IGSL Limited
Ground Investigation
O'Devaney Gardens Dublin (Phase 2)
Project No. 10009
On Behalf Of
Arup
Consulting Engineers

FOREWORD

Notes on Site Investigation Procedure

The following notes should be read in conjunction with the report. Any modifications to the procedures outlined below are indicated in the main text.

GENERAL

The recommendations made and opinions expressed in the Report are based on the "Boring Records, an examination of samples and results of the site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the boreholes, for example, between borehole positions. Whilst the report may express an opinion on a possible configuration of strata both between borehole positions and below the maximum depth of the investigation, this is for guidance only and no liability can be accepted for its accuracy.

BORING TECHNIQUE

Unless otherwise stated the 'Shell and Auger' technique of soft ground boring has been employed. Whilst this technique allows the maximum data to be obtained on strata conditions, a degree of mixing of some layered soils, (e.g. thin layers of coarse and fine granular material) is inevitable. Specific attention is drawn to this factor where evidence of such a condition is available.

GROUND WATER

The ground water conditions entered on the Boring Records are those appertaining at the time of the investigation. The normal rate of boring does not usually permit the recording of an equilibrium water level for any one water strike. Moreover, ground water levels are subject to variations caused by seasonal effects or changes in local drainage conditions. The table of each Boring Record shows the ground water level at the quoted borehole and casing depths, usually at the start of the day's work. The word "none" indicates that ground water was sealed off by the borehole casing.

GAS MONITORING

Unless otherwise stated gas monitoring is carried out using a GA2000 infra red gas detector. The gases monitored for and levels noted are recorded and plotted on the relevant test data sheets. Unless stated otherwise no monitoring is carried out for gas pressure or to calculate gas flow rates.

ROUTINE SAMPLING

Undisturbed samples of predominantly cohesive soils are obtained in a 102mm diameter open-drive sampler, complying with the requirements of the British Standard Code of Practice B.S. 5930. Large disturbed samples of granular soils, or of soils in which undisturbed sampling is not possible or appropriate, are taken from the boring tools and sealed into polythene bags. Small disturbed samples are taken at frequent intervals and sealed into 0.5 kg glass jars or polythene bags for subsequent visual classification. Where encountered in sufficient quantity, samples of groundwater are taken.

Unless otherwise stated in the main text, disturbed soil samples may not be at their natural water content.

REPORT ON A GROUND INVESTIGATION FOR PROPOSED RESIDENTIAL RE-DEVELOPMENT WORKS AT O'DEVANEY GARDENS / ST. BRICINS HOSPITAL , DUBLIN ON BEHALF OF ARUP, CONSULTING ENGINEERS

REPORT NO. 10009

OCTOBER 2004

I.INTRODUCTION

The proposed development site is located in the O'Devaney Gardens and St. Bricins Hospital areas which are situated off the North Circular Road in Dublin.

It is proposed to redevelop this site and construct new multi storey residential developments along with associated commercial and community areas.

An investigation of sub-soil conditions was ordered by the projects consulting engineers, Arup Ireland, on behalf of their clients, Dublin City Council. The ground investigation was completed over two phases of works with phase 1 completed in April 2004 and reported on in IGSL report no. 9606 (May 2004).

The programme of the investigation completed in Phase 2 included,

- ✓ The construction of five exploratory boreholes to establish stratification. During the course of boring in-situ tests were performed at regular intervals and representative soil samples were recovered for visual examination and laboratory analysis.
- ✓ The drilling of seven rotary coreholes to establish the depth to, type of and quality of the underlying bedrock.
- ✓ The installation of groundwater monitoring standpipes at selected borehole and corehole locations.
- ✓ The carrying out of laboratory soils testing (Geotechnical) as specified by the projects engineers.

This report has contains the factual information pertaining to the works completed during the Phase 2 works.

II.FIELDWORK

The site is referred to as the O'Devaney Gardens development and the locations of all of the investigation points are shown on the detailed site plan enclosed in Appendix V to this report.

Site works were supervised by a representative of the consulting engineers and by an IGSL geotechnical engineer. The methods utilised during the course of the field investigations are outlined in the following sections.

Cable Tool Boreholes.

Conventional cable tool techniques (shell and auger) were employed at five locations across the site. All field work was carried out in accordance with BS5930.

Sampling and in - situ testing were performed to BS1377. Disturbed and undisturbed soil samples were taken at regular intervals or at changes in stratification while standard penetration tests (SPT's) were also carried out to establish relative in - situ soil strength.

Full details of stratification, testing, sampling, comments on groundwater and notes on any obstructions to normal boring encountered are given in the detailed borehole records enclosed in Appendix I to this report.

Groundwater monitoring standpipes were installed at each of the cable tool boreholes in accordance with the specifications of the projects engineers. Installations comprised a 50mm standpipe slotted in its lower section with a filter sock and gravel pack installed around the slotted section. The installation was completed with a 50mm riser pipe attached to the slotted section around which an impermeable bentonite seal was placed to prevent surface water migration into the standpipe. Each installation was then capped with a protective steel lockable cover which was then concreted into place.

Rotary Coring

A total of seven rotary coreholes were constructed at six locations across the site. The results of these are enclosed in the detailed coring records enclosed in Appendix II to this report.

Rotary core drilling was undertaken using a top drive lorry mounted Casagrande rotary coring rig

The coring operation utilised HQ coring techniques which open a 90mm hole and recover a 75mm core of rock. Air mist flush was used in the drillhole and the cores were packed in 3m core boxes and returned to I.G.S.L.'s laboratory in Newbridge, County Kildare.

The rock cores were then logged by I.G.S.L.'s engineering geologist and detailed core logs are presented in the relevant appendix. These logs include descriptions and the standard mechanical indices (TCR, SCR and RQD). In addition, a graphic fracture spacing log has been prepared, and this is incorporated as part of the engineering geological core records.

It should be noted that considerable difficulty was encountered while completing the drilling works in the O'Devaney Gardens section of the site. During the drilling of RC5 the drill crew were attacked by the residents of the adjoining developments and were forced to abandon the drillhole for health & safety reasons. Following consultation with the client the drill rig was demobilized while the local authority carried out discussions with the residents of the area. The drill rig was then remobilised to site but was restricted to working from 8.00am to 2.30 pm daily at which time the rig was stood down for the remainder of the day and moved off site to a secure area. Considerable delays and standing time were incurred by IGSL as a results of the above working conditions.

Groundwater monitoring standpipes were installed at selected rotary coreholes locations. As with the cable tool boreholes all standpipes were installed in accordance with the specifications of the projects engineers.

III. TESTING

During the course of the investigation samples of the sub soils were taken from the boreholes and samples of the rock cores were recovered from the coreholes. The disturbed soil samples were returned to IGSL's laboratory where a programme of testing was scheduled by the projects engineers.

In Situ Tests - SPT Tests

The relative in-situ strength of the sub-soils was established at intervals in both the boreholes and coreholes by cone penetration test.

A solid conical point is hammered into the soil and the blow count for 300mm of penetration is recorded in four 75mm increments. Results are presented in the right - hand column of the boring records and in the central section of the relevant coring records.

