Very strong to strong pale grey fine to coarse grained slightly weathered GRITSTONE. Close to medium spaced rough undulating open fractures. Occasionally stained dark brown	(0.85) 1.15		91.45	1.15	95	95	72			
					95	95	21			
Moderately strong light grey fine to medium grained PSAMMITE very closely spaced rough undulating open occasionally stained dark brown to 2.50m depth otherwise clean fractures				2.65	100	100	31	20		
				4.15	100	100	22			
	(8.90)			5.70	100	100	34			
				7.15	100	100	41	72		
				8.55	100	100	71			
END OF BOREHOLE 10.50m	10.05		82.55	10.05						

Remarks

Packer test at 5.00m
Casing installed to 1.15m
Standpipe installed to 10.05m.

Scale	Logged By
1:100	TR

Figure No. 4659.BH1

Borehole Number BH1

Glover Site Investigations Ltd

Site	Borehole Number
BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL	BH1

Installation Type	Dimensions	Client	Job Number
St[illegible] ipe	Internal Diameter of Tube (A) = 19 mm Diameter of Filter Zone = 86 mm	DONEGAL COUNTY COUNCIL	4659

Location	Ground Level (mOD)	Engineer	Sheet
AS PLAN	92.6	KIRK McCLURE MORTON	1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
		92.30	0.30	Concrete
				Bentonite Seal
		83.60	9.00	
		83.30	9.30	Sand Filter
		83.00	9.60	Piezometer Tip
		82.55	10.05	Sand Filter

Remarks

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Start of Shift Depth Hole (m)	Start of Shift Casing Depth (m)	Start of Shift Water Depth (m)	Start of Shift Water Level (mOD)	End of Shift Time	End of Shift Depth Hole (m)	End of Shift Casing Depth (m)	End of Shift Water Depth (m)	End of Shift Water Level (mOD)

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH2
Machine : ATLAS COPCO Flush : WATER Bit Size : 86.00mm Method : ROTARY CORING	Dates: 26/07/02 - 29/07/02	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD): 88.60

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
Peaty TOPSOIL	0.10		88.50							
BOULDERS	(1.10)									
	1.20		87.40	1.20						
Strong light grey fine to medium grained PSAMMITE very closely spaced rough undulating tight to open clean fractures					95	95	33	12		
				2.30	100	100	80	8		
				3.80	100	100	70	13		
	(8.80)			5.30	100	100	79	8		
				6.80	100	100	96			
				7.80						
				8.30	100	100	51	9		
				8.90	100	100	73			
END OF BOREHOLE 10.00m	10.00		78.60	10.00						

Remarks

Packer test at 5.00m
Casing installed to 1.20m
Artesian water rising to 0.40m above ground level
Standpipe installed to 10.00m.

Scale: 1:100 | Logged: TR

Figure No.: 4659.BH2

Borehole Number: BH2

Glover Site Investigations Ltd

Site	Borehole Number
BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL	BH2

Installation Type	Dimensions	Client	Job Number
St. pipe	Internal Diameter of Tube [A] = 19 mm Diameter of Filter Zone = 86 mm	DONEGAL COUNTY COUNCIL	4659

Location	Ground Level (mOD)	Engineer	Sheet
AS PLAN	88.6	KIRK McCLURE MORTON	1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
		88.30	0.30	Concrete
				Bentonite Seal
		79.60	9.00	
		79.30	9.30	Sand Filter
		79.00	9.60	Piezometer Tip
		78.60	10.00	Sand Filter

Rem s

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)
					5 min	10 min	15 min	20 min	

Groundwater Observations During Drilling

Date	Start of Shift					End of Shift				
	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A]			Remarks
	Time	Depth (m)	Level (mOD)	

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH3
Machine : ATLAS COPCO Flush : WATER Bit Size : 86.00mm Method : ROTARY CORING	Dates: 31/07/02 - 01/08/02	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD): 87.00

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
TOPSOIL	(0.30) 0.30		86.70							
Firm brown slightly gravelly sandy CLAY	(0.50) 0.80		86.20	0.80						
Moderately strong dark grey to black laminated containing occasional bands of weak shale up to 5cm thick fine grained LIMESTONE closely spaced smooth stepped to undulating open clean fractures	(9.25)			1.50	95	95	48			
				3.00	100	100	84			
				4.50	100	100	86			
				6.00	100	100	82	7		
				7.50	100	100	92			
				9.00	100	100	96			
				10.05	100	100	69			
END OF BOREHOLE 10.05m	10.05		76.95	10.05						

Remarks

Packer test at 2.00m and 5.00m
Casing installed to 1.15m
Standpipe installed to 10.05m.

Scale	Logge
1:100	TR

Figure No. 4659.BH3

Borehole Number BH3

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH3
Installation Type: Standpipe	Dimensions: Internal Diameter of Tube (A) = 19 mm Diameter of Filter Zone = 86 mm	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Ground Level (mOD): 87.0	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
		86.70	0.30	Concrete
				Bentonite Seal
		78.00	9.00	
				Sand Filter
		77.70	9.30	
				Piezometer Tip
		77.40	9.60	
				Sand Filter
		76.95	10.05	

Remarks

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)
					5 min	10 min	15 min	20 min	

Groundwater Observations During Drilling

Date	Start of Shift					End of Shift				
	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A]			Remarks
	Time	Depth (m)	Level (mOD)	

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH4
Boring Method: Shell & Auger 0.00m - 2.35m Rotary Cored 2.35m - 7.35m	Dates: 01/08/02 - 01/08/02	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
Hole Diameters: 200mm Cased to 2.35m	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD): 86.20

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	Sample	Test	TCR	SCR	RQD	FI	Water Level	Daily Progress
Peaty TOPSOIL	(0.40) 0.40		85.80	0.40-0.80	U							
Plastic dark grey clayey PEAT	(0.40) 0.80		85.40	1.00-1.45	J	CPT N=18						
Medium dense blueish grey gravelly fine to coarse SAND with occasional cobbles	(0.75) 1.55		84.65	0.80 1.45 1.55-2.00	B	CPT N=20						
Compact light grey fine sandy SILT with a trace of gravel	(0.55) 2.10		84.10									
Weak dark grey highly weathered LIMESTONE	2.35		83.85	2.35			100	100	0	30		
Moderately strong dark grey to black thinly laminated fine grained LIMESTONE containing occasional bands of weak shale up to 5cm thick, closely spaced smooth undulating open clean fractures	(5.00)			2.90			100	100	75	8		
				4.35			100	100	58			
				5.40			100	100	93			
				5.85 5.92			100	100	64	8	Non Intact	
END OF BOREHOLE 7.35m	7.35		78.85	7.35								

Remarks

J sample at 0.40m, B sample at 2.00m
2.10m-2.15m SPT (50), 2.30m-2.32m SPT (50)
Packer test at 4.00m
Variable head permeability test at 1.00m and 2.00m
Standpipe installed to 7.35m.

SAMPLE / TEST KEY

J	Disturbed Sample
B	Bulk Sample
U	Undisturbed Core Sample
P	Piston Sample
V	Field Vane Test
W	Water Sample
SPT	Standard Penetration Test
CPT	Cone Penetration Test
( )	Penetration < 300mm

Scale: 1:100 | Logged: DC

Figure No.: 4659.BH4

Borehole Number: BH4

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH4
Installation Type: Standpipe	Dimensions: Internal Diameter of Tube [A] = 19 mm; Diameter of Filter Zone = 86 mm	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Ground Level (mOD): 86.2	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
		85.90	0.30	Concrete
				Bentonite Seal
		79.85	6.35	Sand Filter
		79.45	6.75	Piezometer Tip
		79.15	7.05	Sand Filter
		78.85	7.35	

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Start of Shift Depth Hole (m)	Start of Shift Casing Depth (m)	Start of Shift Water Depth (m)	Start of Shift Water Level (mOD)	End of Shift Time	End of Shift Depth Hole (m)	End of Shift Casing Depth (m)	End of Shift Water Depth (m)	End of Shift Water Level (mOD)

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks

Remarks

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH5
Boring Method: Shell & Auger 0.00m - 10.00m; Rotary Cored 10.00m - 15.00m	Dates: 25/07/02 - 26/07/02	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
Hole Diameters: 200mm Cased to 15.00m	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD): 96.60

Description	Depth m (Thickness)	Level (mOD)	Samples / Tests: Depth (m)	Sample	Test	Water Level *	Daily Progress
Spongy dark brown pseudofibrous PEAT	(0.35) 0.35	96.25	0.50-0.95		SPT N=7		
Soft light brown and grey gravelly sandy CLAY with occasional cobbles	(0.75) 1.10	95.50	0.35	J			
Uncompact (wet) grey blue gravelly fine sandy SILT	(0.65) 1.75	94.85	0.50	J			
Firm to stiff orange brown with light grey mottlings very sandy CLAY with occasional cobbles	(1.75) 3.50	93.10	1.10	B			
Medium dense light orange brown gravelly SAND	(0.50) 4.00	92.60	1.50-1.95		SPT N=17		
Stiff grey with orange brown mottlings sandy CLAY with a little gravel	(0.40) 4.40	92.20	1.50	B			
Medium dense brown fine to medium SAND	(0.80) 5.20	91.40	1.80	J			
Compact grey gravelly sandy SILT with occasional cobbles	(2.00) 7.20	89.40	2.50-2.95		SPT N=19		
Medium dense grey slightly gravelly silty fine to medium SAND	(1.50) 8.70	87.90	2.50	J			
Compact grey gravelly sandy SILT with occasional thin seams of grey fine sand	(1.30) 10.00	86.60	3.50-3.95		SPT N=20		
Moderately strong dark grey with occasional black bands laminated fine grained LIMESTONE containing occasional weak shaley bands closely spaced rough undulating open clean fractures	(5.00) 15.00	81.60	3.50	B			
END OF BOREHOLE 15.00m			4.00	J			
			4.50-4.95		SPT N=18		
			4.50	J			
			5.20	J			
			6.00-6.45		SPT N=21		
			6.00	B			
			7.20	J			
			7.50-7.95		SPT N=12		
			7.50	B			
			9.00-9.45		SPT N=24		
			9.00	B			

Core: Depth (m)	TCR	SCR	RQD	FI
10.00				
	100	100	59	
11.50				
	100	100	100	
12.00				
	100	100	78	12
13.50				
	100	100	76	
15.00				

Remarks

Installed 50mm standpipe to 5.50m and 19mm standpipe to 15.00m
Packer test at 11.50m and 14.00m
Variable head permeabilty test at 1.00m, 2.00m, 3.00m and 5.00m
Machine: Atlas Copco, Flush: Water, Bit Size: 86, Method: Rotary Cored

SAMPLE / TEST KEY

J	Disturbed Sample
B	Bulk Sample
U	Undisturbed Core Sample
P	Piston Sample
V	Field Vane Test
W	Water Sample
SPT	Standard Penetration Test
CPT	Cone Penetration Test
( )	Penetration < 300mm

Scale: 1:100 | Logged: DC

Figure No.: 4659.BH5

Borehole Number: BH5

Glover Site Investigations Ltd

Site	Borehole Number
BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL	BH5

Installation Type	Dimensions	Client	Job Number
St .pipe	Internal Diameter of Tube [A] = 19 mm Internal Diameter of Tube [B] = 50 mm Diameter of Filter Zone = 86/200 mm	DONEGAL COUNTY COUNCIL	4659

Location	Ground Level (mOD)	Engineer	Sheet
AS PLAN	96.6	KIRK McCLURE MORTON	1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
		96.10	0.50	Concrete
		95.50	1.10	Bentonite Seal
				Piezometer Tip
		91.10	5.50	
		90.80	5.80	Sand Filter
				Bentonite Seal
		82.60	14.00	
		82.20	14.40	Sand Filter
		81.90	14.70	Piezometer Tip
		81.60	15.00	Sand Filter

Rem[illegible]

50m[illegible] standpipe to 5.50m
19mm standpipe to 15.00m

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Start of Shift Depth Hole (m)	Start of Shift Casing Depth (m)	Start of Shift Water Depth (m)	Start of Shift Water Level (mOD)	End of Shift Time	End of Shift Depth Hole (m)	End of Shift Casing Depth (m)	End of Shift Water Depth (m)	End of Shift Water Level (mOD)

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH6
Boring Method: Shell & Auger	Dates: 29/07/02 - 29/07/02	Client: DONEGAL COUNTY COUNCIL	Sheet: 1/1
Hole Diameters: 200mm Cased to 6.00m	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD): 89.40

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	Sample	Test	Water Level *	Daily Progress
Spongy dark brown pseudofibrous PEAT	(0.40)							
	0.40		89.00	0.50-0.95		SPT N=18		
Uncompact light yellow brown gravelly sandy SILT	(0.60)			0.40	J			
	1.00		88.40	0.55	J			
Uncompact (saturated) light yellow brown gravelly sandy SILT with occasional cobbles				1.00	J			
				1.50-1.95		SPT N=11		
				1.50	B			
	(2.00)							
				2.50-2.95		SPT N=12		
				2.50	B			
	3.00		86.40	3.00	J			
Stiff grey slightly gravelly sandy CLAY								
	(0.75)			3.50-3.95	U			
	3.75		85.65					
Medium dense thinly laminated silty fine to medium SANDS and grey clayey SILTS				3.95	B			
				4.50-4.95		SPT N=14		
	(1.75)			4.50	B			
	5.50		83.90	5.50-5.65		SPT (50)		
Layer of grey angular and rounded BOULDERS	5.70		83.70	5.70-5.72		SPT (50)		
	6.00		83.40	6.00-6.01		SPT (50)		29/07/02
Moderately strong grey fine grained LIMESTONE								
END OF BOREHOLE 6.00m								

Remarks

Variable head permeability tests at 1.00m, 2.00m, 3.00m, 4.00m and 5.00m
Standpipe installed to 6.00m.

SAMPLE / TEST KEY

J	Disturbed Sample
B	Bulk Sample
U	Undisturbed Core Sample
P	Piston Sample
V	Field Vane Test
W	Water Sample
SPT	Standard Penetration Test
CPT	Cone Penetration Test
( )	Penetration < 300mm

Scale	Logged
1:100	DC

Figure No. 4659.BH6

Borehole Number BH6

Glover Site Investigations Ltd

Site: BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL			Borehole Number: BH6
Instrumentation Type: Standpipe	Dimensions: Internal Diameter of Tube [A] = 50 mm; Diameter of Filter Zone = 200 mm	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Ground Level (mOD):	Engineer: KIRK McCLURE MORTON
			Sheet: 1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
		-0.30	0.30	Concrete
				Bentonite Seal
		-1.00	1.00	
				Well Screen
		-5.70	5.70	Sand Filter
		-6.00	6.00	

Rem

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift: Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	End of Shift: Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
29/07/02							6.00			

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A] Time	Depth (m)	Level (mOD)	Remarks

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 1
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)	Depth m
0.00-0.10	1			
0.10-0.20	1			
0.20-0.30	1			
0.30-0.40	1			
0.40-0.50	1			
0.50-0.60	1			
0.60-0.70	1			
0.70-0.80	1			
0.80-0.90	1			
0.90-1.00	1			
1.00-1.10	1			
1.10-1.20	2			
1.20-1.30	6			
1.30-1.40	9			
1.40-1.50	8			
1.50-1.60	10			
1.60-1.70	8			
1.70-1.80	8			
1.80-1.90	8			
1.90-2.00	8			
2.00-2.10	6			
2.10-2.20	8			
2.20-2.30	9			
2.30-2.40	10			
2.40-2.50	12			
2.50-2.60	16			
2.60-2.70	20			
2.70-2.80	22			
2.80-2.90	22			
2.90-3.00	25			
3.00-3.10	730			

Blows for Depth Increment: 0 | 20 | 40 | 60 | >80

4.00

8.00

Remarks

See key sheet for symbols and abbreviations

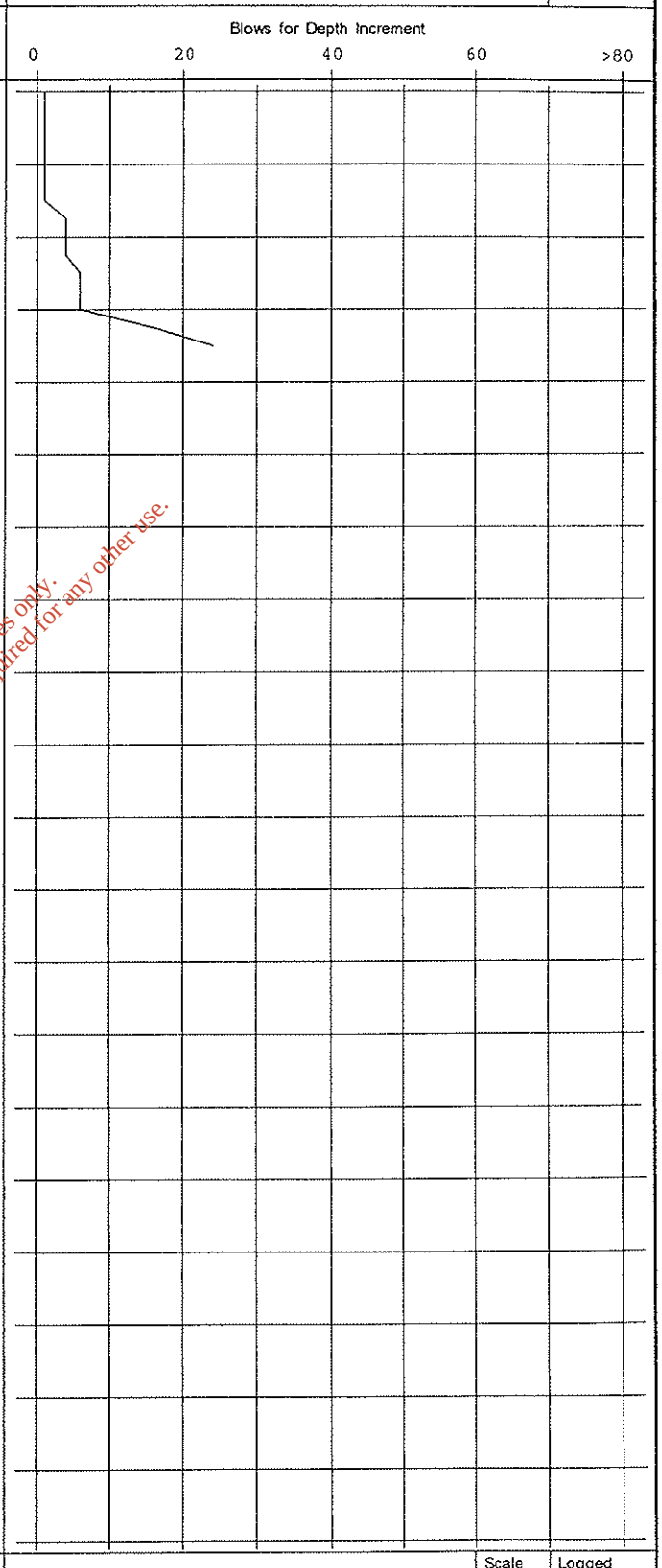
Scale (approx)	Logged By
1:40	TC

Figure No. 4659.1

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 2
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)	Depth m
0.00-0.10	1			
0.10-0.20	1			
0.20-0.30	1			
0.30-0.40	1			
0.40-0.50	1			
0.50-0.60	1			
0.60-0.70	1			
0.70-0.80	4			
0.80-0.90	4			
0.90-1.00	4			
1.00-1.10	6			
1.10-1.20	6			
1.20-1.30	6			
1.30-1.40	16			
1.40-1.50	24			
				4.00
				8.00



Remarks

See key sheet for symbols and abbreviations

Scale (approx): 1:40

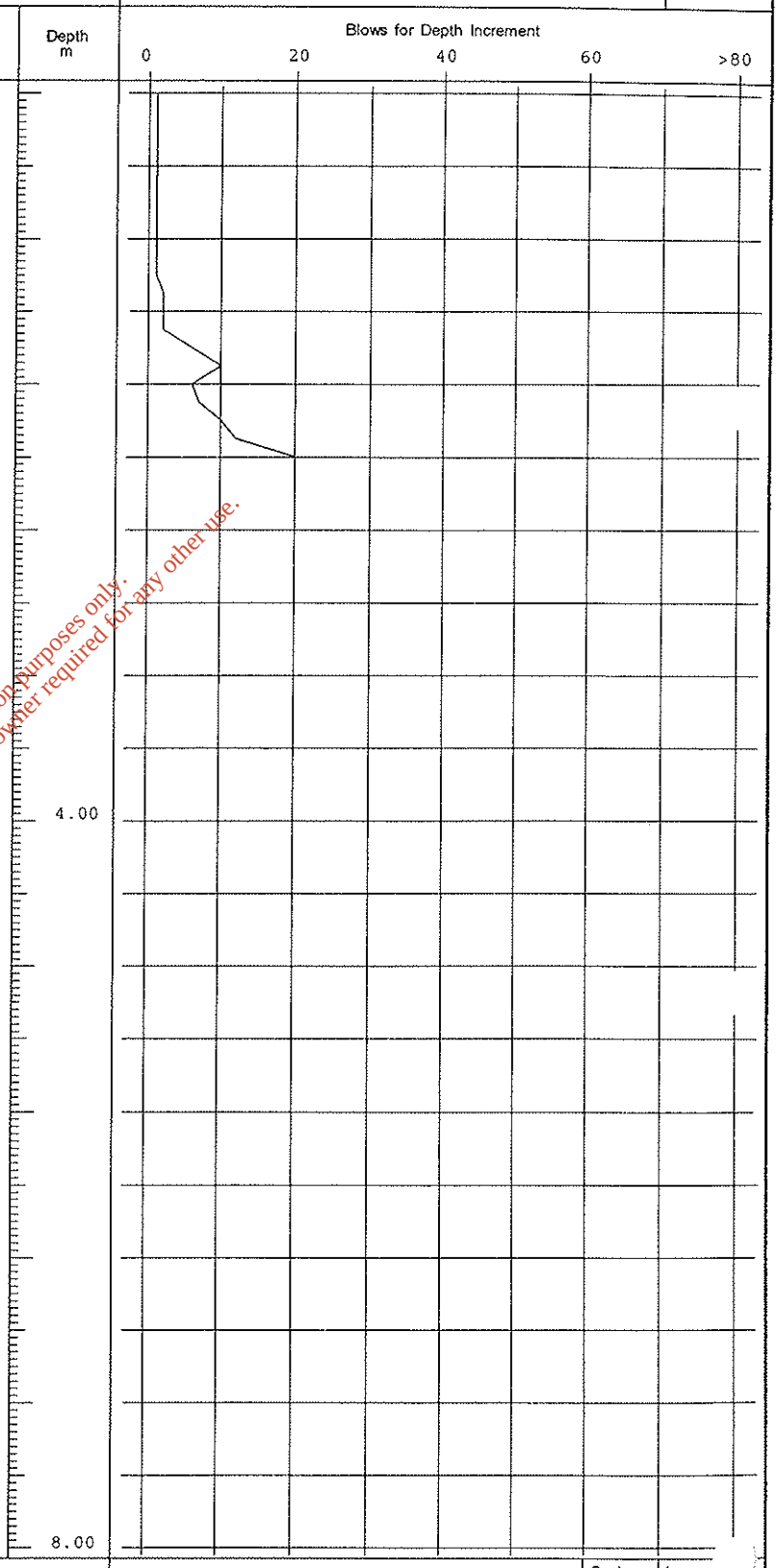
Logged By: TC

Figure No.: 4659.2

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 3
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	2		
1.20-1.30	2		
1.30-1.40	2		
1.40-1.50	6		
1.50-1.60	10		
1.60-1.70	6		
1.70-1.80	7		
1.80-1.90	10		
1.90-2.00	12		
2.00-2.10	20		



Remarks

See key sheet for symbols and abbreviations

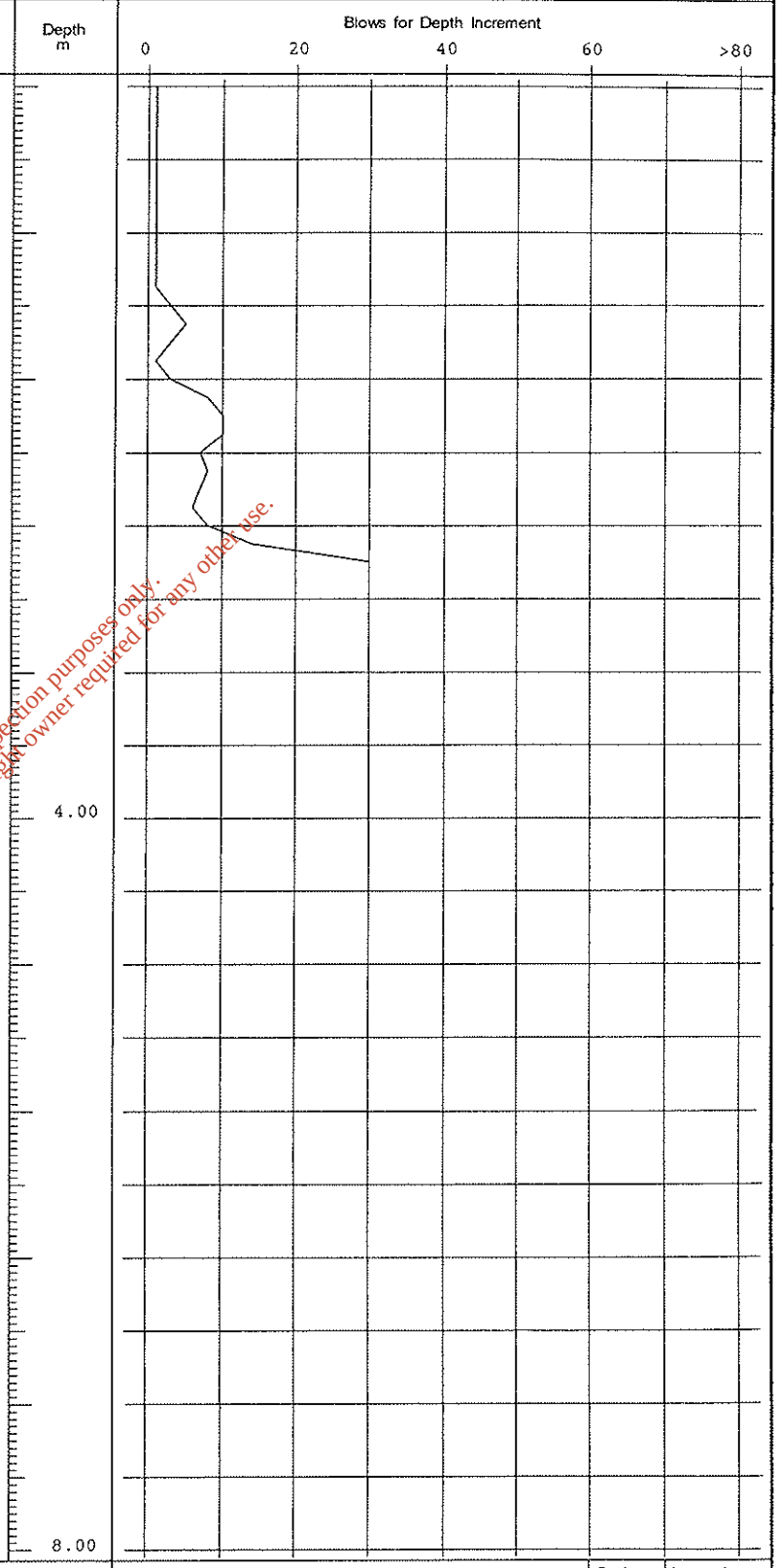
Scale (approx)	Logged By
1:40	TC

Figure No. 4659.3

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 4
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	3		
1.30-1.40	5		
1.40-1.50	3		
1.50-1.60	1		
1.60-1.70	3		
1.70-1.80	8		
1.80-1.90	10		
1.90-2.00	10		
2.00-2.10	7		
2.10-2.20	8		
2.20-2.30	7		
2.30-2.40	6		
2.40-2.50	8		
2.50-2.60	14		
2.60-2.70	30		



Remarks:

See key sheet for symbols and abbreviations

Scale (approx): 1:40

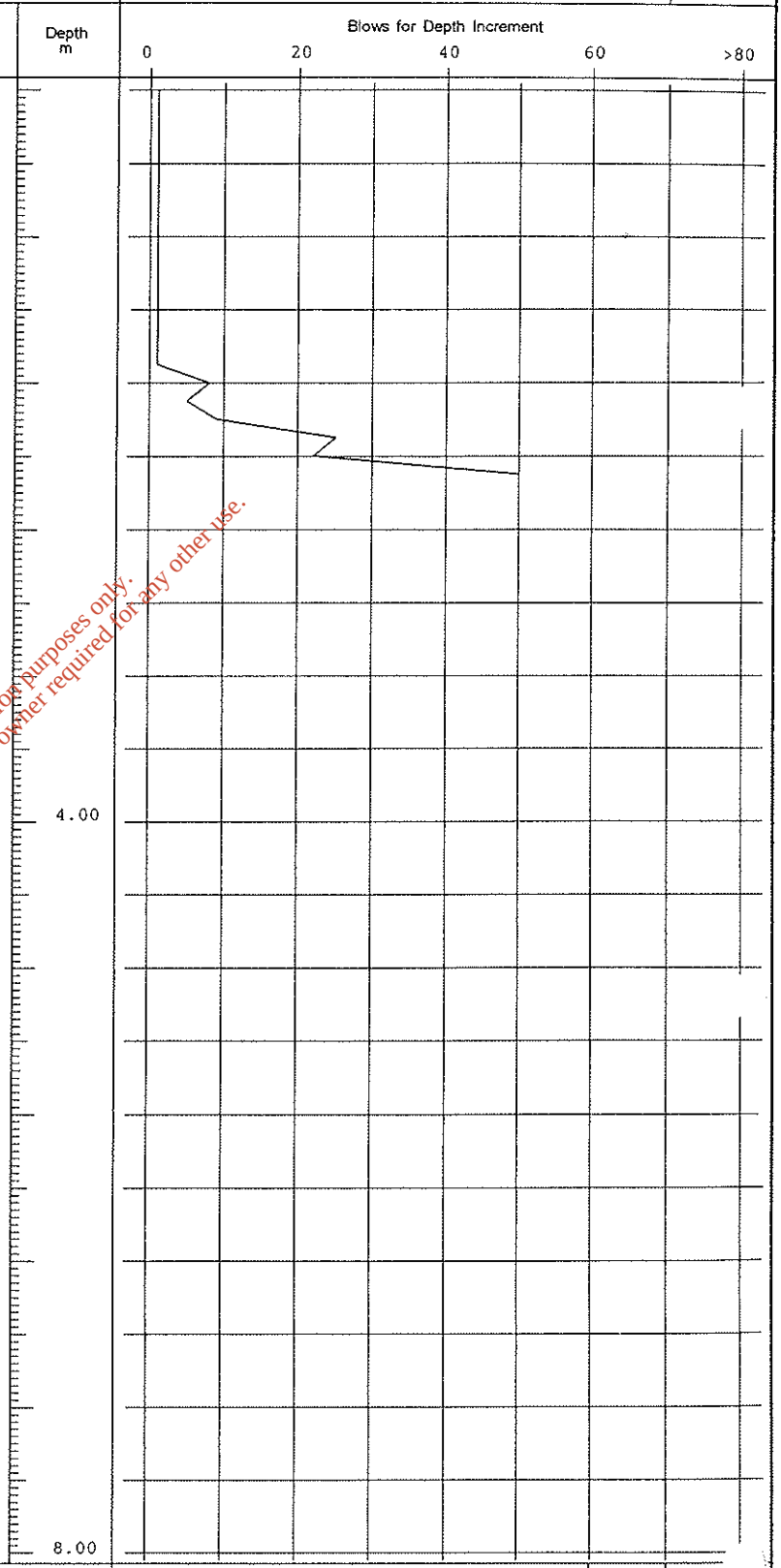
Logged By: TC

Figure No.: 4659.4

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 5
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	1		
1.30-1.40	1		
1.40-1.50	1		
1.50-1.60	1		
1.60-1.70	8		
1.70-1.80	5		
1.80-1.90	9		
1.90-2.00	25		
2.00-2.10	22		
2.10-2.20	>50		



Remarks

See key sheet for symbols and abbreviations

Scale (approx): 1:40

Logged By: TC

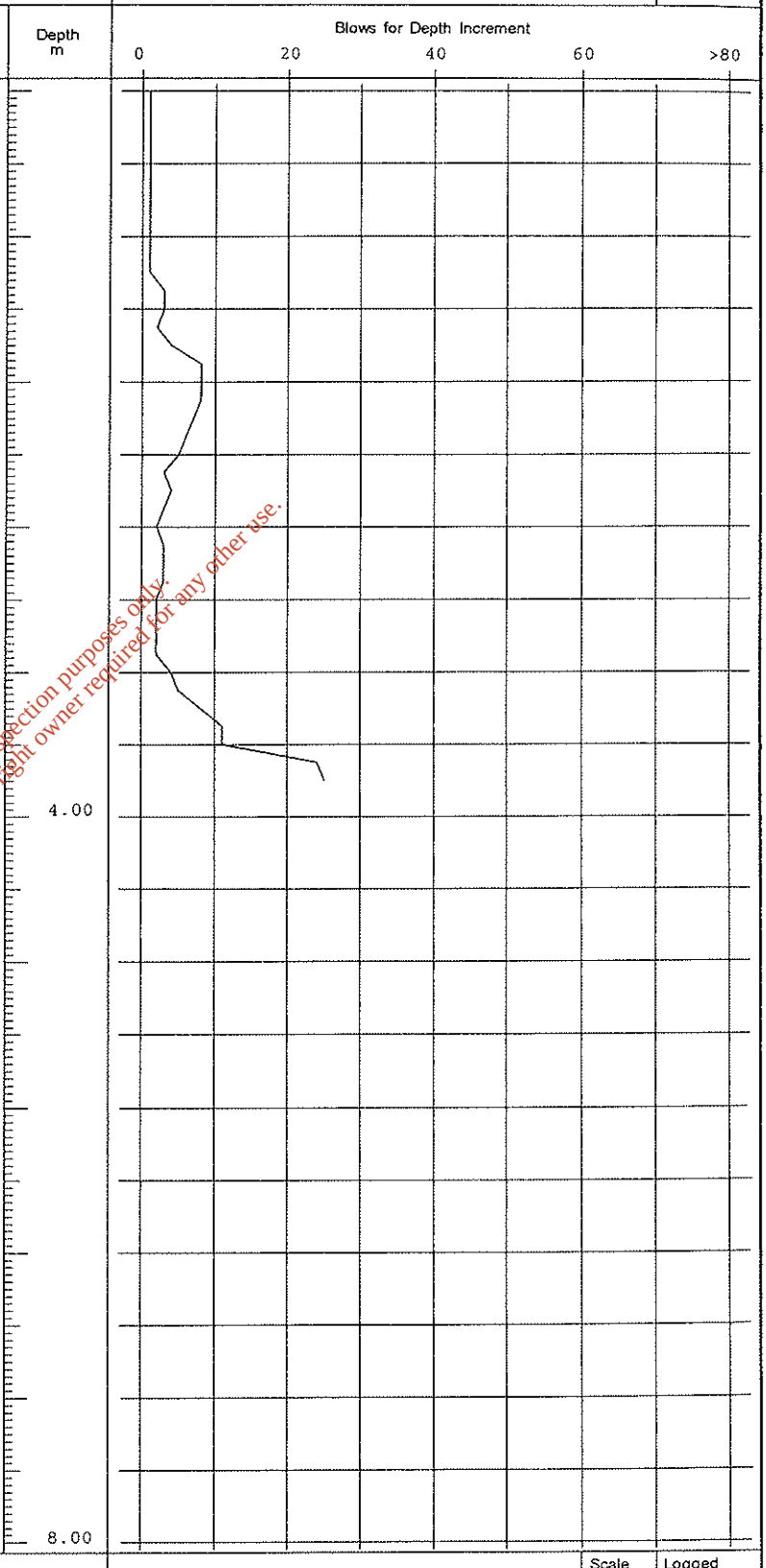
Figure No.: 4659.5

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	6

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	3		
1.20-1.30	3		
1.30-1.40	2		
1.40-1.50	4		
1.50-1.60	8		
1.60-1.70	8		
1.70-1.80	8		
1.80-1.90	7		
1.90-2.00	6		
2.00-2.10	5		
2.10-2.20	3		
2.20-2.30	4		
2.30-2.40	3		
2.40-2.50	2		
2.50-2.60	3		
2.60-2.70	3		
2.70-2.80	3		
2.80-2.90	2		
2.90-3.00	2		
3.00-3.10	2		
3.10-3.20	2		
3.20-3.30	4		
3.30-3.40	5		
3.40-3.50	8		
3.50-3.60	11		
3.60-3.70	11		
3.70-3.80	24		
3.80-3.85	25		



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See key sheet for symbols and abbreviations

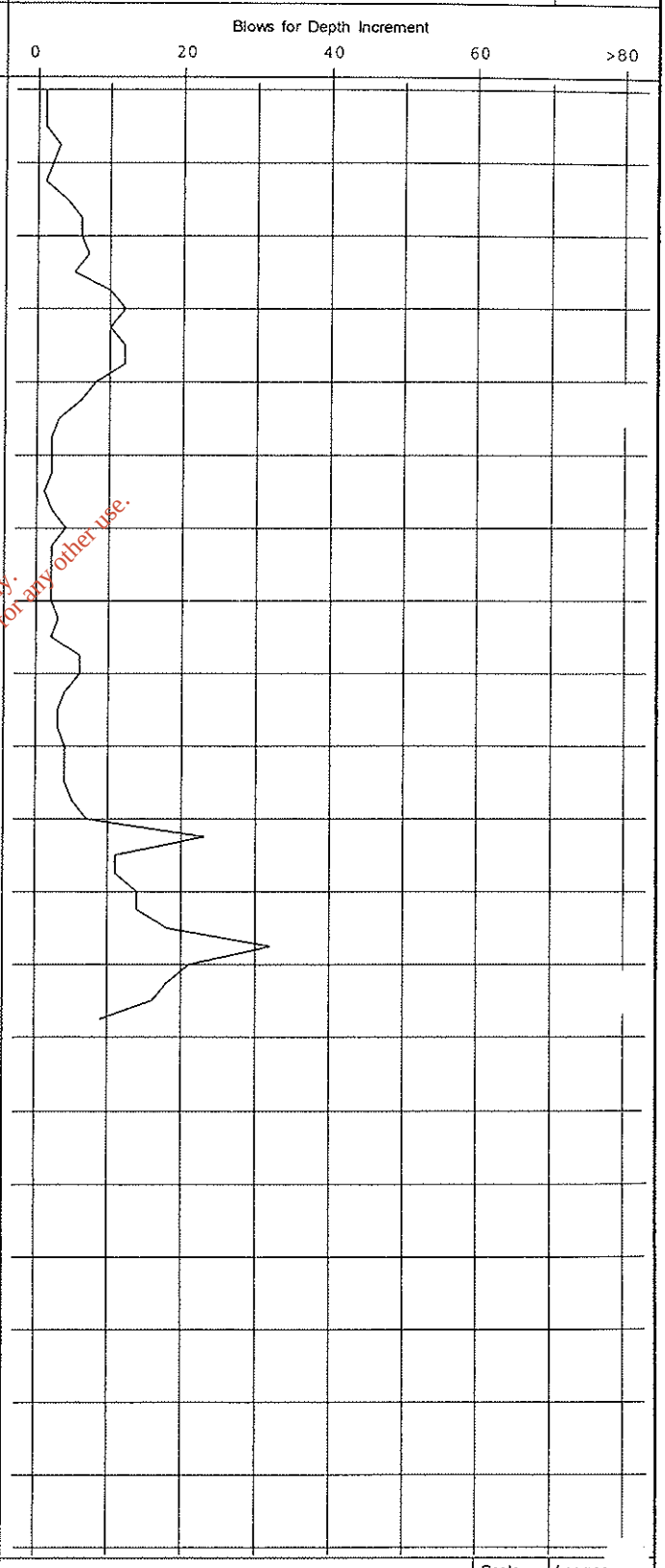
Scale (approx)	Logged By
1:40	TC

Figure No. 4659.6

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 7
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	3		
0.40-0.50	2		
0.50-0.60	1		
0.60-0.70	4		
0.70-0.80	6		
0.80-0.90	6		
0.90-1.00	7		
1.00-1.10	5		
1.10-1.20	10		
1.20-1.30	12		
1.30-1.40	10		
1.40-1.50	12		
1.50-1.60	12		
1.60-1.70	8		
1.70-1.80	6		
1.80-1.90	3		
1.90-2.00	2		
2.00-2.10	2		
2.10-2.20	2		
2.20-2.30	1		
2.30-2.40	2		
2.40-2.50	4		
2.50-2.60	2		
2.60-2.70	2		
2.70-2.80	2		
2.80-2.90	2		
2.90-3.00	3		
3.00-3.10	2		
3.10-3.20	6		
3.20-3.30	6		
3.30-3.40	4		
3.40-3.50	3		
3.50-3.60	3		
3.60-3.70	4		
3.70-3.80	4		
3.80-3.90	4		
3.90-4.00	5		
4.00-4.10	7		
4.10-4.20	23		
4.20-4.30	11		
4.30-4.40	11		
4.40-4.50	14		
4.50-4.60	14		
4.60-4.70	18		
4.70-4.80	32		
4.80-4.90	21		
4.90-5.00	18		
5.00-5.10	16		
5.10-5.20	9		



