

NEW DEVELOPMENT  
UCD CAMPUS BELFIELD  
AREA 1 AND AREA 2

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Consulting Engineers

## CONTENTS

I	INTRODUCTION
II	FIELDWORK
III	TESTING
IV	DISCUSSION

## APPENDICES

I	BOREHOLE RECORDS
II	ROTARY CORE RECORDS
III	TRIAL PIT RECORDS AND PHOTOGRAPHS
IV	DYNAMIC PROBE DATA
V	BRE DIGEST 365 PERCOLATION TESTS
VI A	GEOTECHNICAL LABORATORY TESTS
VI B	ENVIRONMENTAL LABORATORY DATA
VII	SITE LOCATION PLAN

## FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

### General.

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

### Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). The following Irish (IS) and European Standards or Norms are referenced:

- IS EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- IS EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- IS EN ISO 14688-1:2002 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- IS EN ISO 14688-2:2004 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles

### Routine Sampling.

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler or Piston Sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

### In-Situ Testing.

Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 to obtain the Energy Ratio ( $E_r$ ) of each hammer. A calibration certificate is available upon request. The  $E_r$  is defined as the ratio of the actual energy  $E_{meas}$  (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy ( $E_{theor}$ ) as calculated from the drive weight assembly. The recorded number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

### Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

### Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004.

Where peat has been encountered during site works, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 & Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986).

### Retention of Samples.

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

### Reporting

Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for the project client and the information should not be used without prior written permission. Any recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

**REPORT ON A SITE INVESTIGATION  
FOR A STUDENT ACCOMMODATION  
DEVELOPMENT IN BELFIELD**

**FOR  
UNIVERSITY COLLEGE DUBLIN.**

**BARRETT MAHONY  
CONSULTING ENGINEERS**

**Report No. 18911**

**JANUARY 2016**

**I Introduction**

A major new student accommodation development is proposed for the campus at University College Belfield. Two areas are to be developed, the major one designated Area 1 and a smaller development designated Area 2.

The project will include a number of residential blocks, with a basement covering the entire footprint.

A detailed investigation of sub soil conditions in the area of development has been carried out by IGSL, directed by BMCE, acting for the client, University College Dublin

The programme of this investigation included the construction of six boreholes and four trial pits to establish geotechnical and environmental criteria on which to base foundation and infra-structural design. Rotary drilling was used at two borehole locations to extend the investigation depth.

In addition heavy duty dynamic probing was carried out on a grid basis (at eleven locations) to confirm soil strength v depth parameters.

Percolation tests were carried out in three of the trial pits in accordance with BRE Digest 365 to determine the suitability of the soils for soakaway construction.

This geotechnical report includes all factual data pertaining to the project and comments on the findings relative to foundation and infrastructural design.



## II Fieldwork

The investigation has been carried out in two specific areas within the campus of University College Dublin. The development area is a combination of paved car park and green playing fields. The site outlines are indicated on the enclosed aerial map. The larger site is designated “Area 1” and the smaller site as “Area 2”

Exploratory locations are noted on the site plan enclosed in Appendix VIII. Details on this plan have been provided by BMCE. Protective HERRAS fencing was installed at each borehole location prior to commencement of drilling

The field investigation at each area is detailed as follows;

	<b>Area 1</b>	<b>Area 2</b>
* Cable Percussion Boreholes	5 nr	1 nr
* Rotary Boreholes	2 nr	
* Trial Pits	3 nr	1 nr
* BRE Digest 365	2 nr	1 nr
* Dynamic Probe	10 nr	2 nr

### *a. Boreholes*

The six exploratory holes were bored with conventional 200mm cable-tool methods using a Dando Exploratory Rig. Each location was opened by hand to 1.20 metres to ensure that services were not present and electronic scanning was also carried out. Boreholes BH01 to BH05 were located in Area 1 and BH06 was in Area 2.

Detailed geotechnical records are contained in Appendix I to this report - the records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement. In general it was not possible to recover undisturbed samples because of the high stone/cobble content of the strata encountered.

### **AREA 1**

The records show that the stratification at Area 1 consists of the following:

#### **MADE GROUND**

Firm silty CLAY	Recent deposit
Brown or grey brown gravelly CLAY	Boulder Clay /Glacial Till
Grey black sandy very gravelly CLAY	Boulder Clay /Lodgement Till

The investigation extended to a maximum depth of 10.00 metres with rotary holes terminated in the hard black lodgement till (locally referred to as black boulder clay).

Ground water was noted during the course of boring at BH 01, BH03 and BH 04 as light seepage at varying depths. Standpipes were installed in BH01, 02 and 04 to permit long term observation of ground water. The standpipes were 50mm slotted PVC, sealed at surface and protected by a flush metal manhole cover.

## **AREA 2**

In Area 2 a single borehole BH06 revealed FILL to a depth of 1.80 metres overlying loose to medium dense gravelly SAND. Dense coarse angular GRAVEL was noted from 4.80 to 5.60 metres. Borehole refusal was recorded in this location at 5.60 metres after a period of chiselling.

Ground water ingress was noted in the sand at 1.80 metres and more copiously in the coarse granular stratum at 4.80 metres BGL

### ***b. Rotary Drilling***

Rotary drilling was scheduled by the consulting engineer on completion of the shell and auger boreholes.

A truck mounted rotary drilling rig was mobilised to advance the hole depth at two locations in Area 1, adjacent to BH01 and BH03. Holes are designated RC1 and RC3. An air mist flush was used in a 90mm diameter hole. Detailed core records are presented in Appendix II.

The records indicate that very stiff to hard gravelly clay continue below the base of the shell and auger holes to scheduled final depths of about 10.00 metres. Standard Penetration Tests were carried out during drilling, with N values in excess of 50 indicative of hard lodgement till.

While no significant water strike was noted during the course of rotary drilling, a monitoring standpipe was installed in RC3 to 10.00 metres with surface seal and steel manhole cover to facilitate long-term water observation.

No rotary drilling was scheduled in Area 2.

Ground water levels in standpipes installed in boreholes and coreholes have been monitored over two site visits (21.01.2016 and 08.02.2016). Details are presented In Appendix VII.

*c. Trial Pits*

Four trial pits were excavated over the site area under the direction of IGSL. Three pits (TP1 TP2 and TP3) were located in Area 1 and TP4 was located in Area 2.

Geotechnical records with photographs are presented in Appendix II, detailing stratification, sampling, stability and ground water.

All trial excavations were carefully backfilled and the site area levelled on completion of the field investigation.

**Area 1**

The three pits in this area all confirm the presence of MADE GROUND extending to depths varying from 1.00 to 1.60 metres. The fill overlies firm to stiff brown and grey brown sandy gravelly CLAY (glacial till or boulder clay). Pits were terminated at 3.00 metres BGL. A thin layer of water bearing sandy gravel was noted in TP2 from 2.10 to 2.30 metres, while water seepage was also recorded at the fill / clay interface in TP1.

Some excavation instability was noted both in the made ground and in the granular zone identified in TP2.

**Area 2**

A single trial pit (TP4) in this area established the presence of 2.20 metres of variable FILL overlying medium dense brown sandy (slightly clayey) GRAVEL. Water was noted at the base of the fill / gravel horizon. Excavation instability was also noted in this location.

*d. Percolation Testing*

Tests were carried out in three of the trial pits in accordance with BRE Digest 365 to determine the infiltration characteristics of the soils. Testing involves adding water to the excavated trial pit and observing its dissipation into the sub-soils over time. Testing is carried over two cycles and the infiltration rate is calculated from the final cycle.

Test data is presented in Appendix IV with infiltration rates calculated as follows:

SA 1	Carried out in TP01	Area 1	Infiltration Rate (f) = 0.00074 m/min.
SA2	Carried out in TP02	Area 1	Infiltration Rate (f) = 0.00047 m/min
SA3	Carried out in TP04	Area 2	Infiltration Rate (f) = 0.00056 m/min



*e. Dynamic Probing*

A tracked Competitor Probe Rig was used to establish a strength/depth pattern for the sub soils at a total of eleven locations. Nine Probes (DP1 to DP9) were located in Area 1 with two tests (DP11 and DP12) located in Area 2.

Probing is in accordance with the DPH specification of BS 1377: Part 9: 1990. A 50kg hammer falling through 500mm is used to drive a 43.7mm diameter cone into the soil. In these tests, the soil resistance is measured in terms of the number of drop-hammer blows required to drive the test probe through each 100 mm increment of penetration. The results are presented in both graphical and tabular form in Appendix V. Probing is generally terminated following successive blow counts in excess of 25, to avoid damage to the apparatus.

Where very soft soils are encountered, the probe may penetrate the soil under self-weight and blow counts of zero may be entered where this happens. Blow counts of zero do not signify a void, unless specifically mentioned.

The probe graphs typically note stiff/dense material at surface (hardcore / made ground) overlying some weaker material (original ground surface). A probe resistance of  $N_{100} = 5$  to 6 is indicative of brown boulder clay with smoothly increasing strength continuing to probe refusal, probably on hard black lodgement till.

The data is summarised as follows:

Ref No	Surface Hardcore	Weak Soils	Glacial Till	Refusal
<b>Area 1</b>				
DP1	0 – 0.70	0.70 – 1.60	1.60 – 2.90	3.00
DP2	0 – 0.40	0.40 – 1.60	1.60 – 2.80	2.90
DP3	0 – 1.20	1.20 – 1.90	1.90 – 2.20	2.30
DP4	0 – 1.00		1.00 – 2.00	2.10
DP5	0 – 0.60	0.60 – 1.40	1.40 – 2.20	2.30
DP6	0 – 1.30	1.30 – 1.70	1.70 – 3.60	3.70
DP7	0 – 1.40	1.40 – 2.00	2.00 – 3.20	3.30
DP8	0 – 0.30	0.30 – 1.70	1.70 – 2.40	2.50
DP9	0 – 1.30	1.30 – 1.90	1.90 - 3.00	3.10
<b>Area 2</b>				
DP11	0 – 0.30	0.30 – 1.00	1.00 – 3.90	4.00
DP12	0 – 0.40	0.40 – 1.20	1.20 – 3.00	3.10

Final probe refusal depths are not indicative of rock horizon. The probing technique does not allow recovery of samples and consequently identification of soil type is not possible.



### **III Testing**

#### ***(a) In-Situ :***

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes to measure relative in-situ soil strength. N values are noted in the right hand column of the boring records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows. Where full test penetration was not achieved the blow count for a specific penetration is recorded, or refusal is indicated where appropriate

The results of the tests are summarised as follows:

<b>STRATUM</b>	<b>N VALUE RANGE</b>	<b>COMMENT</b>
<b>Area 1</b>		
FILL	7 to 12	Soft to Firm
Gravelly CLAY		
2.00m BGL	15 to 30	Stiff
3.00m BGL	19 to 39	Stiff to very stiff
4.00m BGL	31 to 45	Very stiff to Hard
> 5.00	+ 50	Hard
<b>Area 2</b>		
FILL	5	Soft
Gravelly SAND	10 to 14	Loose to Medium Dense
GRAVEL	+ 50	Dense

Numerous limited penetration SPT tests were recorded on cobbles or boulders in the glacial till (boulder clay) stratum.

#### ***(b) Geotechnical and Environmental Laboratory :***

All samples from the boreholes and trial pits have been returned to the IGSL laboratory for initial visual inspection, a schedule of testing was prepared and tests as appropriate carried out.

All testing other than chemical and environmental was carried out by IGSL to INAB standards. Chemical tests (sulphate / pH) and Murphy Suite tests were performed by Jones Environmental Laboratory.

The programme of testing included the following elements and all results are presented in Appendices VIA (geotechnical) and VIB (chemical and environmental)

- a. Classification (Liquid and Plastic Limits)
- b. Natural Moisture Content
- c. Particle size distribution (Wet Sieve Analysis and Hydrometer)
- d. CBR
- e. Sulphate and pH (Jones Laboratory)
- f. Environmental (Murphy WAC) (Jones Laboratory)

### *Classification*

The liquid and plastic limits were established for samples of the cohesive soils (boulder clay). Results are plotted on the standard Casagrande Chart, falling in the CL / CI zones, indicative of sensitive clay soil of low plasticity. The moisture contents were also determined, varying from 11 to 16 % and in one instance recorded at 23%.

### *Grading*

Grading and hydrometer tests were carried out on the glacial clay encountered in BH01 to BH05 (Area 1)

The glacial till or boulder clay is graded evenly through the clay to coarse gravel fraction. The straight line grading is typical of the regional glacial till deposition.

One sample from BH06 (Area 2) grades as slightly clayey sandy GRAVEL.

### *CBR*

Bulk samples were taken at shallow depth in the four trial pits and laboratory CBR values were established. Results ranged from less than 1% to 8%, the lower values being associated with high natural moisture contents

### *Sulphate and pH*

Chemical Tests were carried out by Jones Environmental Ltd. The results indicate sulphate concentrations ranging from 7 to 140 mg/l (Design Class DS-1 ACEC Classification)) with pH values of about 8.

### *Murphy Suite (Waste Acceptance Criteria)*

Detailed environmental testing was carried out by Jones Environmental Ltd. and results are presented in Appendix VIB. Four samples were sent for analysis, representative of fill material from each trial pit.

Testing was carried out to Murphy Suite Parameters establishing the landfill waste acceptance criteria.

Each test is compared in detail to Murphy requirements.

#### **Area 1**

The samples from here all exhibit very low contaminant concentrations, falling well below the limits for Inert material. No problems are anticipated with disposal of excavated material to licensed landfill facilities.

#### **Area 2**

A single sample from TP4 exhibited an elevated level of Total Organic Carbon (TOC), 4.84% as against the permitted Inert Level of 3%. A loss on ignition value of 8% was also noted. The remaining parameters for this sample were all well below the permitted level. Consultation with the waste facility is advised, to establish if this material is acceptable. Additional testing at construction stage should also be considered.

## **IV Discussion**

The proposed student accommodation development is to incorporate a number of buildings with a basement proposed over the full site area. The ground floor level will be at or about existing level.

A detailed geotechnical investigation of ground conditions has been carried out on the instructions of BMCE, involving borehole, corehole, probe and trial pit investigation with supporting laboratory soil tests.

With regard to the proposed development the following geotechnical issues are discussed.

- Bearing Capacity and foundations for structures
- Ground Retention to support the soils
- Groundwater control and possible uplift
- Buried Concrete

The development is discussed in separate sections dealing with Area 1 and Area 2.

### **AREA 1**

The main investigation was concentrated in this area and the findings are consistent with glacial till or boulder clay deposits underlying upper fill or soft soil deposits.

#### **Bearing Capacity and Foundations**

For the proposed basement, formation level is assumed to be about 4.00 metres BGL. At this depth the boreholes generally note the presence of stiff to very stiff grey brown to grey black gravelly CLAY. This unit is a glacial till or boulder clay, typical of the greater Dublin area, the characteristics of the till are very well documented and confirmed by geotechnical laboratory analysis of samples.

N values at 4.00 metres range from 31 to 45, while all dynamic probes have recorded values in excess of 25 with refusals on hard material at or about basement formation level.

An allowable bearing pressure of 300 kN/sq.m. is indicated by the test data. Settlement in the glacial till under this load will be low and differential movement will be negligible.

Visual examination of excavated formation is advised to ensure uniformity of founding medium and as the soils are sensitive, rapid blinding of excavated formation is advised.



There is a possibility of gravel pockets or lenses occurring within the generally cohesive till stratum. These may be water bearing and some limited control of water may be required.

### **Excavation / Ground Retention**

Given the large site area it is likely that conventional side slopes will be adopted during basement excavation. We would suggest temporary slopes of about 25 degrees in the fill and 32 degrees in the brown boulder clay. Slopes should be protected by netting to avoid any problems associated with falling of loosened material into the excavation and a narrow exclusion area at the base of excavation would also be appropriate.

Should basement construction be envisaged close to existing buildings or roads a retaining wall will be required to support the soils, prevent undermining and help to preclude ground water ingress.

It is likely that a traditional steel sheet pile wall will fulfil requirements in this regard, however a secant piled wall could also be considered.

Specialist contractors should be consulted if piling techniques are proposed over all or part of the site.

### **Groundwater Control and Base Slab Uplift**

Some seepages may occur during excavation in the glacial till deposits, particularly if granular zones are encountered. Control of any such ingress should be readily achieved by conventional pumping from sumps.