<u> Geotechnical Testing – Soils</u>

All of the geotechnical test data is included in Appendix III to this report.

Tests carried out included

- ✓ Moisture Content Tests
- ✓ Atterburg Limits (Classification tests).
- ✓ Moisture Condition Value (MCV) Tests
- ✓ Particle Size Distribution Tests (Wet Sieve)
- ✓ Sedimentation Analysis (by Hydrometer).
- ✓ pH and Sulphate Tests
- ✓ CBR Tests

<u>Environmental Testing – Soils</u>

At the request of the projects engineers, Arup Ireland, selected samples were dispatched to an environmental analytical laboratory for specialist testing.

The carrying out of the environmental laboratory soils testing was completed at the STL testing facilities in Dublin in accordance with the test schedules and specifications issued by Arup.

Appendix I Cable Tool Borehole Records

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	CONTRACT: O'Devaney Gardens Phase 2						BORE! Sheet	HOLE NO): 12	
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1		×	₩			3222	B D	1.00	N=14	
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			l			Ground	water Obse	ervations		
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	Date Tip Depth RZ Top RZ Base	Type SP		24/08/200			-	Dry at end	of boring	
	24/08/2004 7.50 1.00 7.50) or								
-	Remarks: Samples - B = Geotechnical bulk s	ample, D = Chemi	cal S	ample						

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-2		•	2			3245	В	2.0	00 N=17	
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- 6	End of Borehole at 5.50 m		10.5	12.22	5.50				N=R	
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<u>`</u>	Remarks: Samples - B = Geotechnical bulk sa	mple, D = Che	mical S	ample						

RE	EPORT NO: 10009	G	EOTECH	INIC	AL B	ORIN	G REC	ORD)		GSL L	td.
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- 8												
						.						
- 9												
- 1h												
- 10	Hard Strata Barina	/ Chicallina			<u> </u>		Mata	r Strike	Details			l
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<u> </u>	Standpipe Installation			_	Date	Hole Depth	Casing Depth	Depth to Water			mments	
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Re	emarks: Samples - B = Geotechn	ucai nulk san	one D = Chei	mical S	amnie							

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Appendix II
Rotary Corehole Records

RE	POR	T NO)_	10	0009		()EO	TECH	NICA	L CC	DRE	LO	OG RECORD IGSL Ltd	ORD IGSL
co	NTRAC	Γ: ^{Ο' D}	evaney	s Ga	rdens									DRILLHOLE NO: RC1 SHEET: Sheet 1 of 2	
ł	ENT: SINEER	: Ar	up						ORE DIAM				4 5.26	DATE STARTED: 30/09/2004 DATE COMPLETED:30/09/2004	***************************************
	ORDIN			 757.1	 19				CLINATIO					DRILLED BY: Millennium	
	<u> </u>		3137	756.6	39			FL	USH: AI	R/MIST	T			LOGGED BY: Sean/Dan	LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (n 250	nm)	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION	GEOTECHNICAL DESCRIPTION
23		O	0	0										SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of clay and gravel	d by driller as returns of clay
- - - - - 5 -										11.06	4.20			SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of stiff black sandy gravelly SILT/CLAY	d by driller as returns of
	5.50									9.76	5.50			Stiff black/brown sandy very gravelly SILT/CLAY with many sub-angular cobbles Continued next sheet	AY with many sub-angular
REM		10.0m,	i standp gravel m, head	10.0-	installed at -1.0m, seal ks.			nstalla Depth Depth	LLATION ation Type to Respo to Respo ents : Gr	e : SP nse Zor nse Zor	ne top (om (n	n) :	0	

RI	EPOR	T NO).	10	0009	G	EOTECH	INICA	L C	DRE	LC	OG RECORD IGSL L	_td
СО	NTRAC	r: O' [Devan	eys Ga	ardens							DRILLHOLE NO : RC1 SHEET: Sheet 2 0	of 2
	ENT: GINEER	: A	rup				CORE DIA				4 5.26	DATE STARTED: 30/09/200 DATE COMPLETED:30/09/200	
СО	-ORDIN	ATES:		4757. 3756.			INCLINAT			9	0	DRILLED BY: Millennium LOGGED BY: Sean/Dan	
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (m 250	UCS (MPa)	POINT LUAD IS(50) MPa SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTIC	ON
10		100	0	0				18. 18. 18. 18. 18. 18. 18. 18. 18. 18.				Stiff black/brown sandy very gravelly SILT/CLAY with many sub-angular cobbles	
	12.30	100	0	0				2.96	12.30			Moderately weak, thin to medium bedded, grey/black fine grained MUDSTONE, fresh to locally slightly	
13	13.10	100	25	25								weathered, intersected by smooth to locally rough, planar to undulose,	
14	14.60	100	26	0								tight to locally open, possible clay infilled(at 12.55m-12.65m, 13.1m-13.15m, 16.18m-16.2m) fractures dipping sub-45°	•
15		100	45	22							1111111		
16	16.10												
		100	63	29									
	17.60							-2.34				End of Borehole at 17.60 m	
EM		Secon 10.0m, 1.0-0.0	grave	10.0-	installed at -1.0m, seal ks.	 Ins De De	STALLATIO stallation Typepth to Respent to Respentents: Expendents: Expenses the control of the	e : SP onse Zo onse Zo	ne top ne bott	om (n	n) :		

RE	POR	T NC).	10	0009		(GEO	TECH	NICA	L CC	ORE	LC	OG RECORD IGSL Ltd
cor	NTRACT	r: O' [evane	ys Ga	ırdens	•	***************************************							DRILLHOLE NO: RC2 SHEET: Sheet 1 of 3
	ENT: SINEER		-up				4=		RE DIAI				4 7.95	DATE STARTED: 01/10/2004 DATE COMPLETED:01/10/2004
\vdash	ORDIN		•	889.	57				CLINATION					DRILLED BY: Millennium
	ONDIN	LO.		752.0					USH: A					LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (n	nm)	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
		0	0	0		11 11 1				10.75	7.20	N=38		SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of clay and gravel SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of stiff black sandy gravelly silt/clay Continued next sheet
REMA	ARKS:	Standp 16.0-14	ipe slo 4.5m, fi	tted 2	2.0-16.0, so)-0.0m.	lid	-	installa Depth t Depth t	tion Typ to Respo to Respo ents : G	e : SP onse Zor onse Zor	ne top ne bott	tom (n	n) :	

REPOR	RT NO).	10	0009		GE	OTECH	NICA	L C	ORE	LO	G RECORD IGSL Ltd
CONTRAC	OT: O'I	Devane	ys Ga	ırdens							-	DRILLHOLE NO: RC2 SHEET: Sheet 2 of 3
CLIENT: ENGINEE	R: A	rup					CORE DIA		, ,		4 7.95	DATE STARTED: 01/10/2004 DATE COMPLETED:01/10/2004
CO-ORDII	NATES:		4889.9 3752.0				INCLINATI			: 90	0	DRILLED BY: Millennium LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m) CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%,	Fracture Spacing (mi	(a)	COM (03/2) GAO I TINIOG	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
110										N=43		SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of clay and gravel
13 13.00 14 14.50	20	15	15					4.95	13.00	N=66		Strong, thin to medium bedded, dark grey/black, fine grained mud-rich LIMESTONE, fresh to locally slightly weathered, intersected by smooth to locally rough, planar to undulose, locally tight to open, possible clay infilled(at 13.31m-14.5m, 14.57m-18.0m) fractures dipping sub-45°
16 16.00	10	0	0									Continued next sheet
REMARKS:	Stand; 16.0-1	oipe slo 4.5m, fi	tted 2	2.0-16.0, solid)-0.0m.	i	Ins De De	STALLATION tallation Typ pth to Respondent pth to Respondents: G	e : SP onse Zo onse Zo	ne top ne bot	tom (n	n):	00