Remarks

See key sheet for symbols and abbreviations

Scale (approx)	Logged By
1:40	TC

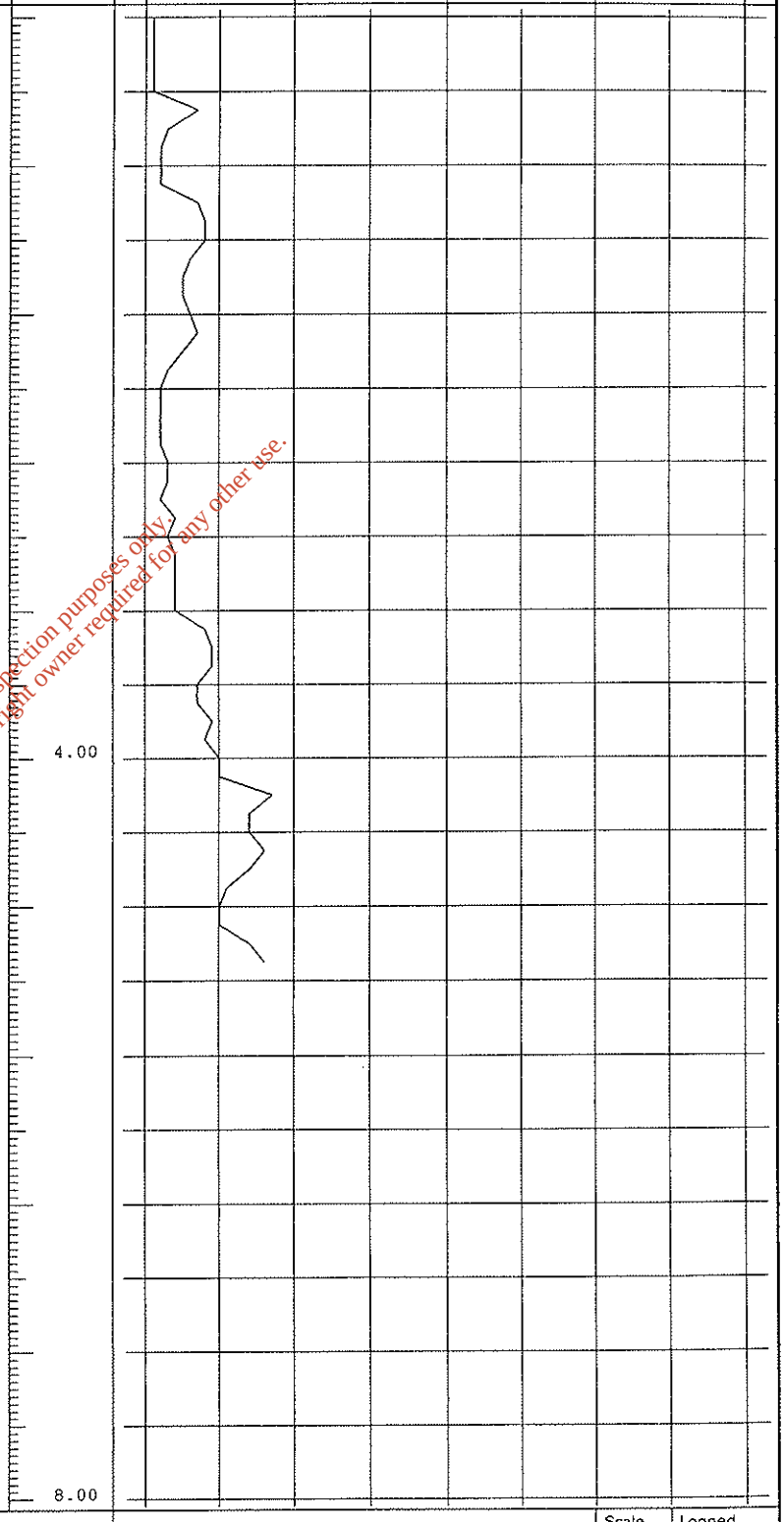
Figure No. 4659.7

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	8

Meth	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	7		
0.60-0.70	3		
0.70-0.80	2		
0.80-0.90	2		
0.90-1.00	2		
1.00-1.10	7		
1.10-1.20	8		
1.20-1.30	8		
1.30-1.40	6		
1.40-1.50	5		
1.50-1.60	5		
1.60-1.70	6		
1.[illegible].80	7		
1.8[illegible].90	5		
1.90-2.00	3		
2.00-2.10	2		
2.10-2.20	2		
2.20-2.30	2		
2.30-2.40	2		
2.40-2.50	3		
2.50-2.60	3		
2.60-2.70	2		
2.70-2.80	4		
2.80-2.90	3		
2.90-3.00	4		
3.00-3.10	4		
3.10-3.20	4		
3.20-3.30	4		
3.30-3.40	8		
3.40-3.50	9		
3.50-3.60	9		
3.60-3.70	7		
3.70-3.80	7		
3.80-3.90	9		
3.90-4.00	8		
4.00-4.10	10		
4.10-4.20	10		
4.20-4.30	17		
4.30-4.40	14		
4.40-4.50	14		
4.50-4.60	16		
4.60-4.70	14		
4.70-4.80	11		
4.80-4.90	10		
4.[illegible].00	10		
5.0[illegible].10	14		
5.10-5.20	16		



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Scale (approx)	Logged By
1:40	TC

Figure No. 4659.8

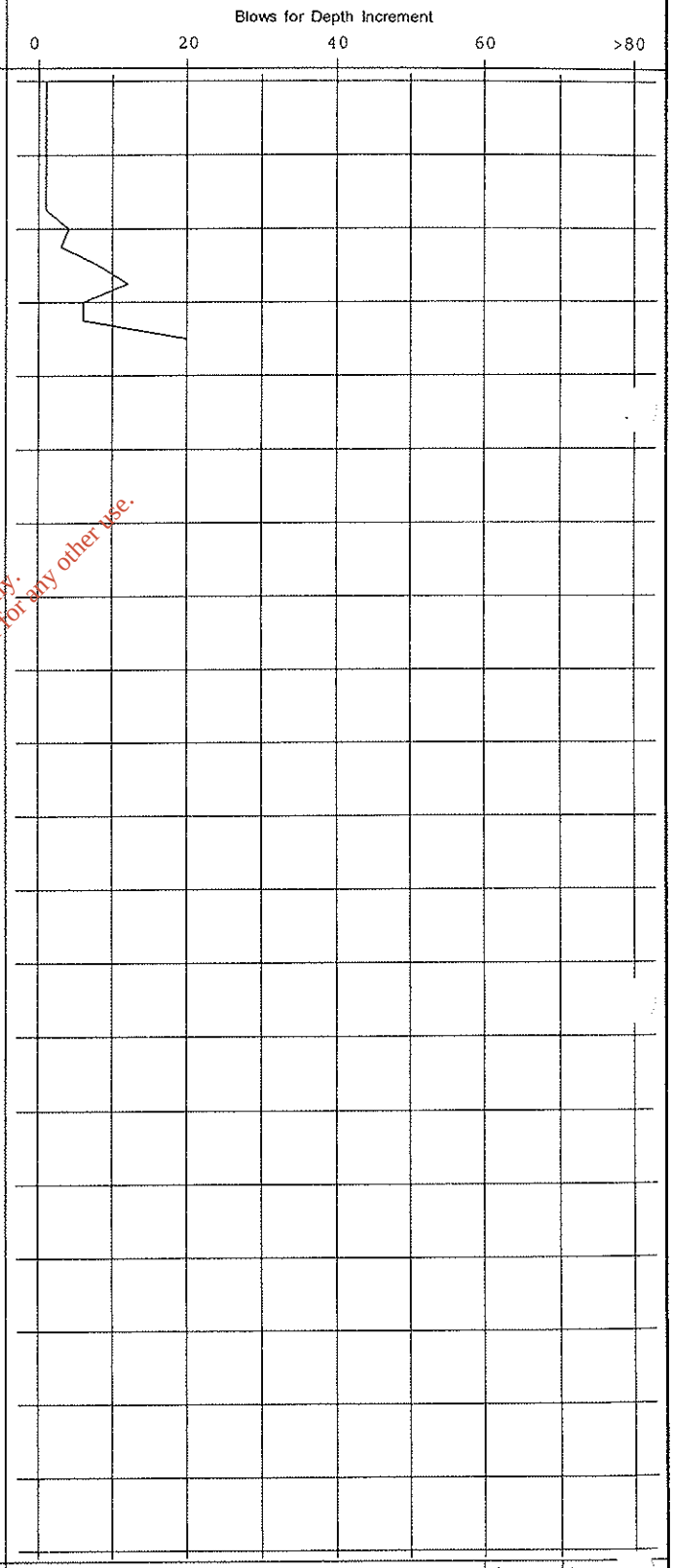
See key sheet for symbols and abbreviations

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	9

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)	Depth m
0.00-0.10	1			
0.10-0.20	1			
0.20-0.30	1			
0.30-0.40	1			
0.40-0.50	1			
0.50-0.60	1			
0.60-0.70	1			
0.70-0.80	1			
0.80-0.90	4			
0.90-1.00	3			
1.00-1.10	8			
1.10-1.20	12			
1.20-1.30	6			
1.30-1.40	6			
1.40-1.50	20			
				4.00
				8.00



Remarks

Scale (approx)	Logge By
1:40	TC

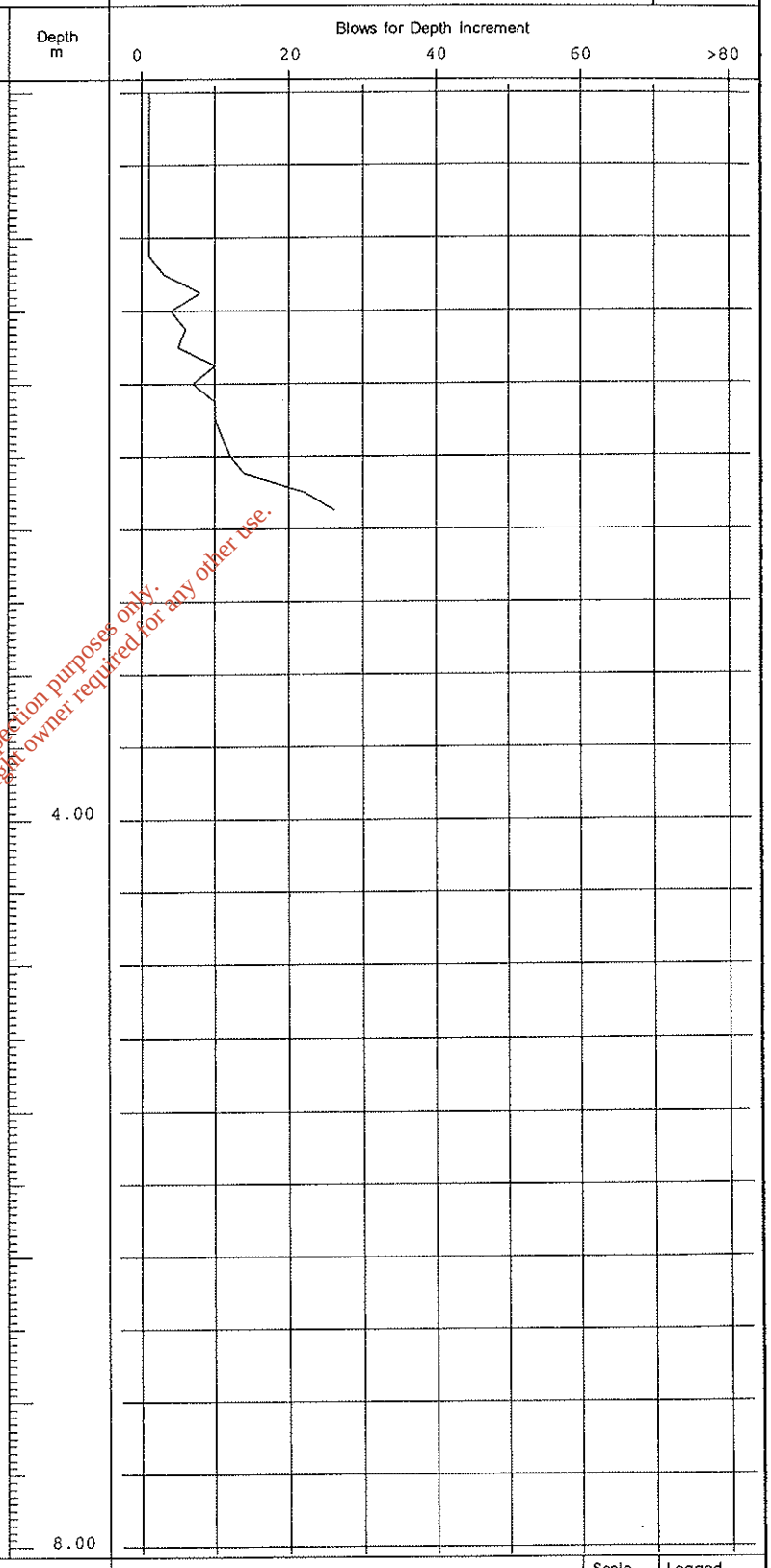
Figure No. 4659.9

See key sheet for symbols and abbreviations

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 10
Meth: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	3		
1.10-1.20	8		
1.20-1.30	4		
1.30-1.40	6		
1.40-1.50	5		
1.50-1.60	10		
1.60-1.70	7		
1.70-1.80	10		
1.80-1.90	10		
1.90-2.00	11		
2.00-2.10	12		
2.10-2.20	14		
2.20-2.30	22		
2.30-2.40	26		



Remarks:

See key sheet for symbols and abbreviations

Scale (approx): 1:40

Logged By: TC

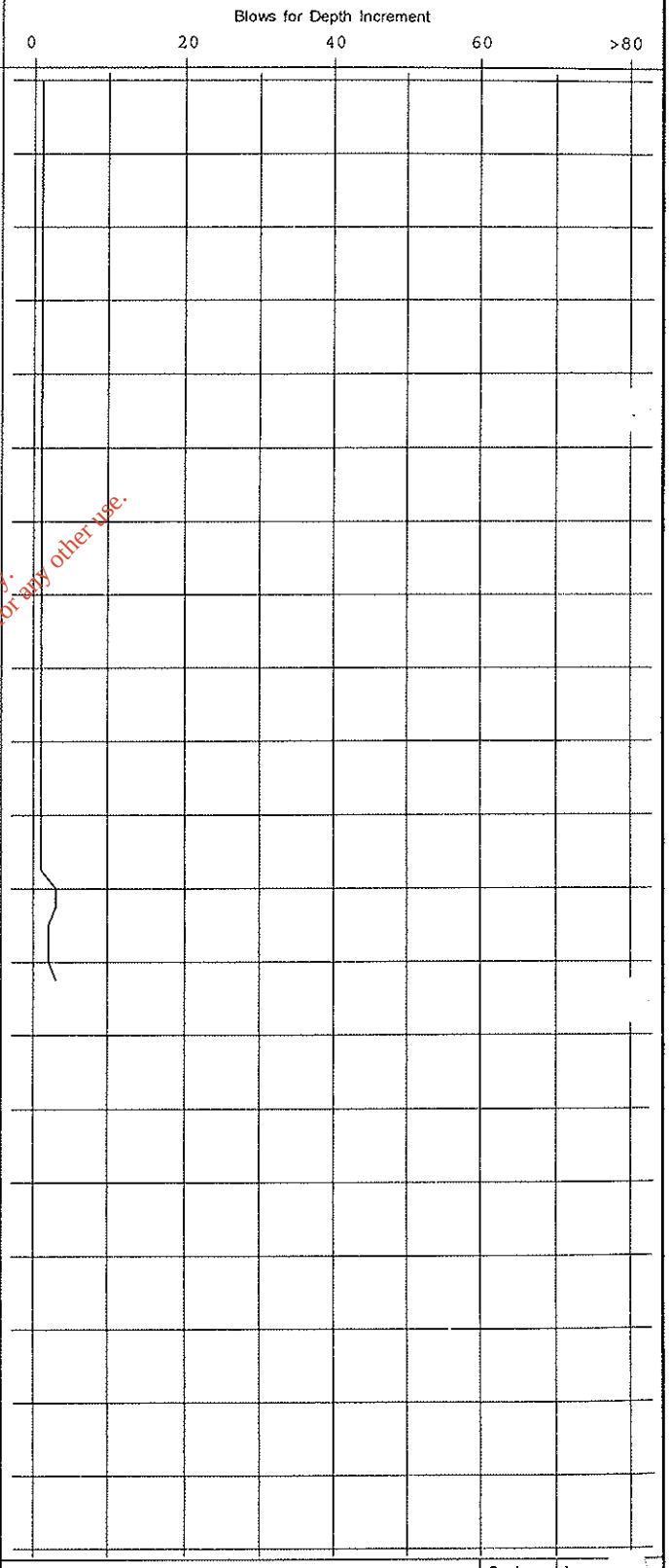
Figure No.: 4659.10

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 11
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	1		
1.30-1.40	1		
1.40-1.50	1		
1.50-1.60	1		
1.60-1.70	1		
1.70-1.80	1		
1.80-1.90	1		
1.90-2.00	1		
2.00-2.10	1		
2.10-2.20	1		
2.20-2.30	1		
2.30-2.40	1		
2.40-2.50	1		
2.50-2.60	1		
2.60-2.70	1		
2.70-2.80	1		
2.80-2.90	1		
2.90-3.00	1		
3.00-3.10	1		
3.10-3.20	1		
3.20-3.30	1		
3.30-3.40	1		
3.40-3.50	1		
3.50-3.60	1		
3.60-3.70	1		
3.70-3.80	1		
3.80-3.90	1		
3.90-4.00	1		
4.00-4.10	1		
4.10-4.20	1		
4.20-4.30	1		
4.30-4.40	1		
4.40-4.50	3		
4.50-4.60	3		
4.60-4.70	2		
4.70-4.80	2		
4.80-4.90	2		
4.90-5.00	3		

Depth m
4.00
8.00



Remarks

See key sheet for symbols and abbreviations

Scale (approx): 1:40

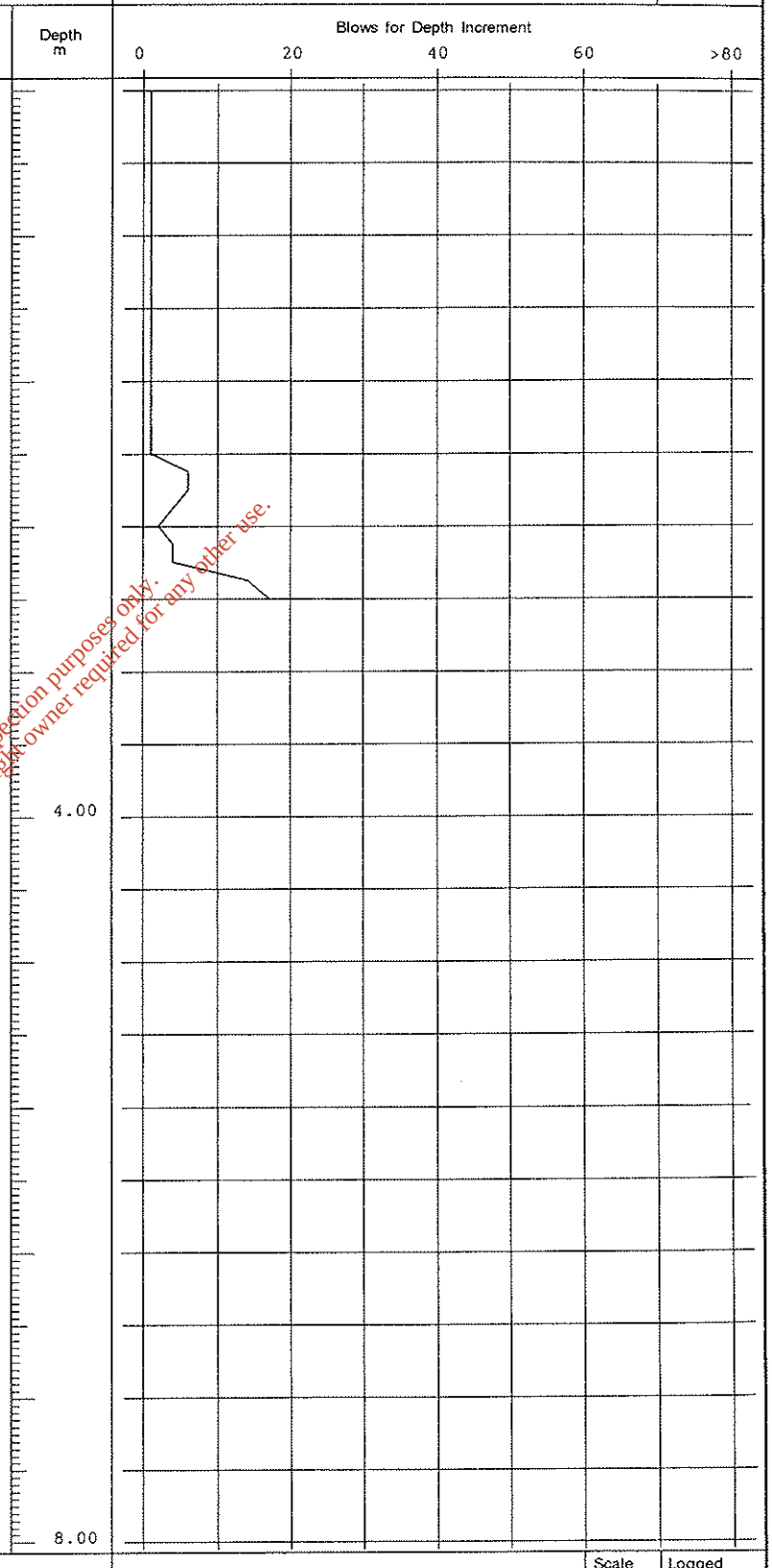
Logged By: TC

Figure No.: 4659.11

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL			Probe Number: 12
Met: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL — Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON — Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	1		
1.30-1.40	1		
1.40-1.50	1		
1.50-1.60	1		
1.60-1.70	1		
1. 1.80	1		
1. 1.90	1		
1.90-2.00	1		
2.00-2.10	1		
2.10-2.20	6		
2.20-2.30	6		
2.30-2.40	4		
2.40-2.50	2		
2.50-2.60	4		
2.60-2.70	4		
2.70-2.80	14		
2.80-2.90	17		



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See key sheet for symbols and abbreviations

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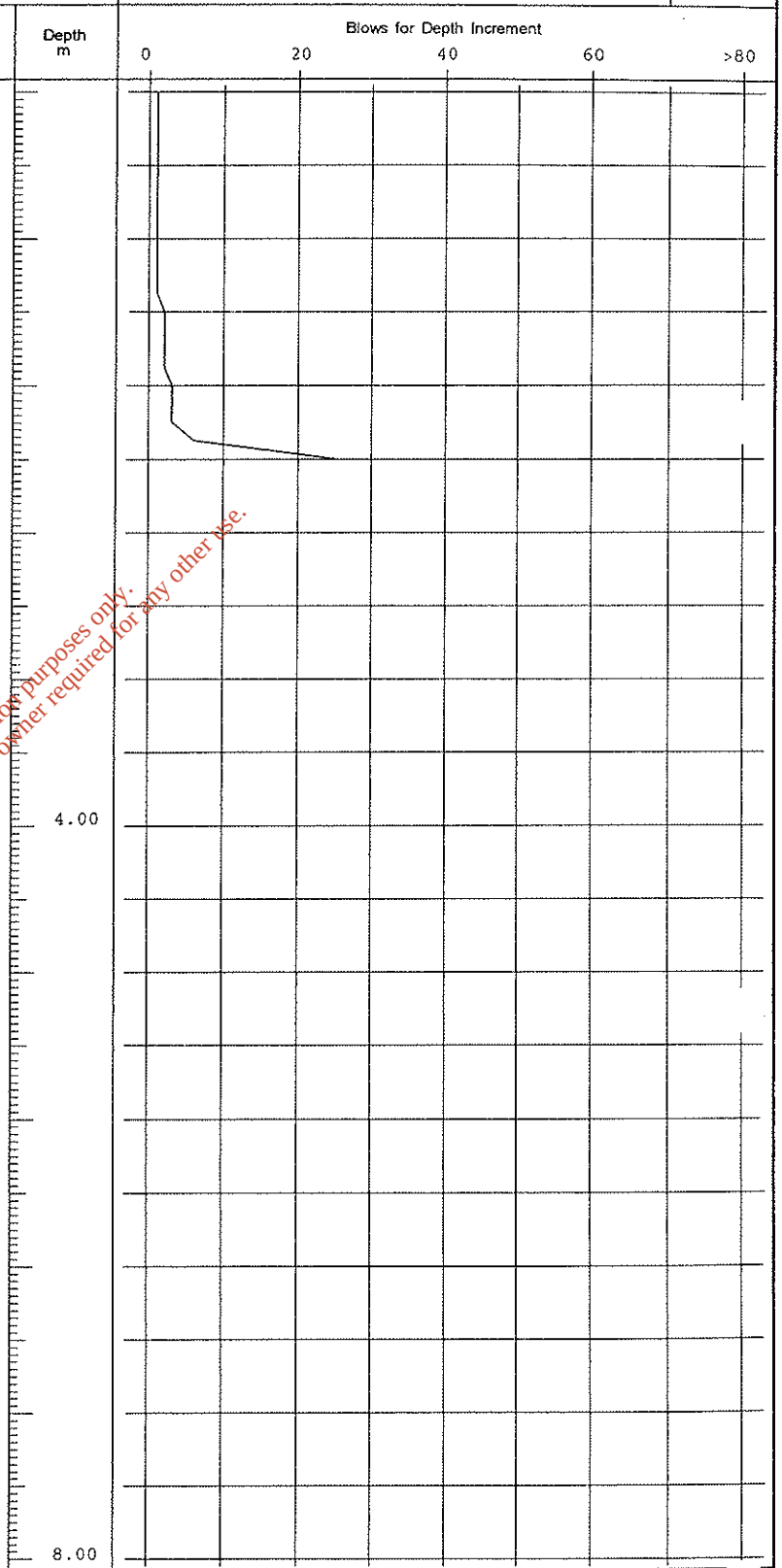
Figure No. 4659.12

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 13
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	2		
1.30-1.40	2		
1.40-1.50	2		
1.50-1.60	2		
1.60-1.70	3		
1.70-1.80	3		
1.80-1.90	3		
1.90-2.00	6		
2.00-2.10	25		



Remarks

See key sheet for symbols and abbreviations

Scale (approx): 1:40

Logged By: TC

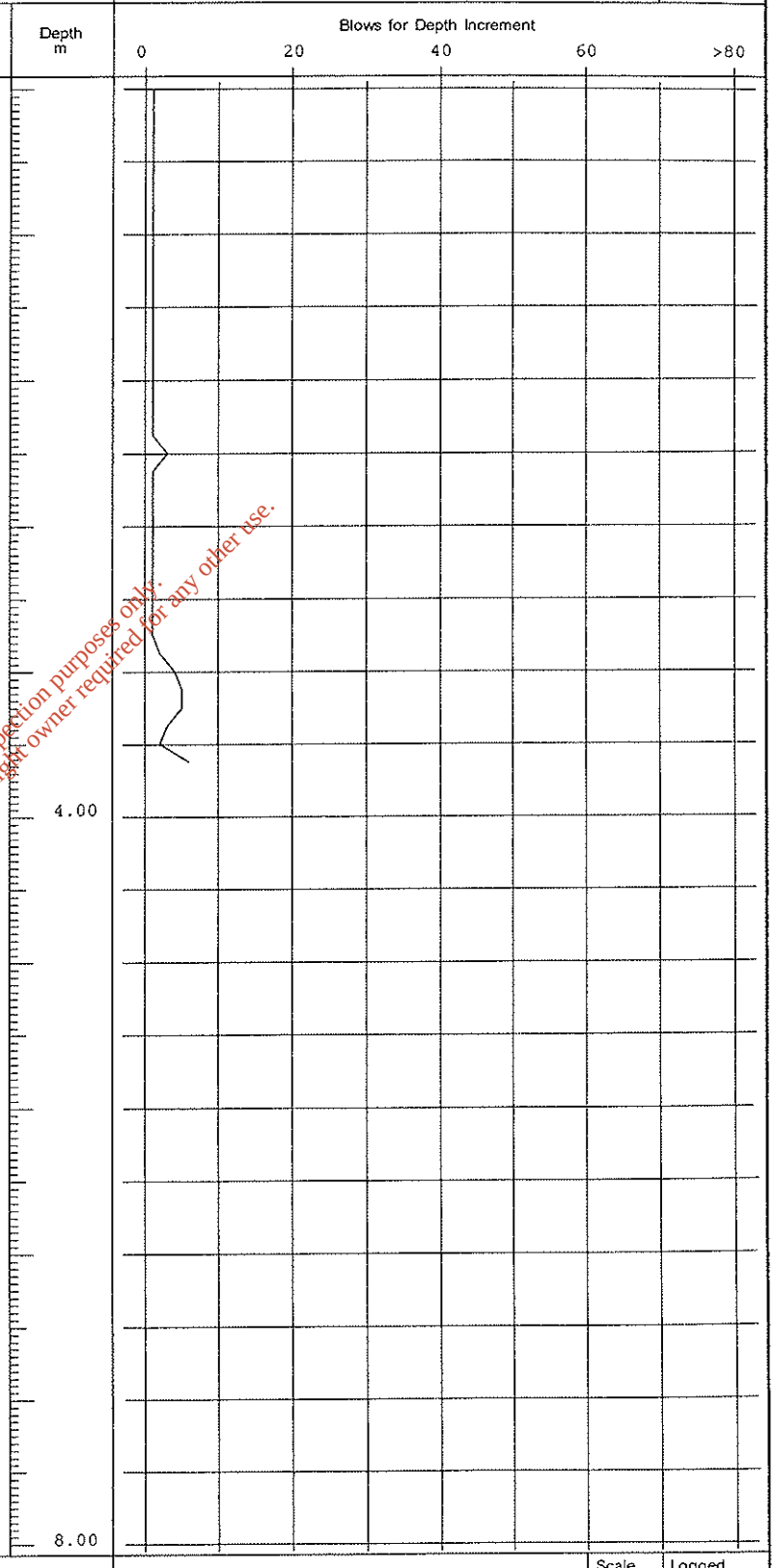
Figure No.: 4659.13

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	14

Meth	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	1		
1.30-1.40	1		
1.40-1.50	1		
1.50-1.60	1		
1.60-1.70	1		
1.70-1.80	1		
1.80-1.90	1		
1.90-2.00	1		
2.00-2.10	3		
2.10-2.20	1		
2.20-2.30	1		
2.30-2.40	1		
2.40-2.50	1		
2.50-2.60	1		
2.60-2.70	1		
2.70-2.80	1		
2.80-2.90	1		
2.90-3.00	1		
3.00-3.10	1		
3.10-3.20	2		
3.20-3.30	4		
3.30-3.40	5		
3.40-3.50	5		
3.50-3.60	3		
3.60-3.70	2		
3.70-3.80	6		



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Scale (approx)	Logged By
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Figure No. 4659.14

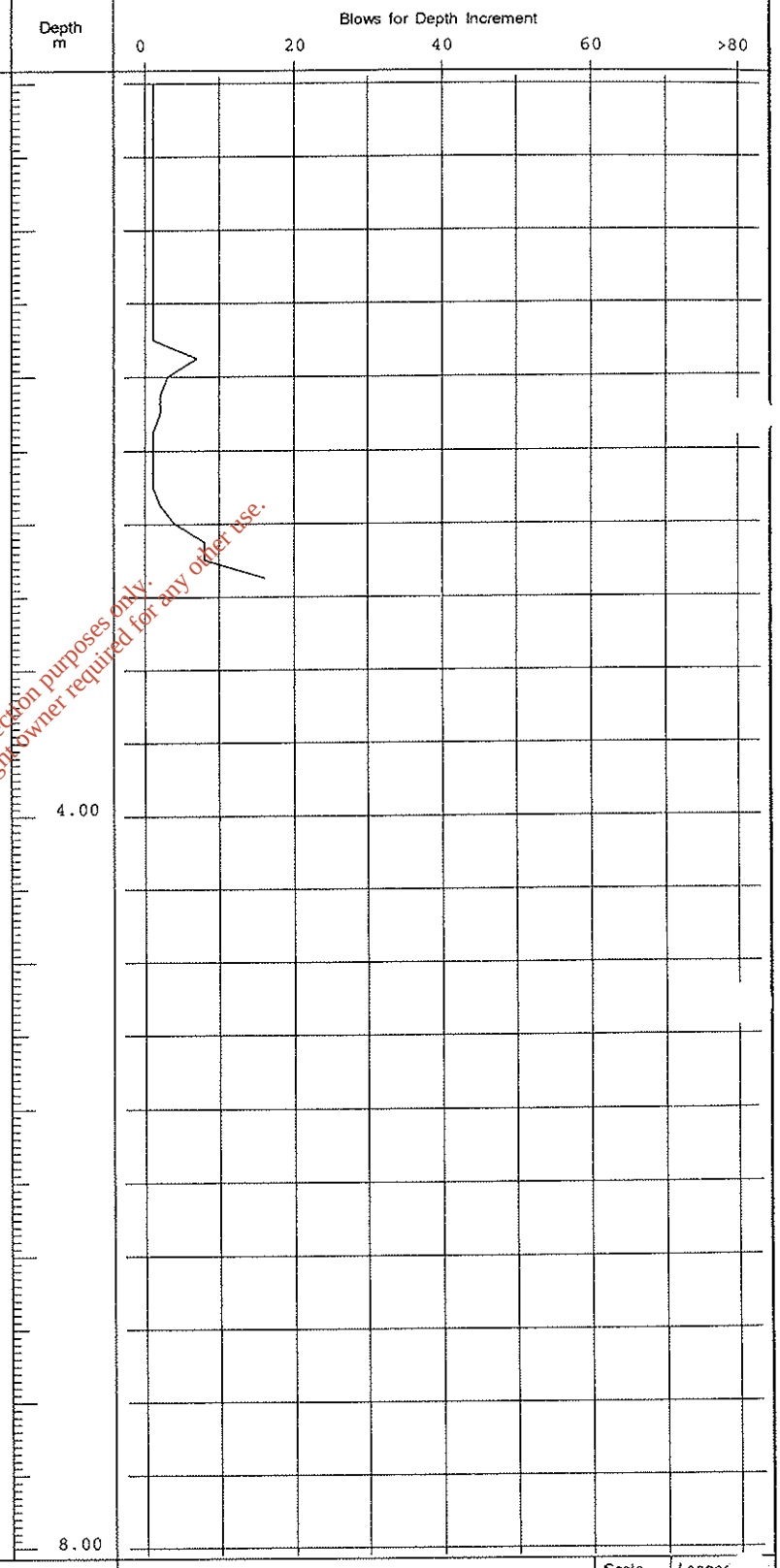
See key sheet for symbols and abbreviations

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	15

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	1		
1.30-1.40	1		
1.40-1.50	1		
1.50-1.60	7		
1.60-1.70	3		
1.70-1.80	2		
1.80-1.90	2		
1.90-2.00	1		
2.00-2.10	1		
2.10-2.20	1		
2.20-2.30	1		
2.30-2.40	2		
2.40-2.50	4		
2.50-2.60	8		
2.60-2.70	8		
2.70-2.80	16		