Standing water levels in the boreholes has been measured over two site visits, with details noted in Appendix VII. Standing water has been recorded at 0.75 metres BGL in RC3 and at 0.90 metres BGL in BH1. Based on these readings we would suggest that uplift design would assume standing water at or about 0.70 metres BGL.

### **Percolation Tests**

BRE Digest 365 tests in the area confirm quite low permeability values, typical of the cohesive glacial till deposits. The soils are unsuitable for dispersion of storm or surface water and consideration should be given to utilising the existing drainage system.

### **Disposal of Excavated Material**

Environmental analysis to Murphy Suite (WAC) guidelines indicate that the soils fall well below the inert level and will be accepted for disposal off site in a licensed landfill facility.

## **AREA 2**

The second area of development is relatively small and investigation included a single borehole, one trial pit with percolation test and two dynamic probes.

The findings are quite different from the main investigation area. The borehole (BH06) reveals 1.80 metres of variable FILL material overlying a stratum of medium dense gravelly SAND / sandy GRAVEL. This extends to 4.80 metres where dense angular gravel sized fragments were recovered. This stratum was penetrated to refusal at 5.60 metres using the heavy chisel to assist advancement. The operators comment was that refusal possibly indicated rock horizon. Proof core drilling was not however scheduled in this location.

The trial pit (TP04) confirms the presence of variable FILL to 2.20 metres overlying a sandy GRAVEL stratum. Ground water was noted at the fill / gravel interface.

Finally two dynamic probes (DP11 and DP12) indicated soft or loose material to respective depths of 1.00 and 1.30 metres with stiff or dense resistance below these depths. Probes were terminated at 4.00 and 3.10 metres respectively.

### **Allowable Bearing Pressures**

The made ground in the area is unsuited as a founding medium, the granular deposits underlying are medium dense, with SPT values ranging from N=10 to N=14. For foundations placed at about 2.00 metres BGL an allowable bearing pressure of the order of 100 to 120 kN/sq.m. can be assumed. Settlement of the order of 20 mm would be expected.

The coarse dense granular deposit at about 5.00 metres should readily support loads in excess of 250 kN/sq.m. This stratum may represent the weathered horizon of the limestone bedrock, although proof coring has not been carried out. Further investigation to confirm bedrock parameters in this area would be recommended if basement construction or piling methods are envisaged.

### **Excavation**

Excavation in this area through fill and granular soils will be unstable and water ingress in the soils will exacerbate the situation. Vertical support of deep excavations will be necessary.

Environmental analysis of the fill material indicates an elevated TOC level and a high Loss on Ignition. Specialist landfill facilities may be required to deal with off site disposal of excavated material from this area.

***IGSL/JC***  
***January 2016***

## **Appendix I Boring Records**



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Campus		<b>BOREHOLE NO.</b> BH01
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (m AOD)</b>	<b>RIG TYPE</b> Dando 2000	<b>DATE COMMENCED</b> 15/12/2015
	<b>BOREHOLE DIAMETER (mm)</b> 200	<b>DATE COMPLETED</b> 15/12/2015
	<b>BOREHOLE DEPTH (m)</b> 6.50	
<b>CLIENT</b> UCD	<b>SPT HAMMER REF. NO.</b>	<b>BORED BY</b> J.O'Toole
<b>ENGINEER</b> Barrett Mahony	<b>ENERGY RATIO (%)</b>	<b>PROCESSED BY</b> I.Reder

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Stacpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	MADE GROUND (comprised of grey angular gravel and cobbles)			0.30						
	Firm, light brown, CLAY with stones (fill)			0.70						
1	Firm, brown, gravelly CLAY with some cobbles			1.30	AA39342	B	1.00-1.00	N = 11 (2, 2, 2, 3, 3, 3)		
	Firm, grey, gravelly CLAY with occasional cobbles			2.00	AA39343	B	2.00-2.00	N = 15 (2, 3, 3, 3, 4, 5)		
2	Firm to stiff, grey, gravelly CLAY			4.00	AA39344	B	3.00-3.00	N = 19 (2, 3, 4, 4, 5, 6)		
3				4.30	AA39345	B	4.00-4.00	N = 45 (7, 7, 10, 10, 12, 13)		
4	Dense, grey, sandy fine to coarse GRAVEL			4.30						
5	Very stiff to hard, grey, gravelly CLAY with many cobbles and occasional boulders			5.00	AA39346	B	5.00-5.00	N = 50/225 mm (7, 10, 12, 12, 18, 8)		
6				6.50	AA39347	B	6.00-6.00	N = 49/225 mm (7, 12, 14, 15, 20)		
7	End of Borehole at 6.50 m									

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.7	4.9	0.75		2.00	2.00	4.20	1.50	20	Slow
6.3	6.5	2							

INSTALLATION DETAILS					GROUNDWATER PROGRESS				
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
15-12-15	6.50	2.00	6.50	50mm SP					

<b>REMARKS</b> CAT scanned location and hand dug inspection pit. Herras fencing erected.	<b>Sample Legend</b> D - Small Disturbed (tub) Sample B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) U - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL\_BH LOG CHISEL SEPARATED 18911.GPJ IGSL\_GDT 22/12/15





# GEOTECHNICAL BORING RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus		<b>BOREHOLE NO.</b> BH02
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (m AOD)</b>	<b>RIG TYPE</b> Dando 2000	<b>DATE COMMENCED</b> 14/12/2015
	<b>BOREHOLE DIAMETER (mm)</b> 200	<b>DATE COMPLETED</b> 14/12/2015
<b>CLIENT</b> UCD	<b>SPT HAMMER REF. NO.</b>	<b>BORED BY</b> J.O'Toole
<b>ENGINEER</b> Barrett Mahony	<b>ENERGY RATIO (%)</b>	<b>PROCESSED BY</b> I.Redder

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	MADE GROUND (comprised of grey angular gravel and cobbles)			0.60						
	Firm, light brown, CLAY with stones (fill)			1.10	AA39336	B	1.00-1.00		N = 11 (2, 1, 2, 3, 3, 3)	
1	MADE GROUND (comprised of cobbles)			1.80						
2	Stiff to very stiff, grey, gravelly CLAY with many cobbles			2.00	AA39337	B	2.00-2.00		N = 30 (2, 6, 6, 7, 8, 9)	
3				3.00	AA39338	B	3.00-3.00		N = 35 (3, 5, 6, 7, 10, 12)	
4				4.00	AA39339	B	4.00-4.00		N = 34 (2, 4, 5, 7, 11, 11)	
5	Hard, grey, gravelly CLAY with many cobbles and occasional boulders			4.80	AA39340	B	5.00-5.00		N = 50/230 mm (4, 8, 13, 17, 16, 4)	
6	End of Borehole at 6.00 m			6.00	AA39341	B	6.00-6.00		N = 50/250 mm (8, 11, 12, 15, 18, 5)	

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
1.1	1.8	1							No water strike
4.9	5.2	0.75							
5.8	6	2							

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					
14-12-15	6.00	3.00	6.00	50mm SP					

<b>REMARKS</b> CAT scanned location and hand dug inspection pit. Herras fencing erected.	<b>Sample Legend</b> D - Small Disturbed (tub) Sample B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) U - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG CHISEL SEPARATED 18911.GPJ IGSL.GDT 22/12/15



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Campus		<b>BOREHOLE NO.</b> BH03
		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b>	<b>RIG TYPE</b> Dando 2000	<b>DATE COMMENCED</b> 17/12/2015
<b>GROUND LEVEL (m AOD)</b>	<b>BOREHOLE DIAMETER (mm)</b> 200	<b>DATE COMPLETED</b> 17/12/2015
	<b>BOREHOLE DEPTH (m)</b> 6.00	
<b>CLIENT</b> UCD	<b>SPT HAMMER REF. NO.</b>	<b>BORED BY</b> J.O'Toole
<b>ENGINEER</b> Barrett Mahony	<b>ENERGY RATIO (%)</b>	<b>PROCESSED BY</b> I.Reider

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	MADE GROUND (comprised of grey angular gravel and cobbles)			0.60						
1	Firm, brown, gravelly CLAY with stones (fill)			1.60	AA45863	B	1.00-1.00		N = 12 (1, 1, 2, 2, 3, 5)	
2	Firm to stiff, grey, gravelly CLAY with some cobbles			3.20	AA45864	B	2.00-2.00		N = 17 (2, 2, 3, 4, 4, 6)	
3	Very stiff to hard, grey, gravelly CLAY with many cobbles and occasional boulders			3.20	AA45865	B	3.00-3.00		N = 39 (2, 4, 7, 9, 11, 12)	
4					AA45866	B	4.00-4.00		N = 45 (3, 6, 7, 9, 11, 18)	
5					AA45867	B	5.00-5.00		N = 50/240 mm (5, 9, 12, 15, 17, 6)	
6	End of Borehole at 6.00 m			6.00	AA45868	B	6.00-6.00		N = 50/225 mm (8, 12, 15, 17, 18)	

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.6	3.8	0.5		1.20	1.20	2.60	0.80	20	Slow
5.8	6	2							

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					

<b>REMARKS</b> CAT scanned location and hand dug inspection pit. Herras fencing erected.	<b>Sample Legend</b> U - Undisturbed 100mm Diameter Sample D - Small Disturbed (tub) Sample B - Bulk Disturbed Sample LB - Large Bulk Disturbed Sample P - Undisturbed Piston Sample Env - Environmental Sample (Jar + Vial + Tub) W - Water Sample
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IGSL BH LOG CHISEL SEPARATED 18911.GPJ IGSL.GDT 22/12/15



# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Campus		<b>BOREHOLE NO.</b> <b>BH04</b>
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (m AOD)</b>	<b>RIG TYPE</b> Dando 2000 <b>BOREHOLE DIAMETER (mm)</b> 200 <b>BOREHOLE DEPTH (m)</b> 6.00	<b>DATE COMMENCED</b> 11/12/2015 <b>DATE COMPLETED</b> 11/12/2015
<b>CLIENT</b> UCD <b>ENGINEER</b> Barrett Mahony	<b>SPT HAMMER REF. NO.</b> <b>ENERGY RATIO (%)</b>	<b>BORED BY</b> J.O'Toole <b>PROCESSED BY</b> I.Redder

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Stancpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL			0.30						
	MADE GROUND (comprised of granite cobbles)			0.50						
	MADE GROUND (Comprised of brown silt/clay with roots)				AA45851	B	1.00-1.00		N = 7 (1, 1, 2, 2, 1, 2)	
1	Firm to stiff, brown, SILT/CLAY with some gravel			1.60						
					AA45852	B	2.00-2.00		N = 23 (3, 5, 6, 5, 5, 7)	
2	Very stiff, grey, gravelly CLAY with some cobbles			2.50						
					AA45853	B	3.00-3.00		N = 39 (2, 5, 6, 8, 11, 14)	
3										
					AA45854	B	4.00-4.00		N = 31 (3, 5, 5, 7, 9, 10)	
4										
					AA45855	B	5.00-5.00		N = 50 (3, 7, 12, 14, 12, 12)	
5	Dense, grey, clayey sandy fine to coarse GRAVEL (Possibly very gravelly clay)			5.00						
					AA45856	B	6.00-6.00		N = 50/235 mm (9, 10, 12, 15, 15, 8)	
6	Hard, grey, slightly sandy gravelly CLAY with many cobbles and occasional boulders			6.00						
	End of Borehole at 6.00 m									
7										
8										
9										

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.6	3.8	0.75		5.00	5.00	NO	4.00	20	Moderate
5.7	6	2							

INSTALLATION DETAILS					GROUNDWATER PROGRESS				
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
11-12-15	6.00	3.00	6.00	50mm SP	11-12-15	6.00	NIL	2.80	End of BH

<b>REMARKS</b> CAT scanned location and hand dug inspection pit. Herras fencing erected.	<b>Sample Legend</b> D - Small Disturbed (tub) Sample B - Bulk Disturbed Sample LB - Large Bulk Disturbed Sample Env - Environmental Sample (Jar + Vial + Tub) U - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG CHISEL SEPARATED 18911.GPJ IGSL.GDT 22/12/15





# GEOTECHNICAL BORING RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Campus		<b>BOREHOLE NO.</b> BH05
		<b>SHEET</b> Sheet 1 of 1
<b>CO-ORDINATES</b>	<b>RIG TYPE</b> Dando 2000	<b>DATE COMMENCED</b> 16/12/2015
<b>GROUND LEVEL (m AOD)</b>	<b>BOREHOLE DIAMETER (mm)</b> 200	<b>DATE COMPLETED</b> 16/12/2015
	<b>BOREHOLE DEPTH (m)</b> 6.60	
<b>CLIENT</b> UCD	<b>SPT HAMMER REF. NO.</b>	<b>BORED BY</b> J.O'Toole
<b>ENGINEER</b> Barrett Mahony	<b>ENERGY RATIO (%)</b>	<b>PROCESSED BY</b> I.Reder

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL			0.30						
	Soft, dark brown, CLAY (subsoil)			0.60						
	Firm, brown, SILT/CLAY with some gravel				AA45857	B	1.00-1.00		N = 10 (1, 2, 2, 3, 3, 2)	
					AA45858	B	2.00-2.00		N = 18 (2, 2, 3, 4, 5, 6)	
				2.20	AA45859	B	3.00-3.00		N = 28 (2, 3, 4, 6, 8, 10)	
					AA45860	B	4.00-4.00		N = 42 (5, 7, 9, 11, 10, 12)	
				5.10	AA45861	B	5.00-5.00		N = 50/265 mm (7, 9, 12, 12, 15, 11)	
					AA45862	B	6.00-6.00		N = 50/230 mm (8, 10, 12, 15, 19, 4)	
	Hard, grey/black, gravelly CLAY with many cobbles and occasional boulders			6.60						
	End of Borehole at 6.60 m									

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.7	5	0.5							No water strike
5.9	6.1	0.75							
6.4	6.6	2							

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					

<b>REMARKS</b> CAT scanned location and hand dug inspection pit. Herras fencing erected.	<b>Sample Legend</b> D - Small Disturbed (tub) Sample B - Bulk Disturbed Sample LB - Large Bulk Disturbed Sample Env - Environmental Sample (Jar + Vial + Tub) U - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG CHISEL SEPARATED 18911.GPJ IGSL.GDT 22/12/15





# GEOTECHNICAL BORING RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus		<b>BOREHOLE NO.</b> BH06
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (m AOD)</b>	<b>RIG TYPE</b> Dando 2000 <b>BOREHOLE DIAMETER (mm)</b> 200 <b>BOREHOLE DEPTH (m)</b> 5.60	<b>DATE COMMENCED</b> 10/12/2015 <b>DATE COMPLETED</b> 10/12/2015
<b>CLIENT</b> UCD <b>ENGINEER</b> Barrett Mahony	<b>SPT HAMMER REF. NO.</b> <b>ENERGY RATIO (%)</b>	<b>BORED BY</b> J.O'Toole <b>PROCESSED BY</b> I.Reder

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	MADE GROUND (comprised of grey angular gravel and cobbles)	[Cross-hatch pattern]		0.20						
	MADE GROUND (comprised of rubble fill, cobbles, red brick)			0.60						
1	MADE GROUND (Comprised of brown silt/clay with some gravel and pieces of concrete)			1.80	AA40893	B	1.00-1.00		N = 5 (1, 1, 1, 1, 1, 2)	
2	Loose medium dense, brown, gravelly fine to coarse silty SAND	[Sand pattern]		1.80	AA40894	B	2.00-2.00		N = 14 (2, 3, 3, 3, 4, 4)	
3				3.00-3.00	AA40895	B		N = 10 (2, 2, 2, 2, 2, 4)		
4				4.00-4.00	AA40896	B		N = 13 (1, 5, 4, 3, 3, 3)		
5				4.80	AA40897	B	5.00-5.00		N = 50/135 mm (5, 10, 22, 28)	
5	Dense, brown, broken angular GRAVEL with cobbles (possible weathered rock)	[Gravel pattern]		5.60				N = 50/40 mm (25, 50)		
6	End of Borehole at 5.60 m									

HARD STRATA BORING/CHISELLING				WATER STRIKE DETAILS					
From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
5.1	5.3	0.75		1.80	1.80	NO	1.40	20	Slow
5.5	5.6	2		4.90	4.90	NO	2.00	20	Rapid

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type	10-12-15	5.60	NIL	2.00	End of BH

<b>REMARKS</b> CAT scanned location and hand dug inspection pit. Herras fencing erected.	<b>Sample Legend</b> D - Small Disturbed (tub) B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial + Tub) U - Undisturbed 100mm Diameter Sample P - Undisturbed Piston Sample W - Water Sample
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IGSL BH LOG CHISEL SEPARATED 18911.GPJ IGSL.GDT 22/12/15