REPOR	T NC).	10	0009		GE	OTE	СН	NICA	L CC	DRE	LC	OG RECORD IGSL Ltd
CONTRAC	T: O' [evane	ys Ga	ırdens									DRILLHOLE NO: RC2 SHEET: Sheet 3 of 3
CLIENT: ENGINEER	· Ar	тир					1		METER _EVEL (4 7.95	DATE STARTED: 01/10/2004 DATE COMPLETED:01/10/2004
CO-ORDIN		234	1889.5 3752.0				INCLIN	ATIO	ON (Deç IR/MIST	rees):)	DRILLED BY: Millennium LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m) CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	Fracture Spacing (m 250	CS (MPa)	DOINT LOAD WEST		SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
18.00	0	0	0						-0.05		N=64		Strong, thin to medium bedded, dark grey/black, fine grained mud-rich LIMESTONE, fresh to locally slightly weathered, intersected by smooth to locally rough, planar to undulose, locally tight to open, possible clay infilled(at 13.31m-14.5m, 14.57m-18.0m) fractures dipping sub-45° Dark grey/black clays and mud-rich angular, fine grained, LIMESTONE gravels, moderately to highly weathered
20.30	100	59	0						-2.35 -3.05	21.00			Strong, thin to medium bedded, dark grey/black, fine grained mud-rich LIMESTONE, fresh to locally slightly weathered, intersected by smooth to locally rough, planar to undulose, locally tight to open, clay infilled(at 18.0m-21.0m) fractures dipping sub-45° Strong, thin to medium bedded, dark grey/black, fine grained mud-rich LIMESTONE, fresh to locally slightly weathered, intersected by smooth to
22.50	100	57	44						-5.55	23.50			locally rough, planar to undulose, locally tight to open, possible clay infilled(at 21.45m-22.0m) fractures dipping sub-45° to locally horizontal
25 REMARKS:	Standp 16.0-14	pipe slo 4.5m, fi	tted 2	2.0-16.0, sol)-0.0m.	id	Ins De	STALLA tallation pth to Repth to Re	Typo espo	e : SP inse Zoi	ne top			

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RE	EPOR	T NC	ວ	11	0009			GEO	TECH	NICA	L C	ORE	<u>L</u> C	OG REC	ORD	IGSL Ltd.
СО	NTRACT	T: O'[Devane	ys Ga	ardens							_			DRILLHOLE NO : SHEET:	RC3 Sheet 1 of 3
	IENT: GINEER	₹: A	тир		ATTENDED TO STATE OF THE STATE				ORE DIAI				74 27.35	;	DATE STARTED: DATE COMPLETED	12/10/2004 D:12/10/2004
CO-	-ORDINA	ATES:	23	4747.4	41			IN	ICLINATIO	ON (Deç	grees):	: 90	0		DRILLED BY: Mi	illennium
	т		31?	3631.2	24		Т	FL	USH: A	IR/MIST	T	т—	т—		i i	ean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%		cture ng (mm) 250 11500	(a)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS		GEOTECHNICAL DE	
	ARKS:	0	0	0	6m-18.9i				LLATION			N=55		observe black sa	TREX: OPEN HOLE Deed by driller as returns andy gravelly clay	s of
REM	ARKS:	Standp	ipe slo	tted 1	6m-18.9	∂m, solid			LLATION ation Type		_S					

10m-16mm, gravel fill 11m-14m, gravel 15.5m-18.9m, seal at 10m-11m & 14m-15.5m.

Installation Type: SP
Depth to Response Zone top (m): 10.00 Depth to Response Zone bottom (m): 18.90 Comments: 7m-8.5m seal, 8.5m-10m gravel

REPOR	T NO)	10	0009			GEO	TECH	NICA	L C	DRE	LO	G RECORD IGSL Ltd
CONTRACT	O' D	evane	ys Ga	rdens									DRILLHOLE NO: RC3 SHEET: Sheet 2 of 3
CLIENT: ENGINEER	: Аг	up				-216/0Fe	- 1	ORE DIAM				1 7.35	DATE STARTED: 12/10/2004 DATE COMPLETED:12/10/2004
CO-ORDINA	ATES:		4747.4 3631.2					CLINATIO			90)	DRILLED BY: Millennium LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m) CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	3.Q.D.%	Fractu Spacing Spacing	(mm)	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
9													SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of black sandy gravelly clay
10											N=68		
11					1						N=76		
13								,	14.45	12.90			SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of angular fragments of moderately weathered limestone, possible rockhead
14.40	100	69	41						12.95	14.40			Strong very strong, medium to thickly bedded, grey/dark grey, fine grained mud-rich LIMESTONE, fresh to slightly to locally moderately weathered, intersected by smooth to rough, planar to undulose to locally irregular, tight to open, clay infilled(at 5.31m-5.42m, 16.64m-16.67m), locally Fe oxide stained fractures dipping 45° to locally sub horizontal
15.90	100	64	49										to locally sub-horizontal
17.40	<u> </u>												Continued next sheet

REMARKS: Standpipe slotted 16m-18.9m, solid 10m-16mm, gravel fill 11m-14m, gravel 15.5m-18.9m, seal at 10m-11m & 14m-15.5m.

Depth to Response Zone top (m): 10.00
Depth to Response Zone bottom (m): 18.90
Comments: 7m-8.5m seal, 8.5m-10m gravel

RE	EPOF	RT NC).	10	0009			GEC	TECH	NICA	L CC	ORE	E L(OG RECORD	IGSL Ltd.
СО	NTRAC	:T: O'[Devane	ys Ga	ardens									DRILLHOLE NO SHEET:	: RC3 Sheet 3 of 3
1	ENT: GINEEF	R: 'A	rup						ORE DIA				'4 ?7.35	DATE STARTED: DATE COMPLET	
СО	-ORDIN	IATES:		4747.4					NCLINATI			9	Ю	DRILLED BY:	Millennium
	1	1	313	3631.2	24	Т		Fl	LUSH: A	JR/MIST	T		Τ	LOGGED BY:	Sean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing ((mm)	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEРТН (m)	SPT (N value)	STANDPIPE DETAILS		
	18.90	100	35	18	6m-18.9m,	solid	1		LLATION		18.90			Strong very strong, mediun bedded, grey/dark grey; fin mud-rich LIMESTONE, fres to locally moderately weath intersected by smooth to rot undulose to locally irregutight to open, clay infilled(at 5.31m-5.42m, 16.64m-16.6 Fe oxide stained fractures to locally sub-horizontal End of Borehole at	e grained sh to slightly ered, ugh, planar ili 7m), locally dipping 45°
KEWI	!	10m-16	3mm, gi 15.5m-	ıravel f ∙18.9m	fill 11m-14r n, seal at	n,		Depth Depth	ation Type to Respo to Respo nents : 7m	nse Zon nse Zon	ne botto	om (m	n) :	18.90	