Remarks

See key sheet for symbols and abbreviations

Scale (approx)	Logged By
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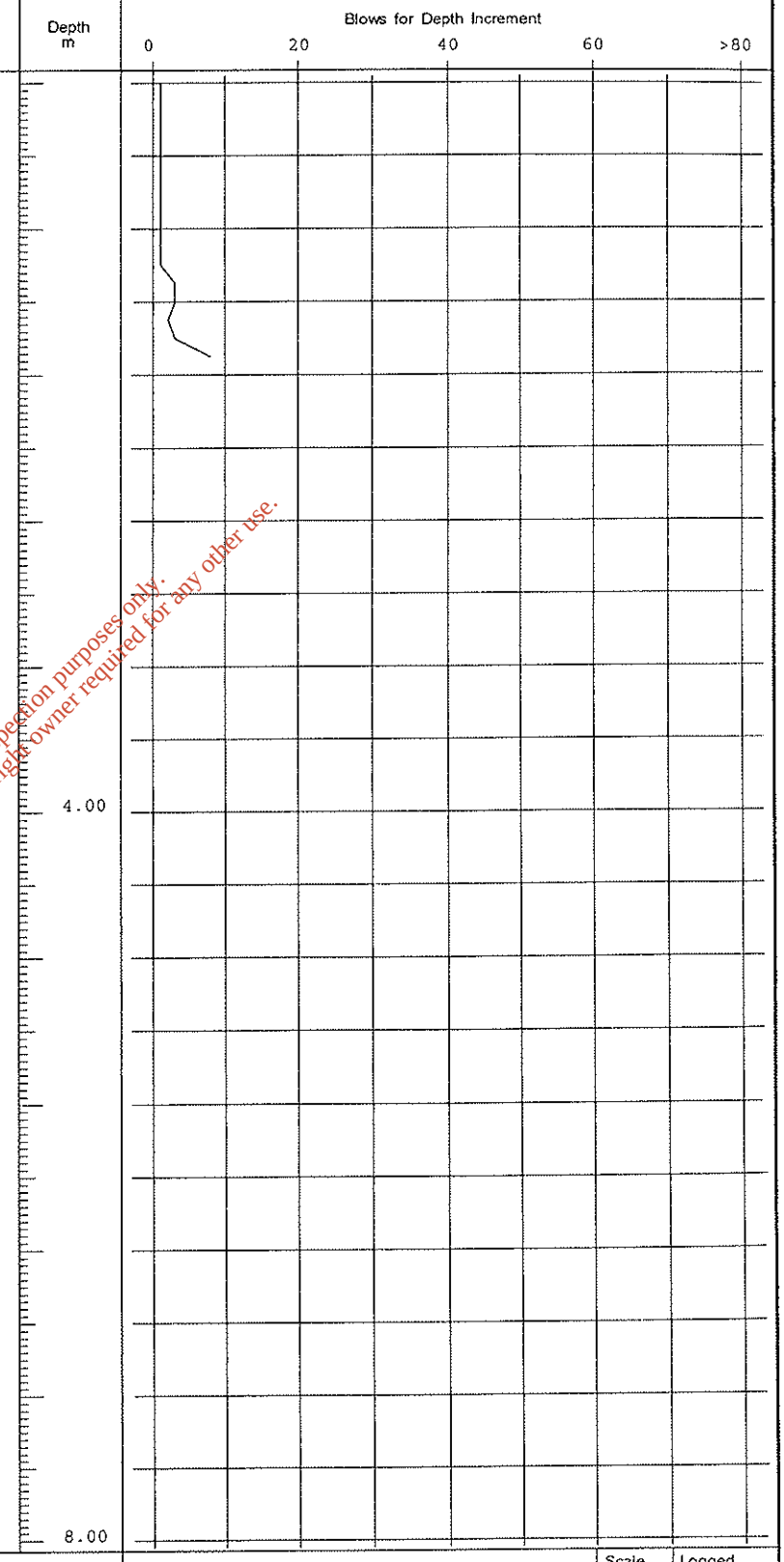
Figure No. 4659.15

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	16

Met	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	3		
1.20-1.30	3		
1.30-1.40	2		
1.40-1.50	3		
1.50-1.60	8		



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Scale (approx)	Logged By
1:40	TC

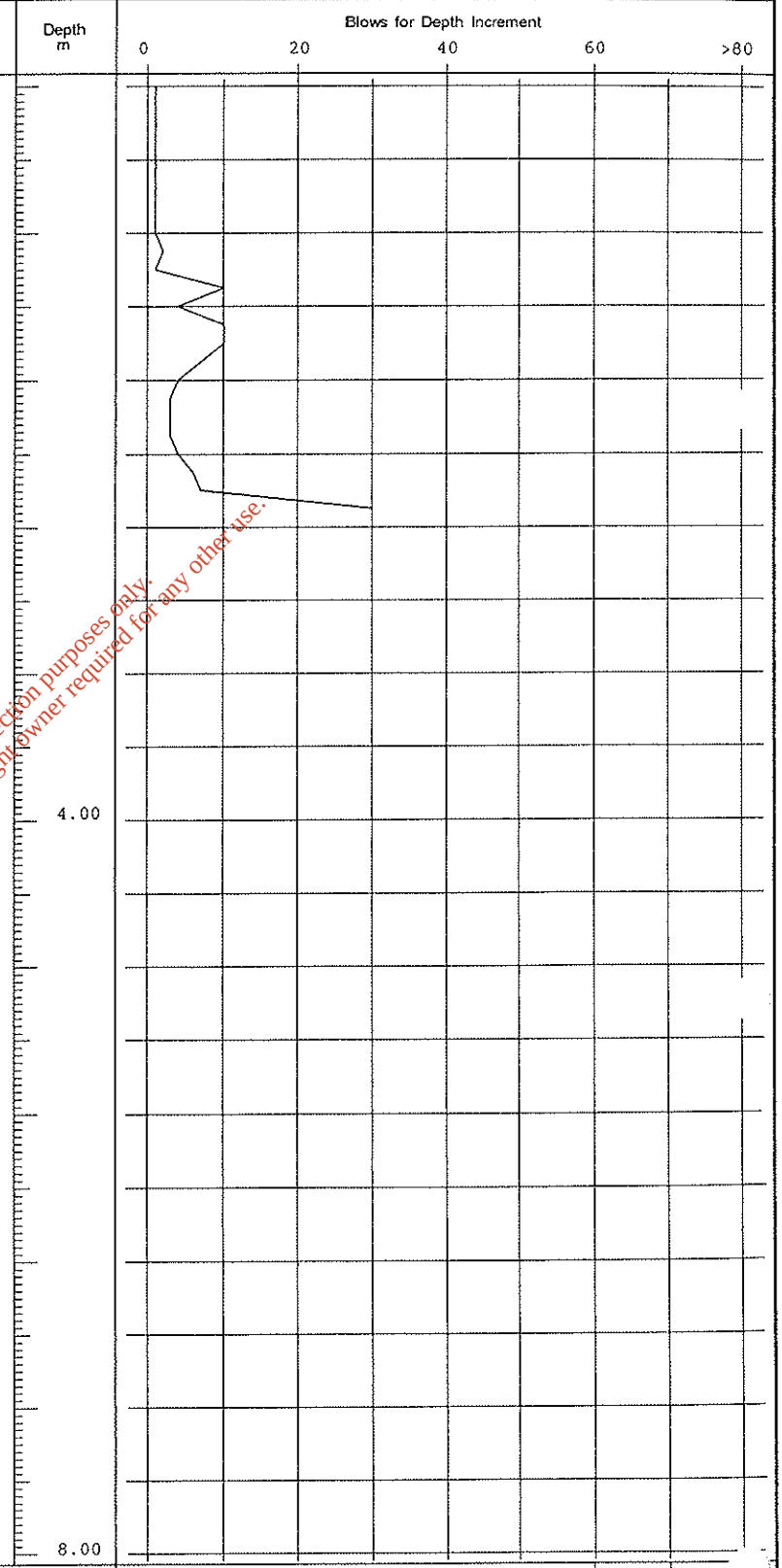
Figure No. 4659.16

See key sheet for symbols and abbreviations

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 17
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	2		
1.00-1.10	1		
1.10-1.20	10		
1.20-1.30	4		
1.30-1.40	10		
1.40-1.50	10		
1.50-1.60	7		
1.60-1.70	4		
1.70-1.80	3		
1.80-1.90	3		
1.90-2.00	3		
2.00-2.10	4		
2.10-2.20	6		
2.20-2.30	7		
2.30-2.40	>30		



Remarks

See key sheet for symbols and abbreviations

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Logged By: TC

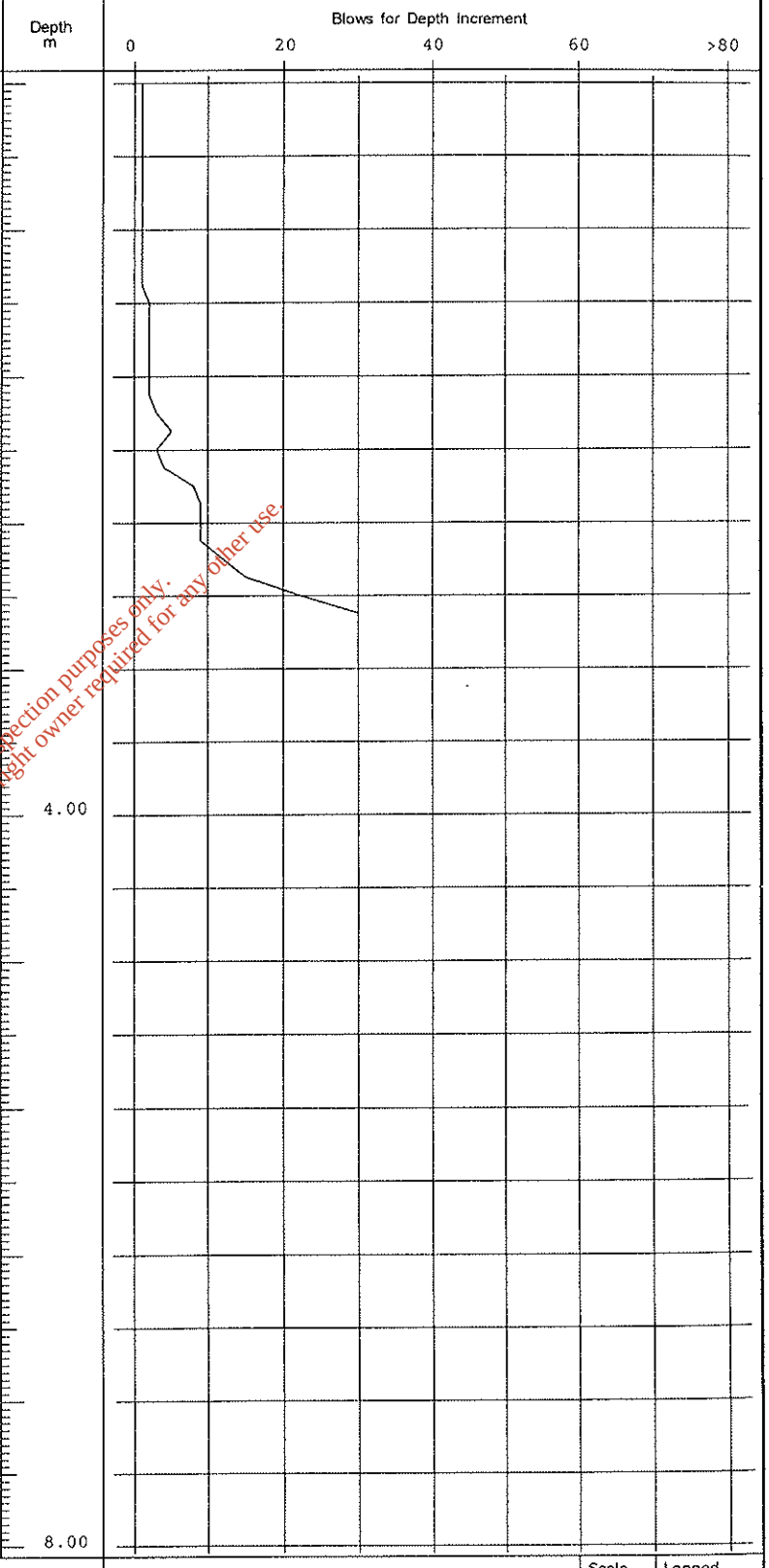
Figure No.: 4659.17

Glover Site investigations Ltd

Site	Probe Number
BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL	18

Meth.	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe			DONEGAL COUNTY COUNCIL	4659
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	29/07/02 - 29/07/02	KIRK McCLURE MORTON	1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	2		
1.30-1.40	2		
1.40-1.50	2		
1.50-1.60	2		
1.60-1.70	2		
1.70-1.80	2		
1.80-1.90	3		
1.90-2.00	5		
2.00-2.10	3		
2.10-2.20	4		
2.20-2.30	8		
2.30-2.40	9		
2.40-2.50	9		
2.50-2.60	9		
2.60-2.70	12		
2.70-2.80	15		
2.80-2.90	22		
2.90-3.00	30		



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Scale (approx)	Logged By
1:40	TC

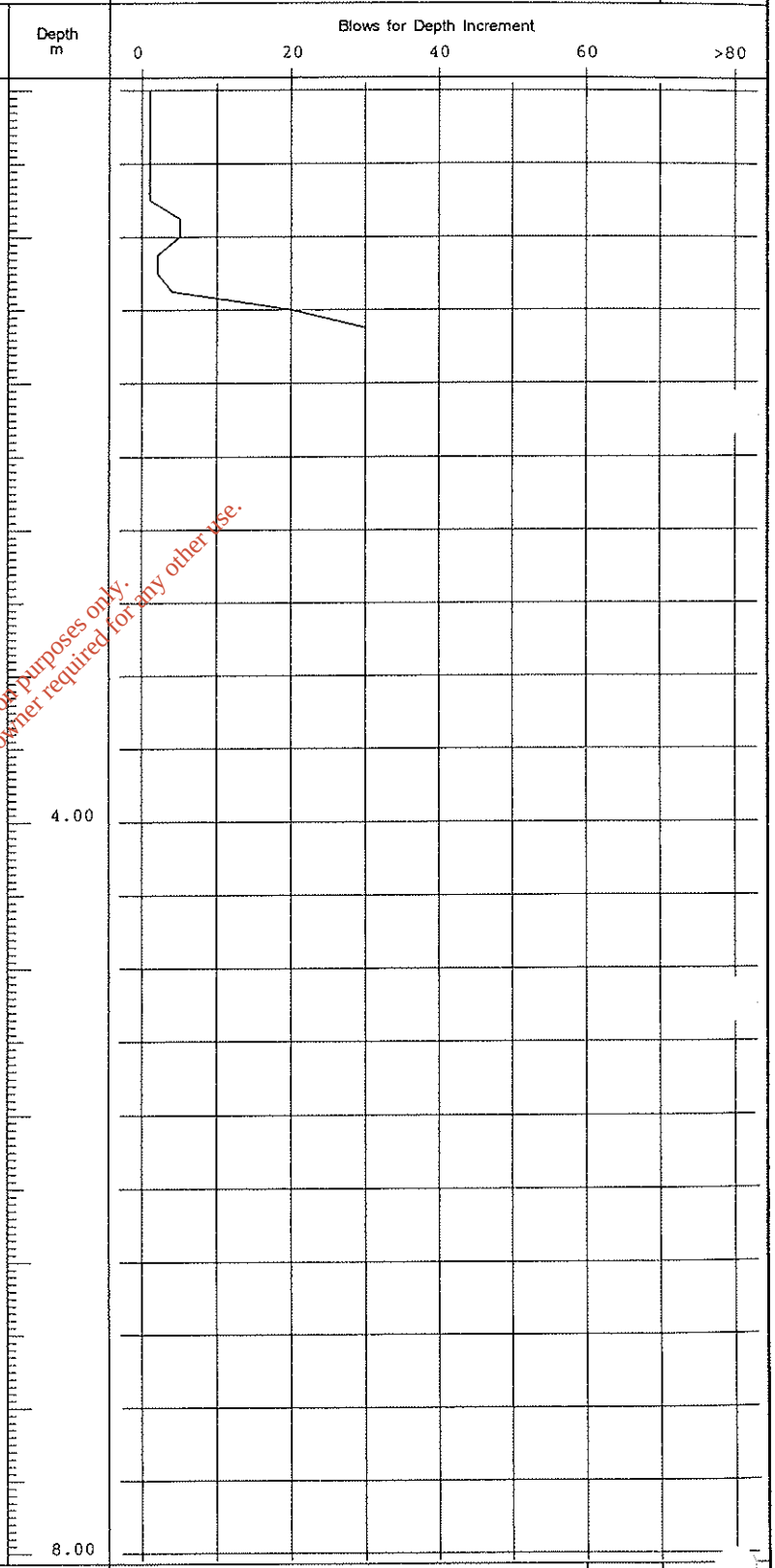
Figure No. 4659.18

See key sheet for symbols and abbreviations

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 19
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records
0.00-0.10	1	
0.10-0.20	1	
0.20-0.30	1	
0.30-0.40	1	
0.40-0.50	1	
0.50-0.60	1	
0.60-0.70	1	
0.70-0.80	5	
0.80-0.90	5	
0.90-1.00	2	
1.00-1.10	2	
1.10-1.20	4	
1.20-1.30	20	
1.30-1.40	30	



Remarks

See key sheet for symbols and abbreviations

Scale (approx): 1:40

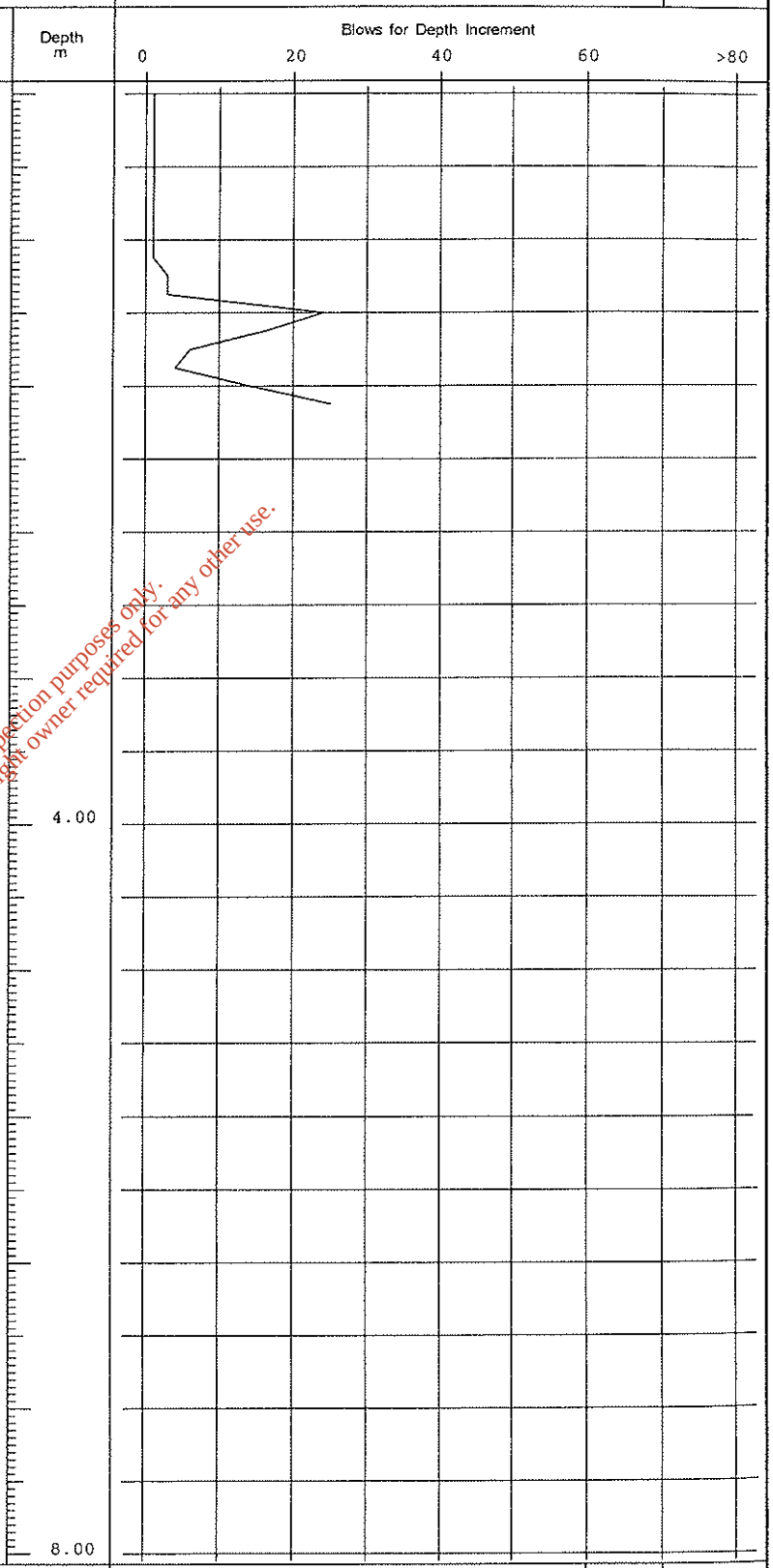
Logged By: TC

Figure No.: 4659.19

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 20
Meth.: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	1		
0.70-0.80	1		
0.80-0.90	1		
0.90-1.00	1		
1.00-1.10	3		
1.10-1.20	3		
1.20-1.30	24		
1.30-1.40	16		
1.40-1.50	6		
1.50-1.60	4		
1.[illegible] 1.70	14		
1.[illegible] .80	25		



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Scale (approx)	Logged By
1:40	TC

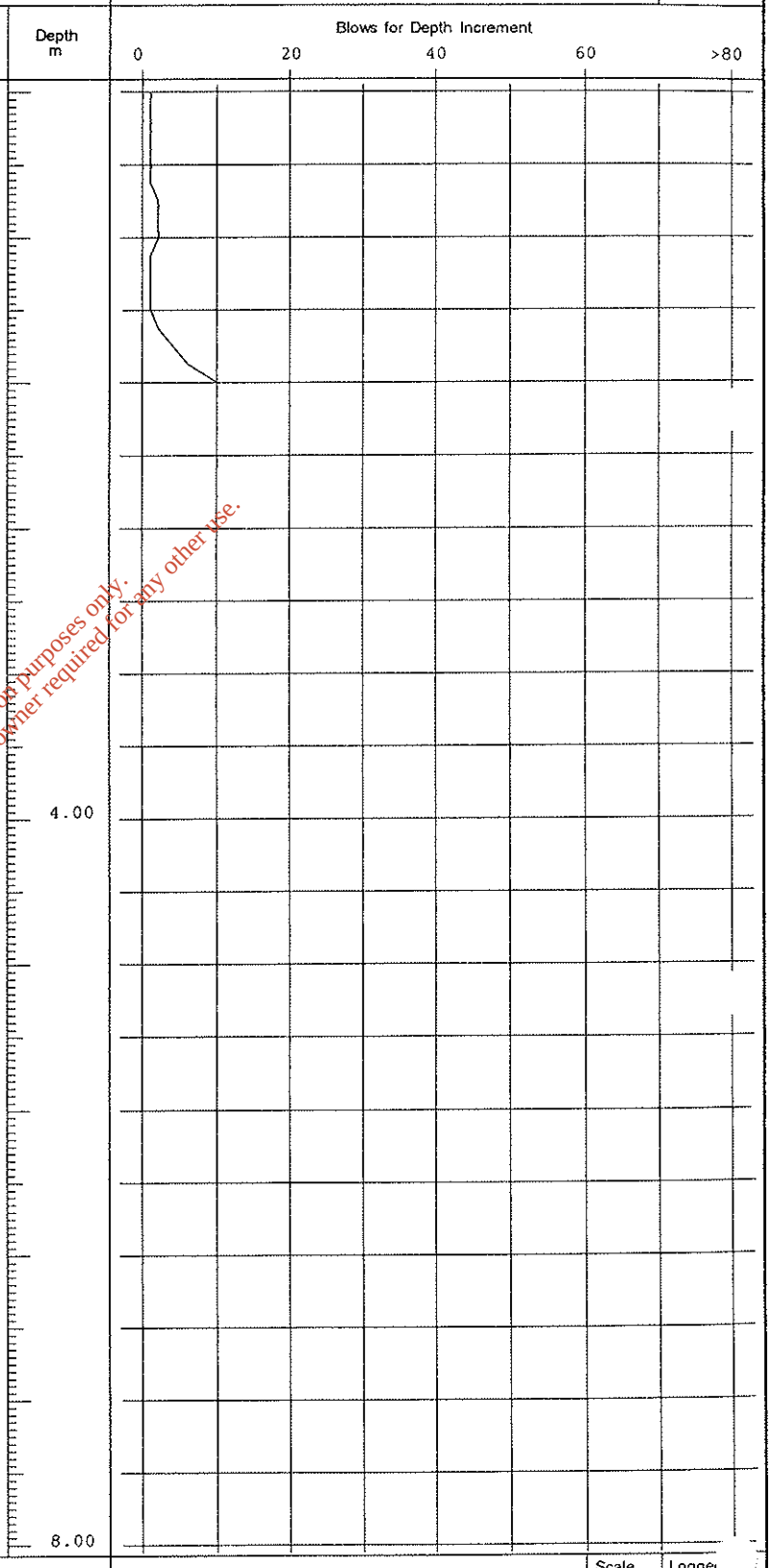
Figure No. 4659.20

See key sheet for symbols and abbreviations

Glover Site investigations Ltd

Site: BALLYMACARRICK LANDFILL SITE, COUNTY DONEGAL				Probe Number: 21
Method: Dynamic Probe	Cone Dimensions:	Ground Level (mOD):	Client: DONEGAL COUNTY COUNCIL	Job Number: 4659
	Location: AS PLAN	Dates: 29/07/02 - 29/07/02	Engineer: KIRK McCLURE MORTON	Sheet: 1/1

Depth m	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	1		
0.30-0.40	1		
0.40-0.50	1		
0.50-0.60	1		
0.60-0.70	2		
0.70-0.80	2		
0.80-0.90	2		
0.90-1.00	1		
1.00-1.10	1		
1.10-1.20	1		
1.20-1.30	1		
1.30-1.40	2		
1.40-1.50	4		
1.50-1.60	6		
1.60-1.70	10		



Remarks

See key sheet for symbols and abbreviations

Scale (approx)	Logged By
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Figure No. 4659.21

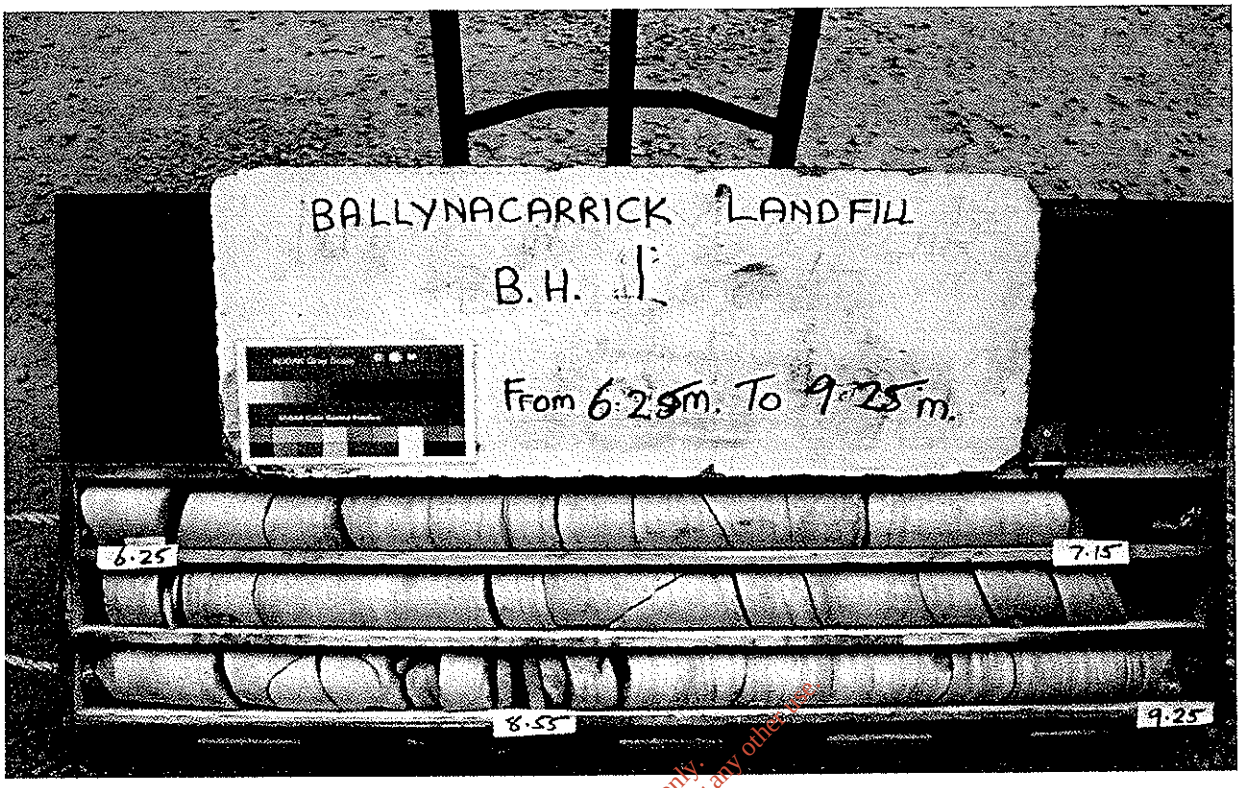
APPENDIX 3
ROCK CORE PHOTOGRAPHS

BALLYNACARRICK LANDFILL

BH 1 from 0.40m to 3.30m

BH 1 from 3.30m to 6.25m

BALLYNACARRICK LANDFILL



BH 1 from 6.25m to 9.25m

BH 1 from 9.15m to 10.05m

BALLYNACARRICK LANDFILL

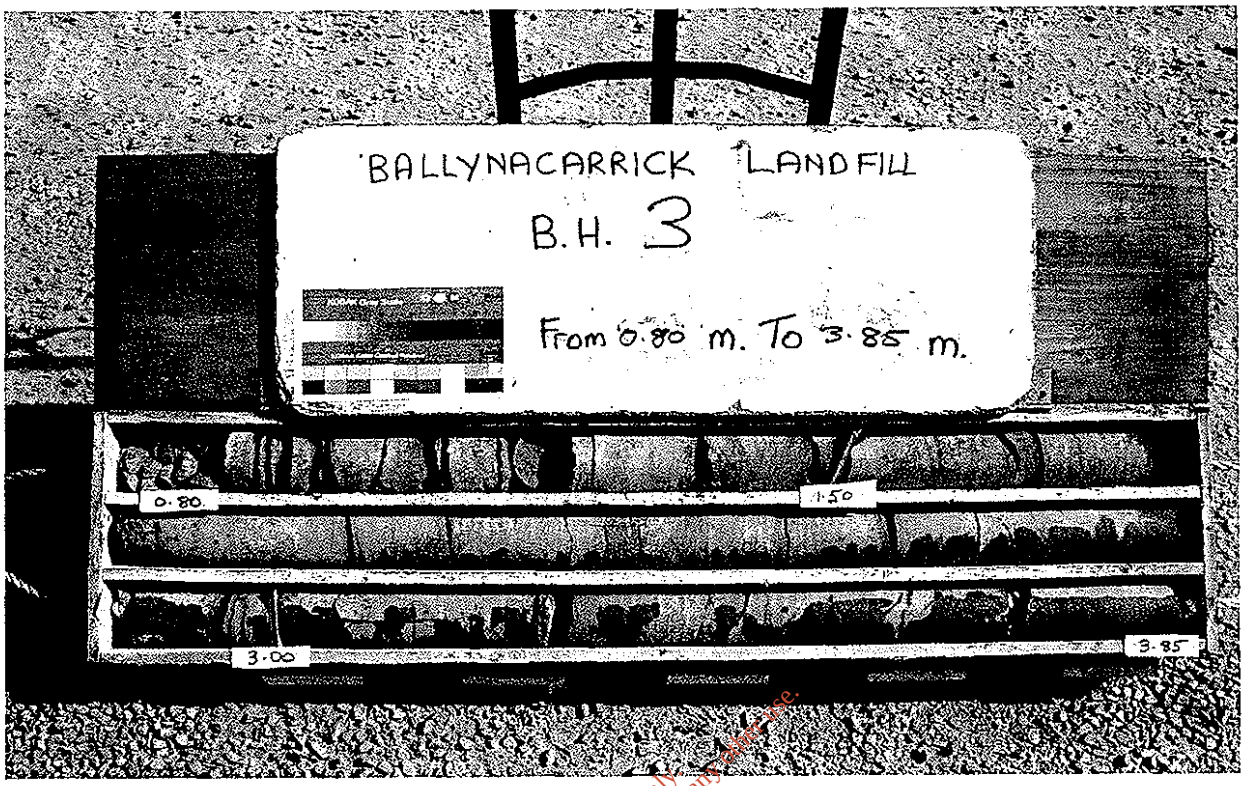
BH 2 from 1.20m to 3.80m

BH 2 from 3.80m to 6.80m

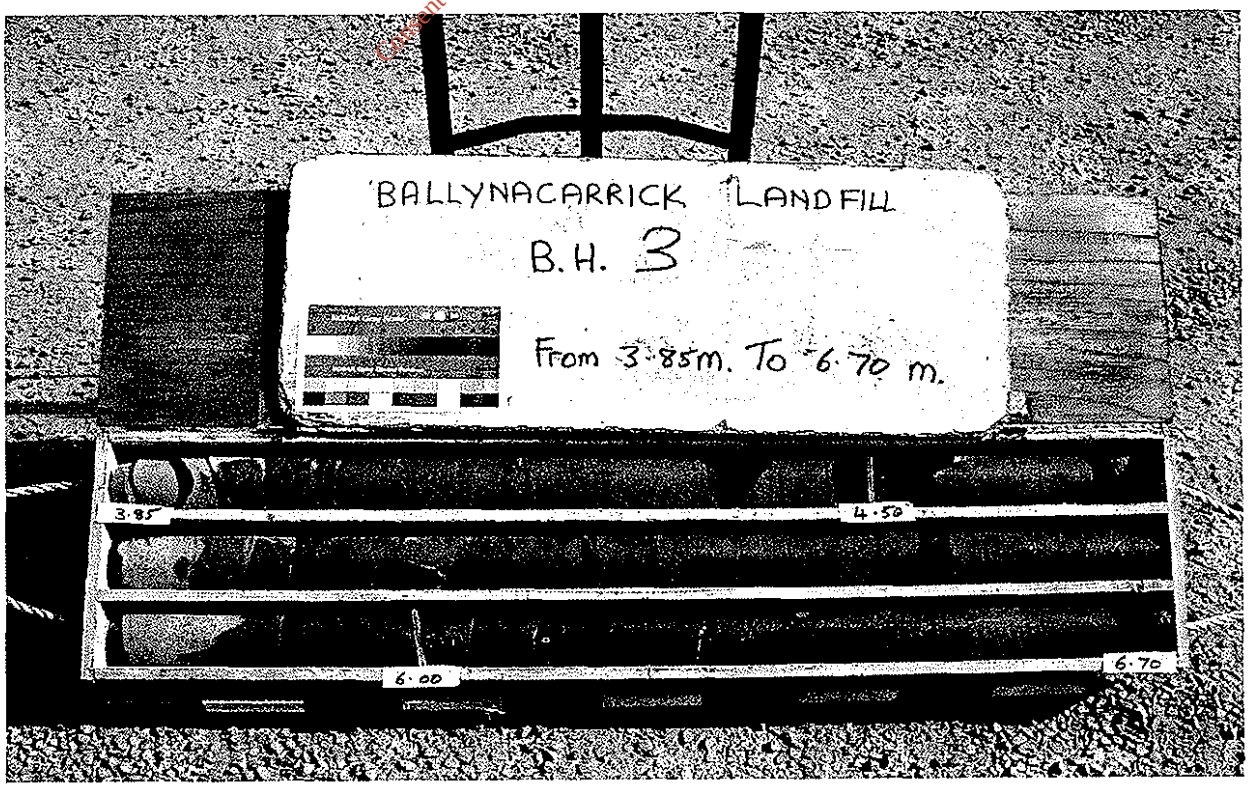
BALLYNACARRICK LANDFILL

BH 2 from 6.80m to 10.0m

BALLYNACARRICK LANDFILL



BH 3 from 0.80m to 3.85m



BH 3 from 3.85m to 6.70m

BALLYNACARRICK LANDFILL

BH 3 from 6.70m to 9.40m

BH 3 from 9.40m to 10.05m

BALLYNACARRICK LANDFILL

BH 4 from 2.35m to 5.40m

BH 4 from 5.40m to 7.35m

BALLYNACARRICK LANDFILL

BH 5 from 10.0m to 13.10m

BH 5 from 13.10m to 15.00m

BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL

ATTERBERG LIMIT TESTS

Tests 4.3 & 5.3 of BS 1377 : Part 2 : 1990

BH No.	Sample Type	Sample No.	Sample Depth (m)	Moisture Content (%)	Moisture Content of 'Fines'* (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Casagrande Classification
BH4	U	U1	0.4	163	163	190	86	104	CEO
BH4	B	B2	2.0	17	18	29	NP	-	ML
BH5	J	J2	0.5	21	21	40	15	25	CI
BH5	B	B1	1.1	15	18	28	NP	-	ML
BH5	J	J4	2.5	20	21	46	15	31	CI
BH5	J	J5	4.0	17	19	35	15	20	CL/CI
BH5	B	B4	6.0	14	15	27	NP	-	ML
BH5	B	B6	9.0	16	18	28	NP	-	ML
BH6	J	J1	0.4	12	14	26	NP	-	ML
BH6	J	J3	1.0	16	19	28	NP	-	ML
BH6	B	B1	1.5	15	18	29	NP	-	ML
BH6	J	J4	3.0	20	22	44	15	29	CI

* Fraction < 425 μm sieve. NP indicates soil is non-plastic. $ Insufficient material for Limits tests.

Small sample necessitated One-point Cone Penetrometer method for determination of Liquid Limit as Test 4.4 of BS 1377 : Part 2 : 1990.

BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL

SUMMARY OF INSITU PERMEABILITY TEST RESULTS

Test Location	Test Section (m.b.g.l)	Type of Permeability Test	Measured Insitu Permeability metres per second (m/s)
1	1.3 - 10.05	Falling head	1.2×10^{-5}
1	5.0 - 10.05	Packer	1.1×10^{-7}
2	1.2 - 10.0	Falling head	1.6×10^{-6}
2	5.0 - 10.0	Packer	4.1×10^{-7}
3	1.5 - 10.05	Falling head	2.2×10^{-6}
3	2.0 - 10.05	Packer	6.7×10^{-8}
3	5.0 - 10.05	Packer	3.3×10^{-8}
4	0.0 - 1.0	Rising head	7.4×10^{-5}
4	1.7 - 2.0	Falling head	1.7×10^{-4}
4	2.8 - 7.35	Falling head	1.3×10^{-5}
4	4.0 - 7.35	Packer	3.0×10^{-7}
5	0.0 - 1.0	Falling head	3.9×10^{-8}
5	1.7 - 2.0	Falling head	2.0×10^{-7}
5	2.7 - 3.0	Falling head	1.5×10^{-7}
5	4.7 - 5.0	Falling head	1.4×10^{-5}
5	10.1 - 15.0	Falling head	2.4×10^{-7}
5	11.5 - 15.0	Packer	7.7×10^{-7}
5	14.0 - 15.0	Packer	2.3×10^{-7}
6	0.0 - 1.0	Rising head	7.0×10^{-6}
6	1.7 - 2.0	Rising head	3.1×10^{-5}
6	2.3 - 3.0	Rising head	2.3×10^{-5}
6	3.7 - 4.0	Falling head	3.4×10^{-5}
6	4.7 - 5.0	Falling head	6.6×10^{-5}

APPENDIX 4
LABORATORY TEST RESULTS

(b) Compaction Tests

COMPACTION TEST

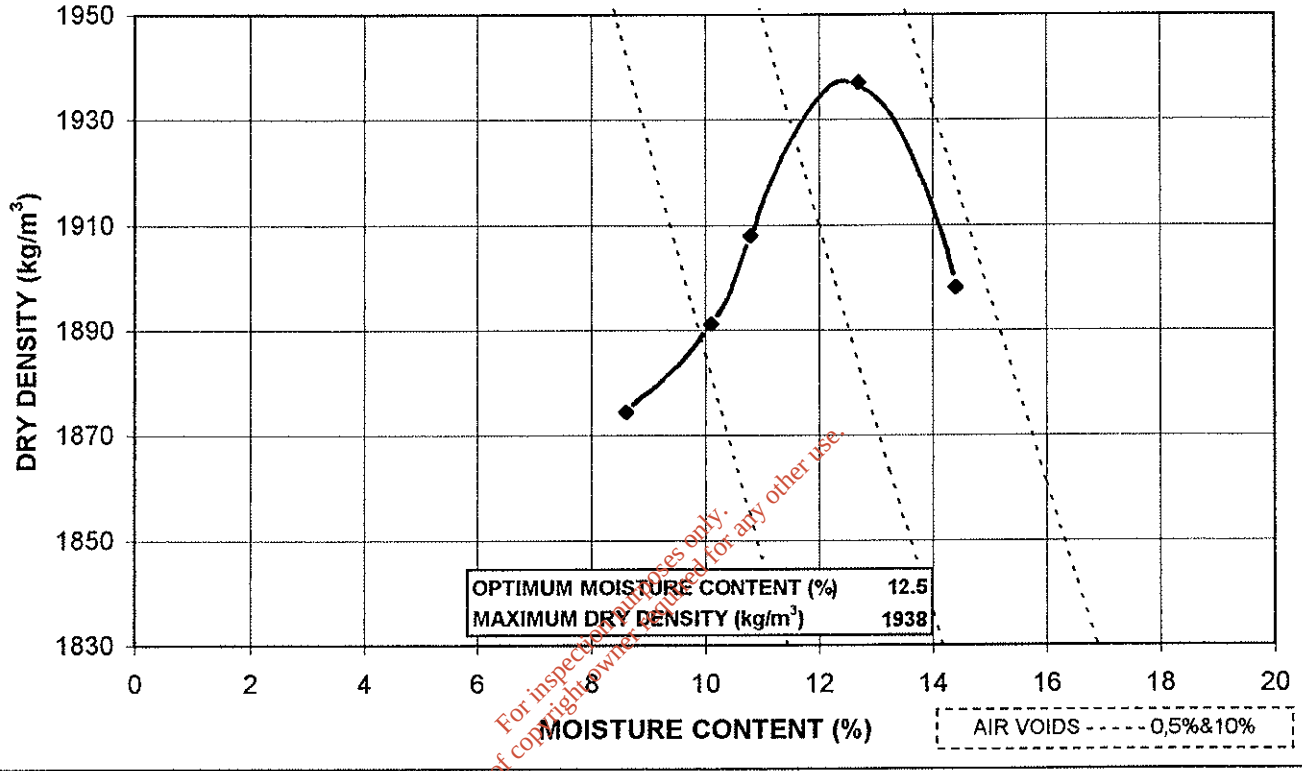
CONTRACT: Ballynacarrick Landfill Site. **T.H.No.:** BH4 **DEPTH:** B1.45m

SAMPLE DESCRIPTION: Medium dense bluish grey gravelly fine to coarse SAND.

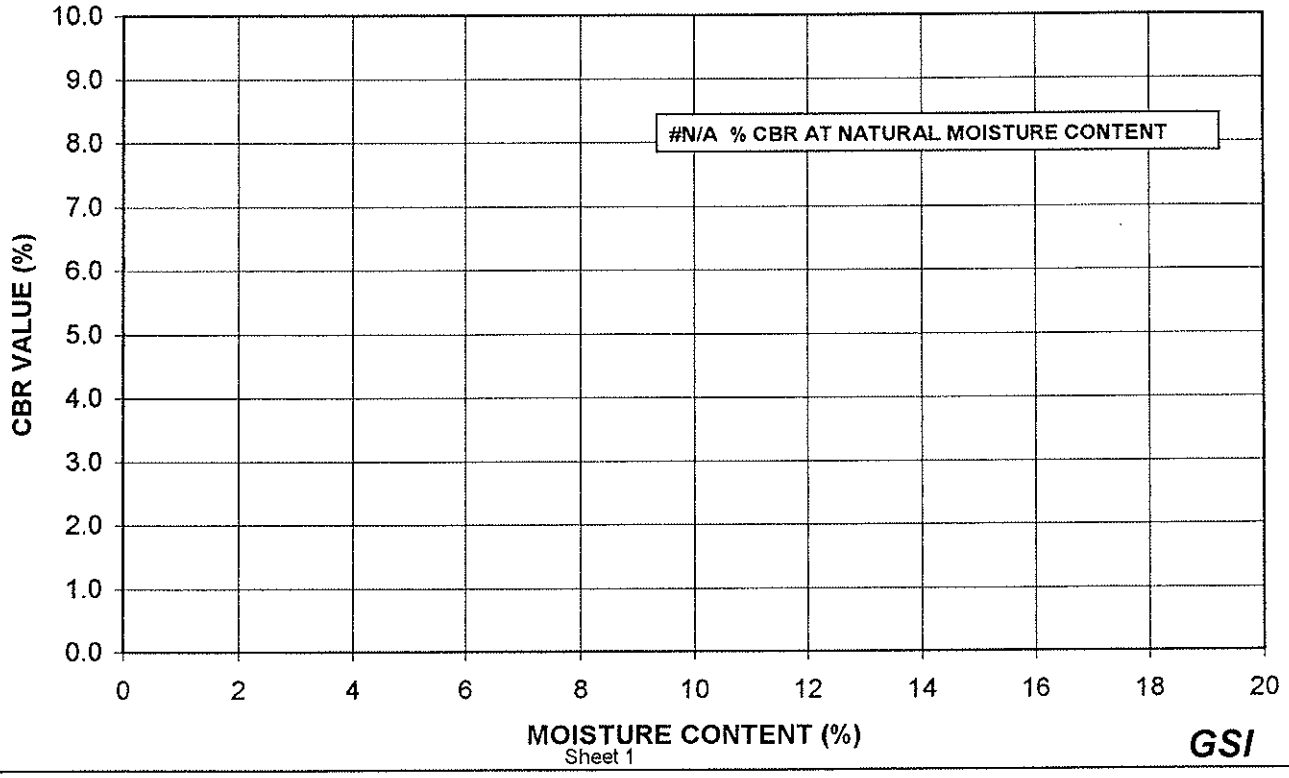
NATURAL MOISTURE CONTENT: 10.1 **(%)**
TYPE OF COMPACTION: **BS 1377 : Part 4 : 1990 TEST 3.3 ('Light')**

PARTICLE DENSITY (ρ_s): 2.65 (assumed)
MATERIAL RETAINED ON 20mm B.S.TEST SIEVE: 4.9 **(%)**

DRY DENSITY v. MOISTURE CONTENT



CBR VALUE v. MOISTURE CONTENT



GSI

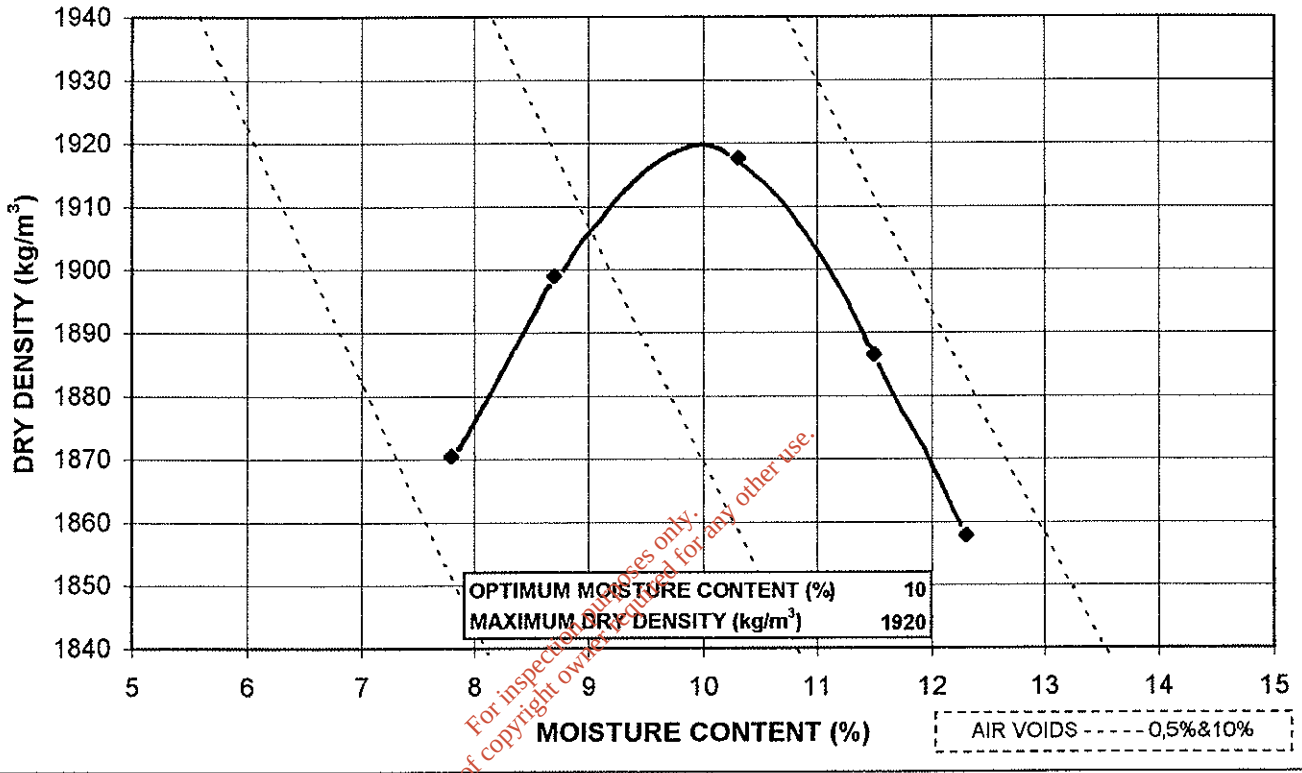
COMPACTION TEST

CONTRACT: Ballynacarrick Landfill Site. **T.H.No.:** BH5 **DEPTH:** B3.50m

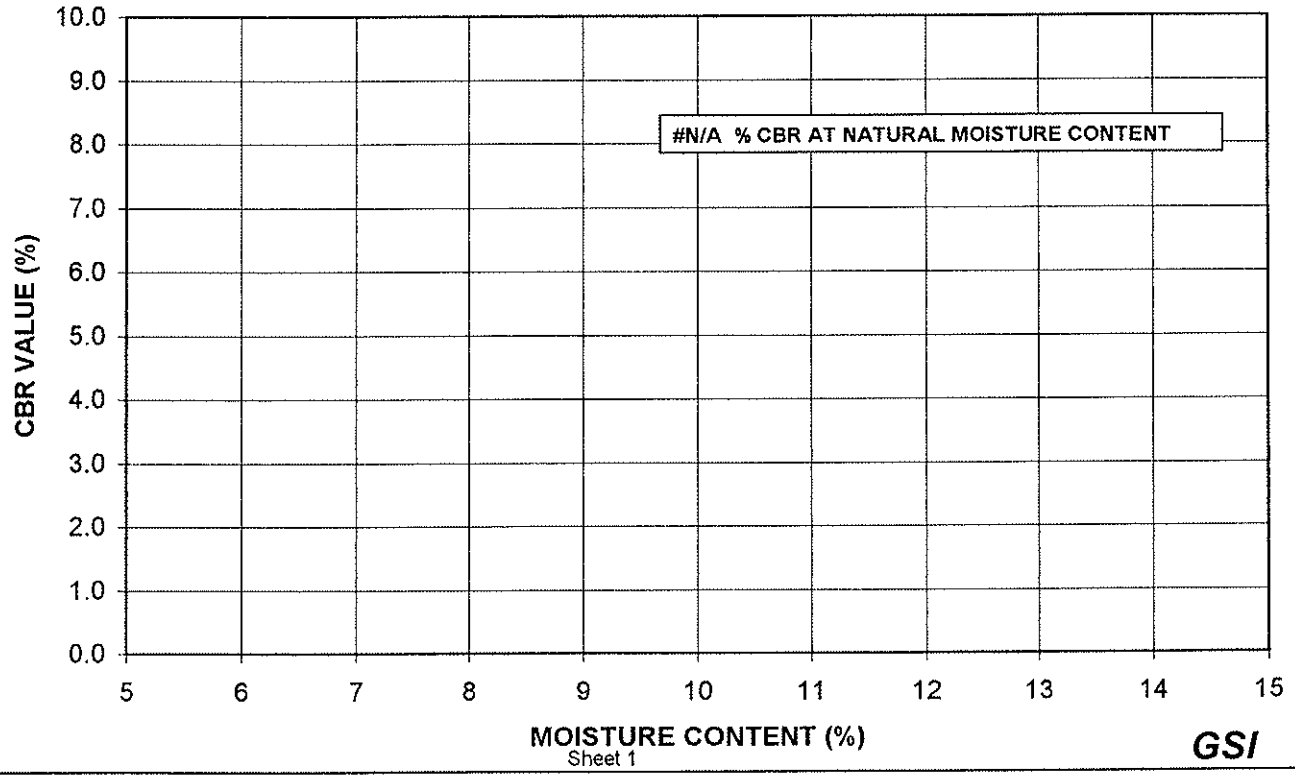
SAMPLE DESCRIPTION: Medium dense light orange brown gravelly fine to medium SAND.

NATURAL MOISTURE CONTENT: 11.5 (%)
TYPE OF COMPACTION: BS 1377 : Part 4 : 1990 TEST 3.3 ('Light')
PARTICLE DENSITY (ρ_s): 2.45 (assumed)
MATERIAL RETAINED ON 20mm B.S.TEST SIEVE: 3.5 (%)

DRY DENSITY v. MOISTURE CONTENT



CBR VALUE v. MOISTURE CONTENT



GSI

COMPACTION TEST

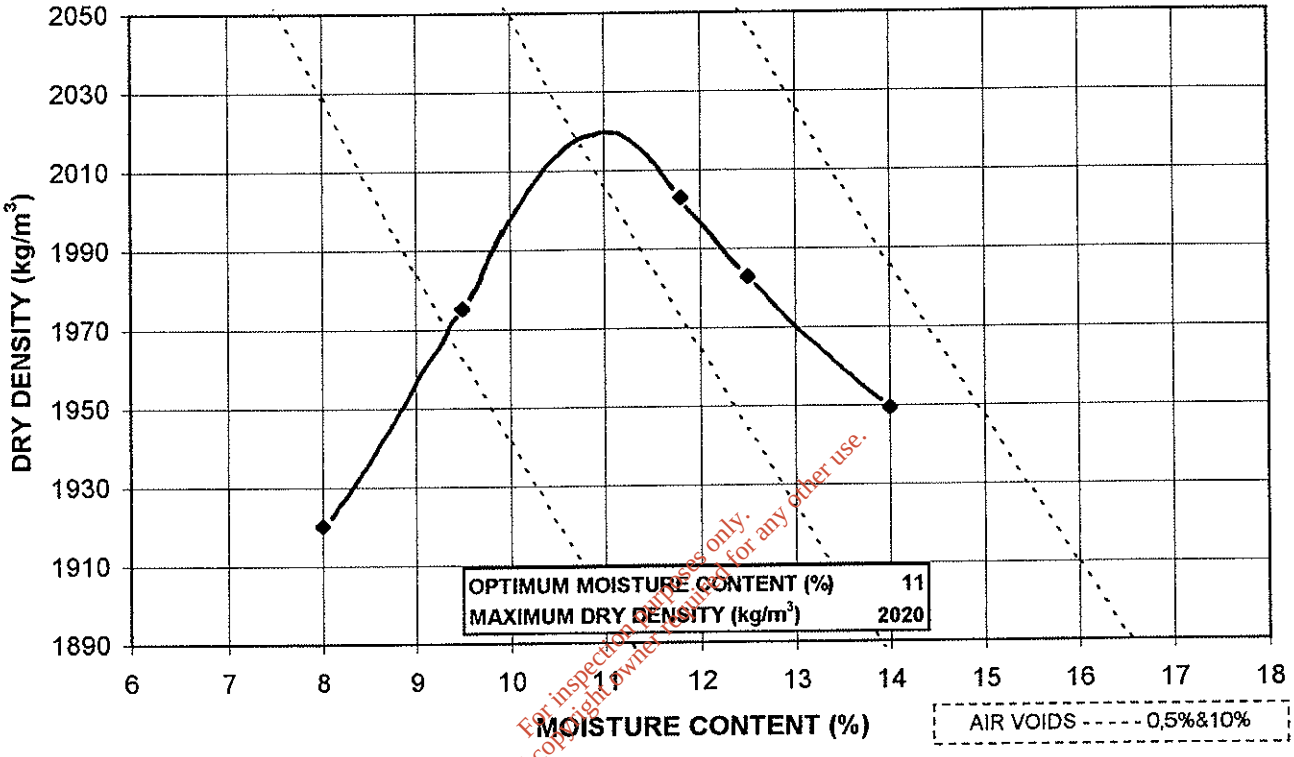
CONTRACT: Ballynacarrick Landfill Site. **T.H.No.:** BH5 **DEPTH:** B6.00m

SAMPLE DESCRIPTION: Compact grey gravelly sandy SILT.

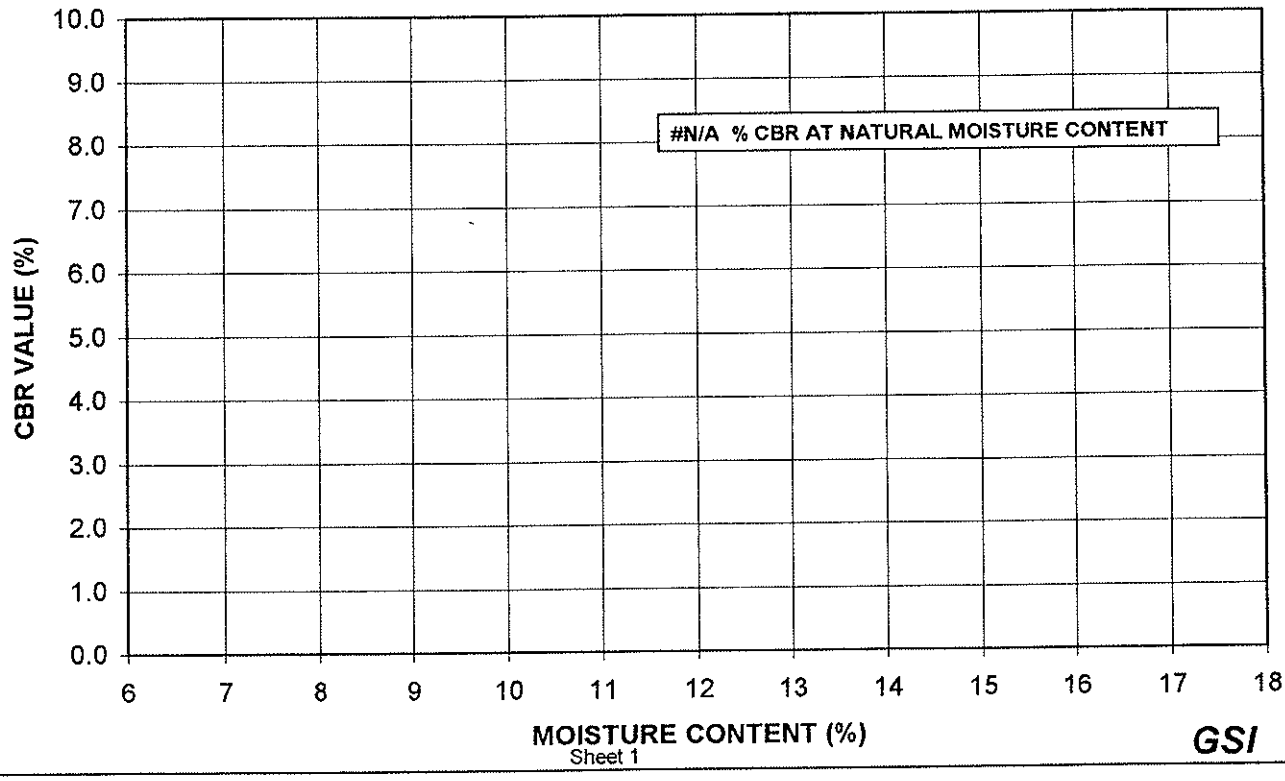
NATURAL MOISTURE CONTENT: 14.0 **(%)**
TYPE OF COMPACTION: **BS 1377 : Part 4 : 1990 TEST 3.3 ('Light')**

PARTICLE DENSITY (ρ_s): 2.75 (assumed)
MATERIAL RETAINED ON 20mm B.S.TEST SIEVE: 3.9 **(%)**

DRY DENSITY v. MOISTURE CONTENT



CBR VALUE v. MOISTURE CONTENT



GSI

Sheet 1

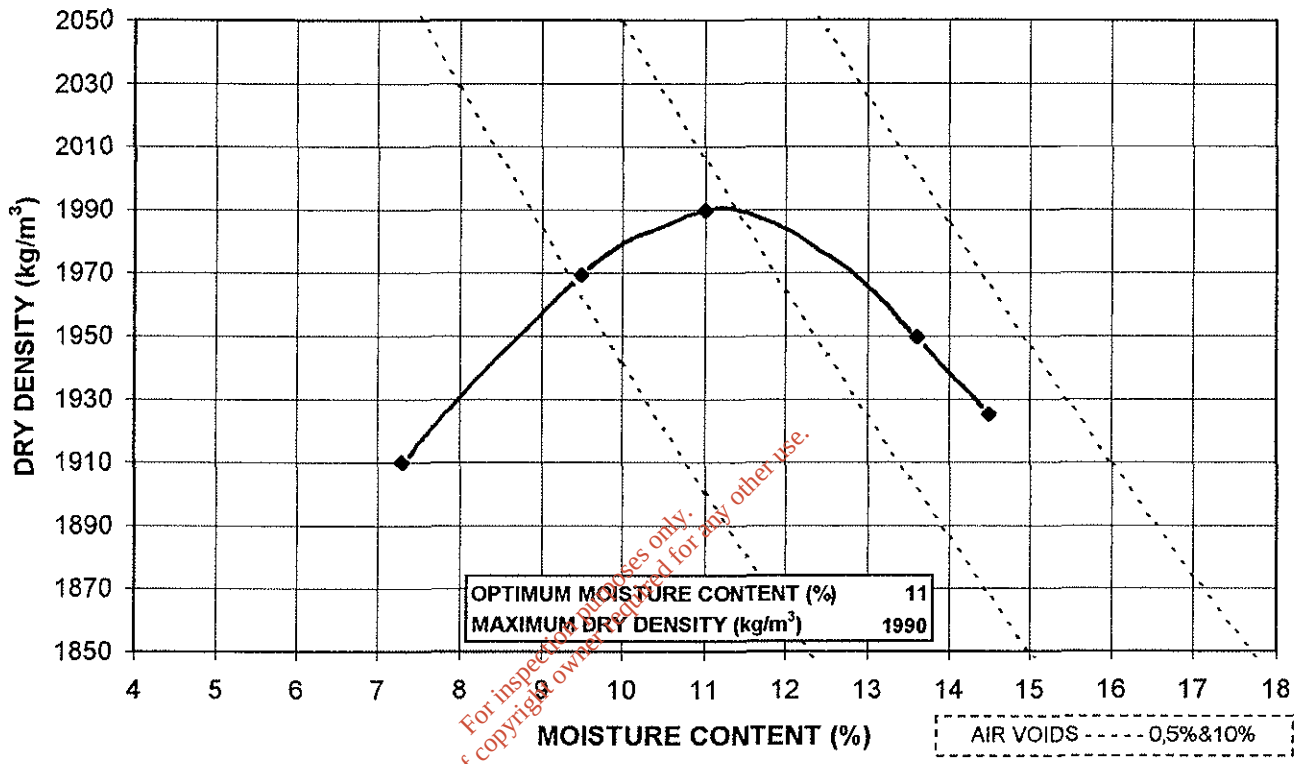
COMPACTION TEST

CONTRACT: Ballynacarrick Landfill Site. **T.H.No.:** BH5 **DEPTH:** B9.00m

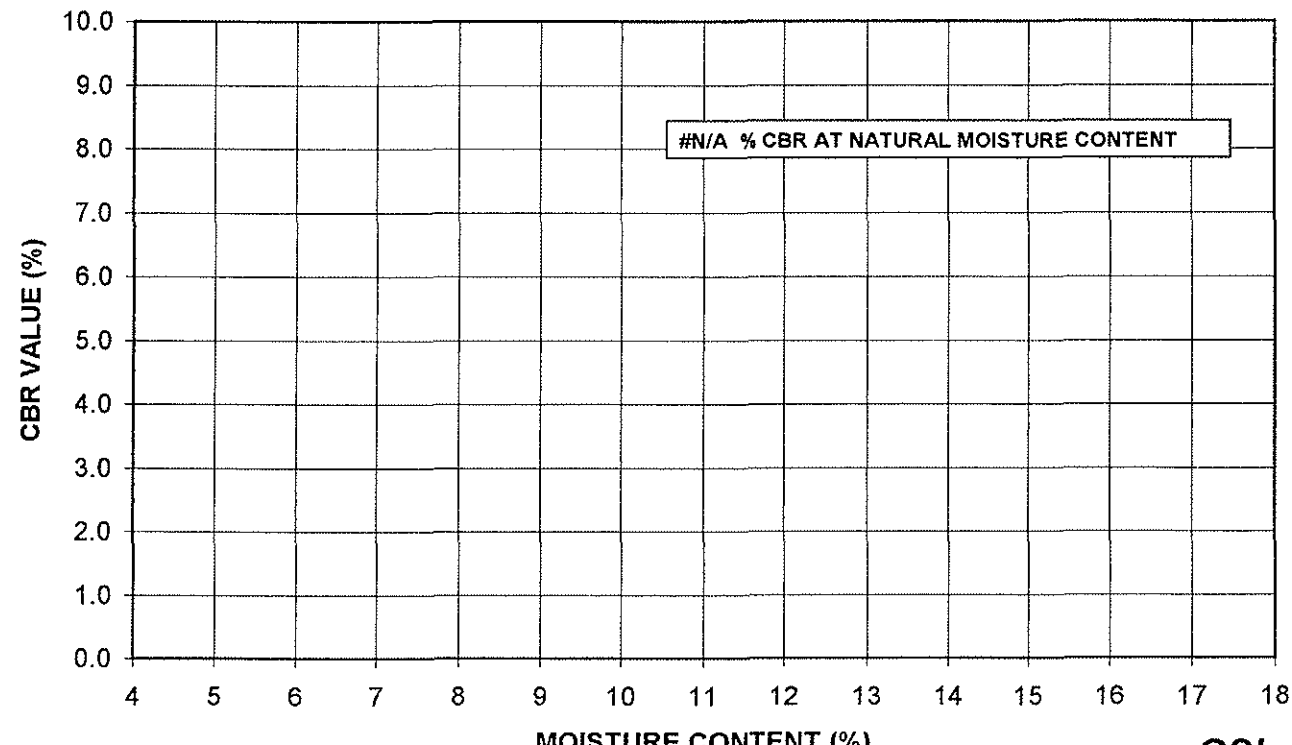
SAMPLE DESCRIPTION: Compact grey gravelly sandy SILT with occasional thin seams of grey fine sand.

NATURAL MOISTURE CONTENT: 14.5 (%)
TYPE OF COMPACTION: BS 1377 : Part 4 : 1990 TEST 3.3 ('Light')
PARTICLE DENSITY (ρ_s): 2.75 (assumed)
MATERIAL RETAINED ON 20mm B.S.TEST SIEVE: 5.0 (%)

DRY DENSITY v. MOISTURE CONTENT



CBR VALUE v. MOISTURE CONTENT



GSI

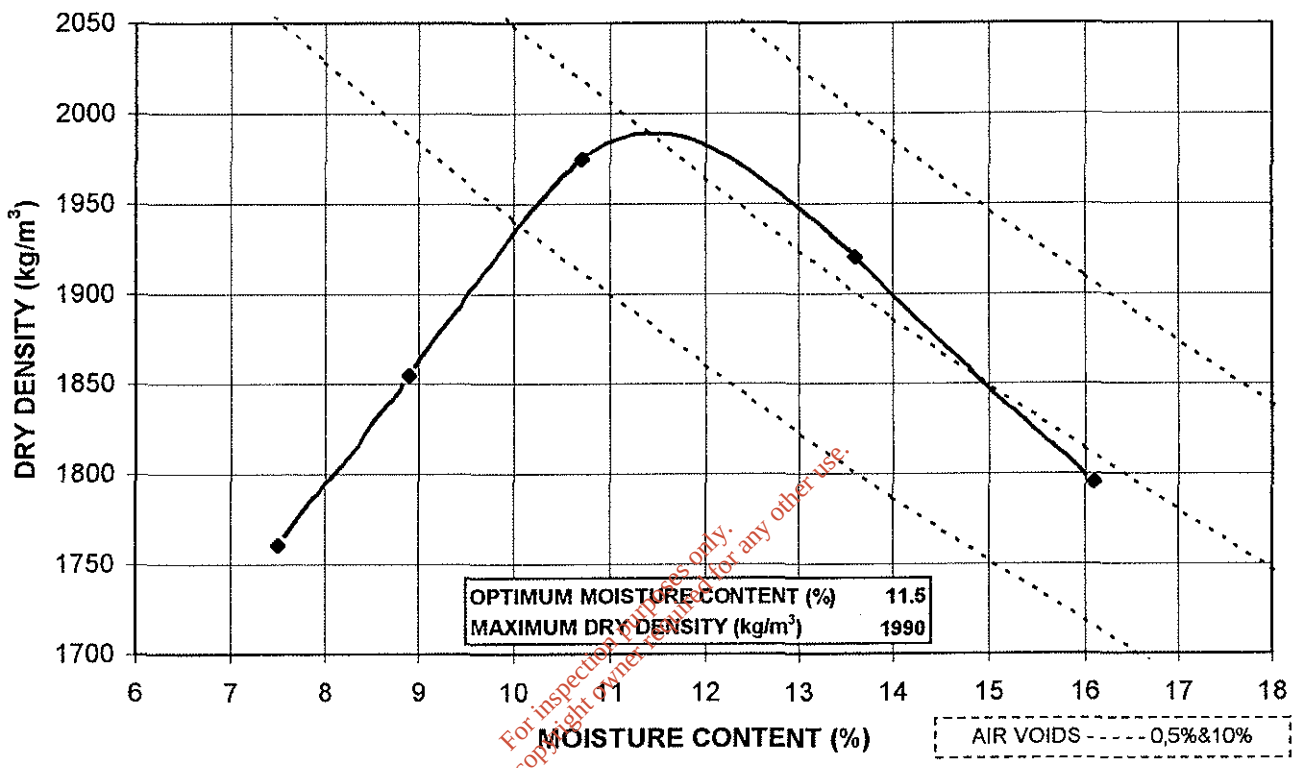
COMPACTION TEST

CONTRACT: Ballynacarrick Landfill Site. **T.H.No.:** BH6 **DEPTH:** B1.50m

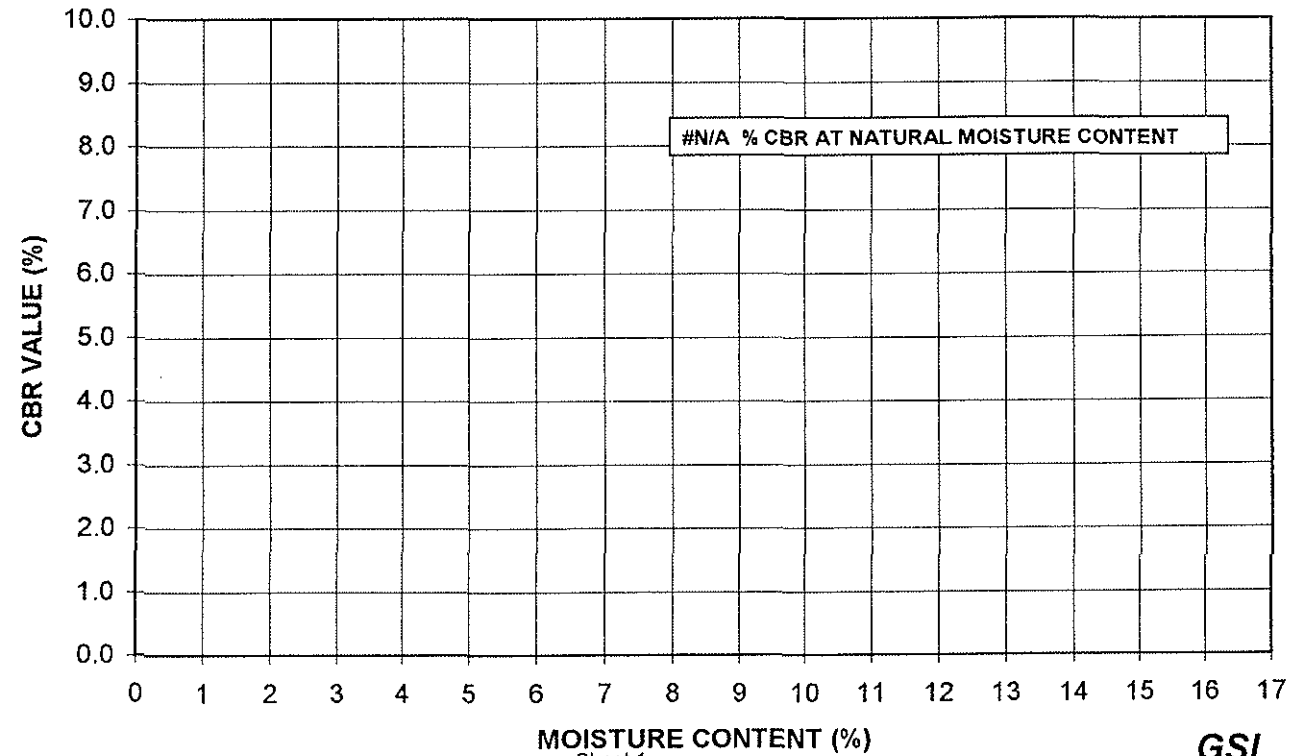
SAMPLE DESCRIPTION: Uncompact light yellowish brown gravelly sandy SILT.

NATURAL MOISTURE CONTENT: 10.7 (%)
TYPE OF COMPACTION: BS 1377 : Part 4 : 1990 TEST 3.4 ('Light')
PARTICLE DENSITY (ρ_s): 2.75 (assumed)
MATERIAL RETAINED ON 20mm B.S.TEST SIEVE: 7.0 (%)

DRY DENSITY v. MOISTURE CONTENT



CBR VALUE v. MOISTURE CONTENT



GSI

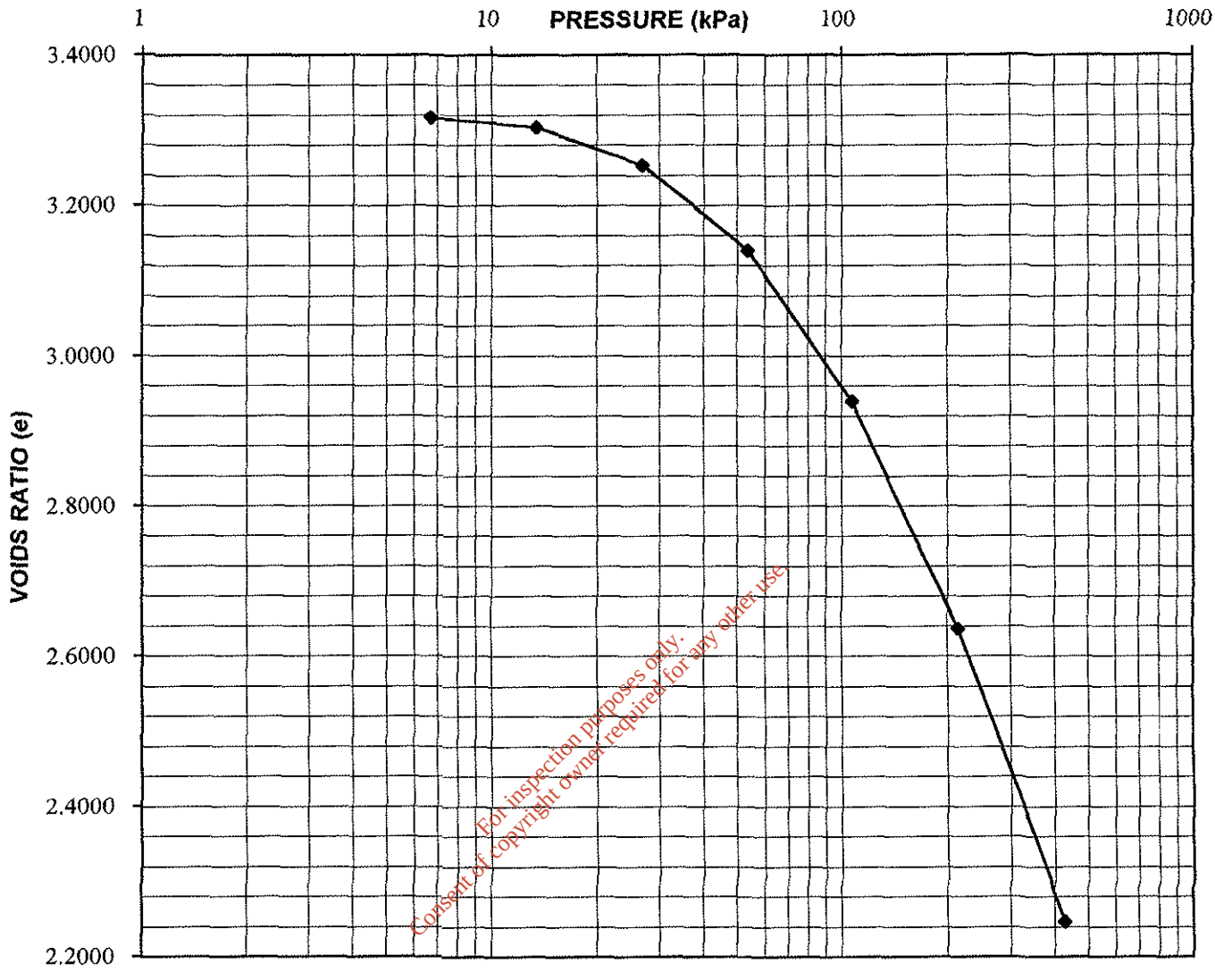
APPENDIX 4
LABORATORY TEST RESULTS

(c) Oedometer Consolidations

OEDOMETER CONSOLIDATION TEST

CONTRACT: Ballynacarrick Landfill Site.