## **Appendix II Rotary Drilling Records**



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus	<b>DRILLHOLE NO</b> RC1
<b>CO-ORDINATES</b>	<b>SHEET</b> Sheet 1 of 2
<b>GROUND LEVEL (mOD)</b>	<b>DATE DRILLED</b> 22/12/2015
<b>CLIENT</b> UCD	<b>DATE LOGGED</b> 22/12/2015
<b>ENGINEER</b> Barrett Mahony	<b>DRILLED BY</b> IGSL
<b>RIG TYPE</b> Knebel	<b>LOGGED BY</b> D. O'Shea
<b>FLUSH</b> Air/Mist	
<b>INCLINATION (deg)</b> -90	
<b>CORE DIAMETER (mm)</b>	

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			Symmetrix Drilling - No recovery, observed by driller as made ground consisting of Shell and Auger material (clayey gravel).				
1								Symmetrix Drilling - No recovery, observed by driller as grey/brown sandy gravelly clay	1.30			
2								Symmetrix Drilling - No recovery, observed by driller as grey/black gravelly clay	2.20			
3												
4												
5												
6												
7												
8												
8.40								Symmetrix Drilling - No recovery, observed by driller as grey/brown gravelly clay with occasional cobbles	8.40			N = 25/20 mm (12, 25)
9												

<b>REMARKS</b> Hole cased 0.00-10.10m						<b>WATER STRIKE DETAILS</b>					
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
						No water strike recorded					
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>					
						Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type							

IGSL RC Fl 10M -18911.GPJ IGSL.GDT 11/1/16



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

18911

CONTRACT UCD Campus

DRILLHOLE NO **RC1**

SHEET Sheet 2 of 2

CO-ORDINATES

GROUND LEVEL (mOD)

RIG TYPE Knebel  
FLUSH Air/Mist

DATE DRILLED 22/12/2015

DATE LOGGED 22/12/2015

CLIENT UCD  
ENGINEER Barrett Mahony

INCLINATION (deg) -90  
CORE DIAMETER (mm)

DRILLED BY IGSL  
LOGGED BY D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10					0 250 500			End of Borehole at 10.10 m	10.10			N = 25/30 mm (25, 25)
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS					WATER STRIKE DETAILS					
Hole cased 0.00-10.10m					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
										No water strike recorded
INSTALLATION DETAILS					GROUNDWATER DETAILS					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments	

IGSL RC FL 10M 18911.GPJ IGSL.GDT 11/1/16





# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus	<b>DRILLHOLE NO</b> RC3
<b>CO-ORDINATES</b>	<b>SHEET</b> Sheet 1 of 2
<b>GROUND LEVEL (mOD)</b>	<b>DATE DRILLED</b> 21/12/2015 <b>DATE LOGGED</b> 21/12/2015
<b>CLIENT</b> UCD <b>ENGINEER</b> Barrett Mahony	<b>RIG TYPE</b> Knebel <b>FLUSH</b> Air/Mist <b>INCLINATION (deg)</b> -90 <b>CORE DIAMETER (mm)</b>
	<b>DRILLED BY</b> IGSL <b>LOGGED BY</b> D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0					0 250 500			Symmetrix Drilling - No recovery, observed by driller as made ground consisting of Shell and Auger material (clayey gravel).				
1												
2												
3												
4												
5												
6								Symmetrix Drilling - No recovery, observed by driller as grey/black gravelly clay	6.00			
7								Symmetrix Drilling - No recovery, observed by driller as grey/brown sandy gravel	7.30			
8								Symmetrix Drilling - No recovery, observed by driller as grey/black gravelly clay with occasional cobbles	7.90			
9												

<b>REMARKS</b> Hole cased 0.00-10.20m						<b>WATER STRIKE DETAILS</b>							
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments		
											No water strike recorded		
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>							
						Date	Hole Depth	Casing Depth	Depth to Water	Comments			
21-12-15	10.20	1.00	10.20	50mm SP									

IGSL-RC-FI-10M-18911-GPJ-IGSL-GDT-11/11/16

N = 21/30 mm  
(25, 29, 21)



# GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus		<b>DRILLHOLE NO</b> RC3
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 2 of 2
<b>GROUND LEVEL (mOD)</b>		<b>DATE DRILLED</b> 21/12/2015
<b>CLIENT</b> UCD		<b>DATE LOGGED</b> 21/12/2015
<b>ENGINEER</b> Barrett Mahony		<b>DRILLED BY</b> IGSL
<b>RIG TYPE</b> Knebel		<b>LOGGED BY</b> D. O'Shea
<b>FLUSH</b> Air/Mist		
<b>INCLINATION (deg)</b> -90		
<b>CORE DIAMETER (mm)</b>		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10					0 250 500		○	End of Borehole at 10.20 m	10.20		□ □	N = 17/10 mm (25, 33, 17)
11												
12												
13												
14												
15												
16												
17												
18												
19												

<b>REMARKS</b> Hole cased 0.00-10.20m						<b>WATER STRIKE DETAILS</b>					
						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
											No water strike recorded
<b>INSTALLATION DETAILS</b>						<b>GROUNDWATER DETAILS</b>					
						Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type							
21-12-15	10.20	1.00	10.20	50mm SP							

IGSL RC Fl 10M 18911.GPJ IGSL.GDT 11/11/16

**Appendix III Trial Pit Records / Photographs**





# TRIAL PIT RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Campus	<b>TRIAL PIT NO.</b> TP01
	<b>SHEET</b> Sheet 1 of 1
<b>LOGGED BY</b> I.Reider	<b>CO-ORDINATES</b>
	<b>DATE STARTED</b> 08/06/2015
	<b>DATE COMPLETED</b> 08/06/2015
<b>CLIENT</b> UCD	<b>GROUND LEVEL (m)</b>
<b>ENGINEER</b> Barrett Mahony	<b>EXCAVATION METHOD</b> 5T Track Machine

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (kPa)	Hand Penetrometer (kPa)
						Sample Ref	Type	Depth		
0.0	MADE GROUND (comprised of grey slightly clayey slightly sandy angular gravel with occasional angular cobbles - C.L.804)		0.35							
	Soft, brown/grey mottled very sandy gravelly CLAY with occasional cobbles (possible very clayey sand) - fill		1.00		↓ (Slow)	AA39373	B	0.70-0.70		
1.0	Firm to stiff, grey, slightly sandy gravelly CLAY with many subangular to subrounded cobbles and occasional boulders		1.70			AA39374	B	1.70-1.70		
2.0			2.70			AA39375	B	2.70-2.70		
3.0	End of Trial Pit at 3.00m		3.00							
4.0										

**Groundwater Conditions**  
Slow water flow at 1.0m

**Stability**  
TP slightly unstable

**General Remarks**  
SA test 01 done in TP01 location - for all soakaway test information see SA01 log

IGSL TP LOG 18911 GPJ IGSL\_GDT 14/12/15



# TRIAL PIT RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus		<b>TRIAL PIT NO.</b> TP02
<b>LOGGED BY</b> I.Reder		<b>SHEET</b> Sheet 1 of 1
<b>CLIENT</b> UCD		<b>DATE STARTED</b> 08/06/2015
<b>ENGINEER</b> Barrett Mahony		<b>DATE COMPLETED</b> 08/06/2015
<b>CO-ORDINATES</b>		<b>EXCAVATION METHOD</b> 5T Track Machine
<b>GROUND LEVEL (m)</b>		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (kPa)	Hand Penetrometer (kPa)
					Sample Ref	Type	Depth		
MADE GROUND (comprised of grey slightly clayey slightly sandy angular gravel with occasional angular cobbles - C.L.804)		0.20							
MADE GROUND (comprised of brown/grey clayey sandy gravel, cobbles, boulders, sandy gravel)		0.60-0.60			AA39376	B	0.60-0.60		
Firm to stiff, grey, slightly sandy gravelly CLAY with many subangular to subrounded cobbles and occasional boulders		1.30		↓ (Seepage)					
Medium dense, dark grey, slightly clayey gravelly SAND (possible clayey sandy gravel)		2.10		↓ (Slow)					
Firm to stiff, dark grey, gravelly CLAY with many subangular cobbles		2.30							
		2.60-2.60			AA39378	B	2.60-2.60		
End of Trial Pit at 3.00m		3.00							

**Groundwater Conditions**  
Slow water flow at 2.2m; seepage flow at 1.3m

**Stability**  
TP slightly unstable from 2.1m to 2.3m

**General Remarks**  
SA test 02 done in TP02 location - for all soakaway test information see SA02 log

IGSL TP LOG 18911.GPJ IGSL GDT 14/12/15



# TRIAL PIT RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Campus	<b>TRIAL PIT NO.</b> TP03
	<b>SHEET</b> Sheet 1 of 1
<b>LOGGED BY</b> I.Reider	<b>CO-ORDINATES</b>
	<b>DATE STARTED</b> 08/06/2015
	<b>DATE COMPLETED</b> 08/06/2015
<b>CLIENT</b> UCD	<b>GROUND LEVEL (m)</b>
<b>ENGINEER</b> Barrett Mahony	<b>EXCAVATION METHOD</b> 5T Track Machine

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (kPa)	Hand Penetrometer (kPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Soft, brown, slightly sandy CLAY with occasional gravel - fill		0.25			AA39382	B	0.50-0.50		
1.0	MADE GROUND (comprised of brown/grey sandy gravelly clay, sandy gravel, cobbles, boulders)		1.00			AA39383	B	1.40-1.40		
	Firm to stiff, brownish grey to grey, slightly sandy gravelly CLAY with some subangular cobbles		1.60							
2.0						AA39384	B	2.40-2.40		
3.0	End of Trial Pit at 3.00m		3.00							
4.0										

**Groundwater Conditions**  
TP dry

**Stability**  
TP slightly unstable from 1.0m to 1.6m

**General Remarks**

IGSL\_TP LOG 18911.GPJ IGSL\_GDT 14/12/15





# TRIAL PIT RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Campus	<b>TRIAL PIT NO.</b> TP04
<b>LOGGED BY</b> I.Reeder	<b>SHEET</b> Sheet 1 of 1
<b>CLIENT</b> UCD	<b>DATE STARTED</b> 08/06/2015
<b>ENGINEER</b> Barrett Mahony	<b>DATE COMPLETED</b> 08/06/2015
<b>CO-ORDINATES</b>	<b>EXCAVATION METHOD</b> 5T Track Machine
<b>GROUND LEVEL (m)</b>	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	MADE GROUND (comprised of grey slightly sandy angular gravel with occasional angular cobbles - C.L.804)									
0.35	Soft, dark brown/brown, sandy CLAY with some gravel - fill		0.35			AA39379	B	0.50-0.50		
1.20	MADE GROUND (comprised of brown clayey sandy gravel, gravelly clay, cobbles, boulders, red brick, angular stones)		1.20			AA39380	B	1.50-1.50		
2.20	Medium dense, brown, slightly clayey sandy fine to coarse GRAVEL - possible original ground		2.20		↓ (Seepage)					
2.80	End of Trial Pit at 2.80m		2.80		↓ (Moderate)	AA39381	B	2.50-2.50		
3.0										
4.0										

**Groundwater Conditions**  
Seepage flow at 1.8m; Moderate water flow at 2.2m

**Stability**  
TP very unstable from 2.2m

**General Remarks**  
SA test 03 done in TP04 location - for all soakaway test information see SA03 log

IGSL TP LOG 18911.GPJ IGSL\_GDT 14/12/15

Project Number: 18911  
Site: UCD Campus  
Project Engineer: Barrett Mahony



## TRIAL PIT PHOTOGRAPHY RECORD TP 1



TP 1 – spoil

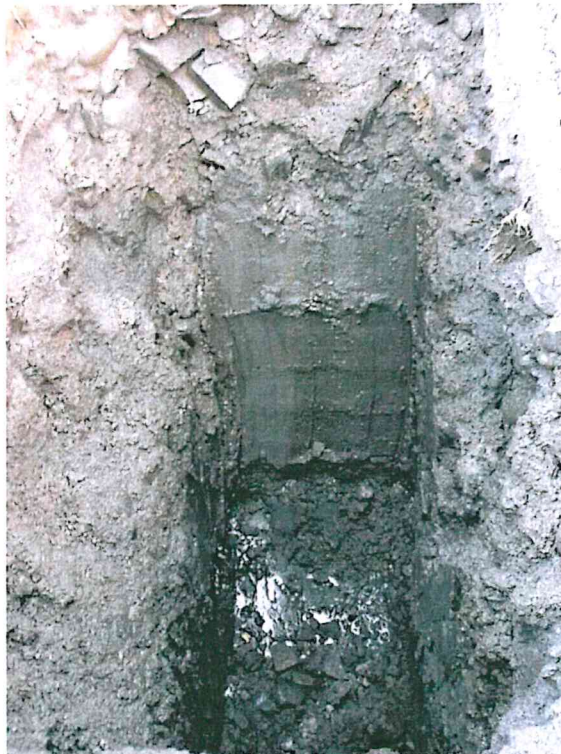




**Project Number: 18911**  
**Site: UCD Campus**  
**Project Engineer: Barrett Mahony**



**TRIAL PIT PHOTOGRAPHY RECORD**  
**TP 2**



**TP 2 – spoil**





**Project Number: 18911**  
**Site: UCD Campus**  
**Project Engineer: Barrett Mahony**



## **TRIAL PIT PHOTOGRAPHY RECORD**

### **TP 3**



**TP 3 – spoil**



**Project Number: 18911**  
**Site: UCD Campus**  
**Project Engineer: Barrett Mahony**



**TRIAL PIT PHOTOGRAPHY RECORD**  
**TP 4**



**TP 4 – spoil**



## **Appendix IV Dynamic Probes**





# DYNAMIC PROBE RECORD

**REPORT NUMBER**

18911

<b>CONTRACT</b> UCD Student Accomodation			<b>PROBE NO.</b> DP1	
			<b>SHEET</b> Sheet 1 of 1	
<b>CO-ORDINATES</b>		<b>DATE DRILLED</b> 10/12/2015		
<b>GROUND LEVEL (mOD)</b>		<b>DATE LOGGED</b> 10/12/2015		
<b>CLIENT</b> UCD		<b>HAMMER MASS (kg)</b> 50		<b>PROBE TYPE</b> DPH
<b>ENGINEER</b> Barrett Mahony		<b>INCREMENT SIZE (mm)</b> 100		
		<b>FALL HEIGHT (mm)</b> 500		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	20	
						0.10	10	
						0.20	7	
						0.30	4	
						0.40	4	
						0.50	4	
						0.60	6	
						0.70	4	
						0.80	3	
						0.90	3	
						1.00	6	
						1.10	6	
						1.20	4	
						1.30	3	
						1.40	4	
						1.50	3	
						1.60	4	
						1.70	8	
						1.80	8	
						1.90	8	
						2.00	7	
						2.10	11	
						2.20	10	
						2.30	10	
						2.40	11	
						2.50	11	
						2.60	11	
						2.70	15	
						2.80	15	
						2.90	25	
3.0	End of Probe at 3.00 m							
4.0								

<b>GROUNDWATER OBSERVATIONS</b>	
<b>REMARKS</b>	

IGSL.DP.LOG 100MM INCREMENTS 18911.GPJ IGSL.GDT 11/12/15





# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Student Accomodation		<b>PROBE NO.</b> DP2
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 1
<b>GROUND LEVEL (mOD)</b>	<b>HAMMER MASS (kg)</b> 50	<b>DATE DRILLED</b> 10/12/2015
<b>CLIENT</b> UCD	<b>INCREMENT SIZE (mm)</b> 100	<b>DATE LOGGED</b> 10/12/2015
<b>ENGINEER</b> Barrett Mahony	<b>FALL HEIGHT (mm)</b> 500	<b>PROBE TYPE</b> DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	20	
						0.10	18	
						0.20	18	
						0.30	6	
						0.40	6	
						0.50	4	
						0.60	4	
						0.70	4	
						0.80	4	
						0.90	4	
						1.00	4	
						1.10	3	
						1.20	4	
						1.30	3	
						1.40	4	
						1.50	3	
						1.60	8	
						1.70	9	
						1.80	9	
						1.90	7	
						2.00	12	
						2.10	15	
						2.20	15	
						2.30	15	
						2.40	17	
						2.50	17	
						2.60	20	
						2.70	20	
						2.80	20	
3.0	End of Probe at 2.90 m							
4.0								