RE	POR	T NC).	10	0009		G	EO	TECH	NICA	L CC	DRE	LC	OG RECORD IGSL Ltd.
CON	NTRACT	-: O' E	evane)	ys Ga	ırdens	·			·					DRILLHOLE NO: RC4 SHEET: Sheet 1 of 3
CLIE	ENT: SINEER:	- Δr	up	-					RE DIAI				4 7.07	DATE STARTED: 07/10/2004
—	ORDINA		-	893.8	33				CLINATIO					DATE COMPLETED:08/10/2004 DRILLED BY: Millennium
				554.0					USH: A			,		LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (n		UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DЕРТН (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
- 1 - 2 - 3 - 4 - 5 - 6	ARKS:	0	0	0					LATION		LS	N=51 N=59		SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of black sandy gravelly clay with occasional cobbles Continued next sheet
	(Seal-9.	5m-10.	5m				epth t	tion Type to Respo to Respo	nse Zor	ne top			50 12.00

Comments : Fill Seal 12m-14m

RE	POR	T NC).	10	0009			GEO	TECH	NICA	L CC	DRE	LC	OG RECORD IGSL Ltd.
CO	NTRAC	T: O' [Devane	ys Ga	ardens									DRILLHOLE NO: RC4 SHEET: Sheet 2 of 3
	ENT: GINEER	:: A	rup						ORE DIA				4 7.07	DATE STARTED: 07/10/2004 DATE COMPLETED:08/10/2004
CO-	-ORDIN	ATES:		4893.8 3554.8				ì	CLINATI			9()	DRILLED BY: Millennium LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	Fracture Spacing (m	- 1	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
-9 -10 11 12												N=68		SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of black sandy gravelly clay with occasional cobbles
-13										14.27	12.80			SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of angular fragments of moderately weathered limestone, possible rockhead
- 14 - 15	14.00	100	70	45						13.07	14.00			Strong to very strong, medium to thickly bedded, grey/dark grey, fine grained mud-rich LIMESTONE, fresh to locally slightly weathered, intersected by smooth to rough, planar to undulose to localy irregular, tight to open, locally calcite filled (3mm-to 10mm) fractures dipping 45°
- 16	17.00	100	67	61										
														Continued next sheet
REM	ARKS:	Seal-0 Seal-9	.0m-1n .5m-10	n, Fill-).5m	1m-9.5,			Installa Depth Depth	LLATION tion Typ to Respo to Respo ents : Fil	e: SPI inse Zor inse Zor	E ne top ne bott	om (n		

RE	EPOR	T NO		10	0009		GEO	TECH	NICA	L CC	RE	LC	OG RECORD IGSL Ltd.
CO	NTRAC	Γ: O' D	evaney	ys Ga	rdens								DRILLHOLE NO: RC4 SHEET: Sheet 3 of 3
	ENT: SINEER	: Ar	un					RE DIAI				4 7.07	DATE STARTED: 07/10/2004 DATE COMPLETED:08/10/2004
	ORDIN			893.8	13			CLINATIO	<u> </u>				DRILLED BY: Millennium
	-OKDIN	\ I IO.		554.0			Į.	USH: A					LOGGED BY: Sean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%		Fracture Spacing (m	UCS (MPa)	POINT LOAD IS(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
- 18		100	82	66					·				Strong to very strong, medium to thickly bedded, grey/dark grey, fine
- - - - - - - - 19 - -	18.60								8.47	18.60			grained mud-rich LIMESTÖNE, fresh to locally slightly weathered, intersected by smooth to rough, planar to undulose to localy irregular, tight to open, locally calcite filled (3mm-to 10mm) fractures dipping 45° End of Borehole at 18.60 m
Ē								·					
— 20 - -													,
1													·
-													
— 21 - -													
— 22 - -													
_													
-													
— 23 - -													
_													
-													
— 24 - -													
— 25 - -													
E						-							
- -													
REM	IARKS:	Seal-0. Seal-9.	.0m-1m .5m-10	ı, Fill- .5m	1m-9.5,		Installa Depth Depth	LLATION tion Typ to Respo to Respo ents : Fi	e : SPI onse Zo onse Zo	E ne top ne bott	om (r		

RE	POR	T NO		1(0009			GEO	TECH	NICA	L C	ORE	LC	OG RECORD	IGSL Ltd.
CON	NTRACT	.: O' D	evaney	/s Ga	ardens									DRILLHOLE NO : SHEET:	RC5 Sheet 1 of 2
•	ENT: SINEER:	: Arı	ир					- 1	ORE DIA				5.81	DATE STARTED: DATE COMPLETE	22/09/2004 D:22/09/2004
	ORDINA		-	010.5	56				CLINATI						llennium
<u> </u>	I		313	631.0	03			FL	USH: A	IR/MIST		1			an/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	Fracture Spacing (m	mm)	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DI	
												N=33 N=54		SYMETREX: OPEN HOLE It observed by driller as returns and gravel & black sandy gravel & black	of clay velly clay
REMA	\RKS : F	Relocate insafe s	ed bore site con	∌hole iditior	to 5A due to ns	خ	1: C	nstalla Depth t	LLATION ation Type to Respo to Respo ents	e : onse Zon	ne top		ı) :		

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RE	POR	T NO).	10	0009		G	EO	TECH	NICA	L CC	RE	LC	G RECORD IGSL	Ltd.
CO	NTRAC	() O' D	evaney	's Ga	rdens	1			***************************************	****				DRILLHOLE NO: RC5 SHEET: Sheet 2	of 2
	ENT: SINEER	· ^-							RE DIA				3.81	DATE STARTED: 22/09/20	
\vdash				010.5				-	CLINATI					DATE COMPLETED:22/09/20 DRILLED BY: Millennium)04
00.	ORDIN	AIES.		631.0				ł	USH: A			90	J	LOGGED BY: Sean/Dan	
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	Fracture Spacing (m 250		UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTI	ON
—9 —10 —11			o,							14.81		N=58		SYMETREX: OPEN HOLE DRILLING observed by driller as returns of clay and gravel & black sandy gravelly clay	
13 14 15 16														End of Borenole at 12.00 m	
REM			ited bore site coi		e to 5A due t	0		nstalla Depth 1	LLATION tion Typ to Respo to Respo ents:	e : onse Zo	ne top		n) :		