BOREHOLE No.: 4
SAMPLE DEPTH: U0.40m



Initial Bulk Density:	1206	**kg/m3**
Final Bulk Density:	1257	**kg/m3**
Initial Voids Ratio e_o :	3.3274	
Final Voids Ratio e_f:	2.8593	
Initial Moisture Content:	160.9	**%**
Final Moisture Content:	142.6	**%**
Specific Gravity,G_s:	2.00	**#**
Degree of saturation,S:		**%**
Depth below ground level:	0.75	**m**

Sample Description: *Plastic dark grey clayey PEAT.*

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Notes:

*Indicates* ***assumed*** **value.**
***** " square root **time plot.**
- " **swelling.**

Specimen dimensions: 50 **mm dia. x**
19.5 **mm thick.**

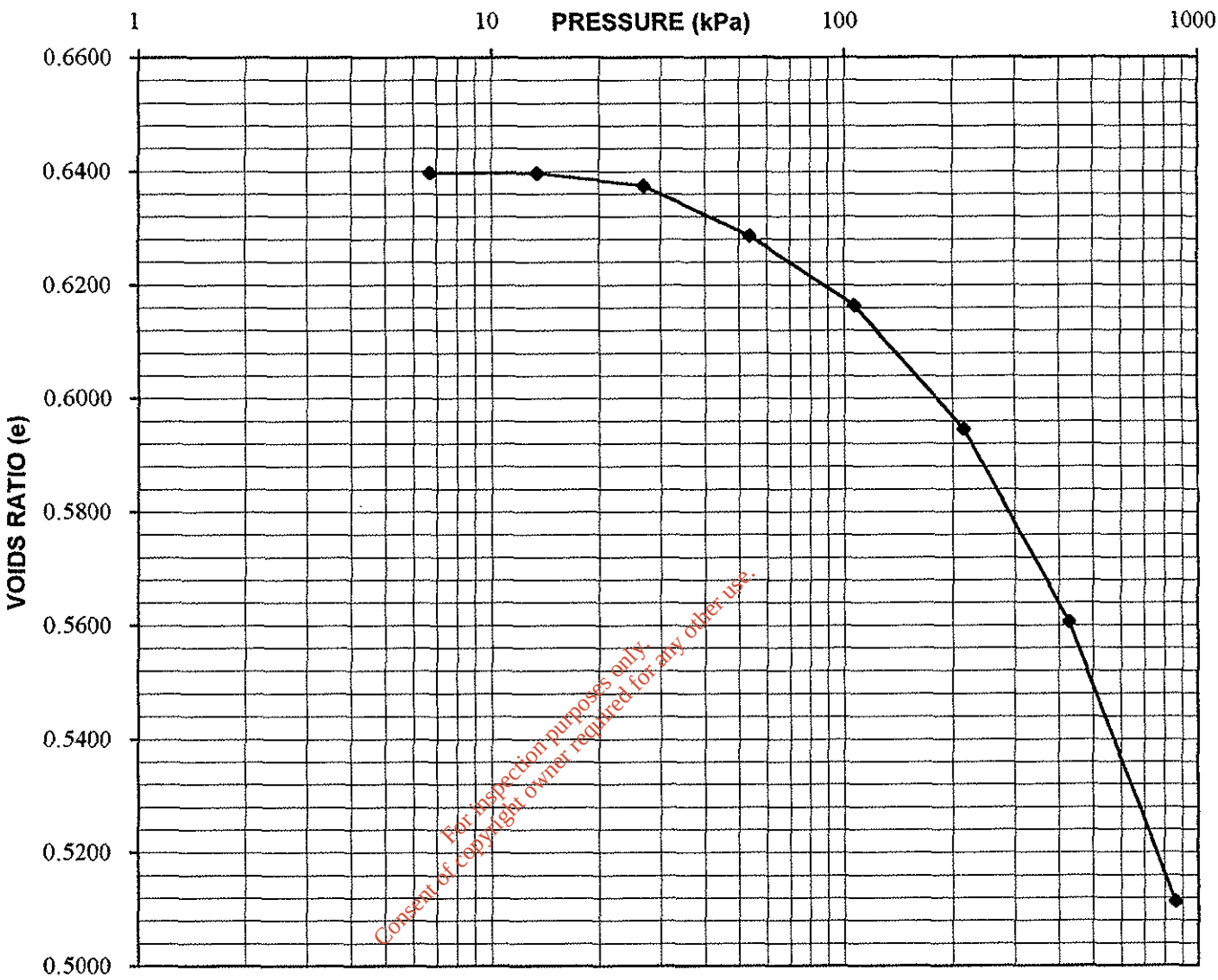
PRESSURE RANGE		CONSOLIDATION COEFFICIENTS *			
p_i (kPa)	p_f (kPa)	m_v (m^2/MN)	c_v (m^2/yr)	r_s	c_{sec}
0	7	Swelling	Swelling		
7	13	0.4478	3.06		
13	27	0.8729	2.23		
27	54	1.0099	1.47		
54	107	0.9271	1.29		
107	215	0.7465	0.63		
215	429	0.5274	0.24		

TUBE No.: **DC88**

OEDOMETER CONSOLIDATION TEST

CONTRACT: Ballynacarrick Landfill Site.

BOREHOLE No.: 6
SAMPLE DEPTH: U3.50m



Initial Bulk Density:	2022	**kg/m3**
Final Bulk Density:	2068	**kg/m3**
Initial Voids Ratio e_o :	0.6417	
Final Voids Ratio e_f:	0.5956	
Initial Moisture Content:	23.0	**%**
Final Moisture Content:	22.2	**%**
Specific Gravity,G_s:	2.70	**#**
Degree of saturation,S:		**%**
Depth below ground level:	3.85	**m**

Sample Description: Stiff grey slightly gravelly sandy CLAY.

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Notes:

# Indicates **assumed value.**
***** " logarithmic **time plot.**
- " **swelling.**

Specimen dimensions: 76.2 **mm dia. x**
18.5 **mm thick.**

PRESSURE RANGE		CONSOLIDATION COEFFICIENTS			
p_i (kPa)	p_f (kPa)	m_v (m^2/MN)	c_v (m^2/yr)	r_s	c_{sec}
0	7	Swelling	Swelling		
7	13	Swelling	Swelling		
13	27	Swelling	Swelling		
27	54	0.2013	2.49		
54	107	0.1403	1.76		
107	215	0.1273	1.81		
215	429	0.1002	1.60		
429	858	0.0748	1.46		

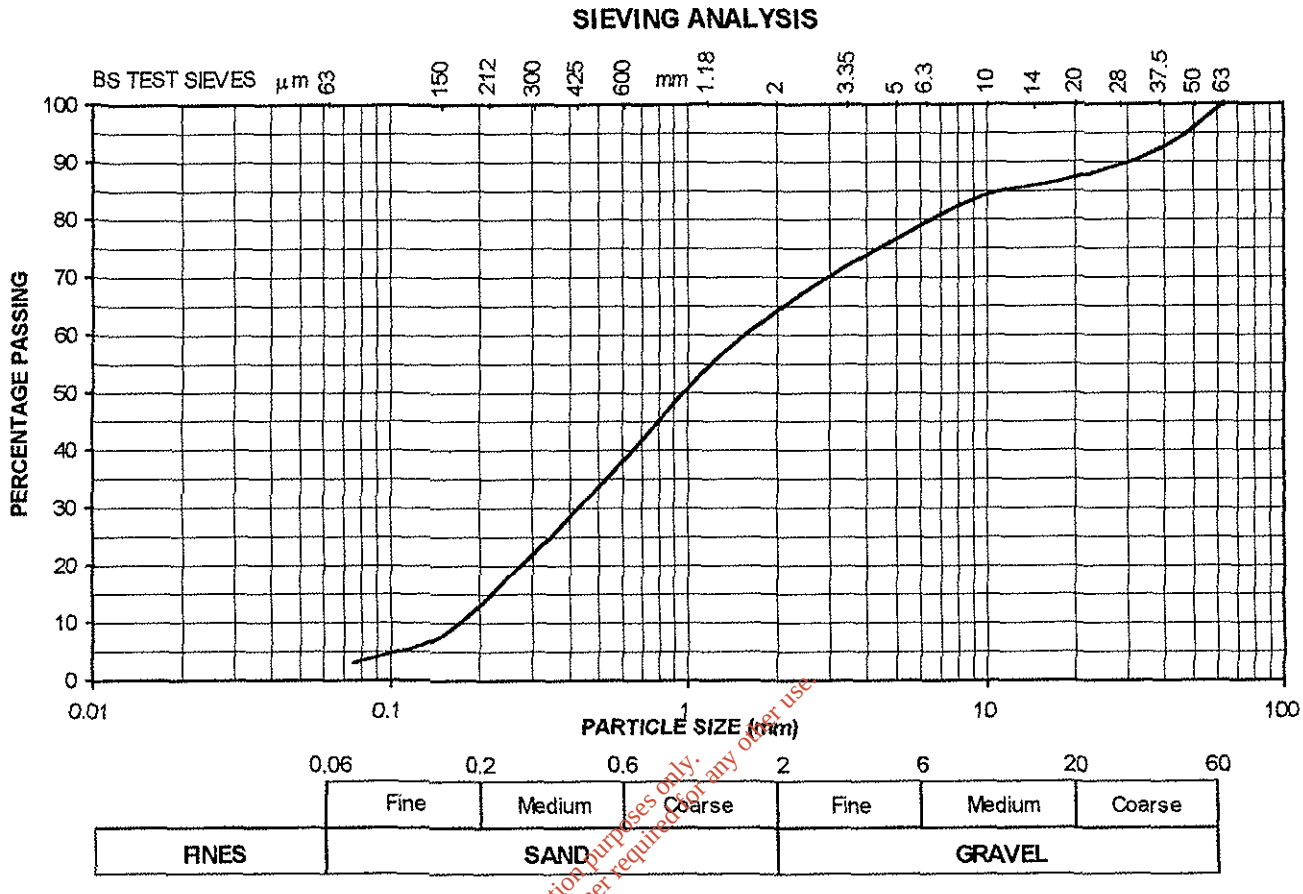
TUBE No.: **G6**

APPENDIX 4
LABORATORY TEST RESULTS

(d) Particle Size Analysis

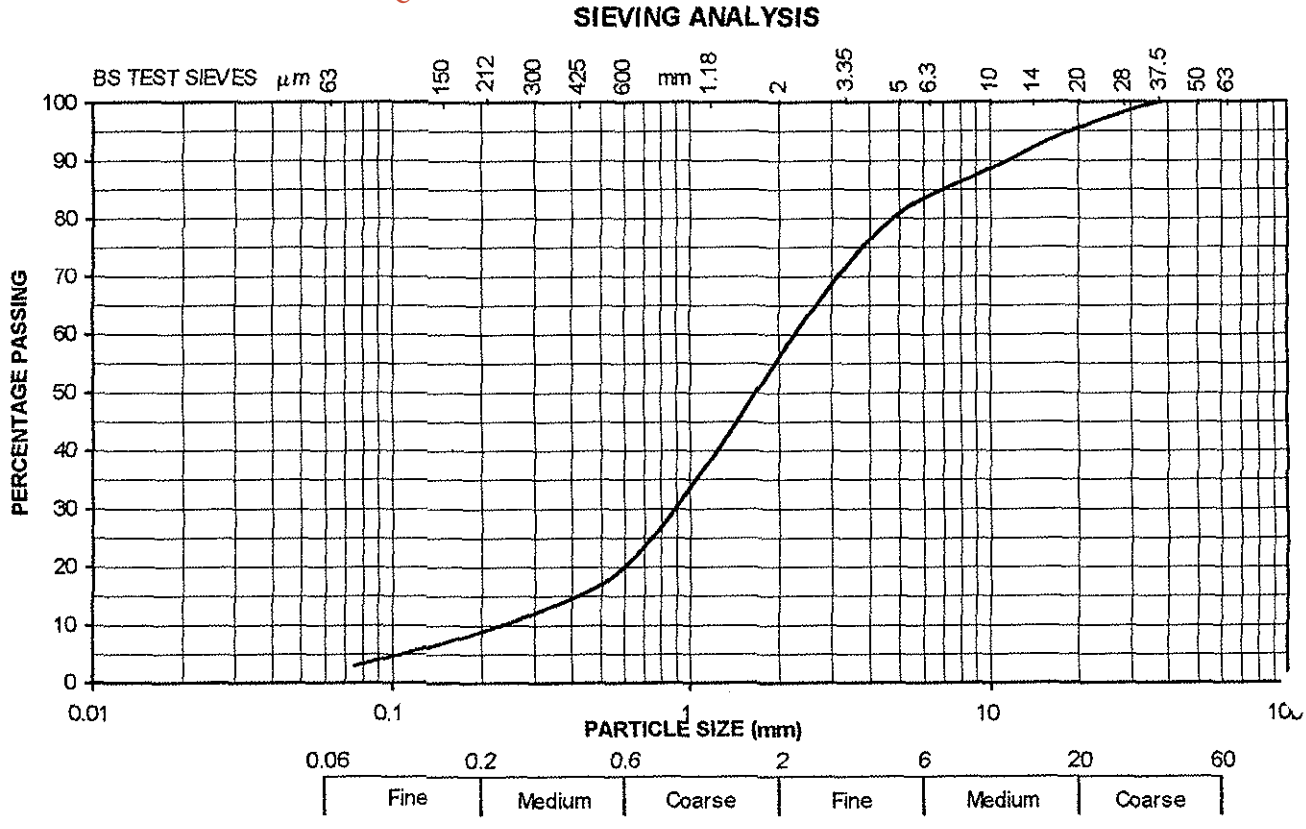
SIEVING ANALYSIS

CONTRACT: Ballynacarrick Landfill Site.
TRIAL HOLE No.: BH4
SAMPLE : B
SAMPLE DEPTH: 1.45m



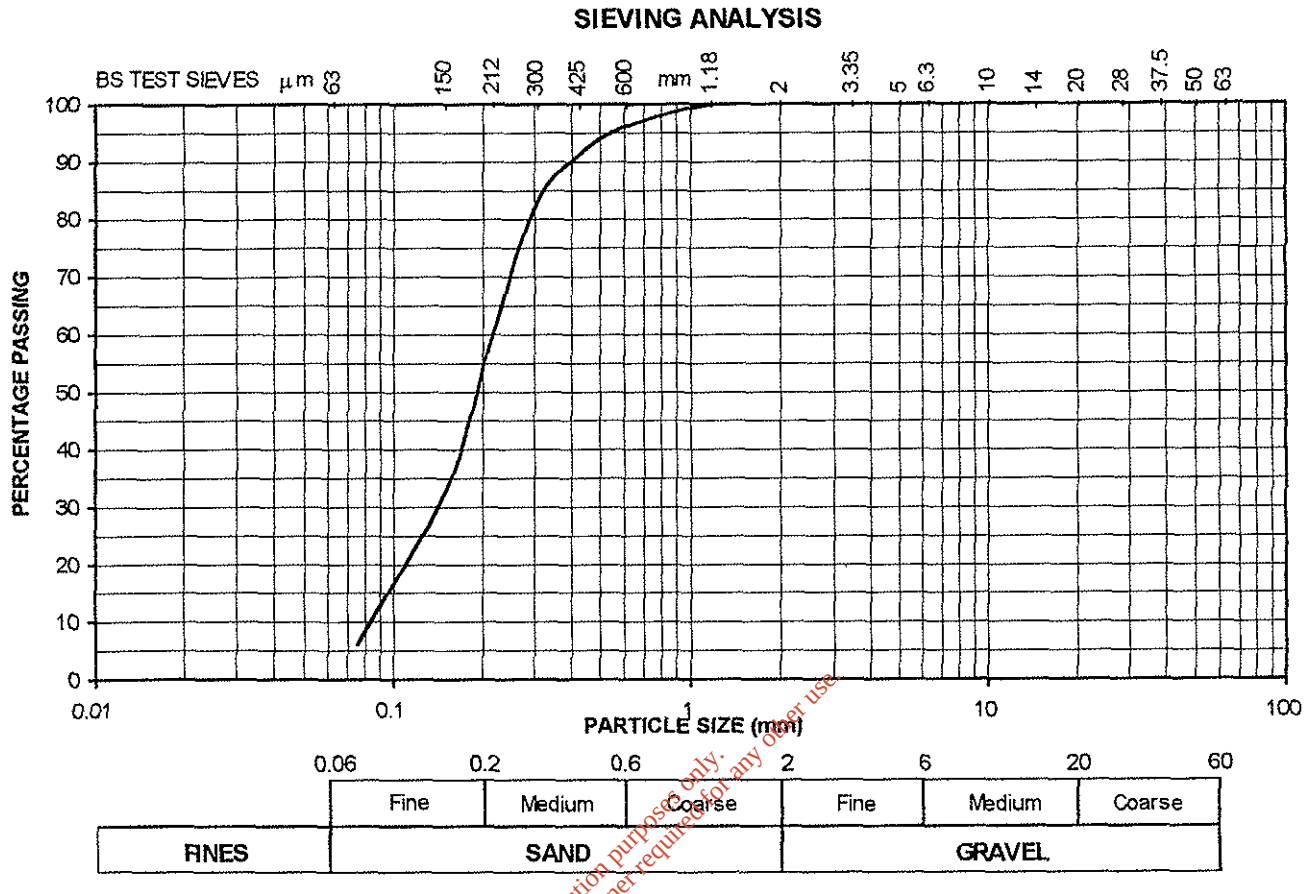
Tests 9.2 & 9.3 of BS 1377 : Part 2 : 1990

CONTRACT: Ballynacarrick Landfill Site.
TRIAL HOLE No.: BH5
SAMPLE : B
SAMPLE DEPTH: 3.50m



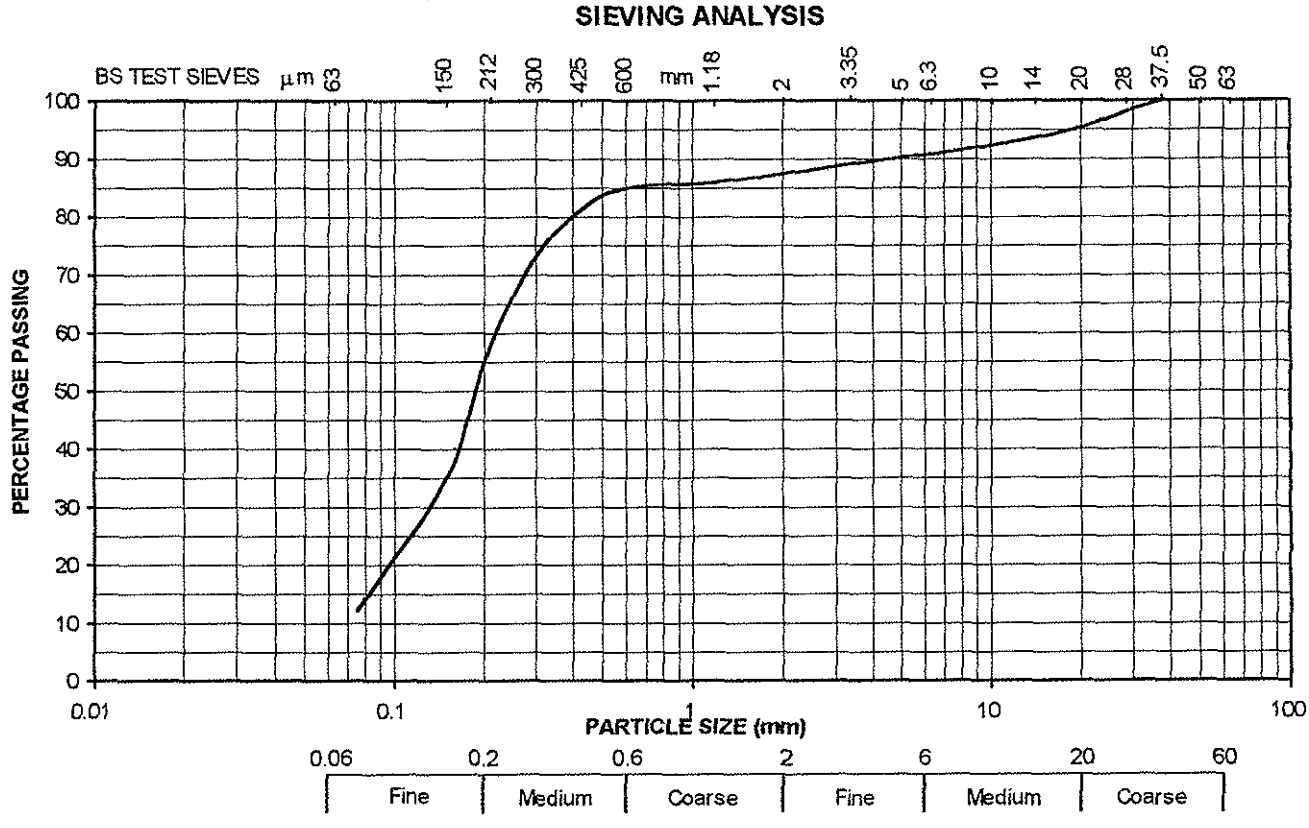
SIEVING ANALYSIS

CONTRACT: Ballynacarrick Landfill Site.
TRIAL HOLE No.: BH5
SAMPLE : J
SAMPLE DEPTH: 4.50m



Tests 9.2 & 9.3 of BS 1377 : Part 2 : 1990

CONTRACT: Ballynacarrick Landfill Site.
TRIAL HOLE No.: BH5
SAMPLE : B
SAMPLE DEPTH: 9.50m



APPENDIX 4
LABORATORY TEST RESULTS

(e) Unconfined Compression Tests

UNIAXIAL COMPRESSIVE STRENGTH TEST RESULTS

Contract: Ballynacarrick Landfill Site.

Borehole	Core Depth (m bgl)	Specimen Diameter D (mm)	Specimen Length L (mm)	Specimen Mass M (kg)	Failure Load P (tonf)	Failure Load P (kN)	Bulk Density γ_b (Mg/m^3)	Measured Compressive Strength (MCS) (MPa)	Correction Factor F	Uniaxial Compressive Strength (UCS) (MPa)	Remarks
1	0.40-0.60	85	117	1.72	34.5	343.8	2.59	60.58	0.93	56.4	
1	6.95-7.15	72	83	0.85	38.0	378.6	2.52	93.00	0.91	84.3	
2	3.50-3.80	72	91	0.95	53.5	533.1	2.56	130.93	0.92	120.3	
2	5.03-5.30	72	104	1.08	46.0	458.3	2.55	112.57	0.94	105.7	
3	1.80-2.0	72	87	0.9	12.5	124.6	2.54	30.59	0.91	27.9	
3	6.70-6.90	72	125	1.32	18.5	184.3	2.59	45.27	0.97	44.0	
3	9.85-10.05	72	102	1.07	19.5	194.3	2.58	47.72	0.94	44.7	
4	3.35-3.75	72	126	1.33	35.5	353.7	2.59	86.88	0.97	84.5	
5	10.8-11.0	72	90	0.95	21.5	214.2	2.59	52.62	0.92	48.3	
5	13.1-13.3	72	88	0.93	19.0	189.3	2.60	46.50	0.91	42.5	

D = core diameter
L = specimen length
M = specimen mass
P = applied load for failure

γ_b = Bulk Density ($4M \times 10^6/\pi \times D^2 \times L$)
MCS = Uncorrected compressive strength ($4P \times 10^3/\pi \times D^2$)
UCS = Size corrected unlaxial compression strength (MCS x F)
F = Size correction factor for core L/D<2 (0.89 + 0.11x(L/D - 1))

APPENDIX 4
LABORATORY TEST RESULTS

(f) Point Load Tests

POINT LOAD STRENGTH TEST RESULTS

Contract: Ballynacarrick Landfill Site.

Borehole	Core Depth (m bgl)	Test Type A = Axial D = Diametral I = Irregular	W (mm)	D (mm)	D' (mm)	L (kN)	P (kN)	D_e^2 (mm^2)	D_e (mm)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	Remarks
1	6.00-6.20	D		72	68	18	16.2	4896	69.97	3.32	1.16	3.86	
1	9.15-9.25	D		72	68	8.5	7.7	4896	69.97	1.57	1.16	1.82	
2	3.30-3.50	D		72	67	29	26.2	4824	69.46	5.42	1.16	6.29	
2	6.80-6.93	D		72	68	20	18.0	4896	69.97	3.69	1.16	4.29	
2	9.90-10.0	A	72	102	97	20	18.0	8892	94.30	2.03	1.33	2.70	
3	2.00-2.10	A	72	95	91	9.5	8.6	8342	91.34	1.03	1.31	1.35	
3	5.75-5.90	D		72	68	23	20.8	4896	69.97	4.24	1.16	4.93	
3	7.40-7.50	A	72	89	85	12.5	11.3	7792	88.27	1.45	1.29	1.87	
4	7.17-7.35	D		72	68	14	12.6	4896	69.97	2.58	1.16	3.00	
5	12.0-12.2	D		72	68	17.5	15.8	4896	69.97	3.23	1.16	3.75	
5	14.9-15.1	A	72	106	98	22	19.9	8954	94.78	2.21	1.33	2.95	

W = core diameter (Axial test) or specimen width (Irregular lump test)

D = core diameter (Diametral test) or specimen length (Axial test / Irregular lump test)

L = measured applied load for failure

P = actual applied load for failure (L x calibration factor)

D' = distance between platens at point of failure

D_e^2 = D x D' (Diametral test)

D_e^2 = $4/\pi$ (W x D') (Axial test / Irregular lump test)

I_s = Uncorrected point load strength (P/D_e^2)

$I_{s(50)}$ = Size corrected point load strength (I_s x F)

F = $(D_e/50)^{0.45}$ Size correction factor for core other than 50mm diameter

APPENDIX 5
INSITU TEST RESULTS

BALLYNACARRICK LANDFILL SITE, COUNTY DONEGAL

STANDPIPE WATER LEVEL READINGS

All water levels in metres below ground level

Date of Reading	Monitor Location						
	BH1 (Rock)	BH2 (Rock)	BH3 (Rock)	BH4 (Rock)	BH5 (Soil)	BH5 (Rock)	BH6 (Soil)
1st August 2002	1.72	+1.5	0.70	+0.4	4.61	6.72	0.69
8th August 2002	1.83	+1.5	0.68	+0.35	4.65	6.68	0.68
15th August 2002	1.71	+1.5	0.67	+0.35	4.62	6.69	0.69

For monitor well installation details see relevant borehole installation sheet in Appendix 2

+ Before a water level reading indicates the water level is above ground level (ie artesian)

PACKER / LUGEON TEST

(SHEET 1 OF 2)

CONTRACT: Ballynacarrick B.H.No. 1 TEST No.: 1

Depths below ground level to:		Ground Level: m (Ordnance datum)	Crew/Operator: JC
(a) top of test section:	5.0m	Packer Type: SINGLE	Weather:
(b) bottom of test section:	10.05m	Packer Pressure: 200 #	Date: 25-7-02
(c) centre of test section:	7.53m	Diameter of hole in test area:	86 mm
(d) bottom of hole at time of test:	10.05m		
(e) bottom of casing:	1.15m		
(f) initial ground water level:	1.71m		
Gauge height above ground level:	+0.66 m	Type of Rock:	SCHIST

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12458.3	12459.7	12461.3	12462.9	
10 #	Water take (litres)	1.4	1.6	1.6		0.31
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12463.4	12467.0	12470.6	12474.3	
20 #	Water take (litres)	3.6	3.6	3.7		0.73
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12475.2	12483.3	12491.3	12499.4	
40 #	Water take (litres)	8.1	8	8.1		1.61
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12500.5	12504.6	12508.7	12512.7	
20 #	Water take (litres)	4.1	4.1	4		0.81
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12513.0	12514.7	12516.3	12518.0	
10 #	Water take (litres)	1.7	1.6	1.7		0.33

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick B.H. No.: 1 TEST No.: 1

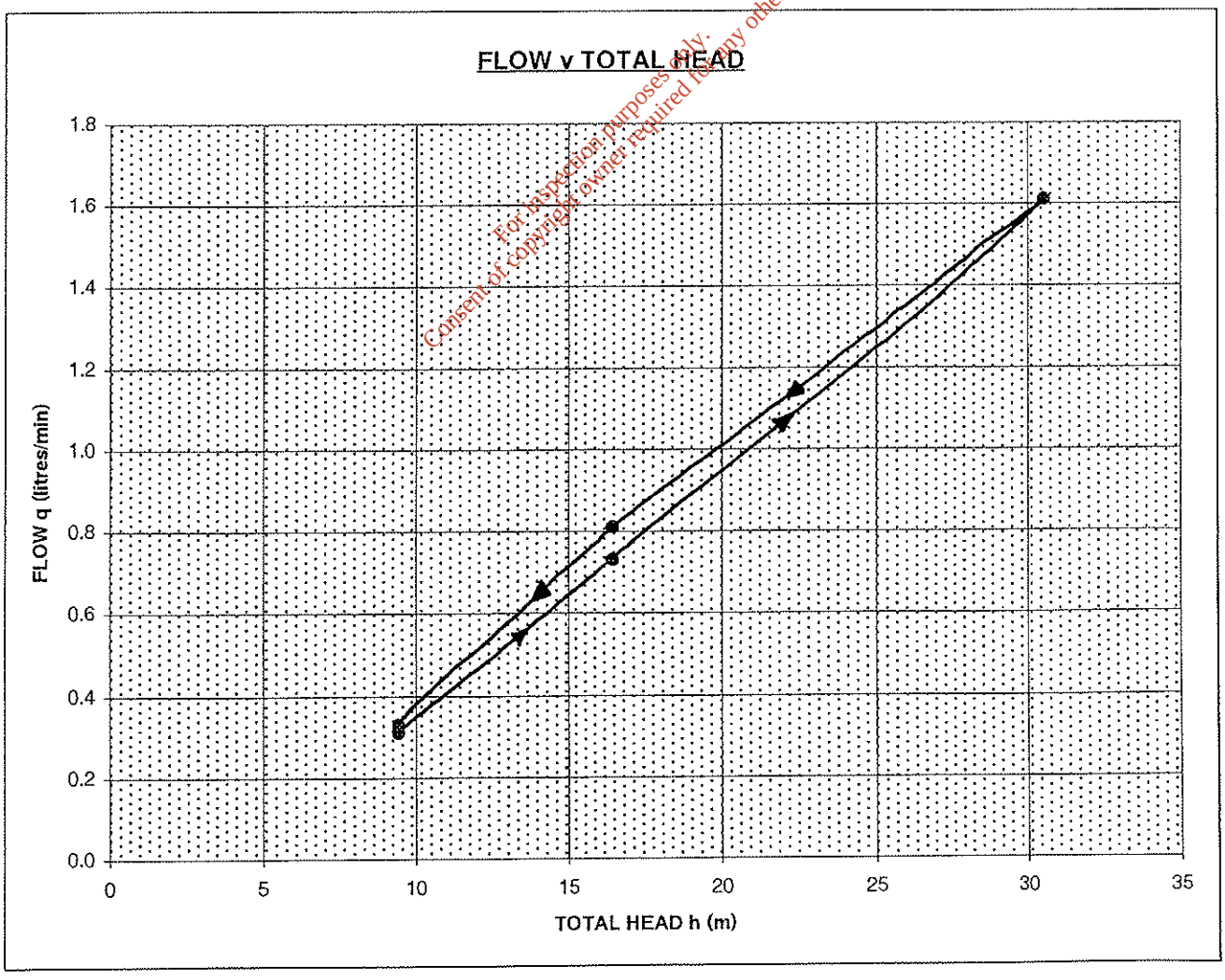
Type of Packer: ***SINGLE***

Depths below ground level to:

(a) Top of test section:	*5.00* (m)	Length of test section (l):	5.1
(b) Bottom of test section:	*10.05* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*1.71* (m)	Height of gauge above g.l.:	*0.66*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	0.31	7.04	2.37	0.00	9.41	8.2E-08	0.7
2nd	20	0.73	14.09	2.37	0.00	16.45	1.1E-07	0.9
3rd	40	1.61	28.17	2.37	0.01	30.53	1.3E-07	1.0
4th	20	0.81	14.09	2.37	0.00	16.45	1.2E-07	1.0
5th	10	0.33	7.04	2.37	0.00	9.41	8.8E-08	0.7

NOTES: $k = q \cdot \log_e(l/r) / 2.\Pi.l.h$



Average Permeability: k = 1.1E-07 m/s

Assessed Permeability:k = 1.1×10^{-7} m/s

Flow Condition: Laminar

GSI

PACKER / LUGEON TEST

(SHEET 1 OF 2)

CONTRACT: Ballynacarrick B.H.No. 2 TEST No.: 1

Depths below ground level to:		Ground Level: m	Crew/Operator:
(a) top of test section:	5.0m •	(Ordnance datum)	JC
(b) bottom of test section:	10.0m •	Packer Type: SINGLE	Weather:
(c) centre of test section:	7.5m		
(d) bottom of hole at time of test:	10.0m	Packer Pressure: 200 #	Date: 29-7-02
(e) bottom of casing:	1.2m		
(f) initial ground water level:	+1.50m	Diameter of hole in test area:	86 mm
Gauge height above ground level:	+1.45m	Type of Rock:	SCHIST

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12533.1	12539.2	12545.5	12551.6	
10 #	Water take (litres)	6.1	6.3	6.1		1.23
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12554.8	12568.5	12582.1	12595.7	
20 #	Water take (litres)	13.7	13.6	13.6		2.73
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12598.3	12628.2	12658.9	12690.0	
40 #	Water take (litres)	29.9	30.7	31.1		6.11
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12694.5	12709.7	12724.7	12739.8	
20 #	Water take (litres)	15.2	15	15.1		3.02
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12744.9	12751.9	12759.5	12766.9	
10 #	Water take (litres)	7	7.6	7.4		1.47

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick **B.H. No.:** 2 **TEST No.:** 1

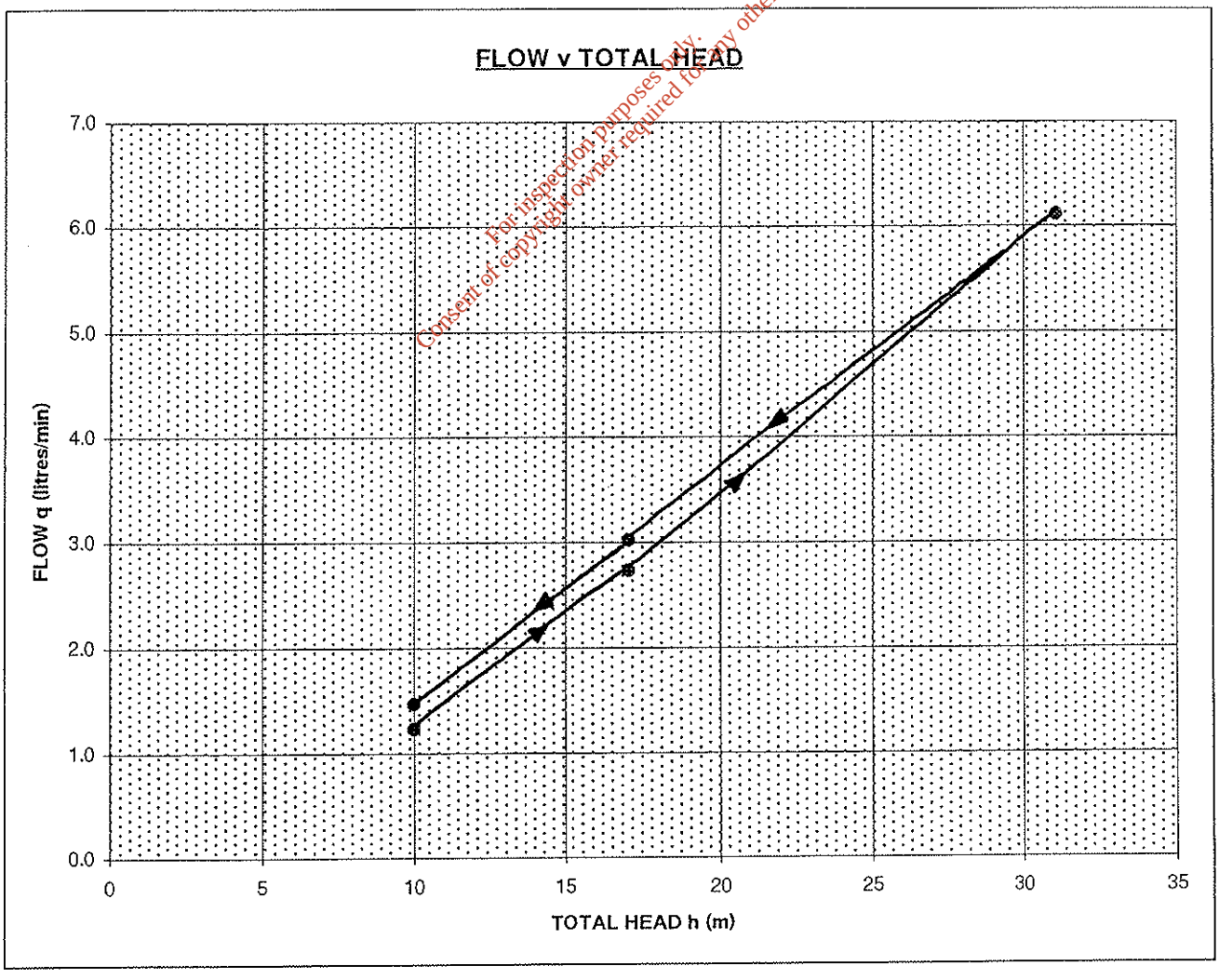
Type of Packer: ***SINGLE***

Depths below ground level to:

(a) Top of test section:	*5.00* (m)	Length of test section (l):	5.0
(b) Bottom of test section:	*10.00* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*1.50* (m)	Height of gauge above g.l.:	*1.45*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	1.23	7.04	2.95	0.01	9.99	3.1E-07	2.5
2nd	20	2.73	14.09	2.95	0.01	17.02	4.0E-07	3.2
3rd	40	6.11	28.17	2.95	0.03	31.09	5.0E-07	3.9
4th	20	3.02	14.09	2.95	0.02	17.02	4.5E-07	3.5
5th	10	1.47	7.04	2.95	0.01	9.99	3.7E-07	2.9

NOTES: $k = q \cdot \log_e(l/r) / 2.\Pi.l.h$



Average Permeability: k = 4.1E-07 m/s

Assessed Permeability:k = 4.1×10^{-7} m/s

Flow Condition: Laminar

GSI

PACKER / LUGEON TEST

CONTRACT: Ballynacarrick B.H.No. 3 TEST No.: 1

Depths below ground level to:		Ground Level: m	Crew/Operator:
(a) top of test section:	2.0m	(Ordnance datum)	JC
(b) bottom of test section:	10.05m	Packer Type: SINGLE	Weather:
(c) centre of test section:	6.025m		
(d) bottom of hole at time of test:	10.05m	Packer Pressure: 200 #	Date: 1-8-02
(e) bottom of casing:	1.5m		
(f) initial ground water level:	0.67m	Diameter of hole in test area:	86 mm
Gauge height above ground level:	1.51m	Type of Rock:	LIMESTONE

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13376.1	13377.6	13379.1	13380.6	
10 #	Water take (litres)	1.5	1.5	1.5		0.30
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13381.0	13384.1	13387.1	13390.2	
20 #	Water take (litres)	3.1	3	3.1		0.61
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13392.4	13400.6	13408.3	13416.2	
40 #	Water take (litres)	8.2	7.7	7.9		1.59
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13417.3	13420.4	13423.5	13426.7	
20 #	Water take (litres)	3.1	3.1	3.2		0.63
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13428.8	13430.3	13431.8	13433.4	
10 #	Water take (litres)	1.5	1.5	1.6		0.31