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL DP LOG 100MM INCREMENTS 18911.GPJ IGSL.GDT 11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

CONTRACT UCD Student Accomodation			PROBE NO. <b>DP3</b>
CO-ORDINATES			SHEET Sheet 1 of 1
GROUND LEVEL (mOD)	HAMMER MASS (kg)	50	DATE DRILLED 10/12/2015
CLIENT UCD	INCREMENT SIZE (mm)	100	DATE LOGGED 10/12/2015
ENGINEER Barrett Mahony	FALL HEIGHT (mm)	500	PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	12	
						0.10	7	
						0.20	6	
						0.30	12	
						0.40	12	
						0.50	10	
						0.60	5	
						0.70	10	
						0.80	10	
						0.90	7	
						1.00	8	
						1.10	7	
						1.20	8	
						1.30	5	
						1.40	6	
						1.50	4	
						1.60	6	
						1.70	4	
						1.80	4	
						1.90	9	
						2.00	20	
						2.10	20	
						2.20	25	
	End of Probe at 2.30 m							

**GROUNDWATER OBSERVATIONS**

REMARKS

IGSL DP LOG 100MM INCREMENTS 18911.GPJ IGSL GDT 11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

**CONTRACT** UCD Student Accomodation

**PROBE NO.** DP4

**SHEET** Sheet 1 of 1

**CO-ORDINATES**

**DATE DRILLED** 10/12/2015

**GROUND LEVEL (mOD)**

**HAMMER MASS (kg)** 50

**DATE LOGGED** 10/12/2015

**CLIENT** UCD  
**ENGINEER** Barrett Mahony

**INCREMENT SIZE (mm)** 100

**FALL HEIGHT (mm)** 500

**PROBE TYPE** DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	0	
						0.10	18	
						0.20	10	
						0.30	6	
						0.40	6	
						0.50	4	
						0.60	7	
						0.70	12	
						0.80	10	
						0.90	7	
						1.00	5	
						1.10	7	
						1.20	12	
						1.30	22	
						1.40	16	
						1.50	14	
						1.60	15	
						1.70	18	
						1.80	20	
						1.90	20	
						2.00	20	
	End of Probe at 2.10 m							

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL DP LOG 100MM INCREMENTS 18911.GPJ IGSL.GDT 11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

CONTRACT UCD Student Accomodation			PROBE NO. <b>DP5</b>	
CO-ORDINATES			SHEET Sheet 1 of 1	
GROUND LEVEL (mOD)		HAMMER MASS (kg)	DATE DRILLED 11/12/2015	
CLIENT UCD		INCREMENT SIZE (mm)	DATE LOGGED 11/12/2015	
ENGINEER Barrett Mahony		FALL HEIGHT (mm)	PROBE TYPE DPH	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	2	
0.10						0.10	3	
0.20						0.20	5	
0.30						0.30	5	
0.40						0.40	8	
0.50						0.50	6	
0.60						0.60	3	
0.70						0.70	3	
0.80						0.80	3	
0.90						0.90	3	
1.00						1.00	4	
1.10						1.10	4	
1.20						1.20	10	
1.30						1.30	9	
1.40						1.40	4	
1.50						1.50	6	
1.60						1.60	12	
1.70						1.70	15	
1.80						1.80	15	
1.90						1.90	15	
2.00						2.00	18	
2.10						2.10	20	
2.20						2.20	20	
End of Probe at 2.30 m								
3.0								
4.0								

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL.DP.LOG 100MM INCREMENTS 18911.GPJ IGSL.GDT 11/12/15





# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

CONTRACT UCD Student Accomodation		PROBE NO. DP6
CO-ORDINATES		SHEET Sheet 1 of 1
GROUND LEVEL (mOD)	HAMMER MASS (kg) 50	DATE DRILLED 11/12/2015
CLIENT UCD	INCREMENT SIZE (mm) 100	DATE LOGGED 11/12/2015
ENGINEER Barrett Mahony	FALL HEIGHT (mm) 500	PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	0	
						0.10	3	
						0.20	4	
						0.30	3	
						0.40	2	
						0.50	2	
						0.60	3	
						0.70	6	
						0.80	3	
						0.90	4	
1.0						1.00	7	
						1.10	11	
						1.20	10	
						1.30	8	
						1.40	5	
						1.50	5	
						1.60	3	
						1.70	6	
						1.80	7	
						1.90	10	
2.0						2.00	9	
						2.10	18	
						2.20	14	
						2.30	15	
						2.40	6	
						2.50	4	
						2.60	4	
						2.70	6	
						2.80	6	
						2.90	7	
3.0						3.00	8	
						3.10	8	
						3.20	9	
						3.30	10	
						3.40	13	
						3.50	20	
						3.60	20	
4.0	End of Probe at 3.70 m							

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL DP LOG 100MM INCREMENTS 18911.GPJ IGSL.GDT 11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

CONTRACT UCD Student Accommodation

PROBE NO. DP7

SHEET Sheet 1 of 1

CO-ORDINATES

DATE DRILLED 11/12/2015

DATE LOGGED 11/12/2015

GROUND LEVEL (mOD)

HAMMER MASS (kg) 50

CLIENT UCD

INCREMENT SIZE (mm) 100

ENGINEER Barrett Mahony

FALL HEIGHT (mm) 500

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	0	
1.0						0.10	2	
						0.20	2	
						0.30	2	
						0.40	3	
						0.50	3	
						0.60	4	
						0.70	3	
						0.80	3	
						0.90	6	
						1.00	5	
						1.10	6	
						1.20	8	
						1.30	9	
						1.40	9	
						1.50	3	
						1.60	3	
						1.70	3	
						1.80	3	
						1.90	3	
						2.00	5	
						2.10	7	
						2.20	10	
						2.30	12	
						2.40	12	
						2.50	10	
						2.60	7	
						2.70	12	
						2.80	15	
						2.90	15	
						3.00	18	
						3.10	18	
						3.20	20	
	End of Probe at 3.30 m							

**GROUNDWATER OBSERVATIONS**

REMARKS

IGSL DP LOG 100MM INCREMENTS 18911.GPJ IGSL.GDT 11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

CONTRACT UCD Student Accomodation		PROBE NO. DP8
CO-ORDINATES		SHEET Sheet 1 of 1
GROUND LEVEL (mOD)	HAMMER MASS (kg) 50	DATE DRILLED 11/12/2015
CLIENT UCD	INCREMENT SIZE (mm) 100	DATE LOGGED 11/12/2015
ENGINEER Barrett Mahony	FALL HEIGHT (mm) 500	PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record																																																				
0.0						0.00	2	<table border="1" style="display: none;"> <caption>Graphic Probe Record Data</caption> <thead> <tr> <th>Depth (m)</th> <th>Probe Readings (Blows/Increment)</th> </tr> </thead> <tbody> <tr><td>0.00</td><td>2</td></tr> <tr><td>0.10</td><td>4</td></tr> <tr><td>0.20</td><td>5</td></tr> <tr><td>0.30</td><td>4</td></tr> <tr><td>0.40</td><td>1</td></tr> <tr><td>0.50</td><td>2</td></tr> <tr><td>0.60</td><td>1</td></tr> <tr><td>0.70</td><td>1</td></tr> <tr><td>0.80</td><td>2</td></tr> <tr><td>0.90</td><td>2</td></tr> <tr><td>1.00</td><td>3</td></tr> <tr><td>1.10</td><td>3</td></tr> <tr><td>1.20</td><td>3</td></tr> <tr><td>1.30</td><td>3</td></tr> <tr><td>1.40</td><td>3</td></tr> <tr><td>1.50</td><td>3</td></tr> <tr><td>1.60</td><td>4</td></tr> <tr><td>1.70</td><td>5</td></tr> <tr><td>1.80</td><td>5</td></tr> <tr><td>1.90</td><td>11</td></tr> <tr><td>2.00</td><td>6</td></tr> <tr><td>2.10</td><td>12</td></tr> <tr><td>2.20</td><td>12</td></tr> <tr><td>2.30</td><td>18</td></tr> <tr><td>2.40</td><td>20</td></tr> </tbody> </table>	Depth (m)	Probe Readings (Blows/Increment)	0.00	2	0.10	4	0.20	5	0.30	4	0.40	1	0.50	2	0.60	1	0.70	1	0.80	2	0.90	2	1.00	3	1.10	3	1.20	3	1.30	3	1.40	3	1.50	3	1.60	4	1.70	5	1.80	5	1.90	11	2.00	6	2.10	12	2.20	12	2.30	18	2.40	20
Depth (m)	Probe Readings (Blows/Increment)																																																											
0.00	2																																																											
0.10	4																																																											
0.20	5																																																											
0.30	4																																																											
0.40	1																																																											
0.50	2																																																											
0.60	1																																																											
0.70	1																																																											
0.80	2																																																											
0.90	2																																																											
1.00	3																																																											
1.10	3																																																											
1.20	3																																																											
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1.80	5																																																											
1.90	11																																																											
2.00	6																																																											
2.10	12																																																											
2.20	12																																																											
2.30	18																																																											
2.40	20																																																											
1.0						0.10	4																																																					
						0.20	5																																																					
						0.30	4																																																					
						0.40	1																																																					
						0.50	2																																																					
						0.60	1																																																					
						0.70	1																																																					
						0.80	2																																																					
						0.90	2																																																					
						1.00	3																																																					
						1.10	3																																																					
						1.20	3																																																					
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						1.80	5																																																					
						1.90	11																																																					
						2.00	6																																																					
						2.10	12																																																					
						2.20	12																																																					
						2.30	18																																																					
						2.40	20																																																					
	End of Probe at 2.50 m																																																											

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL\_DP\_LOG\_100MM\_INCREMENTALS\_18911.GPJ IGSL.GDT 11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

<b>CONTRACT</b> UCD Student Accomodation		<b>PROBE NO.</b> DP9	
<b>CO-ORDINATES</b>		<b>SHEET</b> Sheet 1 of 1	
<b>GROUND LEVEL (mOD)</b>		<b>DATE DRILLED</b> 11/12/2015	<b>DATE LOGGED</b> 11/12/2015
<b>CLIENT</b> UCD		<b>PROBE TYPE</b> DPH	
<b>ENGINEER</b> Barrett Mahony		<b>HAMMER MASS (kg)</b> 50	<b>INCREMENT SIZE (mm)</b> 100
		<b>FALL HEIGHT (mm)</b> 500	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	0	
1.0						0.10	0	
						0.20	2	
						0.30	3	
						0.40	2	
						0.50	3	
						0.60	4	
						0.70	3	
						0.80	3	
						0.90	3	
						1.00	4	
						1.10	7	
						1.20	7	
						1.30	7	
						1.40	3	
						1.50	3	
						1.60	3	
						1.70	3	
						1.80	3	
						1.90	3	
						2.00	6	
						2.10	6	
						2.20	10	
						2.30	12	
						2.40	12	
						2.50	12	
						2.60	9	
						2.70	15	
						2.80	18	
						2.90	18	
						3.00	25	
3.0	End of Probe at 3.10 m							
4.0								

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL\_DP\_LOG\_100MM\_INCREMENTALS\_18911.GPJ IGSL.GDT\_11/12/15





# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

CONTRACT UCD Student Accomodation

PROBE NO. **DP11**

SHEET Sheet 1 of 1

CO-ORDINATES

GROUND LEVEL (mOD)

HAMMER MASS (kg) 50

DATE DRILLED 10/12/2015

DATE LOGGED 10/12/2015

CLIENT UCD  
ENGINEER Barrett Mahony

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	8	
						0.10	10	
						0.20	6	
						0.30	4	
						0.40	3	
						0.50	2	
						0.60	2	
						0.70	1	
						0.80	1	
						0.90	1	
1.0						1.00	6	
						1.10	7	
						1.20	7	
						1.30	8	
						1.40	8	
						1.50	6	
						1.60	6	
						1.70	7	
						1.80	9	
						1.90	11	
2.0						2.00	9	
						2.10	10	
						2.20	9	
						2.30	10	
						2.40	10	
						2.50	10	
						2.60	10	
						2.70	9	
						2.80	8	
						2.90	12	
3.0						3.00	13	
						3.10	13	
						3.20	13	
						3.30	15	
						3.40	15	
						3.50	15	
						3.60	14	
						3.70	15	
						3.80	17	
4.0	End of Probe at 4.00 m					3.90	20	

**GROUNDWATER OBSERVATIONS**

REMARKS

IGSL\_DP\_LOG\_100MM\_INCREMENTS\_18911.GPJ IGSL\_GDT\_11/12/15



# DYNAMIC PROBE RECORD

REPORT NUMBER

18911

**CONTRACT** UCD Student Accomodation

**PROBE NO.** DP12

**CO-ORDINATES**

**SHEET** Sheet 1 of 1

**GROUND LEVEL (mOD)**

**HAMMER MASS (kg)** 50

**DATE DRILLED** 10/12/2015

**DATE LOGGED** 10/12/2015

**CLIENT** UCD

**INCREMENT SIZE (mm)** 100

**PROBE TYPE** DPH

**ENGINEER** Barrett Mahony

**FALL HEIGHT (mm)** 500

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0						0.00	15	
						0.10	9	
						0.20	4	
						0.30	3	
						0.40	2	
						0.50	1	
						0.60	1	
						0.70	1	
						0.80	1	
						0.90	1	
1.0						1.00	2	
						1.10	2	
						1.20	2	
						1.30	8	
						1.40	8	
						1.50	8	
						1.60	9	
						1.70	8	
						1.80	8	
						1.90	12	
2.0						2.00	12	
						2.10	15	
						2.20	14	
						2.30	14	
						2.40	14	
						2.50	12	
						2.60	14	
						2.70	14	
						2.80	18	
						2.90	20	
3.0	End of Probe at 3.10 m					3.00	20	

**GROUNDWATER OBSERVATIONS**

**REMARKS**

IGSL\_DP\_LOG\_100MM\_INCREMENTS\_18911.GPJ IGSL.GDT 11/12/15

## **Appendix V Percolation Tests**

# Soakaway Design f -value from field tests IGSL

Contract: UCD Campus Contract No. 18911  
 Test No. SA 01 (in TP01 loaction)  
 Engineer Barrett Mahony  
 Date: 08/12/2015


Summary of ground conditions			Ground water
from	to	Description	
0.00	0.35	MADE GROUND (grey angular gravel)	Slow water at 1.0m
0.35	1.00	Soft, brown/grey mottled, very sandy gravelly CLAY with occasional cobbles (possible fill)	
1.00	1.20	Firm, grey, slightly sandy gravelly CLAY with many cobbles	

Notes:

Field Data

Depth to Water (m)	Elapsed Time (min)
0.450	0.00
0.460	1.00
0.470	2.00
0.480	3.00
0.490	4.00
0.495	5.00
0.500	6.00
0.515	7.00
0.520	8.00
0.525	9.00
0.530	10.00
0.540	12.00
0.550	14.00
0.560	16.00
0.570	18.00
0.580	20.00
0.595	25.00
0.610	30.00
0.630	40.00
0.640	50.00
0.650	60.00
0.660	70.00
0.670	80.00
0.680	90.00

Field Test

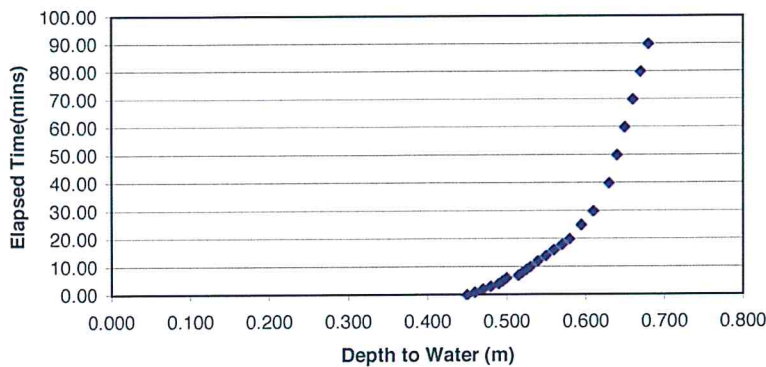
Depth of Pit (D)	1.20	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.50	m
Initial depth to water =	0.45	m
Final depth to water =	0.680	m
Elapsed time (mins)=	90.00	
Top of permeable soil		
Base of permeable soil	m	

Base area=	1.2	m <sup>2</sup>
* Av. side area of permeable stratum over test p	2.921	m <sup>2</sup>
Total Exposed area =	4.121	m <sup>2</sup>