Section 1

RE	POR	T NC).	10	0009		(GEO	TECH	NICA	L CC	ORE	LC	G RECORD	IGSL Ltd.
cor	NTRAC	T: O' E	evane)	ys Ga	ırdens	· '	and a second billion of the							DRILLHOLE NO : SHEET:	RC5A Sheet 1 of 3
	ENT:				· · · · · · · · · · · · · · · · · · ·				RE DIA				4 6.83	DATE STARTED:	06/10/2004
	ORDIN		up	5012.	10				CLINATI					DATE COMPLETE	D:06/10/2004 illennium
00-	ORDIN	ATES.		3632.7				l	USH: A			. 9			ean/Dan
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	2!	ture g (mm) 50	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEРТН (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL D	
		0	0	0					LLATION	I DETAI	LS	N=66		SYMETREX: OPEN HOLE I observed by driller as returns black sandy gravelly clay Continued next s	s of
REMA		Standp 0.0m-1 gravel	5m, fill	cove	5m-20m r 0.0m-1	, solid 2mm,		Installa Depth	tion Typ to Respo to Respo	e : onse Zor	ne top		n) :		:

RE	POR	TNO).	10	0009			GE	DTECH	NICA	L C	ORE	LO	G RECORD IGS	SL Ltd
СО	NTRAC	T: 0'1	Devane	ys Ga	ırdens									DRILLHOLE NO: RCS	5A et 2 of 3
	ENT: GINEEF	R: A	rup		100 A			- 1	ORE DIA				4 6.83	DATE STARTED: 06/1 DATE COMPLETED:06/1	0/2004
	-ORDIN		23	5012.1 3632.7				1	NCLINATI	ON (De	grees):		0	DRILLED BY: Millenniu LOGGED BY: Sean/Da	ım
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	Fracture Spacing (r	nm)	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCR	IPTION
- 9												N=70		SYMETREX: OPEN HOLE DRILLI observed by driller as returns of black sandy gravelly clay	NG -
12						The second secon						N=68			
13												N=67			
- 15	15.60	100	25	12						11.73 11.23				SYMETREX: OPEN HOLE DRILLI observed by driller as returns of angular fragments of moderately weathered limestone, possible rock Strong to very strong, medium to thickly bedded, grey/dark grey, fine grained mud-rich LIMESTONE, free slightly to locally mederately.	head
	17.10	100	35 46	13				INST	ALLATION	I DETAI	LS			slightly to locally moderately weathered, intersected by smooth to rough, planar to undulose to locally irregular, tight to open, locally clay infilled (at 15.6m-15.8m, 18.62m-18.74m, 18.82m-18.87m) fractures dipping sub-45° to sub-vertical Continued next sheet	o
REM		Stand	oipe slo	otted 1	5m-20m, sc r 0.0m-12mi	olid m,		Insta Depti Depti	ALLATION llation Type th to Respondent to Respondents :	e : onse Zo	ne top		n) :	Continued next sheet	

and the second second

COI	NTRAC	т. O'[Devane	eys Ga	rdens						2010			DRILLHOLE NO :	RC5A
	ENT:								ORE DIA	METER	(mm):	7-	4	SHEET: DATE STARTED:	Sheet 3 of 3 06/10/2004
	GINEEF	R: A	rup					1	ROUND				6.83	DATE COMPLETE	
CO-	-ORDIN	IATES:		5012.1 3632.7		-		1	NCLINATI LUSH: A	-	-	9	0		lillennium ean/Dan
EPTH (m)	PTH (m)				Fracti	ure		s(50) MPa	90	10D)			DETAILS	GEOTECHNICAL D	ESCRIPTION
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Spacing 25	in l	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE		
18	18.20	100	37	27		·								Strong to very strong, mediu thickly bedded, grey/dark gr grained mud-rich LIMESTOI slightly to locally moderately weathered, intersected by sr rough, planar to undulose to irregular, tight to open, loca clay infilled (at 15.6m-15.8m 18.62m-18.74m, 18.82m-18 fractures dipping sub-45° to sub-vertical	ey, fine NE, fresh to mooth to localy lly
20	19.70 20.00	100	13	0						6.83	20.00			End of Borehole at	20.00 m
2															
3															
5															
EM.		Standr 0.0m-1 gravel	5m, fill	l cover	5m-20m, 0.0m-12	solid 2mm,		Install Depth	ALLATION ation Typ to Respo	e : onse Zo	ne top		n) :		

REPORT NO.	10009	GEOTECI	HNICAL CORE LC	G RECORD	IGSL Ltd.
CONTRACT: O' Devaneys	Gardens			DRILLHOLE NO : SHEET:	RC6 Sheet 1 of 2
CLIENT: ENGINEER: Arup			AMETER (mm): 74 LEVEL (mOD): 23.64	DATE STARTED: DATE COMPLETED	14/10/2004 D:14/10/2004
	75.49		TION (Degrees): 90	į	llennium
3136	55.77	FLUSH:	AIR/MIST	LOGGED BY: Se	an/Dan
DOWNHOLE DEPTH (m) CORE RUN DEPTH (m) T.C.R.% S.C.R.%	Fracture Spacing (mm) % CO 250 250	CS (MPa)	ELEVATION (mOD) DEPTH (m) SPT (N value) STANDPIPE DETAILS	GEOTECHNICAL DE	ESCRIPTION
	0	INSTALLATIO	N=55	SYMETREX: OPEN HOLE Dobserved by driller as returns black sandy gravelly clay	of.

0.0m-14m, fill 1m-11.5m, seal 0.0m-1m, 11.5m-13m, gravel 13m-17.4m.

Installation Type: SP Depth to Response Zone top (m): 0.00 Depth to Response Zone bottom (m): 20.00 Comments: Standpipe slotted 15m-20m

RE	EPOR	TNO) .	10	0009			GEO	TECH	NICA	L CC	DRE	LO	G RECORD IGSL Ltd
СО	NTRAC	T: O' I	Devan	eys Ga	ardens									DRILLHOLE NO: RC6 SHEET: Sheet 2 of 2
	ENT: GINEEF	R: A	rup						ORE DIAI				4 3.64	DATE STARTED: 14/10/2004 DATE COMPLETED:14/10/2004
СО	-ORDIN	ATES:		4875.4 3655.		,			CLINATION A			90)	DRILLED BY: Millennium LOGGED BY: Sean/Dan
□ DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%.	Fractu Spacing	(mm)	UCS (MPa)	POINT LOAD IS(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of
10												N=58		black sandy gravelly clay
11						***************************************						N=71		
13										10.64	13.00			SYMETREX: OPEN HOLE DRILLING - observed by driller as returns of angular fragments of moderately weathered limestone, possible rockhead
15	14.40	100	21	9			•			9.24	14.40			Strong to very strong, medium to thickly bedded, grey/dark grey, fine to medium grained mud-rich LIMESTONE and MUDSTONE(at 15m-15.4, 16.55m-17.4m), slightly to locally moderately weathered, intersected by smooth to rough, planar to undulose to localy irregular, tight to open, clay infilled (at 14.4m-14.51m, 16.8m-15m, 16.8m-15.7m, 16.8m-15.7m, 16.8m-16.7m, 16.8m-16.7
16	17.40	100	48	44						6.24	17.40			15.6m-15.7m, 16.21m-16.56m), locally calcite filled, locally Fe oxide stained fractures dipping sub-45° to sub-vertical End of Borehole at 17.40 m
REM	ARKS:	0.0m-1	l4m, fil lm, 11.	l 1m-1	4m-17m, 1.5m, sea 8m, gravel	al		installa Depth Depth	LLATION ation Type to Respo to Respo ents : Sta	I DETAI e: SP nse Zon	LS ne top ne bott	(m) : om (m	1):	20.00