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick B.H. No.: 3 TEST No.: 1

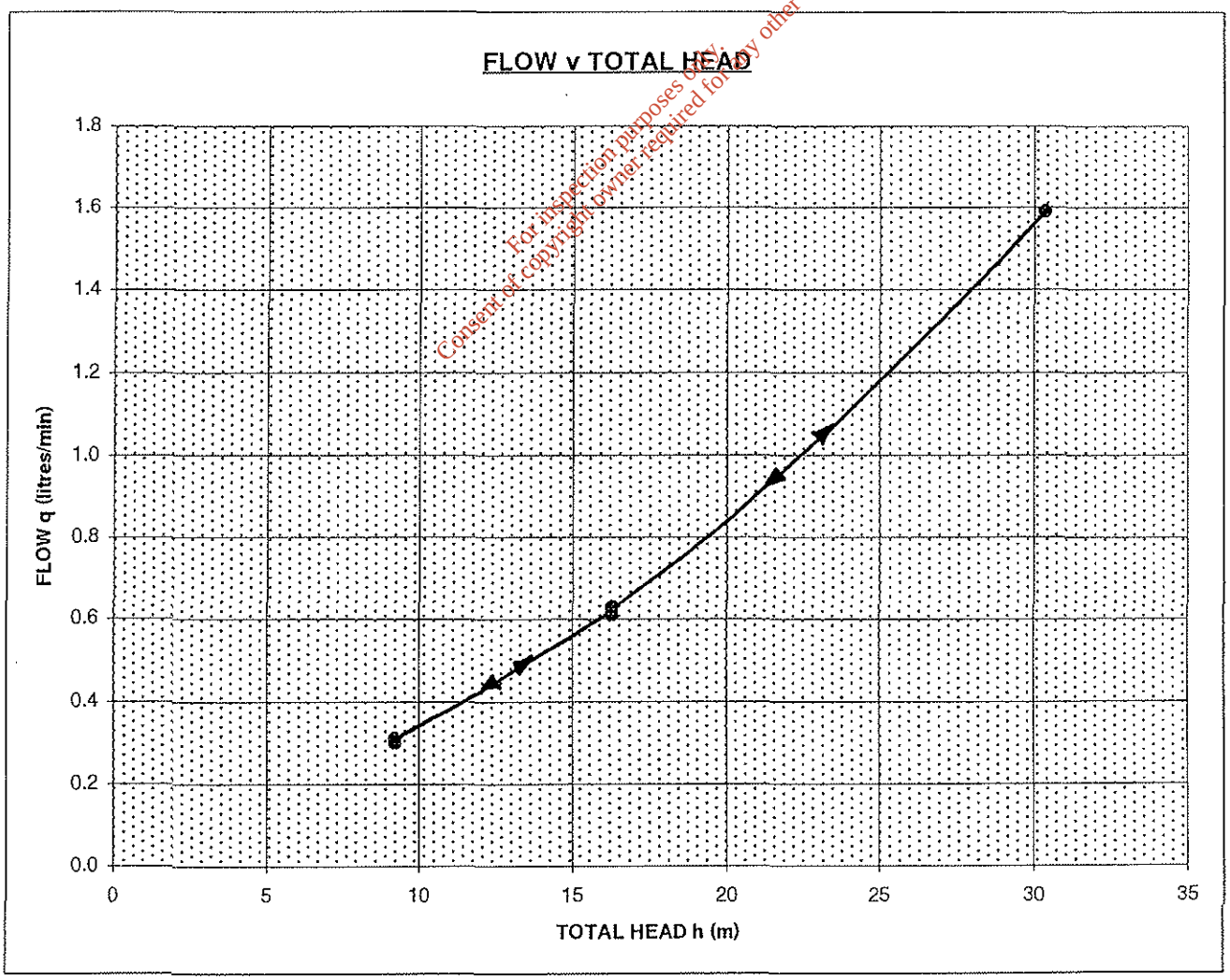
Type of Packer: ***SINGLE***

Depths below ground level to:

(a) Top of test section:	*2.00* (m)	Length of test section (l):	8.1
(b) Bottom of test section:	*10.05* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*0.67* (m)	Height of gauge above g.l.:	*1.51*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	0.30	7.04	2.18	0.00	9.22	5.6E-08	0.4
2nd	20	0.61	14.09	2.18	0.00	16.26	6.5E-08	0.5
3rd	40	1.59	28.17	2.18	0.00	30.35	9.0E-08	0.7
4th	20	0.63	14.09	2.18	0.00	16.26	6.7E-08	0.5
5th	10	0.31	7.04	2.18	0.00	9.22	5.8E-08	0.4

NOTES: $k = q \cdot \log_e(l/r) / 2.\Pi.l.h$



Average Permeability: k = 6.7E-08 m/s

Assessed Permeability:k = 6.7×10^{-8} m/s

Flow Condition: Laminar

GSI

wt32

PACKER / LUGEON TEST

(SHEET 1 OF 2)

CONTRACT: Ballynacarrick **B.H.No.** 3 **TEST No.:** 2

Depths below ground level to:		Ground Level: m	Crew/Operator:
(a) top of test section:	5.0m	(Ordnance datum)	JC
(b) bottom of test section:	10.05m	Packer Type: SINGLE	Weather:
(c) centre of test section:	7.525m		
(d) bottom of hole at time of test:	10.05m	Packer Pressure: 200 #	Date: 1-8-02
(e) bottom of casing:	1.5m		
(f) initial ground water level:	0.67m	Diameter of hole in test area:	86 mm
Gauge height above ground level:	1.35m	Type of Rock:	LIMESTONE

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13456.9	13457.4	13457.9	13458.5	
10 #	Water take (litres)	0.5	0.5	0.6		0.11
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13458.7	13459.7	13460.8	13461.9	
20 #	Water take (litres)	1	1.1	1.1		0.21
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13462.2	13464.3	13466.3	13468.7	
40 #	Water take (litres)	2.1	2	2.4		0.43
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13469.0	13470.1	13471.2	13472.3	
20 #	Water take (litres)	1.1	1.1	1.1		0.22
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13473.5	13474.1	13474.7	13475.3	
10 #	Water take (litres)	0.6	0.6	0.6		0.12

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick B.H. No.: 3 TEST No.: 2

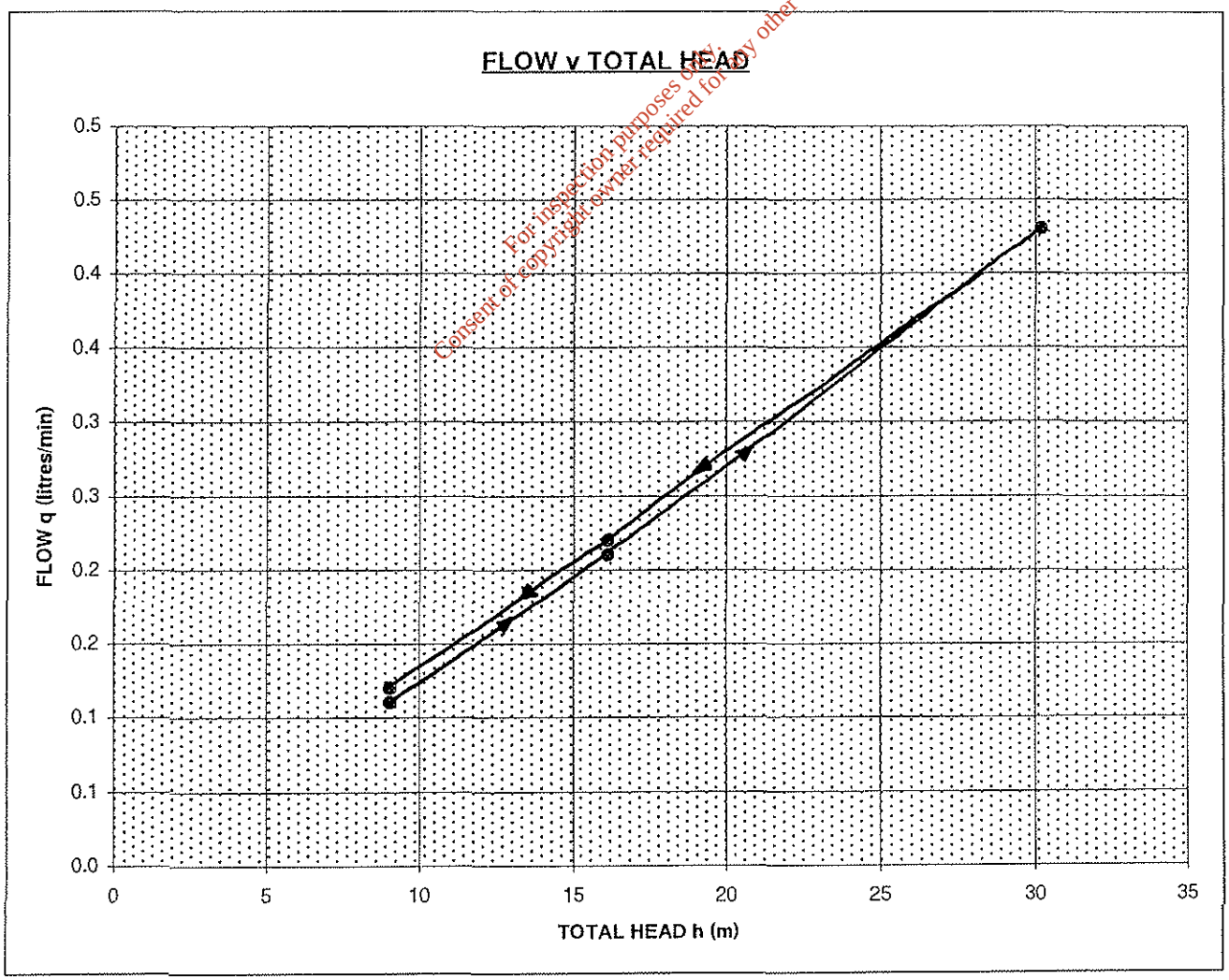
Type of Packer: *SINGLE*

Depths below ground level to:

(a) Top of test section:	*5.00* (m)	Length of test section (l):	5.1
(b) Bottom of test section:	*10.05* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*0.67* (m)	Height of gauge above g.l.:	*1.35*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	0.11	7.04	2.02	0.00	9.06	3.0E-08	0.2
2nd	20	0.21	14.09	2.02	0.00	16.10	3.3E-08	0.3
3rd	40	0.43	28.17	2.02	0.00	30.19	3.6E-08	0.3
4th	20	0.22	14.09	2.02	0.00	16.10	3.4E-08	0.3
5th	10	0.12	7.04	2.02	0.00	9.06	3.3E-08	0.3

NOTES: $k = q \cdot \log_e(l/r) / 2.\Pi.l.h$



Average Permeability: k = 3.3E-08 m/s

Assessed Permeability: k = 3.3×10^{-8} m/s

Flow Condition: Laminar

GSI

wt357

PACKER / LUGEON TEST

(SHEET 1 OF 2)

CONTRACT: Ballynacarrick B.H.No. 4 TEST No.: 1

Depths below ground level to:		Ground Level: m	Crew/Operator:
(a) top of test section:	4.00m	(Ordnance datum)	JC
(b) bottom of test section:	7.35m	Packer Type: SINGLE	Weather:
(c) centre of test section:	5.675m		
(d) bottom of hole at time of test:	7.35m	Packer Pressure: 200 #	Date: 2-8-02
(e) bottom of casing:	2.40m		
(f) initial ground water level:	+0.35m	Diameter of hole in test area:	86 mm
Gauge height above ground level:	1.34m	Type of Rock:	LIMESTONE

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13541.5	13544.5	13547.7	13550.7	
10 #	Water take (litres)	3	3.2	3		0.61
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13552.4	13558.7	13565.2	13571.6	
20 #	Water take (litres)	6.3	6.5	6.4		1.28
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13572.6	13585.7	13598.7	13611.5	
40 #	Water take (litres)	13.1	13	12.8		2.59
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13615.1	13622.8	13630.7	13638.7	
20 #	Water take (litres)	7.7	7.9	8		1.57
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13641.0	13645.0	13648.8	13652.8	
10 #	Water take (litres)	4	3.8	4		0.79

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick **B.H. No.:** 4 **TEST No.:** 1

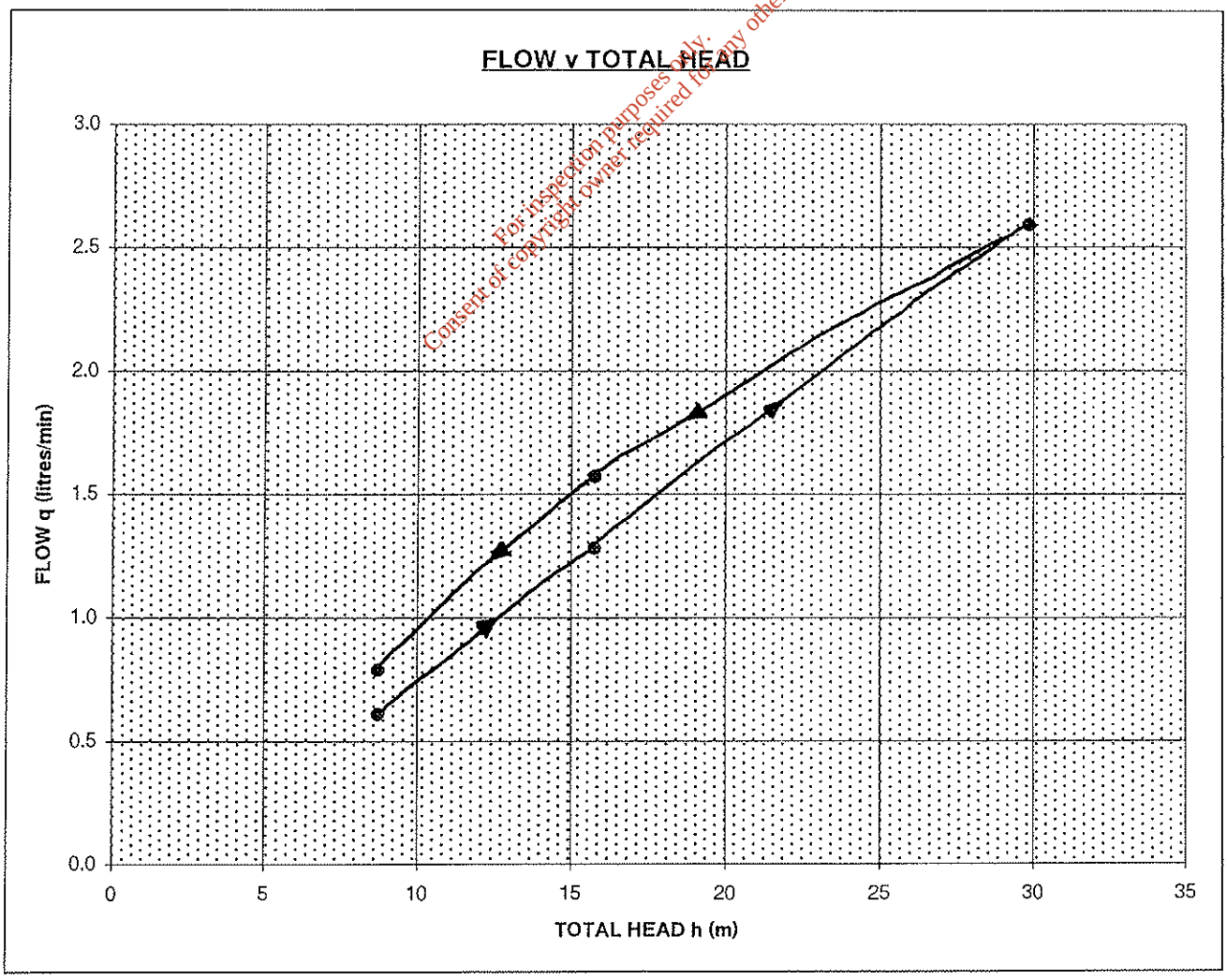
Type of Packer: ***SINGLE***

Depths below ground level to:

(a) Top of test section:	*4.00* (m)	Length of test section (l):	3.4
(b) Bottom of test section:	*7.35* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*0.35* (m)	Height of gauge above g.l.:	*1.34*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	0.61	7.04	1.69	0.00	8.73	2.4E-07	2.1
2nd	20	1.28	14.09	1.69	0.01	15.77	2.8E-07	2.4
3rd	40	2.59	28.17	1.69	0.01	29.85	3.0E-07	2.6
4th	20	1.57	14.09	1.69	0.01	15.77	3.4E-07	3.0
5th	10	0.79	7.04	1.69	0.00	8.73	3.1E-07	2.7

NOTES: $k = q \cdot \log_e(l/r) / 2.\Pi.l.h$



Average Permeability: k = 3.0E-07 m/s
Assessed Permeability:k = 3.0×10^{-7} m/s
Flow Condition: Laminar

GSI

wt97

PACKER / LUGEON TEST

(SHEET 1 OF 2)

CONTRACT: Ballynacarrick **B.H.No.** 5 **TEST No.:** 1

Depths below ground level to:		Ground Level: m (Ordnance datum)	Crew/Operator: JC
(a) top of test section:	11.5m	Packer Type: SINGLE	Weather:
(b) bottom of test section:	15.0m	Packer Pressure: 200 #	Date: 30-7-02
(c) centre of test section:	13.25m	Diameter of hole in test area:	86 mm
(d) bottom of hole at time of test:	15.0m		
(e) bottom of casing:	10.2m		
(f) initial ground water level:	6.69m		
Gauge height above ground level:	1.28m	Type of Rock:	LIMESTONE

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12794.8	12805.9	12817.3	12828.5	
10 #	Water take (litres)	11.1	11.4	11.2		2.25
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12831.1	12856.0	12881.2	12906.8	
20 #	Water take (litres)	24.9	25.2	25.6		5.05
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	12919.1	12981.4	13044.1	13106.7	
40 #	Water take (litres)	62.3	62.7	62.6		12.51
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13112.2	13141.6	13170.7	13200.0	
20 #	Water take (litres)	29.4	29.1	29.3		5.85
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13201.9	13214.0	13226.0	13238.1	
10 #	Water take (litres)	12.1	12	12.1		2.41

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

GSI

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick **B.H. No.:** 5 **TEST No.:** 1

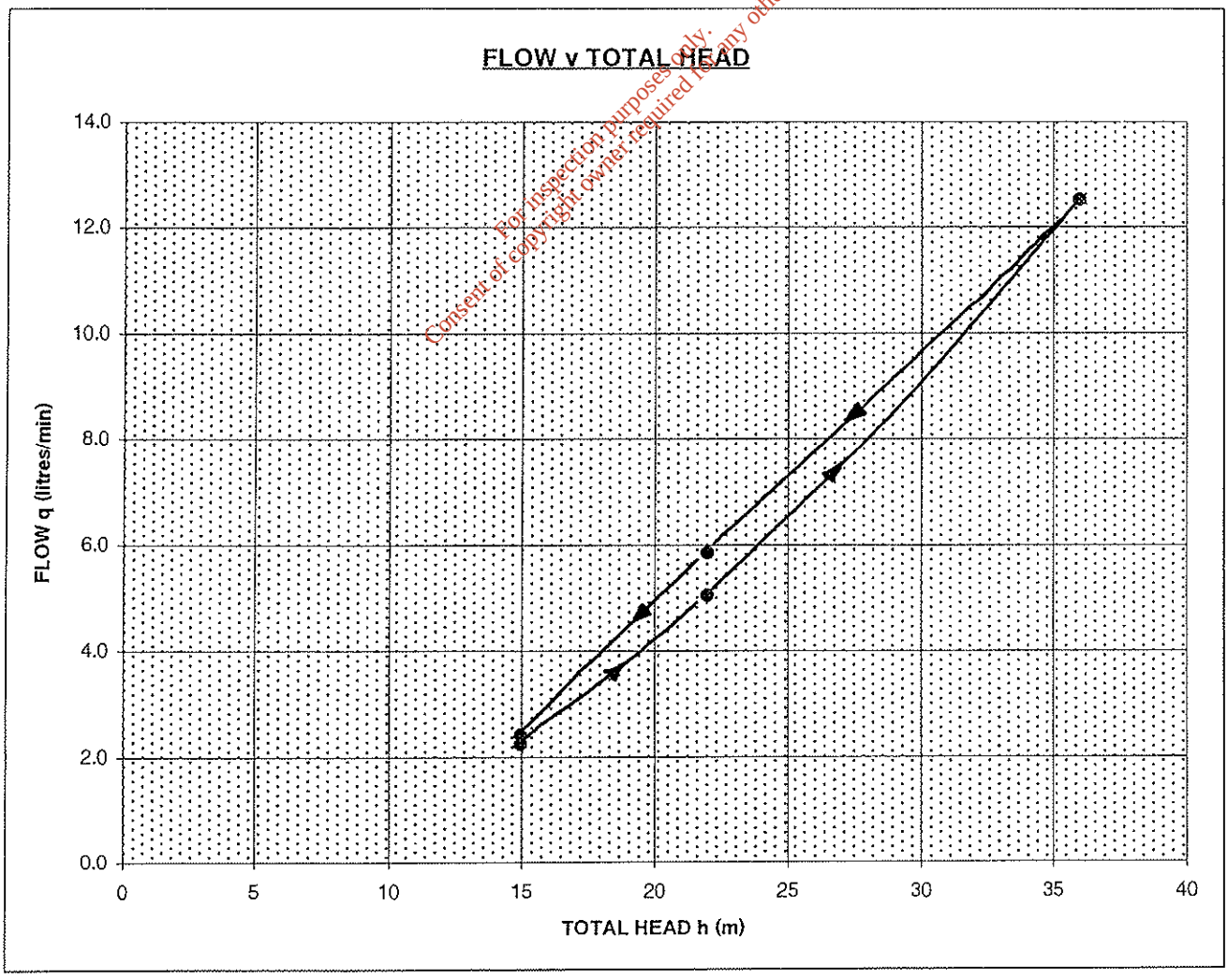
Type of Packer: ***SINGLE***

Depths below ground level to:

(a) Top of test section:	*11.50* (m)	Length of test section (l):	3.5
(b) Bottom of test section:	*15.00* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*6.69* (m)	Height of gauge above g.l.:	*1.28*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	2.25	7.04	7.97	0.02	14.99	5.0E-07	4.3
2nd	20	5.05	14.09	7.97	0.05	22.00	7.7E-07	6.6
3rd	40	12.51	28.17	7.97	0.13	36.01	1.2E-06	9.9
4th	20	5.85	14.09	7.97	0.06	21.99	8.9E-07	7.6
5th	10	2.41	7.04	7.97	0.03	14.99	5.4E-07	4.6

NOTES: $k = q \cdot \log_e(l/r) / 2\pi l.h$



Average Permeability: k =	**7.7E-07**	**m/s**
Assessed Permeability:k =	**7.7×10^{-7}**	**m/s**
Flow Condition:	**Laminar**	

GSI

PACKER / LUGEON TEST

CONTRACT: Ballynacarrick B.H.No. 5 TEST No.: 2

Depths below ground level to:		Ground Level: m	Crew/Operator:
(a) top of test section:	14.0m	(Ordnance datum)	JC
(b) bottom of test section:	15.0m	Packer Type: SINGLE	Weather:
(c) centre of test section:	14.5m		
(d) bottom of hole at time of test:	15.0m	Packer Pressure: 200 #	Date: 30-7-02
(e) bottom of casing:	10.2m		
(f) initial ground water level:	6.69m	Diameter of hole in test area:	86 mm
Gauge height above ground level:	1.52m	Type of Rock:	LIMESTONE

TEST RECORD

1st Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13261.6	13263.1	13264.6	13266.2	
10 #	Water take (litres)	1.5	1.5	1.6		0.31
2nd Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13267.2	13270.5	13273.7	13277.1	
20 #	Water take (litres)	3.3	3.2	3.4		0.66
3rd Period	Time (min)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13279.3	13286.3	13293.5	13300.7	
40 #	Water take (litres)	7	7.2	7.2		1.43
4th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13303.0	13306.4	13309.8	13313.1	
20 #	Water take (litres)	3.4	3.4	3.3		0.67
5th Period	Time (min.)	0	5	10	15	Average flow q (litres/min.)
Gauge Pressure:	Flowmeter Readings (litres)	13313.8	13315.4	13317.0	13318.5	
10 #	Water take (litres)	1.6	1.6	1.5		0.31

REMARKS: (to include details of pipework where relevant)

Packer Pressure and Gauge Pressure in metres Head of Water.

PACKER / LUGEON TEST

(SHEET 2 of 2)

CONTRACT: Ballynacarrick **B.H. No.:** 5 **TEST No.:** 2

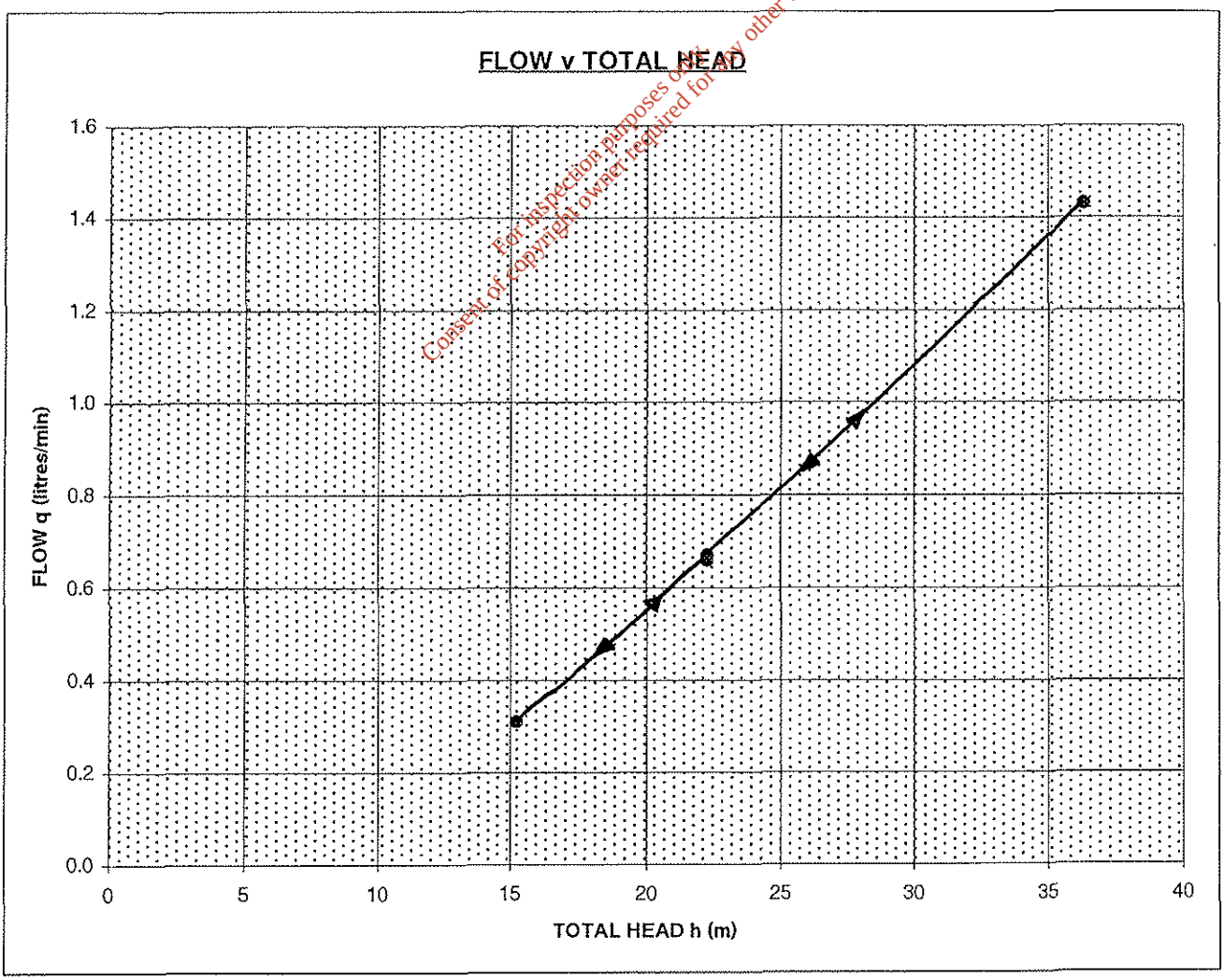
Type of Packer: ***SINGLE***

Depths below ground level to:

(a) Top of test section:	*14.00* (m)	Length of test section (l):	1.0
(b) Bottom of test section:	*15.00* (m)	Radius of hole (r):	*0.043*
(c) Ground water level:	*6.69* (m)	Height of gauge above g.l.:	*1.52*

Period	Gauge Pressure (psi)	Flow q (l/min)	Pressure Head (m)	Gravity Head (m)	Head Loss (m)	Total Head h (m)	Permeability k (m/s)	Water Injection (Lugeon)
1st	10	0.31	7.04	8.21	0.00	15.25	1.7E-07	2.0
2nd	20	0.66	14.09	8.21	0.01	22.29	2.5E-07	3.0
3rd	40	1.43	28.17	8.21	0.02	36.36	3.3E-07	3.9
4th	20	0.67	14.09	8.21	0.01	22.29	2.5E-07	3.0
5th	10	0.31	7.04	8.21	0.00	15.25	1.7E-07	2.0

NOTES: $k = q \cdot \log_e(l/r) / 2.\Pi.l.h$



Average Permeability: k = 2.3E-07 m/s

Assessed Permeability:k = 2.3×10^{-7} m/s

Flow Condition: Laminar

GSI

wt92

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 1 TEST No.: 1

DATE: 25-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*86*	(mm)	
Height of TOP of casing above ground level:	*0.30*	(m)	
Depth to bottom of casing below ground level (m):	*1.30*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*10.05*	(m)	
Depth to bottom of borehole below ground level after test:	*10.05*	(m)	
Standing ground water level (mbgl):	*1.71*	(m)	on 25-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 2.01 m below datum.

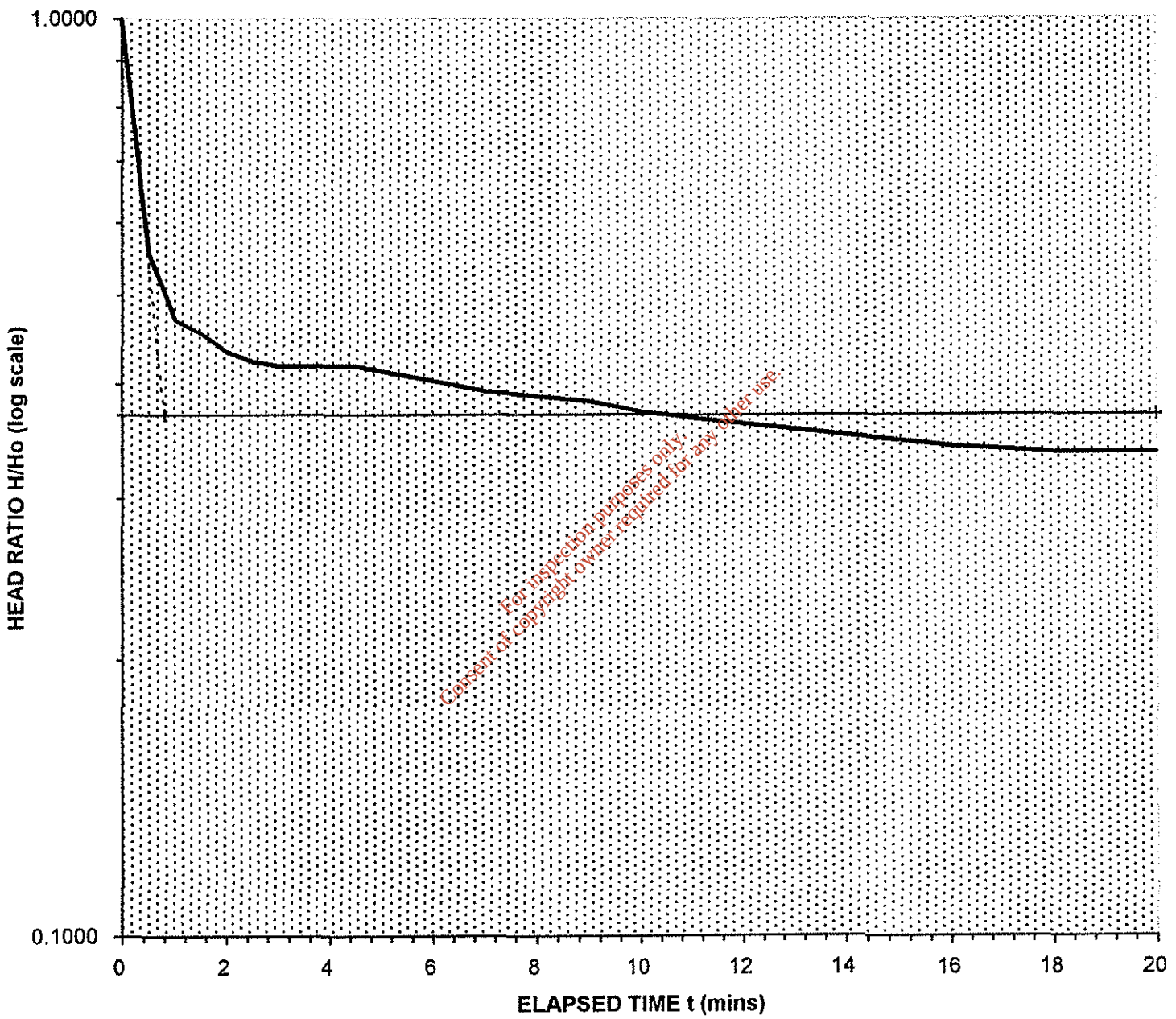
TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.05	1.96	1.0000
0.5	0.92	1.09	0.5561
1	1.09	0.92	0.4694
1.5	1.12	0.89	0.4541
2	1.16	0.85	0.4337
2.5	1.18	0.83	0.4235
3	1.19	0.82	0.4184
4.5	1.19	0.82	0.4184
5	1.2	0.81	0.4133
6	1.22	0.79	0.4031
7	1.24	0.77	0.3929
8	1.25	0.76	0.3878
9	1.26	0.75	0.3827
10	1.28	0.73	0.3724
12	1.3	0.71	0.3622
14	1.32	0.69	0.3520
16	1.34	0.67	0.3418
18	1.35	0.66	0.3367
20	1.35	*0.66*	0.3367
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 1 **TEST #:** 1
DATE: 25-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	0.8	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site
BOREHOLE No.: 2
TEST No.: 1
DATE: 29-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D): *86* (mm)
Height of TOP of casing above ground level: *2.10* (m)
Depth to bottom of casing below ground level (m): *1.20* (m) (Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test: *10.00* (m)
Depth to bottom of borehole below ground level after test: *10.00* (m)
Standing ground water level (mbgl): *-1.50* (m) on 29-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.60 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0	0.6	1.0000
0.5	0.07	0.53	0.8833
1	0.12	0.48	0.8000
1.5	0.16	0.44	0.7333
2	0.19	0.41	0.6833
2.5	0.22	0.38	0.6333
3	0.24	0.36	0.6000
4	0.31	0.29	0.4833
5	0.36	0.24	0.4000
6	0.39	0.21	0.3500
7	0.42	0.18	0.3000
8	0.44	0.16	0.2667
9	0.46	0.14	0.2333
10	0.48	0.12	0.2000
12	0.52	0.08	0.1333
14	0.55	0.05	0.0833
16	0.58	0.02	0.0333
18	0.59	0.01	0.0167
20	0.6	0	0.0000
22	0.6	0	0.0000
24	0.6	0	0.0000
26	0.6	0	0.0000
28	0.6	0	0.0000
30	0.6	0	0.0000
32	0.6	0	0.0000
40	0.6	0	0.0000
45	0.6	0	0.0000
50	0.6	0	0.0000
55	0.6	0	0.0000
60	0.6	0	0.0000
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60			0.37

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:
k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined
in Figure 9 of BS 5930:1981 (Page 38)

Values of *intake factors* (F) for various conditions,
Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case ***C*** ,hence:
F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]
i.e. F = 9.9116 (m)
and A = 0.0058 (m^2)
and T = *6* (mins); (see graph of log H/Ho v Time.)

hence, k = 1.6E-06 m/s

i.e., k = 1.6×10^{-6} m/s

Notes:

Sheet 1 of 2

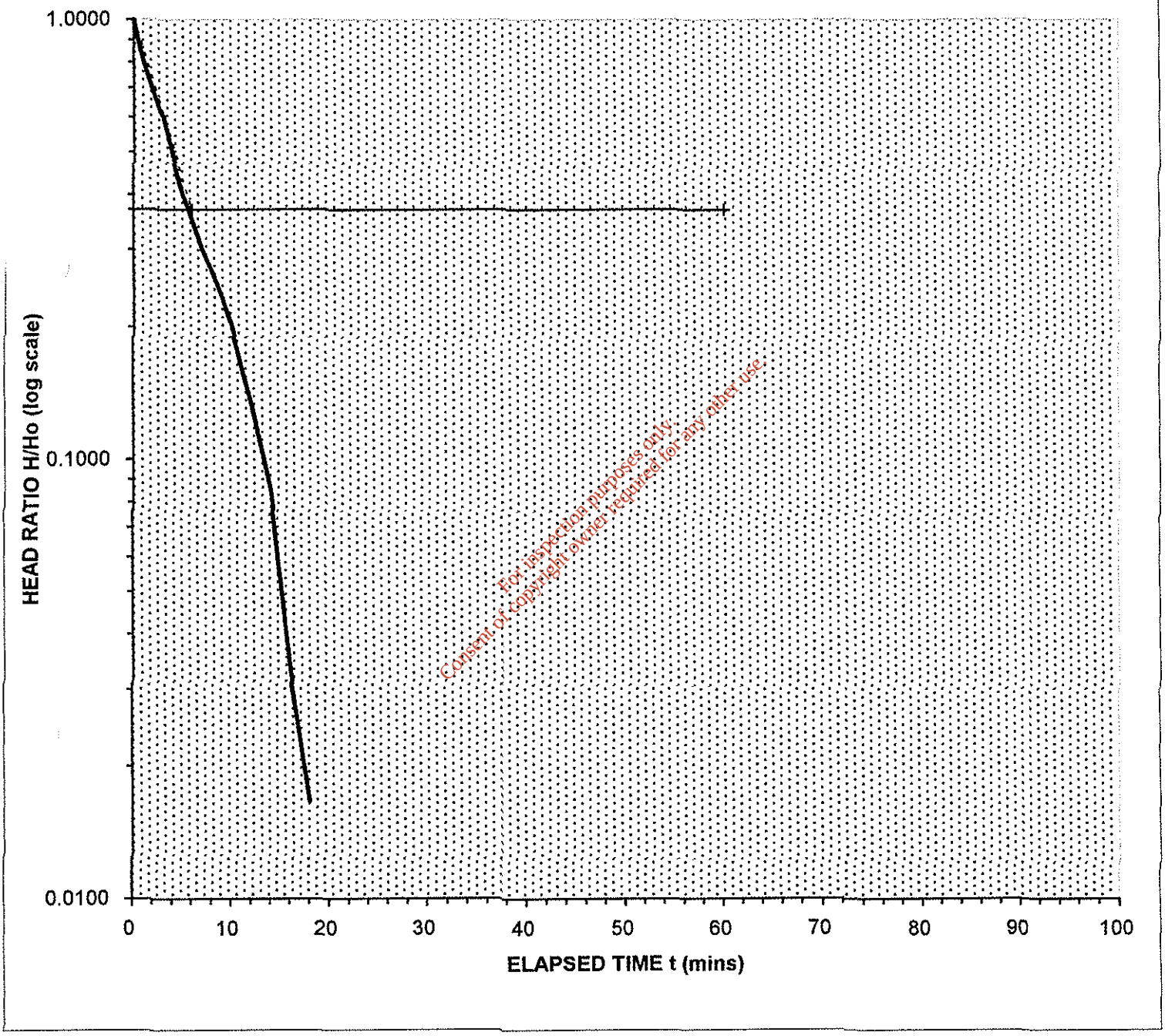
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** *2* **TEST #:** *1*
DATE: 29-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	6	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 3 TEST No.: 1