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

**f= 0.00074 m/min      or      1.24026E-05 m/sec**

Depth of water vs Elapsed Time (mins)





# Soakaway Design f -value from field tests IGSL

Contract: UCD Campus Contract No. 18911  
 Test No. SA 02 (in TP02 loaction)  
 Engineer Barrett Mahony  
 Date: 08/12/2015

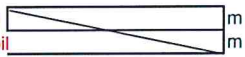
Summary of ground conditions			Ground water
from	to	Description	
0.00	0.20	MADE GROUND (grey angular gravel)	Seepage at 1.3m
0.20	1.30	MADE GROUND (comprised of brown/grey clayey sandy gravel, cobbles, boulders, sandy gravel)	
1.30	1.50	Firm, grey, slightly sandy gravelly CLAY with some cobbles	

Notes:

**Field Data**

Depth to Water (m)	Elapsed Time (min)
0.500	0.00
0.510	1.00
0.520	2.00
0.525	3.00
0.530	4.00
0.535	5.00
0.540	6.00
0.545	7.00
0.550	8.00
0.555	9.00
0.560	10.00
0.565	12.00
0.570	14.00
0.580	16.00
0.585	18.00
0.590	20.00
0.610	25.00
0.630	30.00
0.640	40.00
0.650	50.00
0.660	60.00
0.670	70.00
0.680	80.00
0.690	90.00

**Field Test**

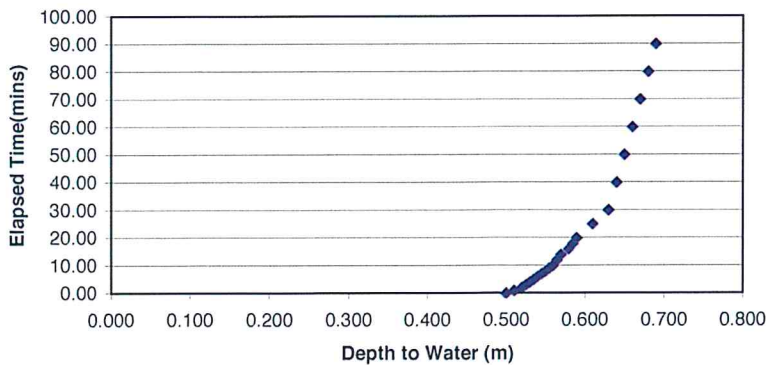
Depth of Pit (D)	1.50	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.50	m
Final depth to water =	0.690	m
Elapsed time (mins)=	90.00	
Top of permeable soil		
Base of permeable soil	m	

Base area=	1.2	m <sup>2</sup>
* Av. side area of permeable stratum over test p	4.163	m <sup>2</sup>
Total Exposed area =	5.363	m <sup>2</sup>

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

**f= 0.00047 m/min      or      7.87287E-06 m/sec**

**Depth of water vs Elapsed Time (mins)**



# Soakaway Design f-value from field tests IGSL

Contract: UCD Campus Contract No. 18911  
 Test No. SA 03 (in TP04 location)  
 Engineer Barrett Mahony  
 Date: 08/12/2015


Summary of ground conditions			Ground water
from	to	Description	
0.00	0.35	MADE GROUND (grey angular gravel - C.L. 804)	DRY
0.35	1.20	MADE GROUND (comprised of dark brown/brown, sandy clay with occasional gravel)	
1.20	1.50	MADE GROUND (comprised of dark brown clayey sandy gravel, gravelly clay, cobbles, boulders, red brick)	

Notes:

Field Data

Depth to Water (m)	Elapsed Time (min)
0.750	0.00
0.755	1.00
0.760	2.00
0.765	3.00
0.770	4.00
0.775	5.00
0.780	6.00
0.785	7.00
0.790	8.00
0.795	9.00
0.800	10.00
0.805	12.00
0.810	14.00
0.820	16.00
0.830	18.00
0.840	20.00
0.850	25.00
0.860	30.00
0.870	40.00
0.880	50.00
0.890	60.00
0.900	70.00
0.910	80.00
0.920	90.00

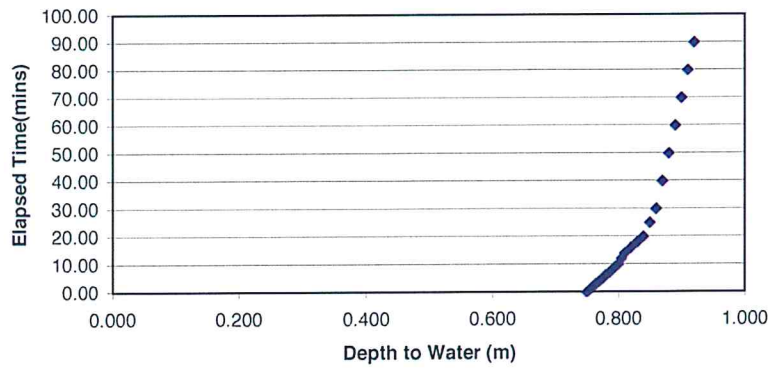
Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.80	m
Initial depth to Water =	0.75	m
Final depth to water =	0.920	m
Elapsed time (mins)=	90.00	
Top of permeable soil		
Base of permeable soil		m

Base area=	1.44	m <sup>2</sup>
*Av. side area of permeable stratum over test p	3.458	m <sup>2</sup>
Total Exposed area =	4.898	m <sup>2</sup>

Infiltration rate (f) = Volume of water used/unit exposed area / unit time  
**f= 0.00056 m/min      or      9.25548E-06 m/sec**

Depth of water vs Elapsed Time (mins)



## **Appendix VI A Geotechnical Laboratory**

IGSL Ltd  
Materials Laboratory  
Unit J5, M7 Business Park  
Newhall, Naas  
Co. Kildare  
045 846176

## Test Report

### Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2\*, 4.3, 4.4 & 5.3



Report No. **R69708**      Contract No. 18911      Contract Name: UCD Dublin  
 Customer **BMCE**  
 Samples Received: 21/12/15      Date Tested: 04/01/16

BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
BH01	AA39344	3.0	A15/7064	B	16	28	15	13	59	WS	4.4	C L	Dark brown/grey sandy gravelly CLAY
BH01	AA39347	6.0	A15/7065	B	15	28	15	13	55	WS	4.4	C L	Dark brown/grey slightly sandy, slightly gravelly, CLAY
BH02	AA39340	5.0	A15/7066	B	14	25	14	11	33	WS	4.4	C L	Dark brown/grey very sandy very gravelly CLAY
BH03	AA45866	4.0	A15/7067	B	16	29	15	14	62	WS	4.4	C L	Dark brown/grey slightly sandy, slightly gravelly, CLAY
BH05	AA45857	1.0	A15/7069	B	23	38	20	18	51	WS	4.4	C I	Brown very sandy gravelly CLAY
BH05	AA45862	6.0	A15/7070	B	11	25	14	11	54	WS	4.4	C L	Dark brown slightly sandy, gravelly, CLAY

Notes: Preparation: WS - Wet sieved  
 AR - As received  
 NP - Non plastic  
 Liquid Limit 4.3 Cone Penetrometer definitive method  
 Clause: 4.4 Cone Penetrometer one point method

Sample Type: B - bulk disturbed  
 U - Undisturbed

Remarks:  
 NOTE: \*Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014  
 Opinions and interpretations are outside the scope of accreditation.  
 The results relate to the specimens tested. Any remaining material will be retained for one month.

IGSL Ltd Materials Laboratory Persons authorized to approve reports H Byrne (Quality Manager)	Approved by	Date	Page
	<i>H Byrne</i>	07/01/16	1 of 1





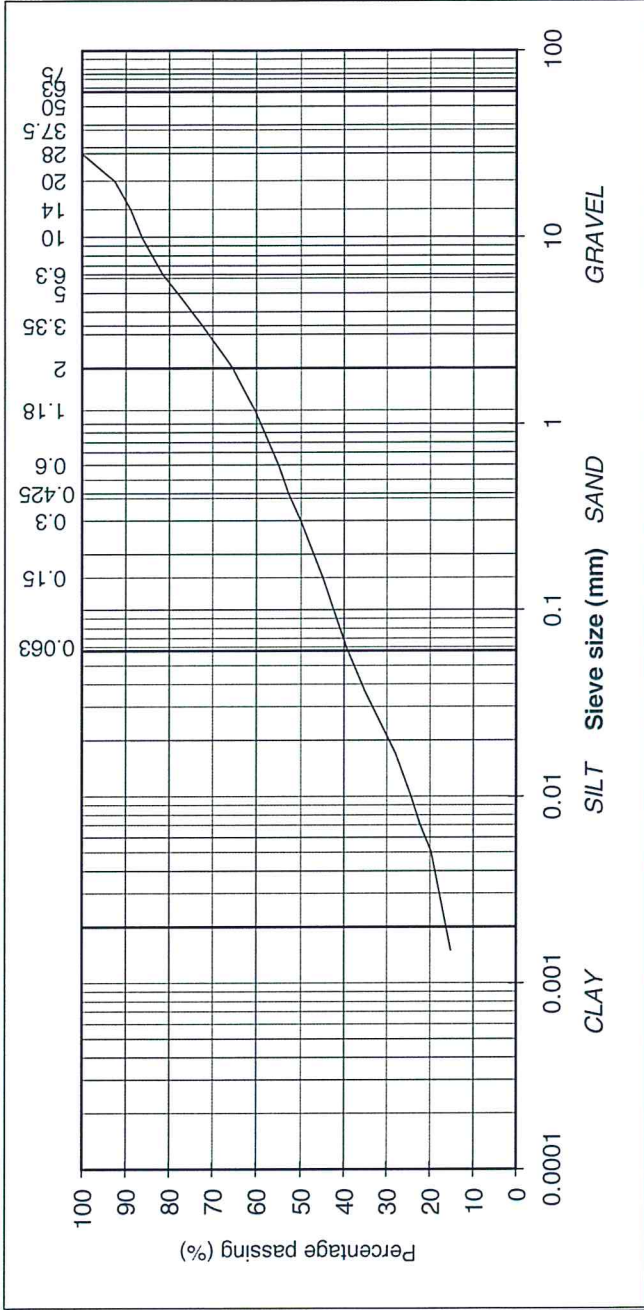
# TEST REPORT

## Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5  
(note: Sedimentation stage not accredited)

Contract No: 18911 Report No. R69737  
 Contract: UCD Dublin  
 Bh: BH01  
 Sample No. AA9347 Lab. Sample No. A15/7065  
 Sample Type: B  
 Depth (m) 6.00 Customer: BMCE  
 Date Received 21/12/2015 Date Testing started 04/01/2016  
 Description: Dark brown/grey slightly sandy, slightly gravelly, CLAY

Remarks



particle size	% passing
75	100
63	100
50	100
37.5	100
28	100
20	93
14	89
10	86
6.3	81
5	78
3.35	72
2	66
1.18	61
0.6	55
0.425	53
0.3	50
0.15	45
0.063	39
0.037	35
0.026	32
0.017	28
0.010	24
0.007	22
0.005	20
0.002	15

**IGSL Ltd Materials Laboratory**

Approved by: *H Byrne* Date: 08/01/16 Page no: 1 of 1

Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

# TEST REPORT

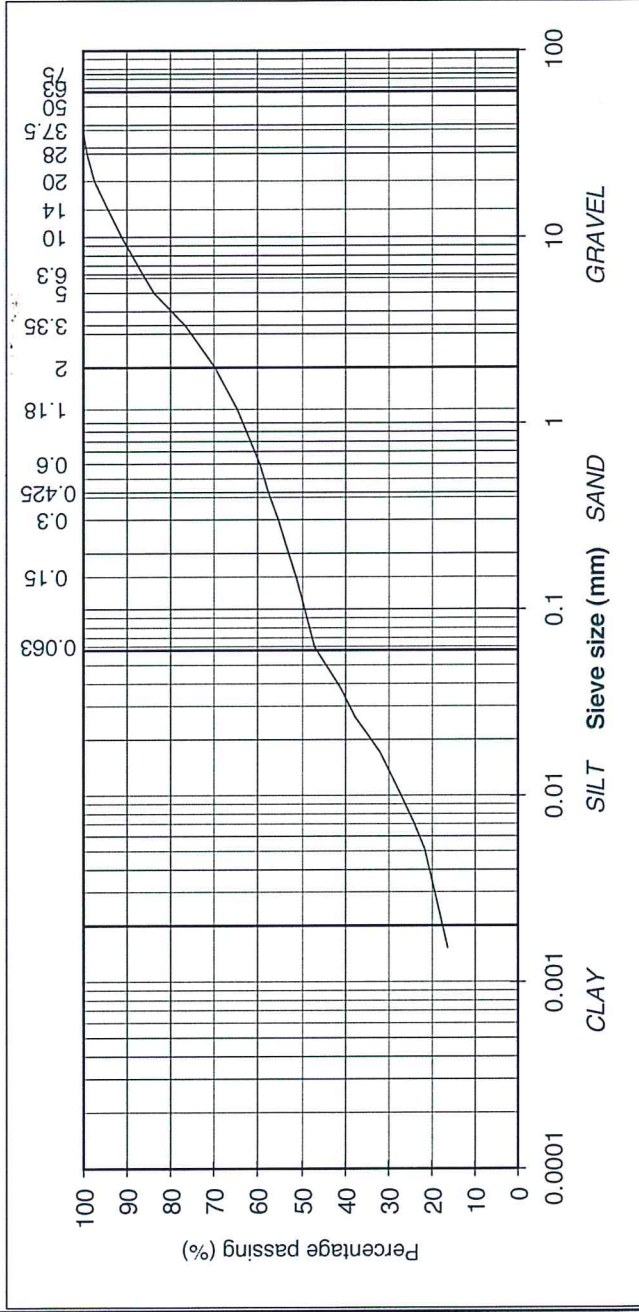
## Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5  
(note: Sedimentation stage not accredited)



Contract No: 18911 Report No. R69738  
 Contract: UCD Dublin  
 Bh: BH03  
 Sample No. AA45866 Lab. Sample No. A15/7067  
 Sample Type: B  
 Depth (m) 4.00 Customer: BMCE  
 Date Received 21/12/2015 Date Testing started 04/01/2016  
 Description: Dark brown/grey slightly sandy, slightly gravelly, CLAY

Remarks



particle size	% passing
75	100
63	100
50	100
37.5	100
28	99
20	97
14	94
10	91
6.3	86
5	84
3.35	77
2	70
1.18	65
0.6	60
0.425	57
0.3	55
0.15	51
0.063	47
0.037	41
0.026	38
0.017	32
0.010	27
0.007	24
0.005	22
0.002	16

**IGSL Ltd Materials Laboratory**

Approved by: *J Barrett* Date: 08/01/16 Page no: 1 of 1

Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

# TEST REPORT

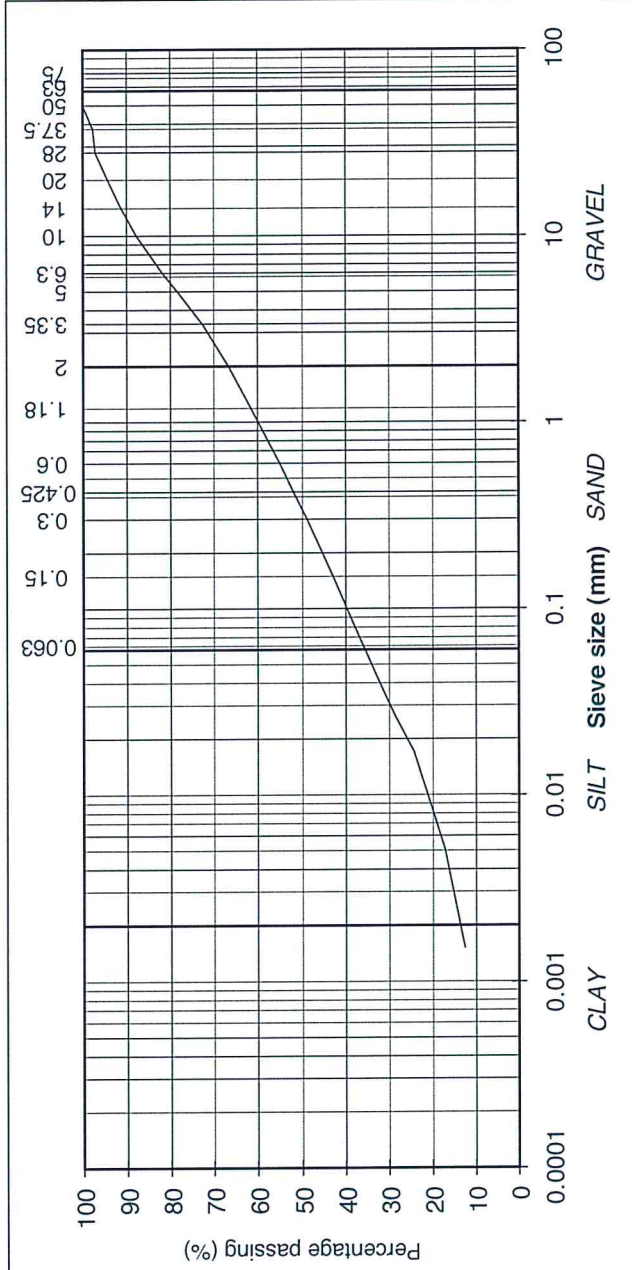
## Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990, clause 9.2 & 9.5  
(note: Sedimentation stage not accredited)