0.00

Section of the sectio

Appendix III

Laboratory Test Records (Geotechnical)

			Determ	Determination of Moisture Content	Content	
BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Description	
BH 12	3222	1.00	O	21.1	Brown slightly organic slightly sandy slightly gravelly SILT/CLAY	IIy SILT/CLAY
BH 12	3224	3.10	a	12.1	Mottled grey brown slightly sandy slightly gravelly SILT/CLAY	SILT/CLAY
BH 12	3226	5.00	۵	7.0	Black slightly sandy gravelly SILT/CLAY	
BH 12	3227	00.9	O	8.7	Black slightly sandy slightly gravelly SILT/CLAY	
BH 12	3228	7.00	О	13.9	Grey slightly sandy slightly gravelly SILT/CLAY	
BH 13	3230	2.00	a	10.7	Brown slightly sandy slightly gravelly SILT/CLAY	
BH 13	3231	2.50	۵	9.4	Brown clayey/silty sandy GRAVEL	
BH 13	3232	3.00	Q	12.5	Grey slightly sandy slightly gravelly SILT/CLAY	
BH 13	3234	5.00	Q	5.2	Black grey slightly sandy slightly gravelly SILT/CLAY	AY
BH 13	3235	6.00	a	10.9	Grey slightly sandy slightly gravelly SILT/CLAY	
BH 13	3236	7.00	a	17.1	Grey slightly sandy slightly gravelly SILT/CLAY	
BH 14	3237	1.00	D	6.8	Mottled grey brown slightly sandy gravelly SILT/CLAY with some cobbles	LAY with some cobbles
BH 14	3239	3.30	а	8.6	Black brown slightly sandy slightly gravelly SILT/CLAY	:LAY
BH 14	3240	4.00	Q	0.7	Black slightly sandy slightly gravelly SILT/CLAY	
BH 14	3241	5.00	D	8.5	Black grey clayey/silty sandy GRAVEL with some cobbles	cobbles
BH 14	3243	7.00	D	6.8	Black slightly sandy slightly gravelly SILT/CLAY	
		,				
		Contract	Andrews Services	O'Devaney (O'Devaney Gardens Phase 2	Contract No. 10009
	į	Compiled By			Date	Page
<u> </u>	IGSL		D CONNOLLY	<u>\</u>	30/9/04	1 of 2

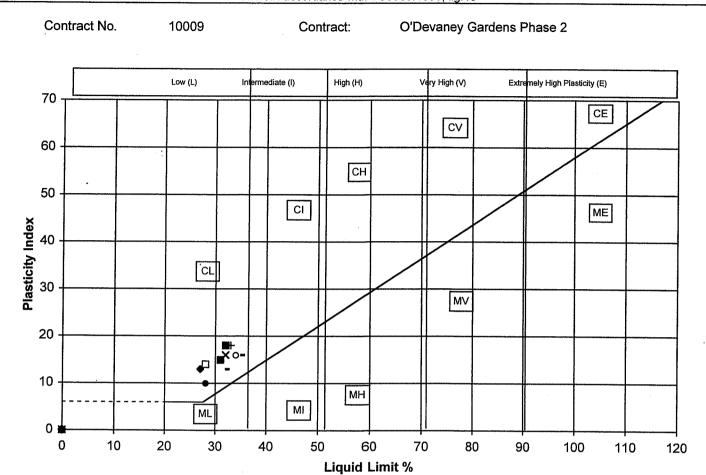
granding through

			Determ BS	Determination of Moisture Content BS1377:Part 2:1990. clauses 3.2	Content	
BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Description	
BH 15	3244	1.00	О	9.2	Brown slightly sandy slightly gravelly SILT/CLAY	
BH 15	3246	3.00	О	8.7	Black grey slightly sandy slightly gravelly SILT/CLAY	AY
BH 15	3248	5.00	Q	15.4	Black slightly sandy slightly gravelly SILT/CLAY	
BH 16	3250	2.00	Q	9.2	Brown slightly sandy slightly gravelly SILT/CLAY	
BH 16	3251	3.10	Q	9.2	Black grey slightly sandy slightly gravelly SILT/CLAY	AY
BH 16	3252	3.00	D	11.0	Grey slightly sandy gravelly SILT/CLAY	
BH 16	3253	4.00	O	7.8	Black slightly sandy slightly gravelly SILT/CLAY	
					Western Communication of the C	
	•					,
		Contract		O'Devaney (O'Devaney Gardens Phase 2	Contract No.
	7	Compiled By			Date	Page
<u>ත</u>	IGSE		D CONNOLLY	<u>\</u>	30/9/04	2 of 2
						١

	Classification	-0	CL	CL	CL	CL	CL	CL	C	CL	CL									
Summary of Classification Tests BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4	iption	Mottled grey brown slightly sandy slightly gravelly CLAY	Grey slightly sandy slightly gravelly CLAY	Brown slightly sandy slightly gravelly CLAY	Grey black slightly sandy slightly gravelly CLAY	Brown slightly sandy slightly gravelly CLAY	Black slightly sandy slightly gravelly CLAY	Mottled grey brown slightly sandy slightly gravelly CLAY	Black slightly sandy slightly gravelly CLAY	Brown slightly sandy slightly gravelly CLAY	Grey slightly sandy slightly gravelly CLAY							Contract No.	Page	of
	n Descr	Mottled	Grey sl	Brown	Grey bl	Brown	Black s	Mottled	Black s	Brown	Grey sl								Date	
	& 5.4 Preparation Description	MS	MS	WS	WS	WS	SW	WS	S/M	SW	WS									
	3.2, 4.3, 5.3 <425µm %	59.1	42.9	54.5	52.3	47.2	60.1	45.3	51.1	51.2	43					-		hase 2		
	Plasticity Index	13	18	10	13	16	18	16	14	16	15						5μm) NP - Non Plastic	O'Devaney Gardens Phase 2	Checked By	
	Plastic Limit	19	14	18	14	16	15	18	14	19	16							O'Devane	Date	30/9/04
	Liquid Limit %	32	32	28	27	32	33	34	28	35	31									
	Moisture Content %	14.7	8.1	12.7	9.2	10.4	9.1	10.2	6.8	17.4	19.7		-				t sieved (425 _l			>-
	Sample Type	۵	D	D	D	D	D	۵	D	D	D	·					NAT - tested as received WS - Wet sieved (425μm)	Compiled By	D CONNOLLY	
	Depth (m)	2.10	4.00	1.00	4.00	2.00	00.9	2.00	4.00	1.00	5.00						ed as receive			
	Sample No.	3223	3225	3229	3233	3238	3242	3245	3247	3249	3254						NAT - teste		IGSL	
	BH/TP No.	BH 12	BH 12	BH 13	BH 13	BH 14	BH 14	BH 15	BH 15	BH 16	BH 16						Notes:			

Plasticity Chart - Summary of Liquid & Plastic Limit Tests BS1377:Part 2:1990, clauses 3.2, 4 & 5