DATE: 1/8/02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*86*	(mm)	
Height of TOP of casing above ground level:	*0.10*	(m)	
Depth to bottom of casing below ground level (m):	*1.50*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*10.05*	(m)	
Depth to bottom of borehole below ground level after test:	*10.05*	(m)	
Standing ground water level (mbgl):	*0.67*	(m)	on 1/8/02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.77 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0	0.77	1.0000
0.5	0.14	0.63	0.8182
1	0.21	0.56	0.7273
1.5	0.27	0.5	0.6494
2	0.33	0.44	0.5714
2.5	0.38	0.39	0.5065
3	0.41	0.36	0.4675
4	0.47	0.3	0.3896
5	0.52	0.25	0.3247
6	0.56	0.21	0.2727
7	0.59	0.18	0.2338
8	0.61	0.16	0.2078
9	0.63	0.14	0.1818
10	0.64	0.13	0.1688
12	0.66	0.11	0.1429
14	0.67	0.1	0.1299
16	0.68	0.09	0.1169
18	0.68	0.09	0.1169
20	0.69	0.08	0.1039
22	0.69	0.08	0.1039
24	0.7	0.07	0.0909
26	0.71	0.06	0.0779
28	0.72	0.05	0.0649
30	0.73	0.04	0.0519
32	0.74	0.03	0.0390
40	0.76	0.01	0.0130
45	0.76	0.01	0.0130
50	0.77	0	0.0000
55	0.77	0	0.0000
60	0.77	0	0.0000
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CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT

where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,*hence:*

F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]

i.e. F = 9.6801 (m)

and A = 0.0058 (m^2)

and T = *4.5* (mins); (see graph of log H/Ho v Time.)

hence, k = 2.2E-06 m/s

i.e., k = 2.2×10^{-6} m/s

Notes:

GSI

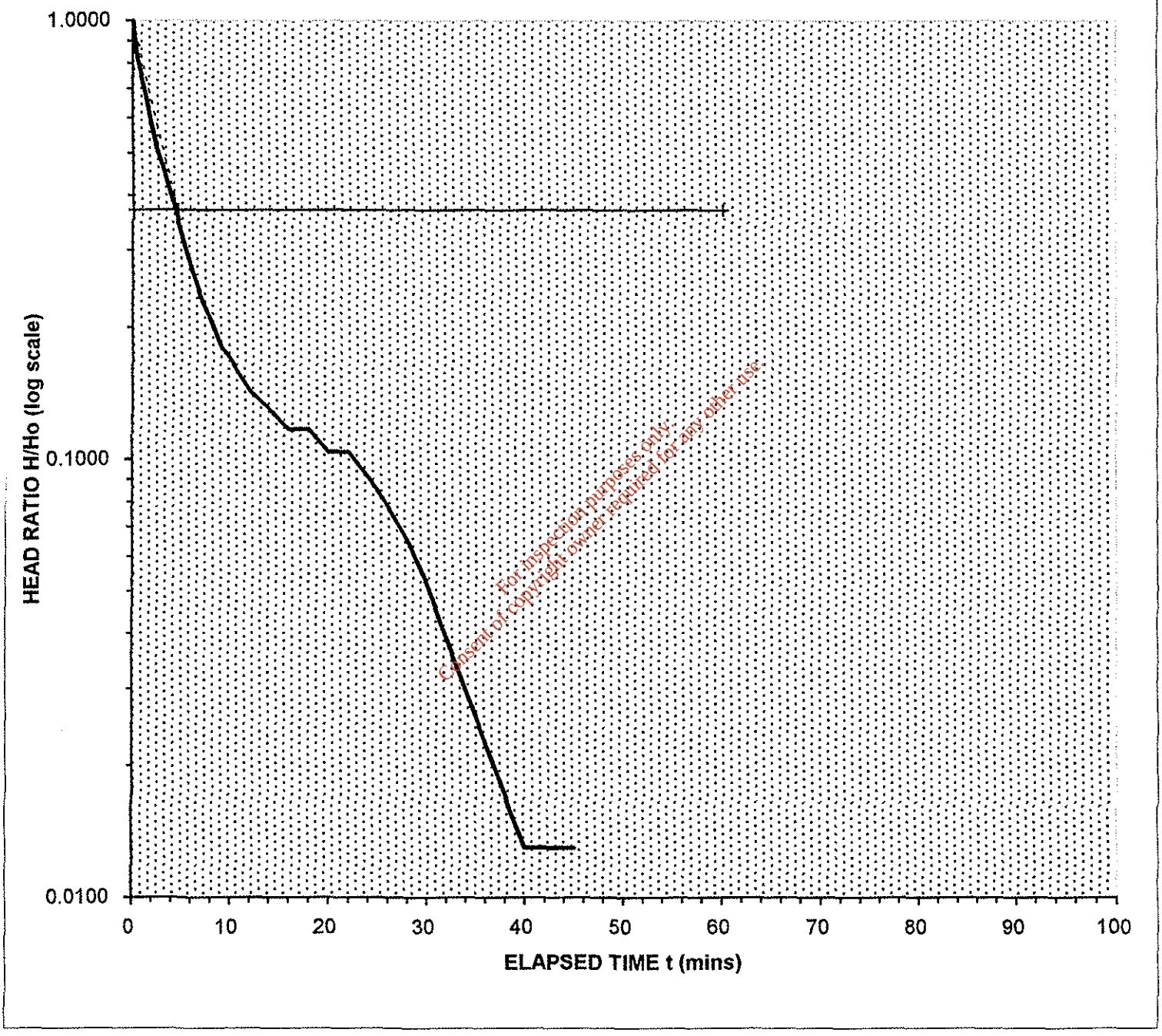
VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 3 **TEST #:** 1

DATE: 1/8/02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	4.5	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 4 TEST No.: 1

DATE: 1/8/02

TYPE OF TEST: ***RISING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.00*	(m)	
Depth to bottom of casing below ground level (m):	*0.00*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*1.00*	(m)	
Depth to bottom of borehole below ground level after test:	*1.00*	(m)	
Standing ground water level (mbgl):	*-0.35*	(m)	on 1/8/02

DATUM:All depths to water level measured from top of casing. i.e.SWL -0.35 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.62	0.97	1.0000
0.5	0.43	0.78	0.8041
1	0.27	0.62	0.6392
1.5	0.16	0.51	0.5258
2	0.08	0.43	0.4433
2.5	0.04	0.39	0.4021
3	0.01	0.36	0.3711
4	0	0.35	0.3608
5	0	0.35	0.3608
6	0	0.35	0.3608
7	0	0.35	0.3608
8	0	0.35	0.3608
9	0	0.35	0.3608
10	0	0.35	0.3608
12	0	0.35	0.3608
14	0	0.35	0.3608
16	0	0.35	0.3608
18	0	0.35	0.3608
20	0	0.35	0.3608
22	0	0.35	0.3608
24	0	0.35	0.3608
26	0	0.35	0.3608
28	0	0.35	0.3608
30	0	0.35	0.3608
32	0	0.35	0.3608
40	0	0.35	0.3608
45	0	0.35	0.3608
50	0	0.35	0.3608
55	0	0.35	0.3608
60	0	0.35	0.3608
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CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT

where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:

F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]

i.e. F = 2.3446 (m)

and A = 0.0314 (m^2)

and T = *3* (mins); (see graph of log H/Ho v Time.)

hence, k = 7.4E-05 m/s

i.e., k = 7.4×10^{-5} m/s

Notes:

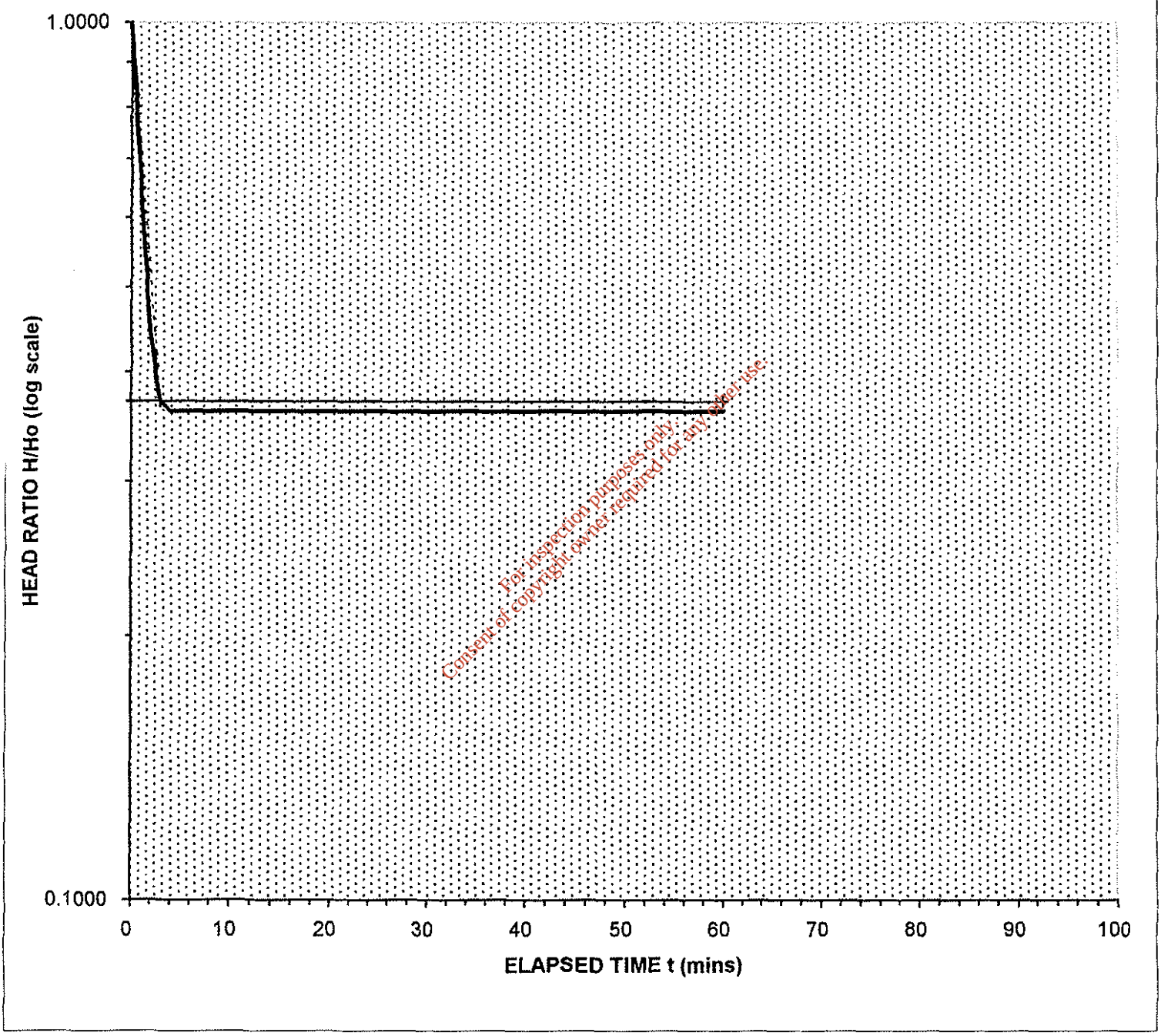
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *RISING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 4 **TEST #:** 1
DATE: 1/8/02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	3	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 4 TEST No.: 2

DATE: 1/8/02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*1.30*	(m)	
Depth to bottom of casing below ground level (m):	*1.70*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*2.00*	(m)	
Depth to bottom of borehole below ground level after test:	*2.00*	(m)	
Standing ground water level (mbgl):	*-0.35*	(m)	on 1/8/02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.95 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0	0.95	1.0000
0.5	0.21	0.74	0.7789
1	0.38	0.57	0.6000
1.5	0.51	0.44	0.4632
2	0.6	0.35	0.3684
2.5	0.67	0.28	0.2947
3	0.72	0.23	0.2421
4	0.81	0.14	0.1474
5	0.87	0.08	0.0842
6	0.89	0.06	0.0632
7	0.91	0.04	0.0421
8	0.92	0.03	0.0316
9	0.93	0.02	0.0211
10	0.94	0.01	0.0105
12	0.95	0	0.0000
14	0.95	0	0.0000
16	0.95	0	0.0000
18	0.95	0	0.0000
20	0.95	0	0.0000
22	0.95	0	0.0000
24	0.95	0	0.0000
26	0.95	0	0.0000
28	0.95	0	0.0000
30	0.95	0	0.0000
32	0.95	0	0.0000
40	0.95	0	0.0000
45	0.95	0	0.0000
50	0.95	0	0.0000
55	0.95	0	0.0000
60	0.95	0	0.0000
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CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT

where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:

F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]

i.e. F = 1.2225 (m)

and A = 0.0314 (m^2)

and T = *2.5* (mins); (see graph of log H/Ho v Time.)

hence, k = 1.7E-04 m/s

i.e., k = 1.7×10^{-4} m/s

Notes:

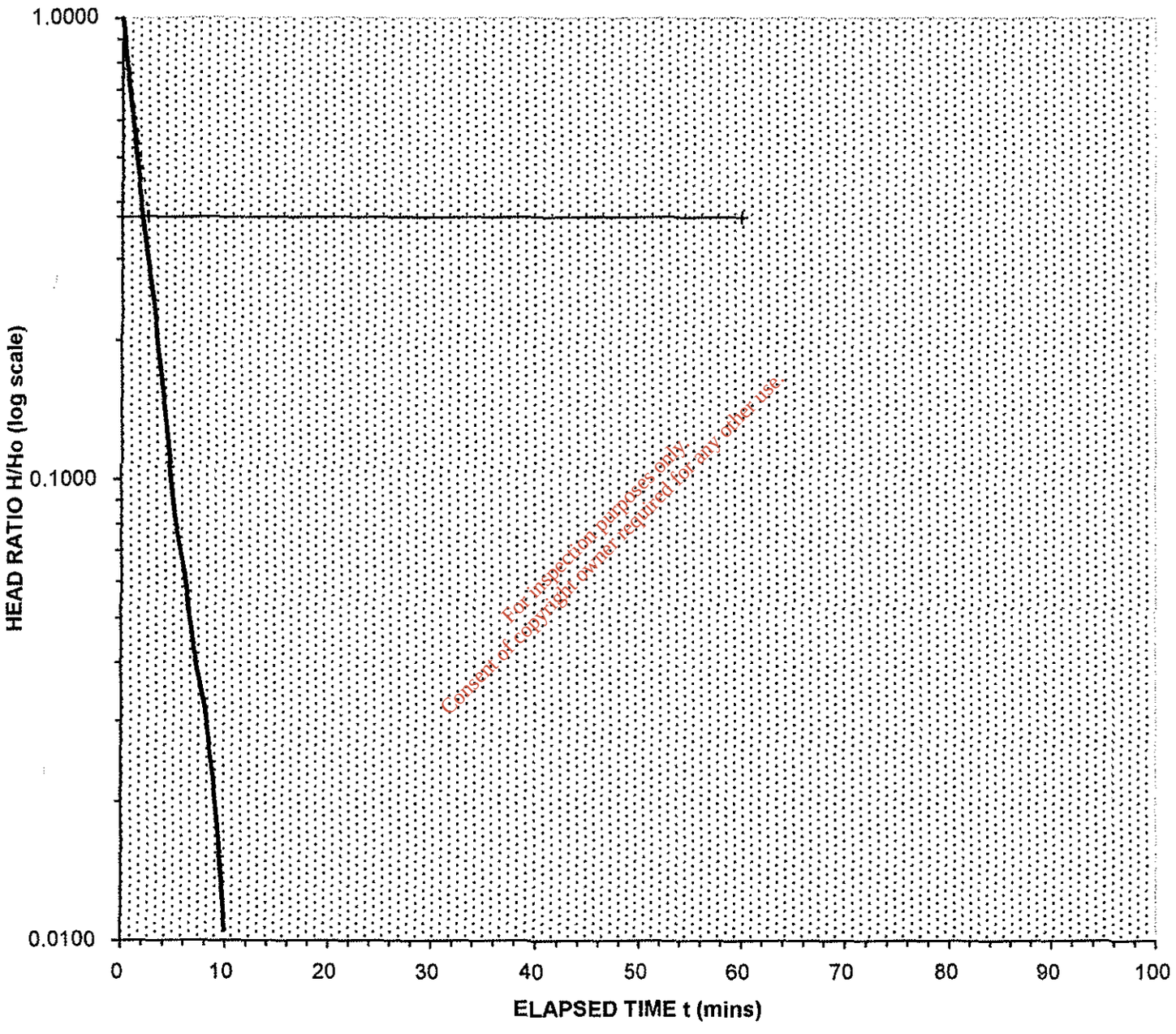
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING HEAD*

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 4 **TEST #:** 2
DATE: 1/8/02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	2.5	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 4 TEST No.: 3
DATE: 2/8/02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*1.16*	(m)	
Depth to bottom of casing below ground level (m):	*2.80*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*7.35*	(m)	
Depth to bottom of borehole below ground level after test:	*7.35*	(m)	
Standing ground water level (mbgl):	*-0.35*	(m)	on 2/8/02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.81 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0	0.81	1.0000
0.5	0.05	0.76	0.9383
1	0.09	0.72	0.8889
1.5	0.13	0.68	0.8395
2	0.17	0.64	0.7901
2.5	0.2	0.61	0.7531
3	0.29	0.52	0.6420
4	0.37	0.44	0.5432
5	0.44	0.37	0.4568
6	0.5	0.31	0.3827
7	0.55	0.26	0.3210
8	0.6	0.21	0.2593
9	0.63	0.18	0.2222
10	0.66	0.15	0.1852
12	0.72	0.09	0.1111
14	0.76	0.05	0.0617
16	0.78	0.03	0.0370
18	0.79	0.02	0.0247
20	0.8	0.01	0.0123
22	0.8	0.01	0.0123
24	0.81	0	0.0000
26	0.81	0	0.0000
28	0.81	0	0.0000
30	0.81	0	0.0000
32	0.81	0	0.0000
40	0.81	0	0.0000
45	0.81	0	0.0000
50	0.81	0	0.0000
55	0.81	0	0.0000
60	0.81	0	0.0000
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:
F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]
i.e. F = 6.8267 (m)
and A = 0.0314 (m^2)
and T = *6* (mins); (see graph of log H/Ho v Time.)
hence, k = 1.3E-05 m/s

i.e., k = 1.3×10^{-5} m/s

Notes:

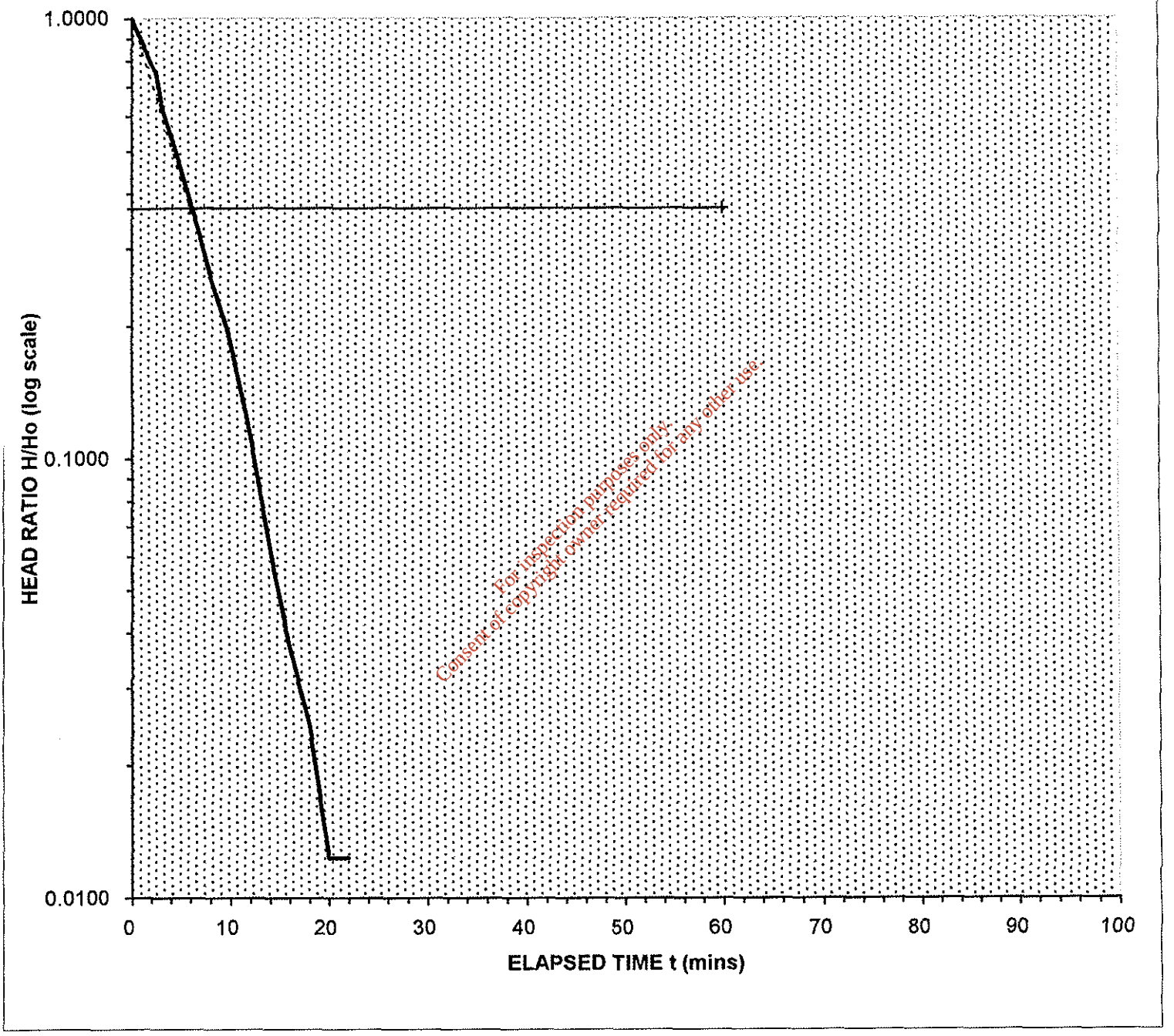
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 4 **TEST #:** 3
DATE: 2/8/02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	6	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 5 TEST No.: 1
DATE: 25-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.00*	(m)	
Depth to bottom of casing below ground level (m):	*0.00*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*1.00*	(m)	
Depth to bottom of borehole below ground level after test:	*1.00*	(m)	
Standing ground water level (mbgl):	*4.62*	(m)	on 25-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 4.62 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0	4.62	1.0000
0.5	0.03	4.59	0.9935
1	0.04	4.58	0.9913
1.5	0.04	4.58	0.9913
2	*0.05*	*4.57*	*0.9892*
2.5	0.05	4.57	0.9892
3	0.05	4.57	0.9892
4	0.05	4.57	0.9892
5	0.05	4.57	0.9892
6	0.06	4.56	0.9870
7	0.06	4.56	0.9870
8	0.06	4.56	0.9870
9	0.06	4.56	0.9870
10	0.06	4.56	0.9870
12	0.06	4.56	0.9870
14	0.06	4.56	0.9870
16	0.06	4.56	0.9870
18	0.06	4.56	0.9870
20	0.06	4.56	0.9870
22	0.06	4.56	0.9870
24	0.06	4.56	0.9870
26	0.06	4.56	0.9870
28	0.06	4.56	0.9870
30	0.06	4.56	0.9870
32	0.06	4.56	0.9870
40	0.06	4.56	0.9870
45	0.06	4.56	0.9870
50	0.06	4.56	0.9870
55	0.06	4.56	0.9870
60	0.06	4.56	0.9870
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:
k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:
F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]
i.e. F = 2.3446 (m)
and A = 0.0314 (m^2)
and T = *5800* (mins); (see graph of log H/Ho v Time.)
hence, k = 3.9E-08 m/s

i.e., k = 3.9×10^{-8} m/s

Notes:

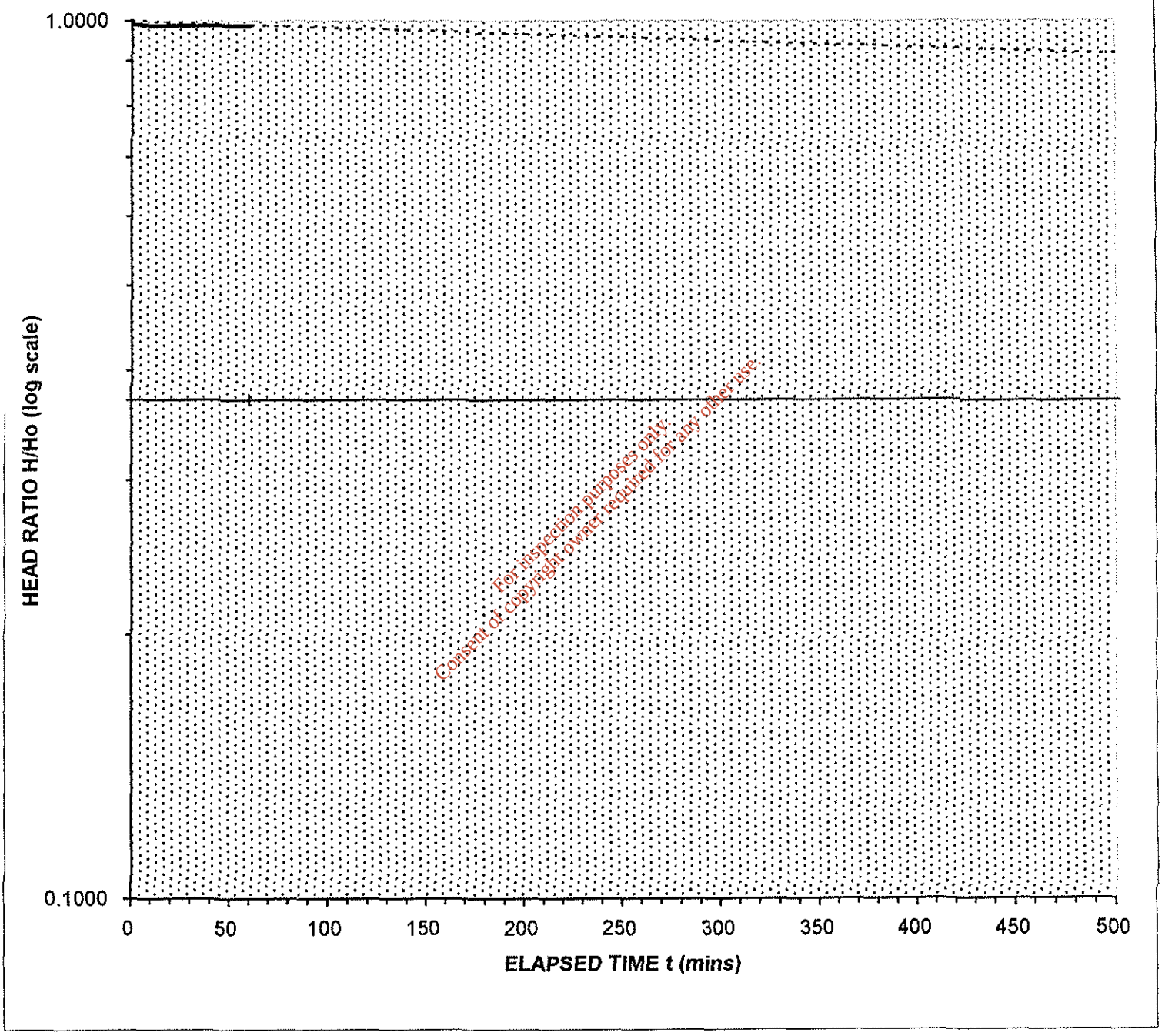
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 5 **TEST #:** 1
DATE: 25-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T = 5800 mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 5 TEST No.: 2

DATE: 25-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*1.30*	(m)	
Depth to bottom of casing below ground level (m):	*1.70*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*2.00*	(m)	
Depth to bottom of borehole below ground level after test:	*2.00*	(m)	
Standing ground water level (mbgl):	*4.62*	(m)	on 25-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 5.92 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.3	5.62	1.0000
0.5	0.32	5.6	0.9964
1	0.33	5.59	0.9947
1.5	0.33	5.59	0.9947
2	0.33	5.59	0.9947
2.5	0.33	5.59	0.9947
3	0.33	5.59	0.9947
4	0.33	5.59	0.9947
5	0.33	5.59	0.9947
6	0.34	5.58	0.9929
7	0.34	5.58	0.9929
8	0.34	5.58	0.9929
9	0.34	5.58	0.9929
10	0.34	5.58	0.9929
12	0.34	5.58	0.9929
14	0.34	5.58	0.9929
16	0.34	5.58	0.9929
18	0.35	5.57	0.9911
20	0.35	5.57	0.9911
22	0.35	5.57	0.9911
24	0.35	5.57	0.9911
26	0.36	5.56	0.9893
28	0.36	5.56	0.9893
30	0.36	5.56	0.9893
32	0.36	5.56	0.9893
40	0.37	5.55	0.9875
45	0.37	5.55	0.9875
50	0.38	5.54	0.9858
55	0.38	5.54	0.9858
60	0.38	5.54	0.9858
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:

k *is the permeability of soil*
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined *in Figure 9 of BS 5930:1981 (Page 38)*

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in *Figure 7 of BS 5930:1981 (p 36)*:

Assumed condition: Case ***C*** ,hence:
F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]
i.e. F = 1.2225 (m)
and A = 0.0314 (m^2)
and T = *2180* (mins); (see graph of log H/Ho v Time.)
hence, k = 2.0E-07 m/s

i.e., k = 2.0×10^{-7} m/s

Notes:

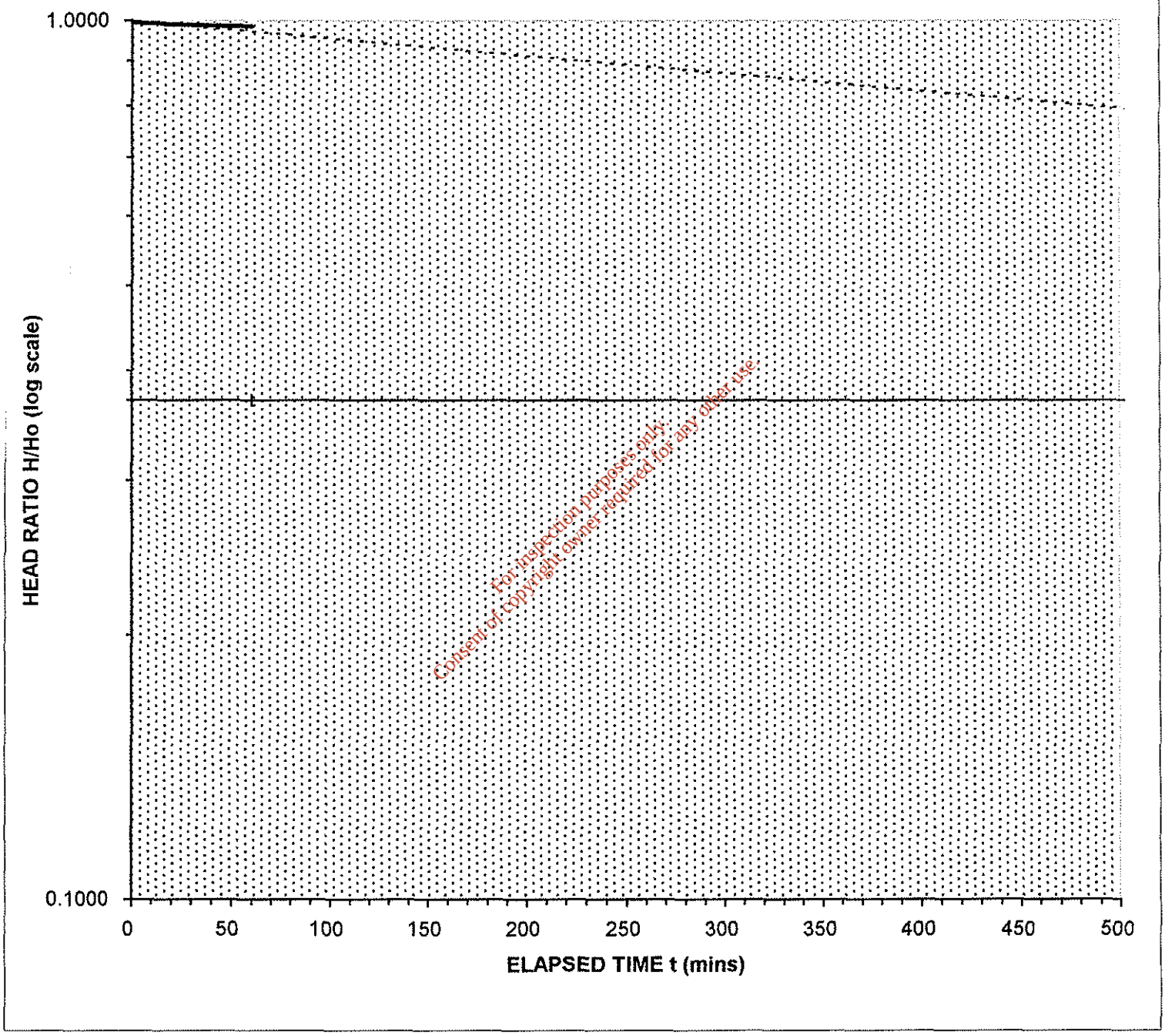
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 5 **TEST #:** 2
DATE: 25-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	2180 mins

wt69

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 5 TEST No.: 3
DATE: 25-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.30*	(m)	
Depth to bottom of casing below ground level (m):	*2.70*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*3.00*	(m)	
Depth to bottom of borehole below ground level after test:	*3.00*	(m)	
Standing ground water level (mbgl):	*4.62*	(m)	on 25-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 4.92 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.42	4.5	1.0000
0.5	0.43	4.49	0.9978
1	0.43	4.49	0.9978
1.5	0.43	4.49	0.9978
2	0.43	4.49	0.9978
2.5	0.43	4.49	0.9978
3	0.43	4.49	0.9978
4	0.43	4.49	0.9978
5	0.44	4.48	0.9956
6	0.44	4.48	0.9956
7	0.44	4.48	0.9956
8	0.44	4.48	0.9956
9	0.44	4.48	0.9956
10	0.45	4.47	0.9933
12	0.45	4.47	0.9933
14	0.45	4.47	0.9933
16	0.45	4.47	0.9933
18	0.45	4.47	0.9933
20	0.45	4.47	0.9933
22	0.46	4.46	0.9911
24	0.46	4.46	0.9911
26	0.46	4.46	0.9911
28	0.46	4.46	0.9911
30	0.47	4.45	0.9889
32	0.47	4.45	0.9889
40	0.47	4.45	0.9889
45	0.47	4.45	0.9889
50	0.48	4.44	0.9867
55	0.48	4.44	0.9867
60	0.48	4.44	0.9867
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case ***C*** ,hence:
F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]
i.e. F = 1.2225 (m)
and A = 0.0314 (m^2)
and T = *2910* (mins); (see graph of log H/Ho v Time.)
hence, k = 1.5E-07 m/s

i.e., k = 1.5×10^{-7} m/s

Notes:

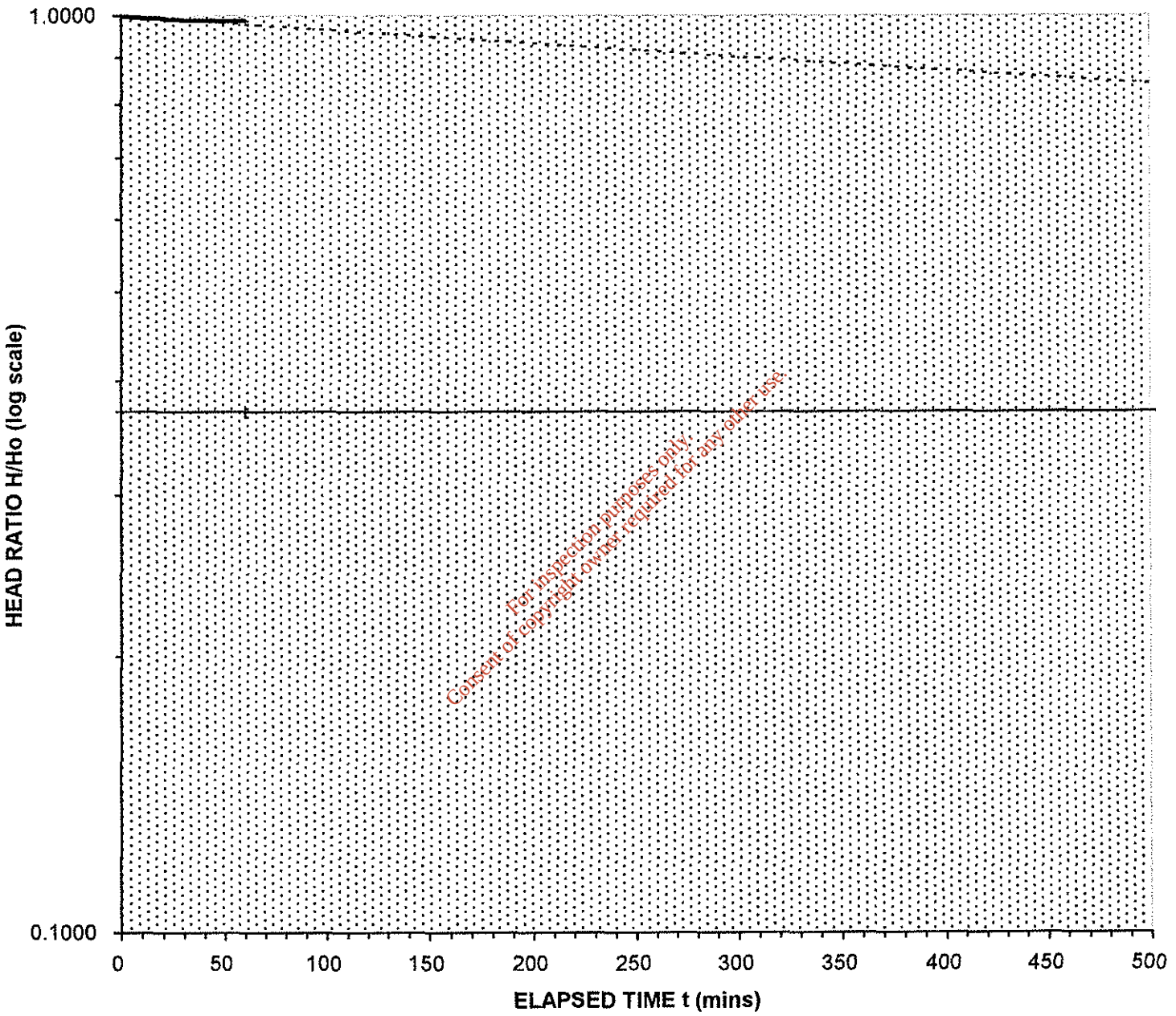
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 5 **TEST #:** 3
DATE: 25-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	2910 mins

wt69

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 5 TEST No.: 4

DATE: 25-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*1.00*	(m)	
Depth to bottom of casing below ground level (m):	*4.70*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*5.00*	(m)	
Depth to bottom of borehole below ground level after test:	*5.00*	(m)	
Standing ground water level (mbgl):	*4.62*	(m)	on 25-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 5.62 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.26	5.36	1.0000
0.5	0.44	5.18	0.9664
1	0.61	5.01	0.9347
1.5	0.77	4.85	0.9049
2	0.93	4.69	0.8750
2.5	1.01	4.61	0.8601
3	1.07	4.55	0.8489
4	1.23	4.39	0.8190
5	1.43	4.19	0.7817
6	1.58	4.04	0.7537
7	1.76	3.86	0.7201
8	1.89	3.73	0.6959
9	2.02	3.6	0.6716
10	2.14	3.48	0.6493
12	2.41	3.21	0.5989
14	2.57	3.05	0.5690
16	2.7	2.92	0.5448
18	2.84	2.78	0.5187
20	2.98	2.64	0.4925
22	3.12	2.5	0.4664
24	3.23	2.39	0.4459
26	3.4	2.22	0.4142
28	3.52	2.1	0.3918
30	3.65	1.97	0.3675
32	3.78	1.84	0.3433
40	3.98	1.64	0.3060
45	4.32	1.3	0.2425
50	4.61	1.01	0.1884
55	4.77	0.85	0.1586
60	4.91	0.71	0.1325
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT

where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in *Figure 7 of BS 5930:1981 (p 36)*:

Assumed condition: Case *C* ,hence:

F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]

i.e. F = 1.2225 *(m)*

and A = 0.0314 (m^2)

and T = *30* (mins); (see graph of log H/Ho v Time.)

hence, k = 1.4E-05 m/s

i.e., k = 1.4×10^{-5} m/s

Notes:

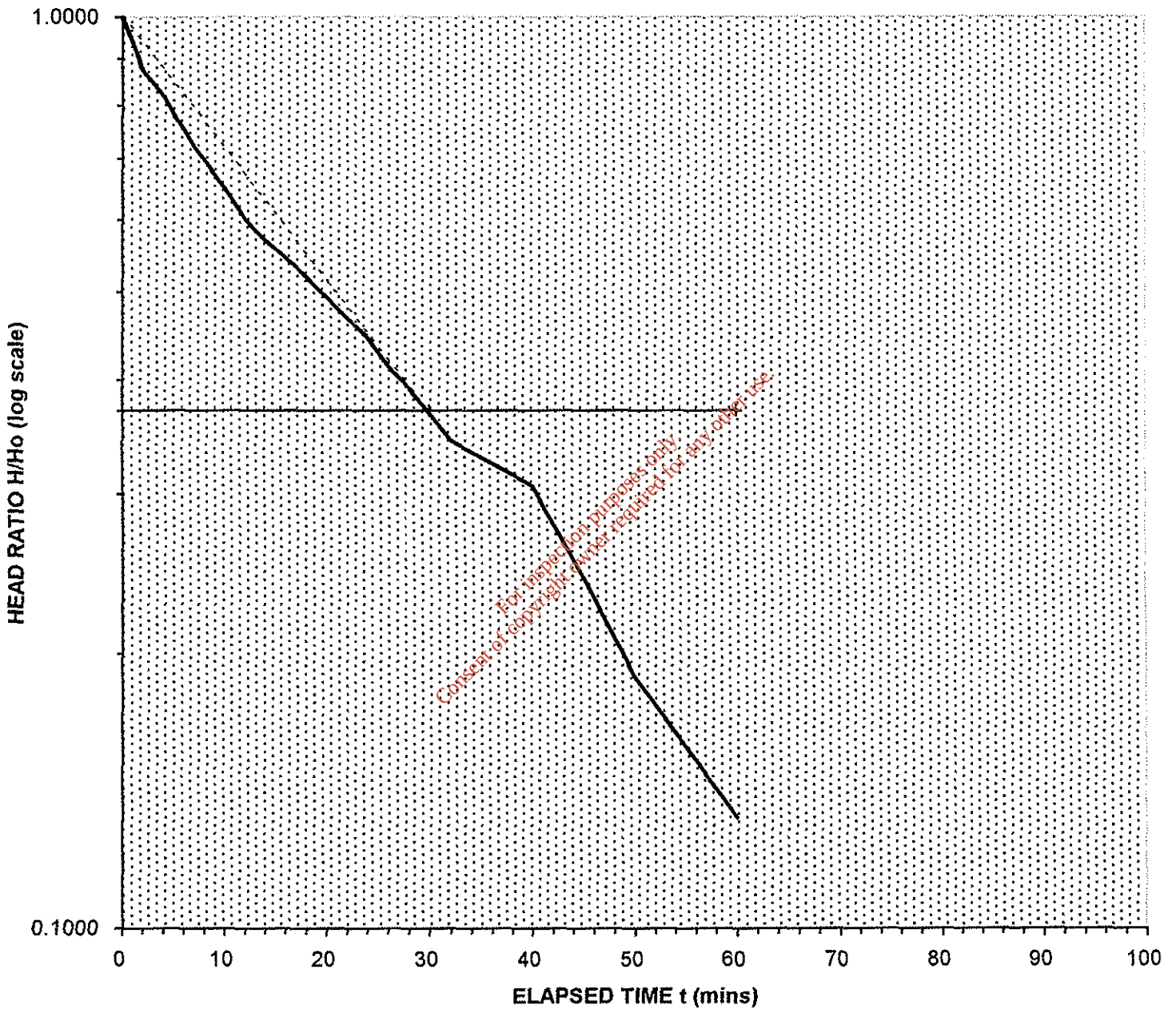
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 5 **TEST #:** 4
DATE: 25-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	30	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 5 TEST No.: 5

DATE: 26-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*86*	(mm)	
Height of TOP of casing above ground level:	*0.30*	(m)	
Depth to bottom of casing below ground level (m):	*10.10*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*15.00*	(m)	
Depth to bottom of borehole below ground level after test:	*15.00*	(m)	
Standing ground water level (mbgl):	*6.69*	(m)	on 26-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 6.99 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.03	6.96	1.0000
0.5	0.16	6.83	0.9813
1	0.24	6.75	0.9698
1.5	0.31	6.68	0.9598
2	0.37	6.62	0.9511
2.5	0.43	6.56	0.9425
3	0.49	6.5	0.9339
4	0.6	6.39	0.9181
5	0.71	6.28	0.9023
6	0.8	6.19	0.8894
7	0.92	6.07	0.8721
8	0.99	6	0.8621
9	1.07	5.92	0.8506
10	1.13	5.86	0.8420
12	1.28	5.71	0.8204
14	1.43	5.56	0.7989
16	1.55	5.44	0.7816
18	1.66	5.33	0.7658
20	1.76	5.23	0.7514
22	1.85	5.14	0.7385
24	1.95	5.04	0.7241
26	2.04	4.95	0.7112
28	*2.13*	*4.86*	*0.6983*
30	2.21	4.78	0.6868
32	2.27	4.72	0.6782
40	2.4	4.59	0.6595
45	2.45	4.54	0.6523
50	2.56	4.43	0.6365
55	2.6	4.39	0.6307
60	2.64	4.35	0.6250
65	2.71	4.28	0.6149
70	2.78	4.21	0.6049
75	2.84	4.15	0.5963
80	2.90	4.09	0.5876
90	2.97	4.02	0.5776
100	3.05	3.94	0.5661
110	3.13	3.86	0.5546
120	3.20	3.79	0.5445
140	3.32	3.67	0.5273
160	3.39	3.6	0.5172
180	3.45	3.54	0.5086
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:
F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]
i.e. F = 6.1661 (m)
and A = 0.0058 (m^2)
and T = *65* (mins); (see graph of log H/Ho v Time.)
hence, k = 2.4E-07 m/s

i.e., k = 2.4×10^{-7} m/s

Notes:

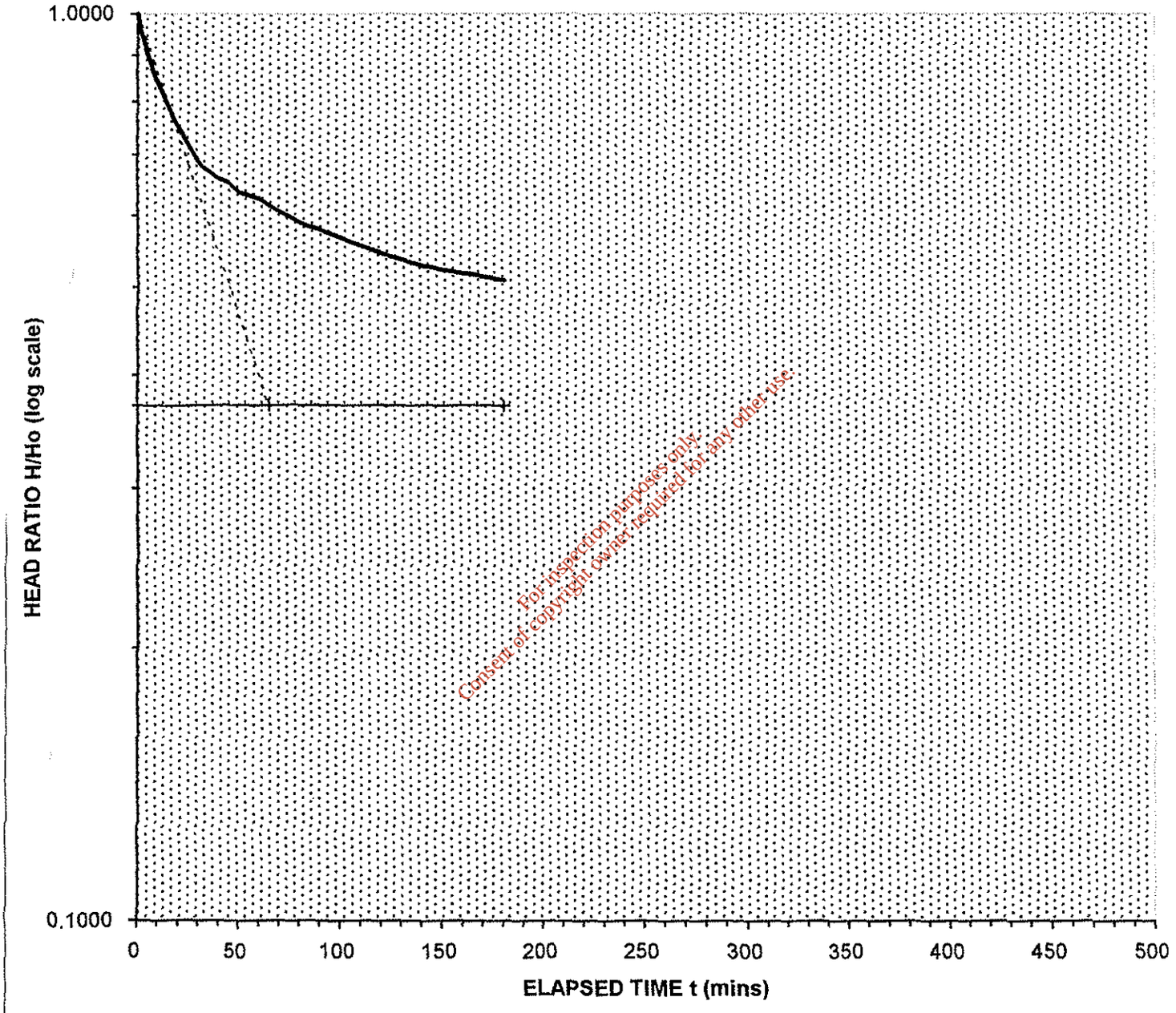
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *FALLING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 5 **TEST #:** 5
DATE: 26-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	65	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 6 TEST No.: 1

DATE: 29-7-02

TYPE OF TEST: ***RISING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.00*	(m)	
Depth to bottom of casing below ground level (m):	*0.00*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*1.00*	(m)	
Depth to bottom of borehole below ground level after test:	*1.00*	(m)	
Standing ground water level (mbgl):	*0.69*	(m)	on 29-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.69 m below datum.

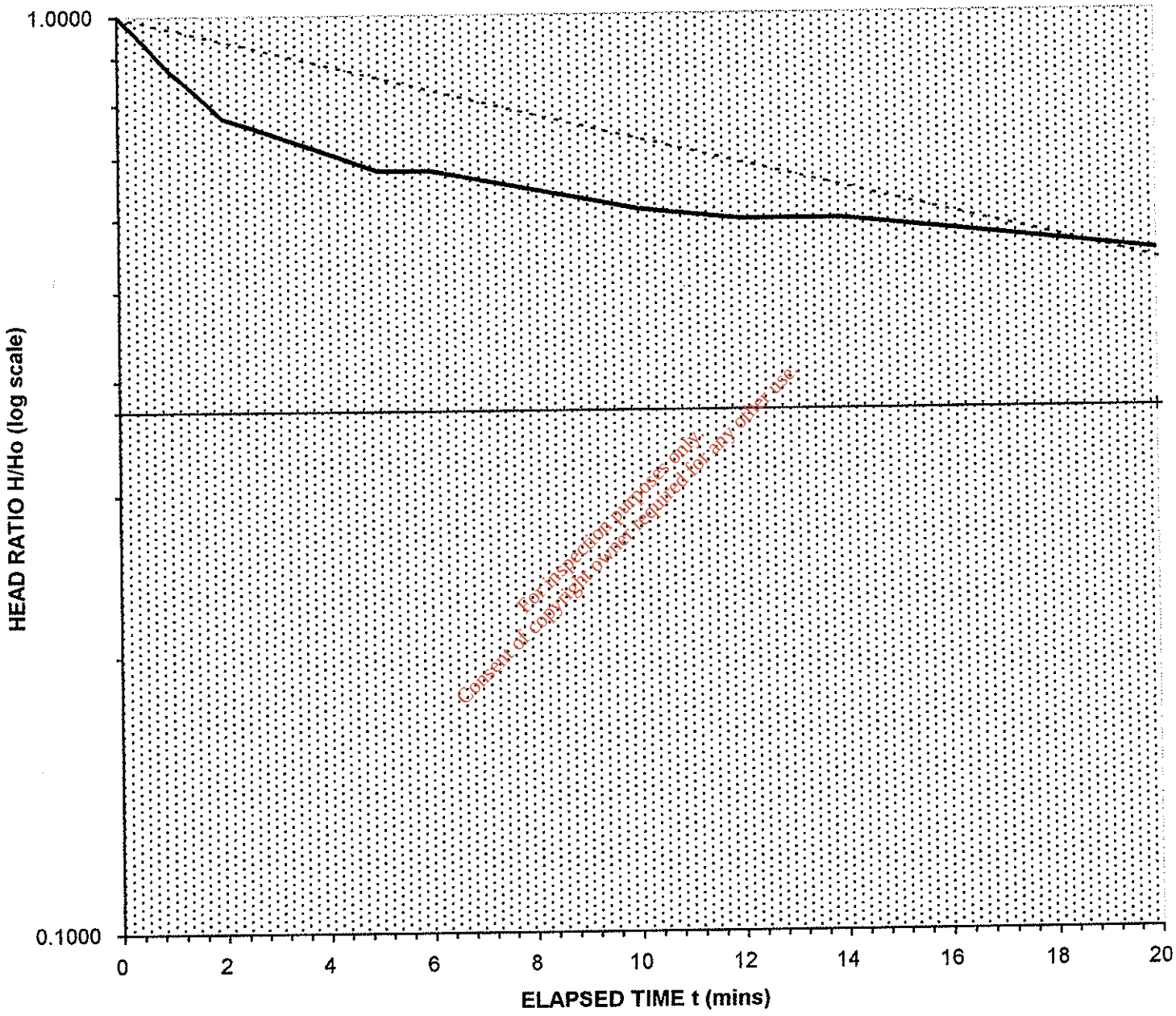
TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	1	0.31	1.0000
0.5	0.98	0.29	0.9355
1	0.96	0.27	0.8710
1.5	0.945	0.255	0.8226
2	0.93	0.24	0.7742
2.5	0.925	0.235	0.7581
3	0.92	0.23	0.7419
4	0.91	0.22	0.7097
5	0.9	0.21	0.6774
6	0.9	0.21	0.6774
7	0.895	0.205	0.6613
8	0.89	0.2	0.6452
9	0.885	0.195	0.6290
10	0.88	0.19	0.6129
12	0.875	0.185	0.5968
14	0.875	0.185	0.5968
16	0.87	0.18	0.5806
18	0.865	0.175	0.5645
20	0.86	0.17	0.5484
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *RISING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 6 **TEST #:** 1
DATE: 29-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	32	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 6 TEST No.: 2

DATE: 29-7-02

TYPE OF TEST: ***RISING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.00*	(m)	
Depth to bottom of casing below ground level (m):	*1.60*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*2.00*	(m)	
Depth to bottom of borehole below ground level after test:	*2.00*	(m)	
Standing ground water level (mbgl):	*0.69*	(m)	on 29-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.69 m below datum.

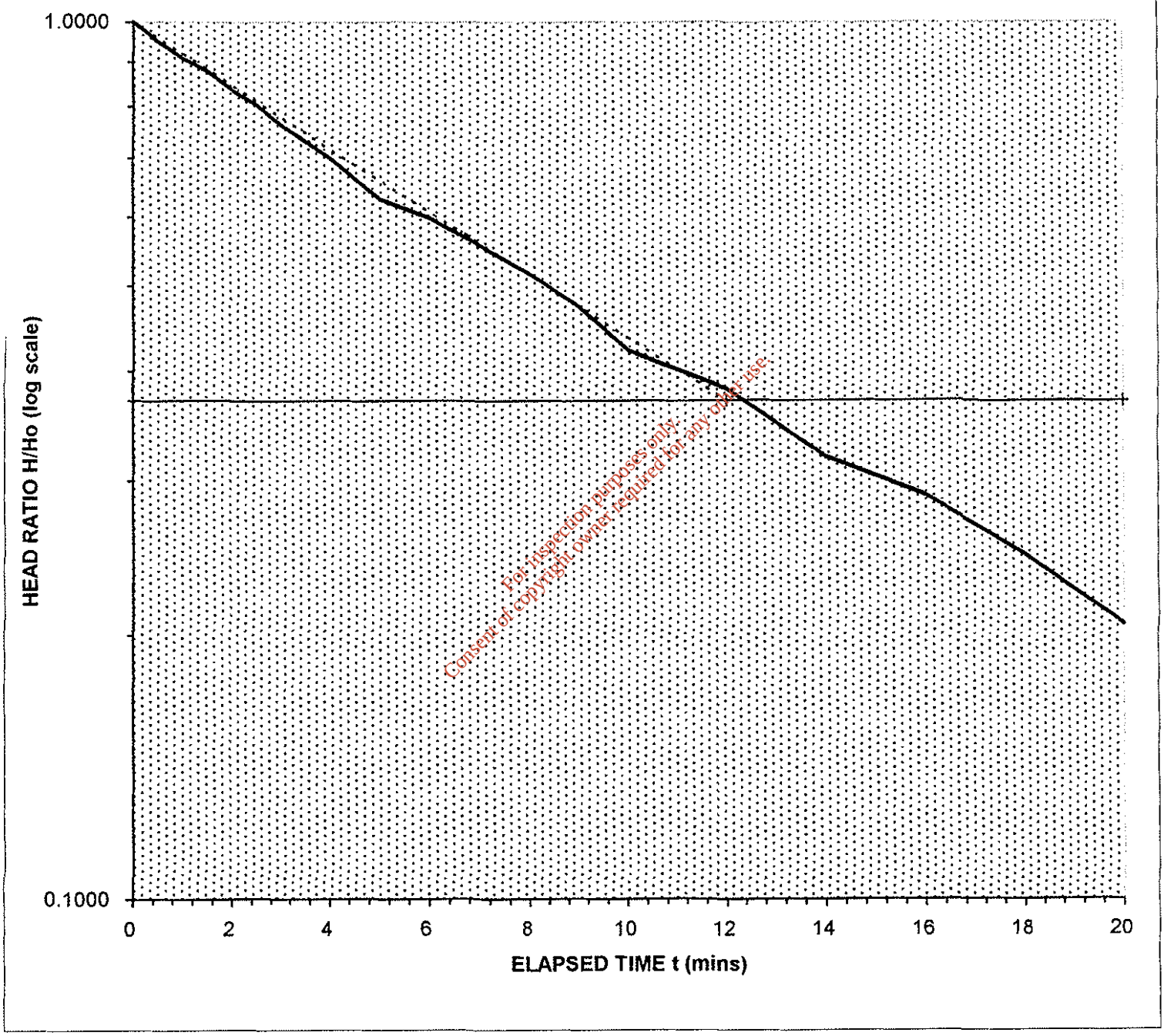
TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	1.66	0.97	1.0000
0.5	1.61	0.92	0.9485
1	1.57	0.88	0.9072
1.5	1.54	0.85	0.8763
2	1.5	0.81	0.8351
2.5	1.47	0.78	0.8041
3	1.43	0.74	0.7629
4	1.37	0.68	0.7010
5	1.3	0.61	0.6289
6	1.27	0.58	0.5979
7	1.23	0.54	0.5567
8	1.19	0.5	0.5155
9	1.15	0.46	0.4742
10	1.1	0.41	0.4227
12	1.06	0.37	0.3814
14	1	0.31	0.3196
16	0.97	0.28	0.2887
18	0.93	0.24	0.2474
20	0.89	0.2	0.2062
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *RISING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 6 **TEST #:** 2
DATE: 29-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	12	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 6 TEST No.: 3
DATE: 29-7-02

TYPE OF TEST: ***RISING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.00*	(m)	
Depth to bottom of casing below ground level (m):	*2.30*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*3.00*	(m)	
Depth to bottom of borehole below ground level after test:	*3.00*	(m)	
Standing ground water level (mbgl):	*0.69*	(m)	on 29-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.69 m below datum.

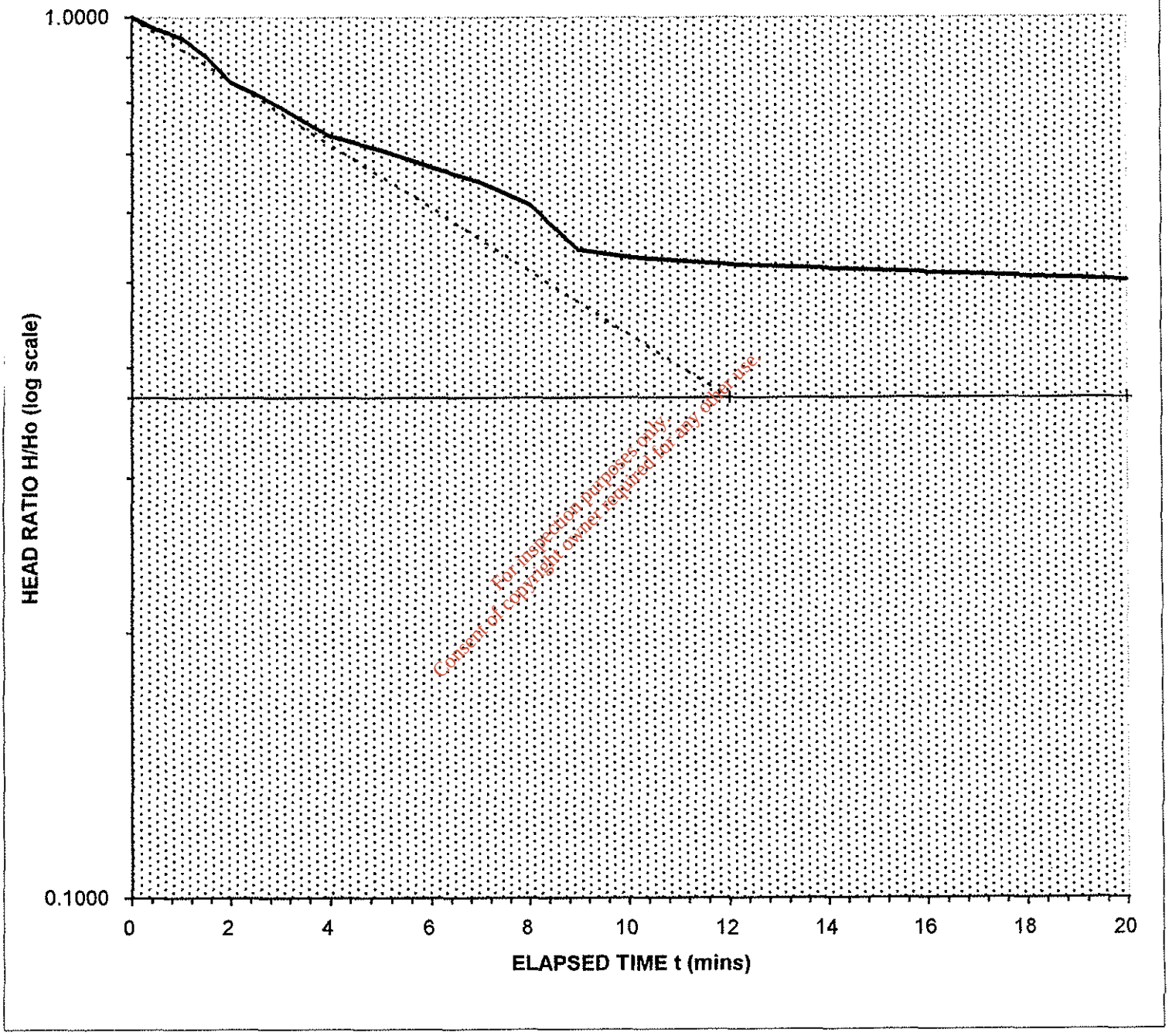
TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	2.6	1.91	1.0000
0.5	2.54	1.85	0.9686
1	2.5	1.81	0.9476
1.5	2.41	1.72	0.9005
2	2.3	1.61	0.8429
2.5	2.25	1.56	0.8168
3	2.2	1.51	0.7906
4	2.09	1.4	0.7330
5	2.04	1.35	0.7068
6	1.98	1.29	0.6754
7	1.93	1.24	0.6492
8	1.86	1.17	0.6126
9	1.73	1.04	0.5445
10	1.71	1.02	0.5340
12	1.69	1	0.5236
14	1.68	0.99	0.5183
16	1.67	0.98	0.5131
18	1.66	0.97	0.5079
20	1.65	0.96	0.5026
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: *RISING* **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 6 **TEST #:** 3
DATE: 29-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	12	mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 6 TEST No.: 4

DATE: 29-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.80*	(m)	
Depth to bottom of casing below ground level (m):	*3.70*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*4.00*	(m)	
Depth to bottom of borehole below ground level after test:	*4.00*	(m)	
Standing ground water level (mbgl):	*0.69*	(m)	on 29-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 1.49 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.82	0.67	1.0000
0.5	0.84	0.65	0.9701
1	0.86	0.63	0.9403
1.5	0.88	0.61	0.9104
2	0.9	0.59	0.8806
2.5	0.91	0.58	0.8657
3	0.92	0.57	0.8507
4	0.94	0.55	0.8209
5	0.96	0.53	0.7910
6	0.98	0.51	0.7612
7	1.01	0.48	0.7164
8	1.05	0.44	0.6567
9	1.1	0.39	0.5821
10	1.14	0.35	0.5224
12	1.21	0.28	0.4179
14	1.28	0.21	0.3134
16	1.34	0.15	0.2239
18	1.39	0.1	0.1493
20	1.44	0.05	0.0746
22	1.46	0.03	0.0448
24	1.48	0.01	0.0149
26	1.49	0	0.0000
28	1.49	0	0.0000
30	1.49	0	0.0000
35	1.49	0	0.0000
40	1.49	0	0.0000
45	1.49	0	0.0000
50	1.49	0	0.0000
55	1.49	0	0.0000
60	1.49	0	0.0000
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT

where:

k is the *permeability of soil*

A is the cross-section area of borehole casing

F is the intake factor (see below)

T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:

F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]

i.e. F = 1.2225 (m)

and A = 0.0314 (m^2)

and T = *12.5* (mins); (see graph of *log H/Ho v Time.*)

hence, k = 3.4E-05 m/s

i.e., k = 3.4×10^{-5} m/s

Notes:

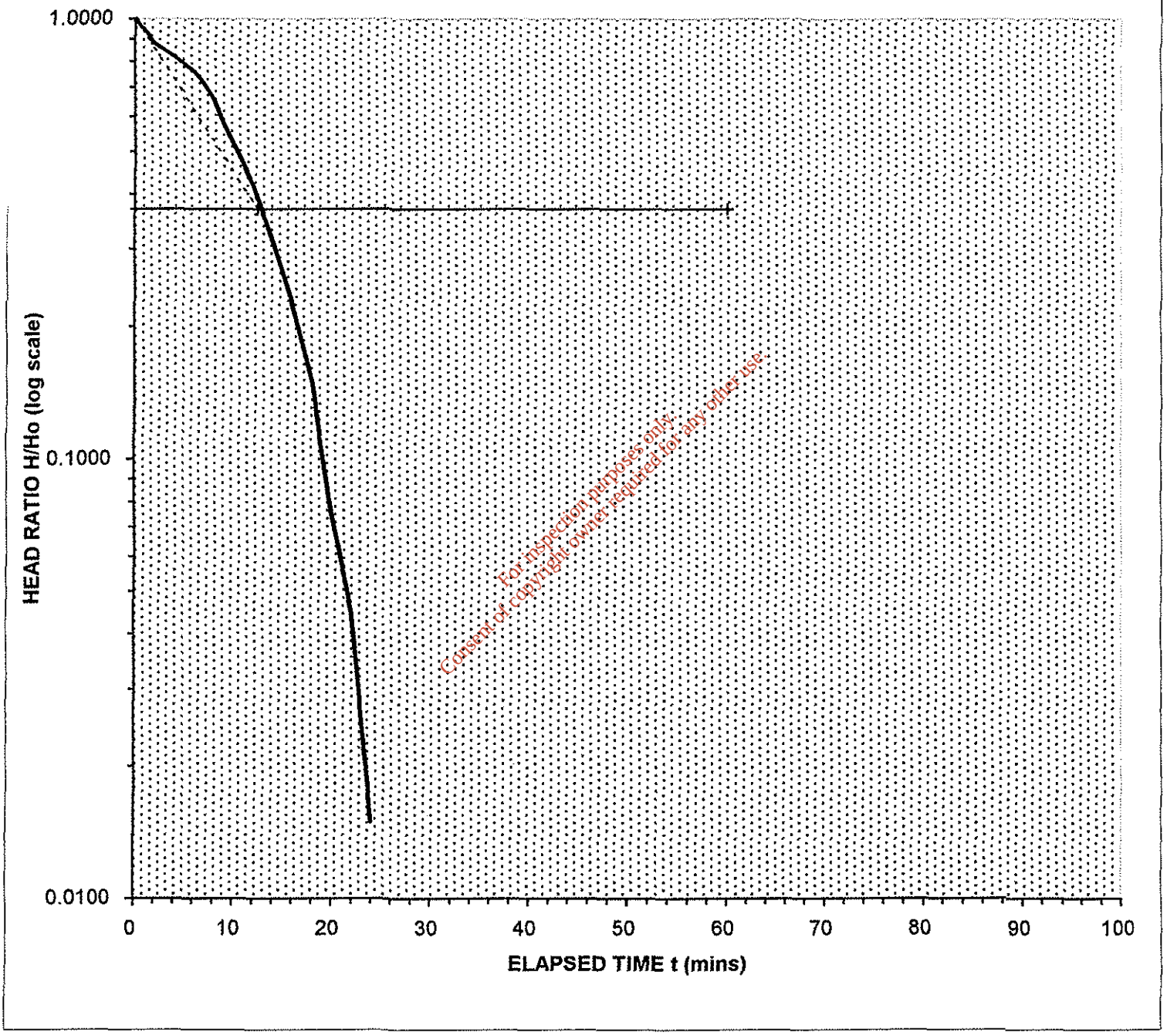
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: ***FALLING HEAD***

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 6 **TEST #:** 4
DATE: 29-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	12.5 mins

GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

CONTRACT: Ballynacarrick Landfill Site BOREHOLE No.: 6 TEST No.: 5

DATE: 29-7-02

TYPE OF TEST: ***FALLING*** HEAD

Diameter of casing (D):	*200*	(mm)	
Height of TOP of casing above ground level:	*0.00*	(m)	
Depth to bottom of casing below ground level (m):	*4.70*	(m)	(Withdrawn to impervious layer)
Depth to bottom of borehole below ground level before test:	*5.00*	(m)	
Depth to bottom of borehole below ground level after test:	*5.00*	(m)	
Standing ground water level (mbgl):	*0.69*	(m)	on 29-7-02

DATUM:All depths to water level measured from top of casing. i.e.SWL 0.69 m below datum.

TIME ELAPSED (mins)	WATER LEVEL* (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.03	0.66	1.0000
0.5	0.08	0.61	0.9242
1	0.12	0.57	0.8636
1.5	0.16	0.53	0.8030
2	0.2	0.49	0.7424
2.5	0.24	0.45	0.6818
3	0.28	0.41	0.6212
4	0.35	0.34	0.5152
5	0.41	0.28	0.4242
6	0.44	0.25	0.3788
7	0.46	0.23	0.3485
8	0.48	0.21	0.3182
9	0.53	0.16	0.2424
10	0.56	0.13	0.1970
12	0.58	0.11	0.1667
14	0.6	0.09	0.1364
16	0.62	0.07	0.1061
18	0.63	0.06	0.0909
20	0.64	0.05	0.0758
22	0.65	0.04	0.0606
24	0.655	0.035	0.0530
26	0.66	0.03	0.0455
28	0.67	0.02	0.0303
30	0.68	0.01	0.0152
32	0.69	0	0.0000
40	0.69	0	0.0000
45	0.69	0	0.0000
50	0.69	0	0.0000
55	*0.69*	*0*	*0.0000*
60	0.69	0	0.0000
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
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	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A
	#N/A	#N/A	#N/A

CALCULATION OF PERMEABILITY OF SOIL:

Employing Hvorslev formula: k = A/FT
where:

k is the permeability of soil
A is the cross-section area of borehole casing
F is the intake factor (see below)
T is the basic time lag factor as defined in Figure 9 of BS 5930:1981 (Page 38)

Values of intake factors (F) for various conditions, Cases (a)-(f), are given in Figure 7 of BS 5930:1981 (p 36):

Assumed condition: Case *C* ,hence:

F = 2*PI*L/loge[(2L/D)+{1+((2L)^2/D)}^0.5]

i.e. F = 1.2225 (m)

and A = 0.0314 (m^2)

and T = *6.5* (mins); (see graph of log H/Ho v Time.)

hence, k = 6.6E-05 m/s

i.e., k = 6.6×10^{-5} m/s

Notes:

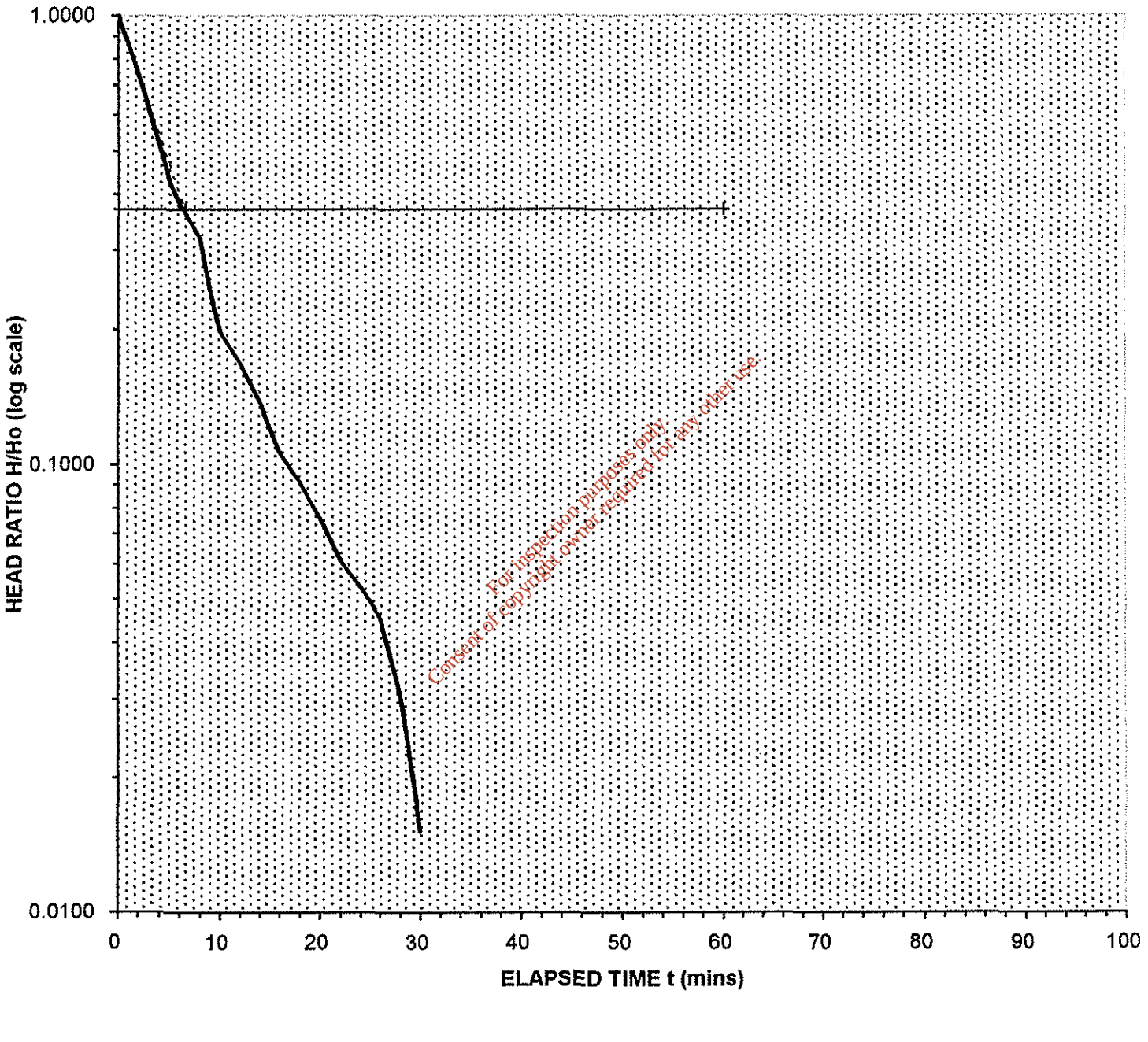
GSI

VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

TYPE OF TEST: ***FALLING*** **HEAD**

CONTRACT: Ballynacarrick Landfill Site **BOREHOLE No.:** 6 **TEST #:** 5
DATE: 29-7-02

HEAD RATIO (log scale) v. ELAPSED TIME



Basic Time Lag Factor T =	6.5	mins

GSI