Contract No: 18911 Report No. R69739  
 Contract: UCD Dublin  
 Bh: BH04  
 Sample No. AA45855 Lab. Sample No. A15/7068  
 Sample Type: B  
 Depth (m) 5.00 Customer: BMCE  
 Date Received 21/12/2015 Date Testing started 04/01/2016  
 Description: Dark brown/grey slightly sandy, slightly gravelly, SILT/CLAY

Remarks



particle size	% passing
75	100
63	100
50	100
37.5	98
28	97
20	94
14	91
10	88
6.3	82
5	78
3.35	73
2	67
1.18	62
0.6	55
0.425	52
0.3	49
0.15	43
0.063	36
0.037	31
0.026	28
0.017	24
0.010	21
0.007	19
0.005	17
0.002	13

Approved by: *J Barrett* Date: 08/01/16 Page no: 1 of 1

**IGSL Ltd Materials Laboratory**

Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)



# TEST REPORT

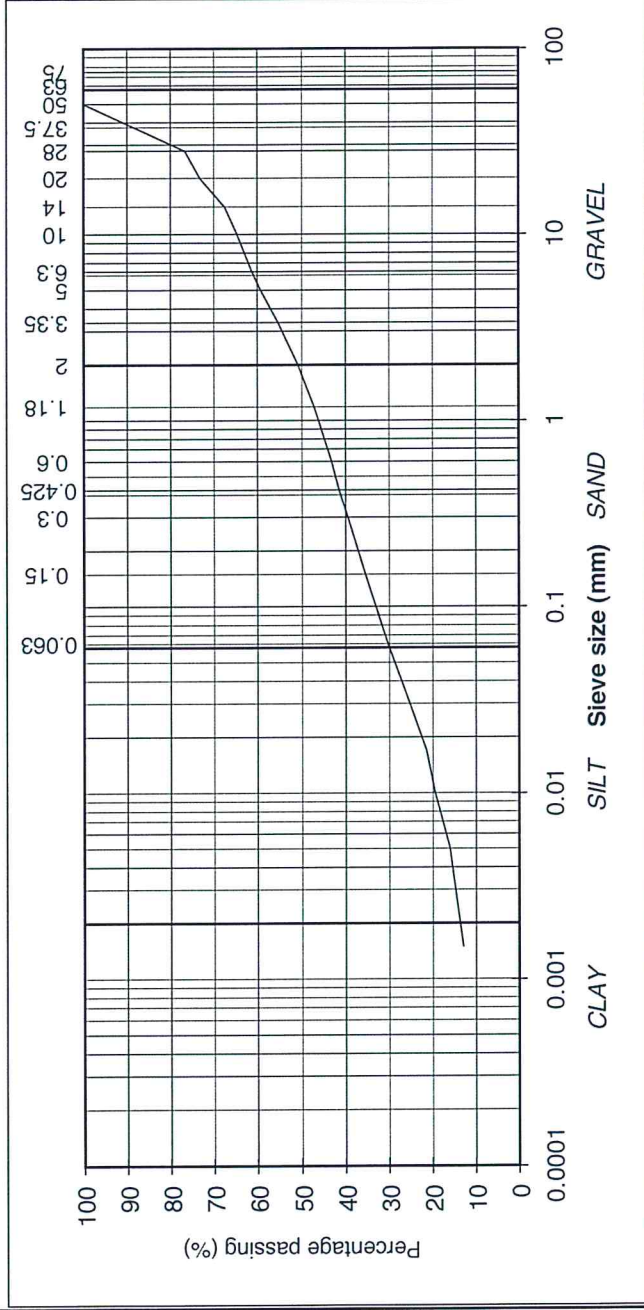
## Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5  
(note: Sedimentation stage not accredited)



Contract No: 18911 Report No. R69740  
 Contract: UCD Dublin  
 Bh: BH05  
 Sample No. AA45862 Lab. Sample No. A15/7070  
 Sample Type: B  
 Depth (m) 6.00 Customer: BMCE  
 Date Received 21/12/2015 Date Testing started 04/01/2016  
 Description: Dark brown slightly sandy, gravelly, CLAY

Remarks



particle size	% passing	COBBLES	GRAVEL	SAND	SILT/CLAY
75	100				
63	100				
50	100				
37.5	88				
28	77				
20	73				
14	68				
10	65				
6.3	61				
5	59				
3.35	55				
2	51				
1.18	47				
0.6	43				
0.425	41				
0.3	39				
0.15	35				
0.063	30				
0.037	26				
0.026	24				
0.017	21				
0.010	19				
0.007	18				
0.005	16				
0.001	13				

Approved by: *H Byrne* Date: 08/01/16 Page no: 1 of 1

**IGSL Ltd Materials Laboratory**

Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)



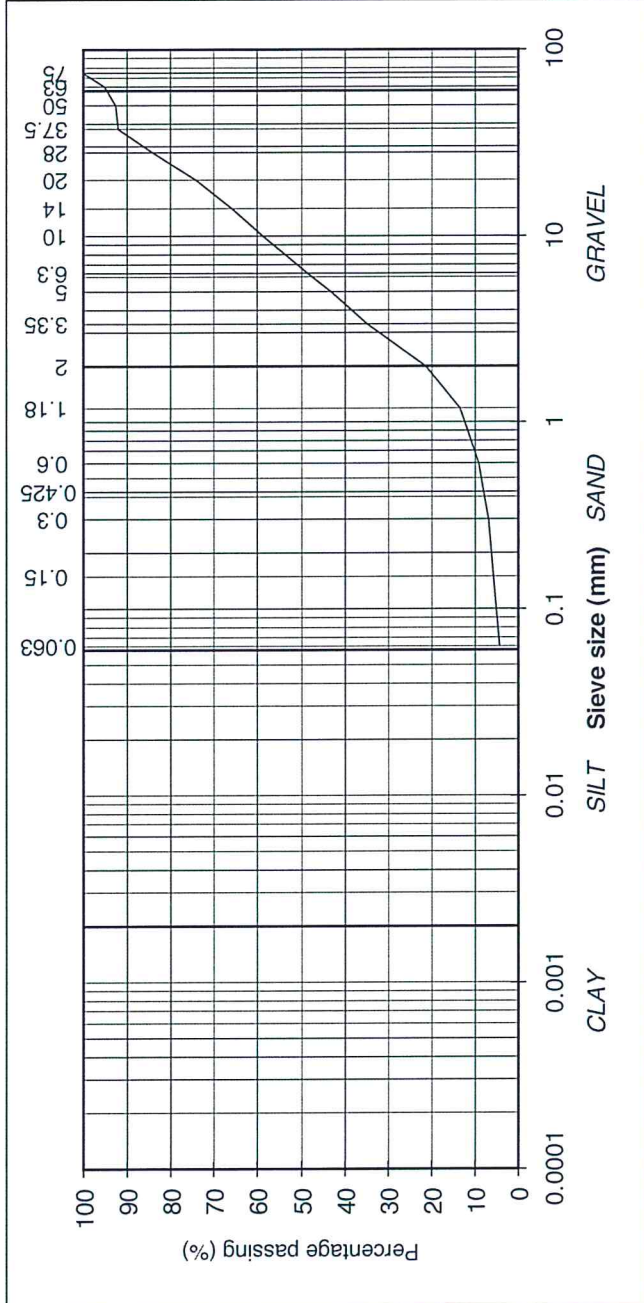


# TEST REPORT

## Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990, clause 9.2 & 9.5  
(note: Sedimentation stage not accredited)

<p>Contract No: 18911    Report No. R69709</p> <p>Contract: UCD Dublin</p> <p>Bh: BH06</p> <p>Sample No. AA40895    Lab. Sample No. A15/7071</p> <p>Sample Type: B</p> <p>Depth (m) 3.00    Customer: BMCE</p> <p>Date Received 21/12/2015    Date Testing started 04/01/2016</p> <p>Description: Ligh brown/grey slightly clayey/silty, sandy, GRAVEL with occasional cobbles</p> <p>Remarks</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>particle size</th> <th>% passing</th> </tr> </thead> <tbody> <tr><td>75</td><td>100</td></tr> <tr><td>63</td><td>95</td></tr> <tr><td>50</td><td>93</td></tr> <tr><td>37.5</td><td>92</td></tr> <tr><td>28</td><td>84</td></tr> <tr><td>20</td><td>74</td></tr> <tr><td>14</td><td>66</td></tr> <tr><td>10</td><td>59</td></tr> <tr><td>6.3</td><td>48</td></tr> <tr><td>5</td><td>43</td></tr> <tr><td>3.35</td><td>35</td></tr> <tr><td>2</td><td>21</td></tr> <tr><td>1.18</td><td>13</td></tr> <tr><td>0.6</td><td>9</td></tr> <tr><td>0.425</td><td>8</td></tr> <tr><td>0.3</td><td>7</td></tr> <tr><td>0.15</td><td>6</td></tr> <tr><td>0.063</td><td>4</td></tr> </tbody> </table>	particle size	% passing	75	100	63	95	50	93	37.5	92	28	84	20	74	14	66	10	59	6.3	48	5	43	3.35	35	2	21	1.18	13	0.6	9	0.425	8	0.3	7	0.15	6	0.063	4
particle size	% passing																																						
75	100																																						
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<b>IGSL Ltd Materials Laboratory</b>	
Approved by: <i>[Signature]</i>	Date: 07/01/16
Page no: 1 of 1	

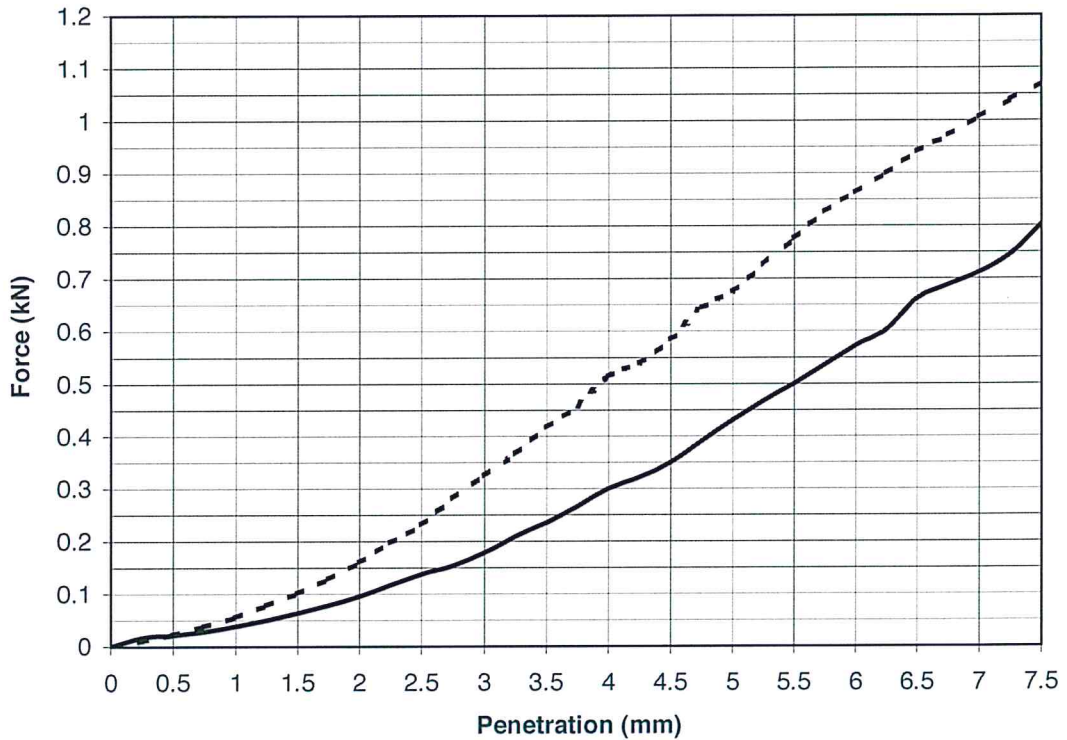
Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

**TEST REPORT**  
**Determination of California Bearing Ratio (CBR)**



Tested in accordance with BS1377:Part 4:1990, clause 7

Report No.	R69700	Contract	UCD
Contract No.	18911	Customer	BMCE
Date received	21/12/15	Date Tested	04/01/16
BH/TP No.	TP01	Sample No.	39373
		Type:	B
Depth (m)	0.70	Lab sample No.	A15/7072



Key: ————— Top      - - - - - Base

Description: Brown sandy gravelly SILT/CLAY			
Initial Condition:		Unsoaked	
Moisture Content (%):	13	Bulk Density (Mg/m <sup>3</sup> ):	2.23
Surcharge (kg):	4	Dry Density (Mg/m <sup>3</sup> ):	1.97
% Material >20mm:	23		
Method of compaction: Static Compaction Method 2			

Test Result	Top	Base
CBR %	2.2	3.4
Moisture Content %	14	13

Persons authorized to approve reports  
 J Barrett (Dep. Quality Manager)  
 H Byrne (Quality Manager)

IGSL Ltd Materials Laboratory

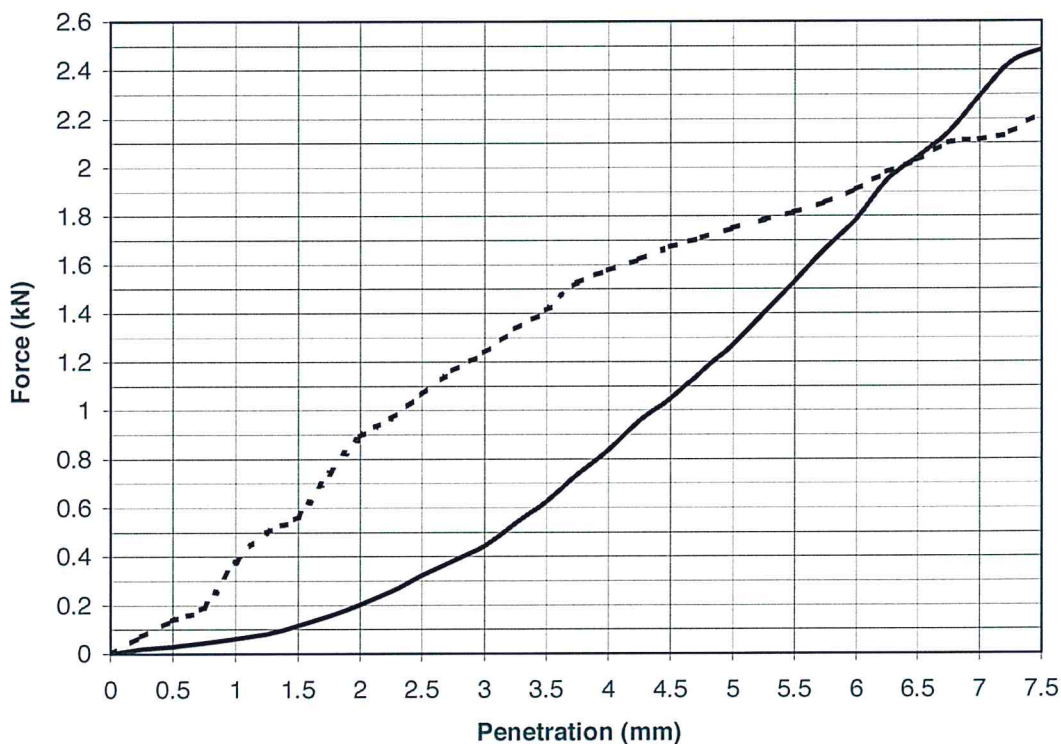
Approved by	Date	Page No.
<i>H Byrne</i>	06/01/16	1 of 1