Chart in accordance with BS5930:1999, fig.18



Code	BH/TP	Sample	Depth (m)	MC%	LL%	PL%	PI%	%<425μm	Description
-	BH 12	3223	2.10	14.7	32	19	13	59.1	Mottled grey brown slightly sandy slightly gravelly CLAY
	BH 12	3225	4.00	8.1	32	14	18	42.9	Grey slightly sandy slightly gravelly CLAY
•	BH 13	3229	1.00	12.7	28	18	10	54.5	Brown slightly sandy slightly gravelly CLAY
•	BH 13	3233	4.00	9.2	27	14	13	52.3	Grey black slightly sandy slightly gravelly CLAY
X	BH 14	3238	2.00	10.4	32	16	16	47.2	Brown slightly sandy slightly gravelly CLAY
+	BH 14	3242	6.00	9.1	33	15	18	60.1	Black slightly sandy slightly gravelly CLAY
0	BH 15	3245	2.00	10.2	34	18	16	45.3	Mottled grey brown slightly sandy slightly gravelly CLAY
	BH 15	3247	4.00	6.8	28	14	14	51.1	Black slightly sandy slightly gravelly CLAY
-	BH 16	3249	1.00	17.4	35	19	16	51.2	Brown slightly sandy slightly gravelly CLAY
	BH 16	3254	5.00	19.7	31	16	15	43	Grey slightly sandy slightly gravelly CLAY
•									
•									
Х									
+									
0									

NP denotes specimen is non-plastic.

	Compiled by	Date	Checked by	Date	Page
IGSL	D CONNOLLY	30/9/04			

(mm) noiretaned	No. of Biows 2 3 4 6 8 12 16 24 32 48 64 96	Comments	D Moisture Condition Value 8.2	BH 16 % Passing 20mm Sieve 95.5 12	Sample Details Moisture Content (%) 11.7 6	10009 Description: Brown slightly sandy slightly gravelly SILT/CLAY 3	ne O'Devaney Gardens Phase 2	Contract Details Test Summary No. Blows Penetration	Moisture Condition Value Test Report Sheet	4			mmary immary by SILT/CLAY	Slightly gravell alue	Pition: slightly sandy re Content (% ssing 20mm Si ents No		3 3 3 3 4 16 4 16 4 16 4 16 4 16 4 16 4	Details Oetails 32 32	Contract De O'Devar 10009 Sample Det	
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	Moisture Condition	on Value Test Report Sheet		1.G.S.L.
	Contract Details	Test Summary	No. Blows	Penetration (mm)
Contract Name Contract No. Client Name	O'Devaney Gardens Phase 2 10009	Description: Black grey slightly sandy slightly gravelly SILT/CLAY	- 0 m	16.7
Engineer	Sample Details	Moisture Content (%) 9.1	4 0	13.2 8.2
BH/TP No.	BH 15	% Passing 20mm Sieve 88.5	4 8 12 8	4
Deptn (m) Sample Type	3 D 3246	Moisture Condition Value	2 4 6	
		Comments	32 48 64 100	
•	2 3	4 6 8 12 16 24	32	90
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0	0 2 4	6 8 10 12 14 MCV Value	16	18
		- Test Plot MCV Values		

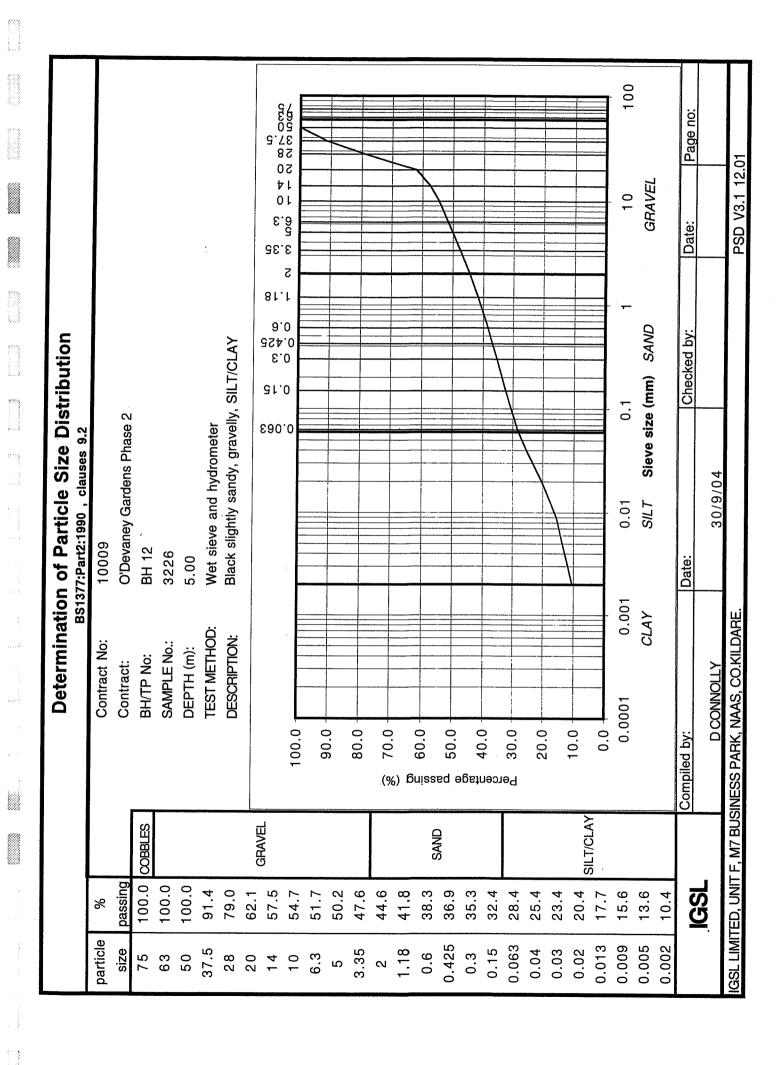
	Moisture Condition	n Value Te	Value Test Report Sheet	heet		1.G.S.L.
	Contract Details		Test Summary		No. Blows	Penetration
Contract Name Contract No. Client Name Engineer	O'Devaney Gardens Phase 2 10009	Description: Brown slightly sandy slightly gravelly CLAY	ly gravelly CLAY		- 0 o 4	17.6 16.9 13
	Sample Details	Moisture Content (%)		12.8	· (O (4
BH/TP No.	BH 14	% Passing 20mm Sieve		64.7	∞ <mark>1</mark> 2	
Sample Type	2 0 2038	Moisture Condition Value		7.5	16 24 6	
	0 2 7 2 7 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Comments			32 64 00	
		No. of Blows	Blows			
L C	2 3	4 6 8	12 16	24 32	48	64 96
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T 0	2 4	8 8	10 12 MCV Value	41	9	18
	—■——Test	est Plot No. of Blows	s5mm line	- MCV Values		