**TEST REPORT**  
 Determination of California Bearing  
 Ratio (CBR)



Tested in accordance with BS1377:Part 4:1990, clause 7

Report No.	R69701	Contract	UCD
Contract No.	18911	Customer	BMCE
Date received	21/12/15	Date Tested	04/01/16
BH/TP No.	TP02	Sample No.	39376 Type: B
Depth (m)	0.60	Lab sample No.	A15/7073



Key: ————— Top      - - - - - Base

Description: Dark brown sandy gravelly SILT/CLAY			
Initial Condition:		Unsoaked	
Moisture Content (%):	11	Bulk Density (Mg/m <sup>3</sup> ):	2.27
Surcharge (kg):	4	Dry Density (Mg/m <sup>3</sup> ):	2.05
% Material >20mm:	41		
Method of compaction: Static Compaction Method 2			

Test Result	Top	Base
<b>CBR %</b>	<b>6.4</b>	<b>8.8</b>
Moisture Content %	11	11

Persons authorized to approve reports  
 J Barrett (Dep. Quality Manager)  
 H Byrne (Quality Manager)

IGSL Ltd Materials Laboratory

Approved by	Date	Page No.
<i>H Byrne</i>	06/01/16	1 of 1



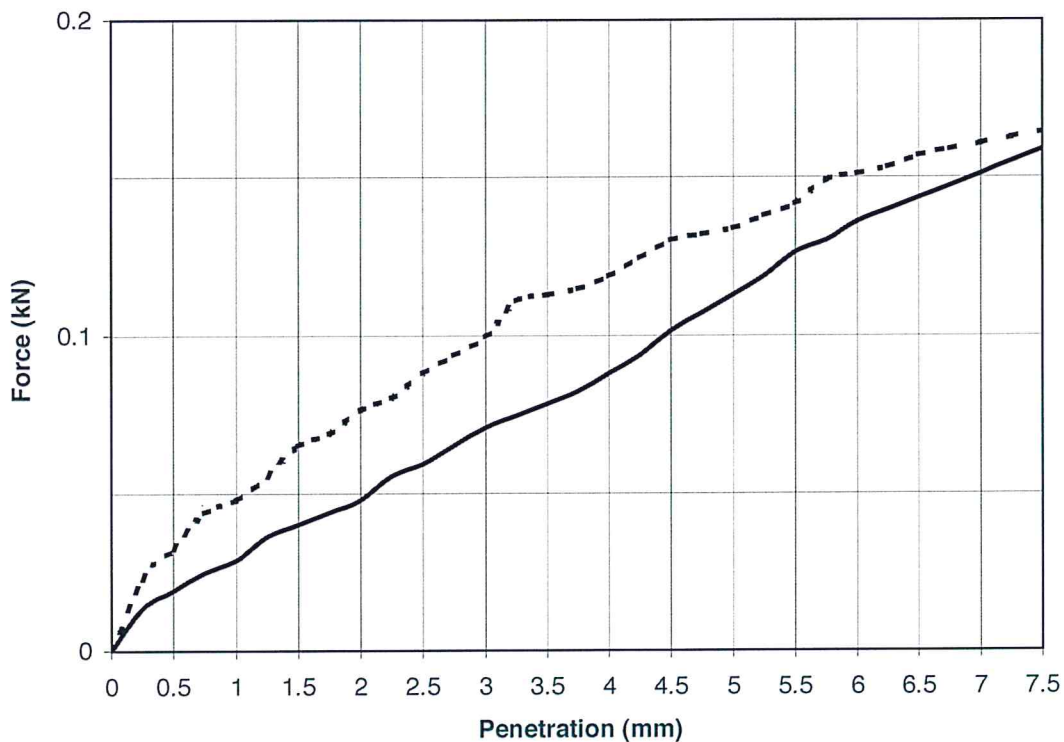
IGSL Ltd  
 Materials Laboratory  
 Unit J5,M7 Business Park  
 Naas Co.Kildare  
 045 899324

**TEST REPORT**  
 Determination of California Bearing  
 Ratio (CBR)



Tested in accordance with BS1377:Part 4:1990, clause 7

Report No.	R69701	Contract	UCD
Contract No.	18911	Customer	BMCE
Date received	21/12/15	Date Tested	04/01/16
BH/TP No.	TP03	Sample No.	39382
		Type:	B
Depth (m)	0.50	Lab sample No.	A15/7074



Key: ————— Top      - - - - - Base

Description: Brown sandy slightly gravelly SILT/CLAY			
Initial Condition:		Unsoaked	
Moisture Content (%):	28	Bulk Density (Mg/m <sup>3</sup> ):	1.89
Surcharge (kg):	4	Dry Density (Mg/m <sup>3</sup> ):	1.48
% Material >20mm:	5		
Method of compaction: Static Compaction Method 2			

Test Result	Top	Base
CBR %	0.6	0.7
Moisture Content %	28	28

Persons authorized to approve reports  
 J Barrett (Dep. Quality Manager)  
 H Byrne (Quality Manager)

IGSL Ltd Materials Laboratory	Approved by	Date	Page No.
	<i>H Byrne</i>	06/01/16	1 of 1

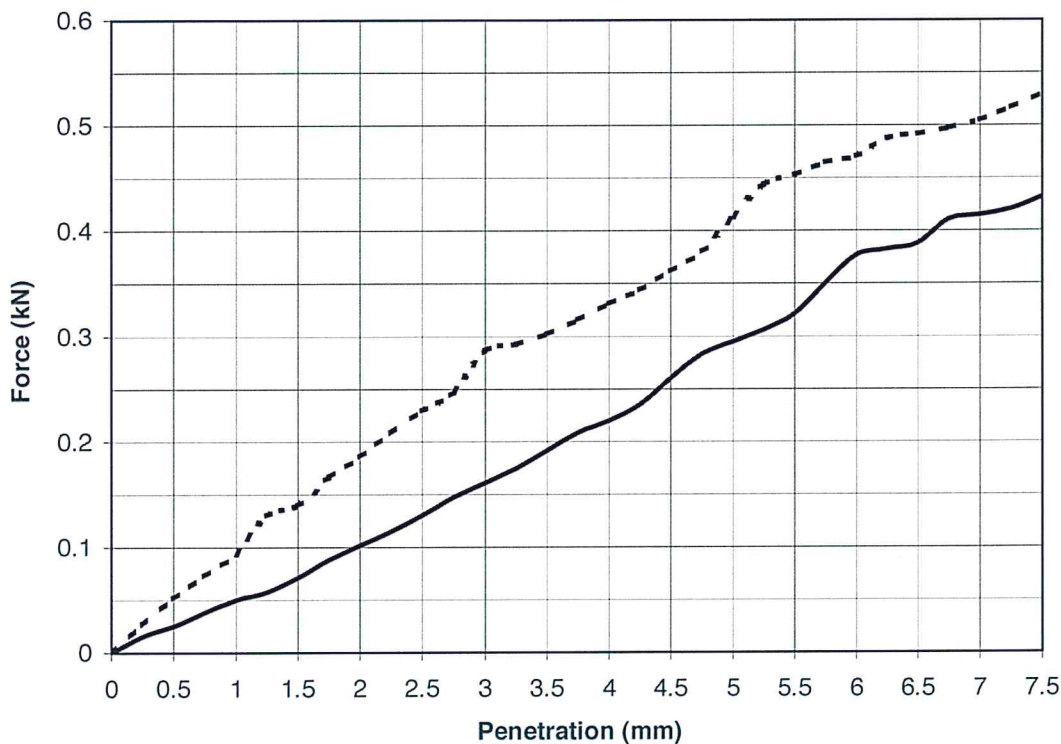


**TEST REPORT**  
 Determination of California Bearing  
 Ratio (CBR)



Tested in accordance with BS1377:Part 4:1990, clause 7

Report No.	R69701	Contract	UCD
Contract No.	18911	Customer	BMCE
Date received	21/12/15	Date Tested	04/01/16
BH/TP No.	TP04	Sample No.	39379 Type: B
Depth (m)	0.50	Lab sample No.	A15/7075



Key: ————— Top      - - - - - Base

Description: Brown/black sandy slightly gravelly SILT/CLAY			
Initial Condition:		Unsoaked	
Moisture Content (%):	34	Bulk Density (Mg/m <sup>3</sup> ):	1.74
Surcharge (kg):	4	Dry Density (Mg/m <sup>3</sup> ):	1.30
% Material >20mm:	0.6		
Method of compaction: Static Compaction Method 2			

Test Result	Top	Base
CBR %	1.5	2.1
Moisture Content %	35	33

Persons authorized to approve reports  
 J Barrett (Dep. Quality Manager)  
 H Byrne (Quality Manager)

IGSL Ltd Materials Laboratory

Approved by	Date	Page No.
<i>H Byrne</i>	06/01/16	1 of 1

**Appendix VI B Environmental Laboratory**



# Jones Environmental Laboratory

Unit 3 Deeside Point  
Zone 3  
Deeside Industrial Park  
Deeside  
CH5 2UA

IGSL  
Unit F  
M7 Business Park  
Naas  
Co Kildare  
Ireland

Tel: +44 (0) 1244 833780  
Fax: +44 (0) 1244 833781



**Attention :** Darren Keogh  
**Date :** 8th January, 2016  
**Your reference :** UCD  
**Our reference :** Test Report 15/18234 Batch 1  
**Location :**  
**Date samples received :** 22nd December, 2015  
**Status :** Final report  
**Issue :** 1

Eight samples were received for analysis on 22nd December, 2015 of which eight were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied. All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

**Compiled By:**

**Phil Sommerton BSc**  
**Project Manager**

**Jones Environmental Laboratory**

Client Name: IGSL  
 Reference: UCD  
 Location:  
 Contact: Darren Keogh  
 JE Job No.: 15/18234

Report : Solid  
 Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2	3	4	5-6	7-8	9-10	11-12			Please see attached notes for all abbreviations and acronyms			
Sample ID	BH1	BH3	BH5	BH5	TP1	TP2	TP3	TP4						
Depth	3.00	4.00	1.00	6.00	0.70	0.60	0.50	0.50						
COC No / misc														
Containers	J	J	J	J	V J	V J	V J	V J						
Sample Date	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1						
Date of Receipt	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015			LOD/LOR	Units	Method No.	
PAH MS														
Naphthalene #	-	-	-	-	<0.04	<0.04	<0.04	0.15	<0.04	mg/kg	TM4/PM8			
Acenaphthylene	-	-	-	-	<0.03	<0.03	<0.03	0.07	<0.03	mg/kg	TM4/PM8			
Acenaphthene #	-	-	-	-	<0.05	<0.05	<0.05	0.42	<0.05	mg/kg	TM4/PM8			
Fluorene #	-	-	-	-	<0.04	<0.04	<0.04	0.26	<0.04	mg/kg	TM4/PM8			
Phenanthrene #	-	-	-	-	<0.03	0.11	<0.03	2.75	<0.03	mg/kg	TM4/PM8			
Anthracene #	-	-	-	-	<0.04	<0.04	<0.04	0.55	<0.04	mg/kg	TM4/PM8			
Fluoranthene #	-	-	-	-	<0.03	0.15	<0.03	3.46	<0.03	mg/kg	TM4/PM8			
Pyrene #	-	-	-	-	<0.03	0.13	<0.03	3.02	<0.03	mg/kg	TM4/PM8			
Benzo(a)anthracene #	-	-	-	-	<0.06	0.09	<0.06	1.89	<0.06	mg/kg	TM4/PM8			
Chrysene #	-	-	-	-	<0.02	0.09	<0.02	2.35	<0.02	mg/kg	TM4/PM8			
Benzo(bk)fluoranthene #	-	-	-	-	<0.07	0.12	<0.07	4.13	<0.07	mg/kg	TM4/PM8			
Benzo(a)pyrene #	-	-	-	-	<0.04	0.07	<0.04	2.87	<0.04	mg/kg	TM4/PM8			
Indeno(123cd)pyrene #	-	-	-	-	<0.04	0.04	<0.04	1.96	<0.04	mg/kg	TM4/PM8			
Dibenzo(ah)anthracene #	-	-	-	-	<0.04	<0.04	<0.04	0.56	<0.04	mg/kg	TM4/PM8			
Benzo(ghi)perylene #	-	-	-	-	<0.04	0.04	<0.04	2.09	<0.04	mg/kg	TM4/PM8			
Coronene	-	-	-	-	<0.04	<0.04	<0.04	0.40	<0.04	mg/kg	TM4/PM8			
PAH 6 Total #	-	-	-	-	<0.22	0.42	<0.22	14.51	<0.22	mg/kg	TM4/PM8			
PAH 17 Total	-	-	-	-	<0.64	0.84	<0.64	26.93	<0.64	mg/kg	TM4/PM8			
Benzo(b)fluoranthene	-	-	-	-	<0.05	0.09	<0.05	2.97	<0.05	mg/kg	TM4/PM8			
Benzo(k)fluoranthene	-	-	-	-	<0.02	0.03	<0.02	1.16	<0.02	mg/kg	TM4/PM8			
PAH Surrogate % Recovery	-	-	-	-	122	120	119	123	<0	%	TM4/PM8			
Mineral Oil >C8-C10	-	-	-	-	<5	<5	<5	<5	<5	mg/kg	TM5/PM16			
Mineral Oil >C10-C12	-	-	-	-	<10	<10	<10	<10	<10	mg/kg	TM5/PM16			
Mineral Oil >C12-C16	-	-	-	-	<10	<10	<10	<10	<10	mg/kg	TM5/PM16			
Mineral Oil >C16-C21	-	-	-	-	<10	<10	<10	<10	<10	mg/kg	TM5/PM16			
Mineral Oil >C21-C40	-	-	-	-	<10	<10	<10	<10	<10	mg/kg	TM5/PM16			
Mineral Oil >C8-C40	-	-	-	-	<45	<45	<45	<45	<45	mg/kg	TM5/PM16			
MTBE #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM31/PM12			
Benzene #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM31/PM12			
Toluene #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM31/PM12			
Ethylbenzene #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM31/PM12			
m/p-Xylene #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM31/PM12			
o-Xylene #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM31/PM12			
PCB 28 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			
PCB 52 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			
PCB 101 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			
PCB 118 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			
PCB 138 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			
PCB 153 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			
PCB 180 #	-	-	-	-	<5	<5	<5	<5	<5	ug/kg	TM17/PM8			



**Jones Environmental Laboratory**

Client Name: IGSL  
 Reference: UCD  
 Location:  
 Contact: Darren Keogh  
 JE Job No.: 15/18234

Report: Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2	3	4	5-6	7-8	9-10	11-12					
Sample ID	BH1	BH3	BH5	BH5	TP1	TP2	TP3	TP4					
Depth	3.00	4.00	1.00	6.00	0.70	0.60	0.50	0.50					
COC No / misc													
Containers	J	J	J	J	V J	V J	V J	V J					
Sample Date	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015	21/12/2015					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015	22/12/2015					
											LOD/LOR	Units	Method No.
Total 7 PCBs <sup>#</sup>	-	-	-	-	<35	<35	<35	<35			<35	ug/kg	TM17/PM8
Natural Moisture Content	-	-	-	-	7.5	6.3	14.2	18.6			<0.1	%	PM4/PM0
% Dry Matter 105°C	-	-	-	-	87.8	91.1	80.3	76.7			<0.1	%	NONE/PM4
Sulphate as SO4 (2:1 Ext) <sup>#</sup>	0.1405	0.0987	0.0076	0.0866	-	-	-	-			<0.0015	g/l	TM38/PM20
Total Organic Carbon <sup>#</sup>	-	-	-	-	0.40	0.26	0.61	4.84			<0.02	%	TM21/PM24
Loss on Ignition <sup>#</sup>	-	-	-	-	1.5	1.1	2.7	8.0			<1.0	%	TM22/PM0
pH <sup>#</sup>	8.28	8.29	8.45	8.36	-	-	-	-			<0.01	pH units	TM73/PM11
Mass of raw test portion	-	-	-	-	0.1022	0.0988	0.1117	0.1174				kg	NONE/PM17
Mass of dried test portion	-	-	-	-	0.09	0.09	0.09	0.09				kg	NONE/PM17

Please see attached notes for all abbreviations and acronyms

**Jones Environmental Laboratory**

**Client Name:** IGSL  
**Reference:** UCD  
**Location:**  
**Contact:** Darren Keogh  
**JE Job No.:** 15/18234

**Report :** CEN 10:1 1 Batch

**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	5-6	7-8	9-10	11-12							LOD/LOR	Units	Method No.
	Sample ID	TP1	TP2	TP3	TP4								
Depth	0.70	0.60	0.50	0.50									
COC No / misc													
Containers	V J	V J	V J	V J									
Sample Date	21/12/2015	21/12/2015	21/12/2015	21/12/2015									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	22/12/2015	22/12/2015	22/12/2015	22/12/2015									
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002							<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02							<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	0.0071							<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	0.071							<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.006	0.004	0.003	0.004							<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.05	0.04	0.03	0.04							<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005							<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005							<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015							<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015							<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007							<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07							<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005							<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05							<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.005	0.006	<0.002	0.003							<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.05	0.06	<0.02	0.03							<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	0.002							<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	0.02							<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003							<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03							<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	0.005	0.006	0.008	0.007							<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.05	0.06	0.08	0.07							<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	0.00012	0.00011	0.00030							<0.00001	mg/l	TM61/PM38
Mercury Dissolved by CVAF #	<0.0001	0.0012	0.0011	0.0030							<0.0001	mg/kg	TM61/PM38
Phenol	<0.01	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1							<0.1	mg/kg	TM26/PM0
Fluoride	0.4	<0.3	0.3	0.4							<0.3	mg/l	TM27/PM0
Fluoride	4	<3	3	4							<3	mg/kg	TM27/PM0
Chloride	<0.3	0.4	0.3	0.8							<0.3	mg/l	TM27/PM0
Chloride	<3	4	3	8							<3	mg/kg	TM27/PM0
Sulphate	0.48	4.95	16.44	31.70							<0.05	mg/l	TM27/PM0
Sulphate	4.8	49.5	164.4	317.1							<0.5	mg/kg	TM27/PM0
Mass of raw test portion	0.1022	0.0988	0.1117	0.1174								kg	NONE/PM17
Leachant Volume	0.887	0.891	0.878	0.873								l	NONE/PM17
Eluate Volume	0.8	0.8	0.8	0.85								l	NONE/PM17
Dissolved Organic Carbon	3	3	8	4							<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	30	80	40							<20	mg/kg	TM60/PM0
Total Dissolved Solids #	74	46	58	111							<10	mg/l	TM20/PM0
Total Dissolved Solids #	740	460	580	1110							<100	mg/kg	TM20/PM0

Please see attached notes for all abbreviations and acronyms

Mass of sample taken (kg)	0.1022	Dry Matter Content Ratio (%) =	87.8					
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.887					
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8					
<b>JEFL Job No</b>	<b>15/18234</b>		<b>Landfill Waste Acceptance Criteria Limits</b>					
<b>Sample No</b>	<b>6</b>							
<b>Client Sample No</b>	<b>TP1</b>							
<b>Depth/Other</b>	<b>0.70</b>							
<b>Sample Date</b>	<b>21/12/2015</b>							
<b>Batch No</b>	<b>1</b>							
<b>Solid Waste Analysis</b>			<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>			
Total Organic Carbon (%)	0.40					3	5	6
Sum of BTEX (mg/kg)	<0.025					6	-	-
Sum of 7 PCBs (mg/kg)	<0.035					1	-	-
Mineral Oil (mg/kg)	<45					500	-	-
PAH Sum of 6 (mg/kg)	<0.22					-	-	-
PAH Sum of 17 (mg/kg)	<0.64					100	-	-
<b>Eluate Analysis</b>			<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>					
	<b>10:1 concn leached</b>							
	<b>A10</b>		<b>mg/kg</b>					
	<b>mg/kg</b>							
Arsenic	<0.025		0.5	2	25			
Barium	0.06		20	100	300			
Cadmium	<0.005		0.04	1	5			
Chromium	<0.015		0.5	10	70			
Copper	<0.07		2	50	100			
Mercury	<0.0001		0.01	0.2	2			
Molybdenum	0.05		0.5	10	30			
Nickel	<0.02		0.4	10	40			
Lead	<0.05		0.5	10	50			
Antimony	<0.02		0.06	0.7	5			
Selenium	<0.03		0.1	0.5	7			
Zinc	0.05		4	50	200			
Chloride	<3		800	15000	25000			
Fluoride	4		10	150	500			
Sulphate as SO4	4.8		1000	20000	50000			
Total Dissolved Solids	740		4000	60000	100000			
Phenol	<0.1		1	-	-			
Dissolved Organic Carbon	30		500	800	1000			

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Mass of sample taken (kg)	0.0988	Dry Matter Content Ratio (%) =	91.1		
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.891		
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8		
<b>JEFL Job No</b>	<b>15/18234</b>		<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>8</b>		<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP2</b>				
<b>Depth/Other</b>	<b>0.60</b>				
<b>Sample Date</b>	<b>21/12/2015</b>				
<b>Batch No</b>	<b>1</b>				
<b>Solid Waste Analysis</b>					
Total Organic Carbon (%)	0.26		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg)	<45		500	-	-
PAH Sum of 6 (mg/kg)	0.42		-	-	-
PAH Sum of 17 (mg/kg)	0.84		100	-	-
<b>Eluate Analysis</b>	<b>10:1 concn leached</b>		<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10</b>		<b>mg/kg</b>		
	<b>mg/kg</b>				
Arsenic	<0.025		0.5	2	25
Barium	0.04		20	100	300
Cadmium	<0.005		0.04	1	5
Chromium	<0.015		0.5	10	70
Copper	<0.07		2	50	100
Mercury	0.0012		0.01	0.2	2
Molybdenum	0.06		0.5	10	30
Nickel	<0.02		0.4	10	40
Lead	<0.05		0.5	10	50
Antimony	<0.02		0.06	0.7	5
Selenium	<0.03		0.1	0.5	7
Zinc	0.06		4	50	200
Chloride	4		800	15000	25000
Fluoride	<3		10	150	500
Sulphate as SO4	49.5		1000	20000	50000
Total Dissolved Solids	460		4000	60000	100000
Phenol	<0.1		1	-	-
Dissolved Organic Carbon	30		500	800	1000

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Mass of sample taken (kg)	0.1117	Dry Matter Content Ratio (%) =	80.3		
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.878		
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8		
<b>JEFL Job No</b>	<b>15/18234</b>		<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>10</b>		<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP3</b>				
<b>Depth/Other</b>	<b>0.50</b>				
<b>Sample Date</b>	<b>21/12/2015</b>				
<b>Batch No</b>	<b>1</b>				
<b>Solid Waste Analysis</b>					
Total Organic Carbon (%)	0.61		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg)	<45		500	-	-
PAH Sum of 6 (mg/kg)	<0.22		-	-	-
PAH Sum of 17 (mg/kg)	<0.64		100	-	-
<b>Eluate Analysis</b>	<b>10:1 concn leached</b>		<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10</b>		<b>mg/kg</b>		
	<b>mg/kg</b>				
Arsenic	<0.025		0.5	2	25
Barium	0.03		20	100	300
Cadmium	<0.005		0.04	1	5
Chromium	<0.015		0.5	10	70
Copper	<0.07		2	50	100
Mercury	0.0011		0.01	0.2	2
Molybdenum	<0.02		0.5	10	30
Nickel	<0.02		0.4	10	40
Lead	<0.05		0.5	10	50
Antimony	<0.02		0.06	0.7	5
Selenium	<0.03		0.1	0.5	7
Zinc	0.08		4	50	200
Chloride	3		800	15000	25000
Fluoride	3		10	150	500
Sulphate as SO4	164.4		1000	20000	50000
Total Dissolved Solids	580		4000	60000	100000
Phenol	<0.1		1	-	-
Dissolved Organic Carbon	80		500	800	1000



Mass of sample taken (kg)	0.1174	Dry Matter Content Ratio (%) =	76.7		
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.873		
Particle Size <4mm =	>95%	Eluate Volume (l)	0.85		
<b>JEFL Job No</b>	<b>15/18234</b>		<b>Landfill Waste Acceptance Criteria Limits</b>		
<b>Sample No</b>	<b>12</b>		<b>Inert</b>	<b>Stable Non-reactive</b>	<b>Hazardous</b>
<b>Client Sample No</b>	<b>TP4</b>				
<b>Depth/Other</b>	<b>0.50</b>				
<b>Sample Date</b>	<b>21/12/2015</b>				
<b>Batch No</b>	<b>1</b>				
<b>Solid Waste Analysis</b>					
Total Organic Carbon (%)	4.84		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg)	<45		500	-	-
PAH Sum of 6 (mg/kg)	14.51		-	-	-
PAH Sum of 17 (mg/kg)	26.93		100	-	-
<b>Eluate Analysis</b>	<b>10:1 concn leached</b>		<b>Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg</b>		
	<b>A10</b>		<b>mg/kg</b>		
	<b>mg/kg</b>				
Arsenic	0.071		0.5	2	25
Barium	0.04		20	100	300
Cadmium	<0.005		0.04	1	5
Chromium	<0.015		0.5	10	70
Copper	<0.07		2	50	100
Mercury	0.0030		0.01	0.2	2
Molybdenum	0.03		0.5	10	30
Nickel	0.02		0.4	10	40
Lead	<0.05		0.5	10	50
Antimony	<0.02		0.06	0.7	5
Selenium	<0.03		0.1	0.5	7
Zinc	0.07		4	50	200
Chloride	8		800	15000	25000
Fluoride	4		10	150	500
Sulphate as SO4	317.1		1000	20000	50000
Total Dissolved Solids	1110		4000	60000	100000
Phenol	<0.1		1	-	-
Dissolved Organic Carbon	40		500	800	1000

--

Matrix : Solid

Client Name: IGSL  
 Reference: UCD  
 Location:  
 Contact: Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
15/18234	1	TP1	0.70	5-6	GRO	Solid Samples were received at a temperature above 9°C.
15/18234	1	TP2	0.60	7-8	GRO	Solid Samples were received at a temperature above 9°C.
15/18234	1	TP3	0.50	9-10	GRO	Solid Samples were received at a temperature above 9°C.
15/18234	1	TP4	0.50	11-12	GRO	Solid Samples were received at a temperature above 9°C.

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.



## NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 15/18234

### SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

### WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

### DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

### SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

### DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

### NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced



**ABBREVIATIONS and ACRONYMS USED**

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 15/18234

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM3	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM3	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified USEPA 8163. Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO <sub>2</sub> generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM27	Modified US EPA method 9056. Determination of water soluble anions using Dionex (Ion-Chromatography).	PM0	No preparation is required.			AR	Yes

JE Job No: 15/18234

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM33	Soluble Ion analysis using the Thermo Aquagem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AD	Yes
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM38	Samples are brominated to reduce all mercury compounds to Mercury (II) which is analysed using method TM061.	Yes		AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 C or 105 C. Calculation based on ISO 11465 and BS1377.			AR	

## Appendix - Methods used for WAC (2003/33/EC)

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometric methods after distillation)* ( BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 ( ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amounts of acid or base needed to cover the pH range
<b>Notes:</b> *If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS **PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180 ***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.	



## **Appendix VII Ground Water Details**



## **Appendix VIII Site Plan**

DP9	318711.36	229420.746	30.12
TP3	318750.623	229447.867	30.626
BH4	318772.186	229458.417	30.973
DP8	318743.559	229470.885	30.275
DP7	318680.572	229473.937	29.608
DP6	318697.919	229514.155	29.607
DP5	318665.734	229539.977	29.395
BH-RC3	318649.227	229525.929	28.185
TP2	318640.853	229521.649	28.238
DP3	318623.816	229559.332	27.62
DP4	318658.818	229584.547	27.448
BH2	318669.534	229593.265	27.416
DP2	318658.243	229602.271	27.23
TP1	318635.032	229590.039	27.266
BH1	318631.268	229586.314	27.214
RC1	318628.175	229583.976	27.266
DP1	318608.745	229567.986	27.368
BH5	318614.714	229385.679	32.519
DP10	318619.643	229248.671	32.876
DP11	318631.792	229249.966	32.756
BH6	318634.59	229239.58	33.038
TP4	318610.244	229233.317	33.014
RTCM-Ref 001	309180.517	228017.727	107.564



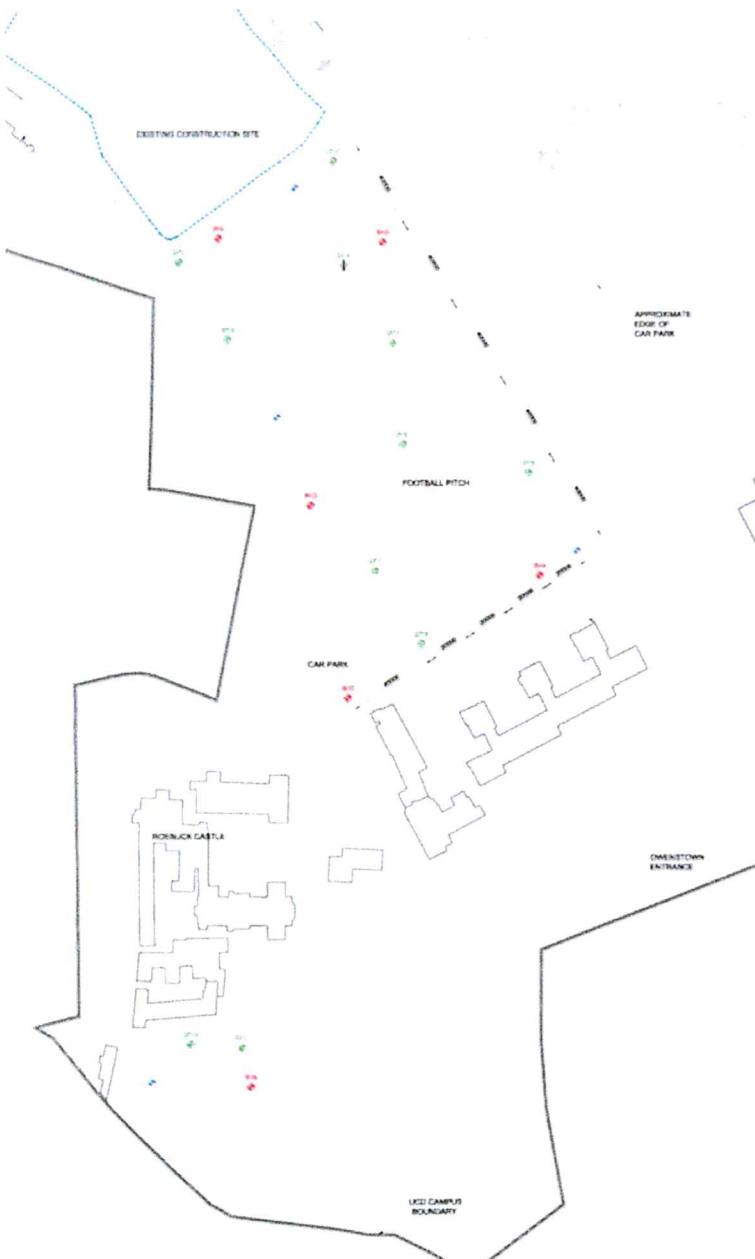
# TENDER

## NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECTS DRAWINGS FOR THE PROJECT. CONTRACTORS ARE TO BE RESPONSIBLE FOR VERIFYING ALL DIMENSIONS AND LEVELS ON SITE.
- DETAILED DETAILS TO BE SUPPLIED AS PART OF ANY CONTRACTORS' PROPOSALS.

## LEGEND

- BOREHOLE LOCATION
- TRIAL PIT LOCATION
- DYNAMIC PROBE LOCATION



**GEOTECHNICAL INVESTIGATION LAYOUT**  
1:1000

**IGSL LTD.**  
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NO.	DATE	ISSUED FOR TENDER
01	01/11/16	ISSUED FOR TENDER

ISSUE STATUS	DESCRIPTION
<input type="checkbox"/> PRELIMINARY (P.L.)	<input type="checkbox"/> PLANNING (P.L.)
<input checked="" type="checkbox"/> TENDER (T.L.)	<input type="checkbox"/> CONSTRUCTION (C.L.)

Author: Eoin O'Connell, D.A. Director, Project Management  
 Checked: Eoin O'Connell, D.A. Director, Project Management  
 Drawn: Eoin O'Connell, D.A. Director, Project Management  
 Scale: AS NOTED FOR THE PROJECT

CLIENT	UNIVERSITY COLLEGE DUBLIN
PROJECT TITLE	UCD STUDENT ACCOMMODATION
DRAWING TITLE	GEOTECHNICAL INVESTIGATION LAYOUT
SHEET NO.	AS NOTED
JOB NO.	15349
DRAWING NO.	C1001
ISSUE	T1