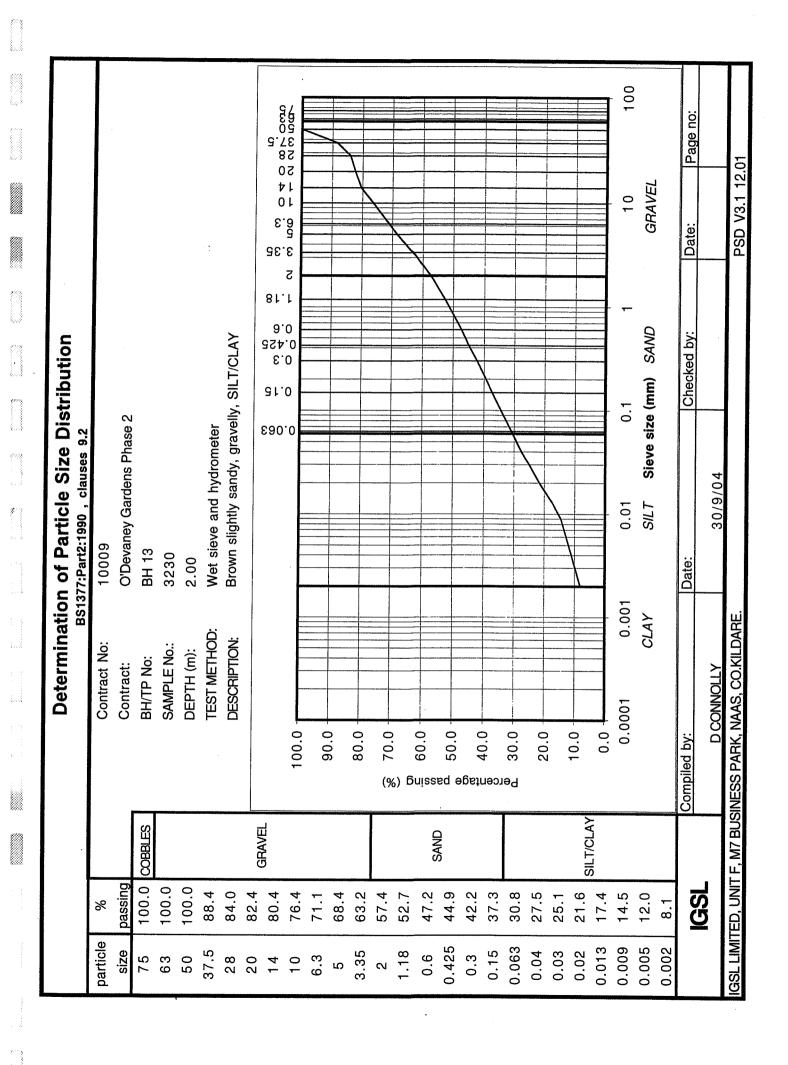
1.G.S.L.	Penetration	(mm) 17 16.5 17.2	12.8 10	7.5				96							
	NS							64						- 8	
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				- · · · · · · · · · · · · · · · · · · ·				32			•				Se
heet			10.7	84.4	10.0			24		 				4-	MCV Values
rt S								16						2	:
} Sepo	Test Summary	CLAY						12 1						12	-5mm line
n Value Test Report Sheet	Test S	Description: Brown slightly sandy gravelly SILT/CLAY			_		No. of Blows	****		 				10 MCV Value	NS
e Te		sandy gra	ent (%)	nm Sieve	tion Value		No. o	∞							-No. of Blows
Valu		Description: Brown slightly	Moisture Content (%)	% Passing 20mm Sieve	Moisture Condition Value	Comments		9				7		8	
ion		Desc Brow	Mois	%	Moist	Comr		4			—			9	-Test Plot
ndit		lse 2						က		1					
OC e		rdens Pha		BH 13	D 3230									4	
Moisture Conditio	t Details	O'Devaney Gardens Phase 2 10009	Details			<u>.</u>		2						2	
Moi	Contract Details	O'Devar 10009	Sample Details					The state of the s			T as standard and an array of the standard and array of the standard array o				
		Contract Name Contract No. Client Name Engineer		No.	Sample Type Sample Reference			25	O C	(mm) 15	noitstan		o	0	
		Contract Nan Contract No. Client Name Engineer		BH/TP No.	Sample										

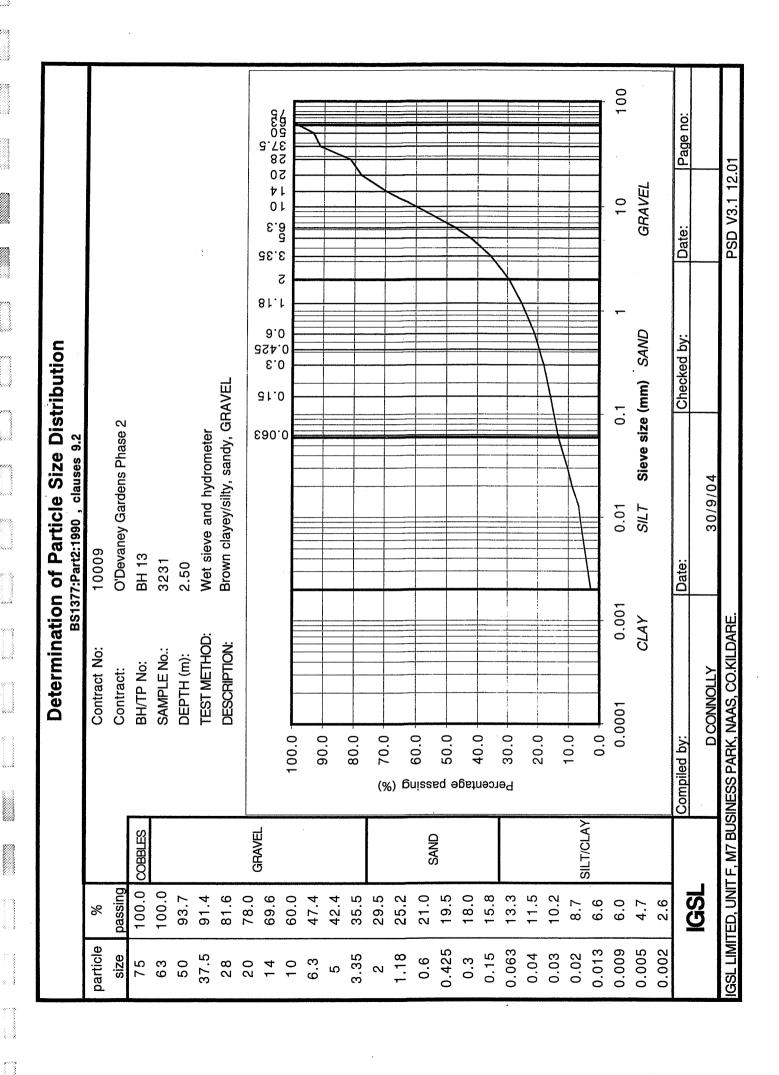
	Moisture Conditio	Moisture Condition Value Test Report Sheet	i	1.G.S.L.
		lest Summary	No. Blows	Penetration (mm)
Contract Name Contract No. Client Name	O'Devaney Gardens Phase 2 10009	Description: Grey slightly sandy slightly gravelly CLAY	- a m	20 19
Engineer	Sample Details	Moisture Content (%) 8.1	4 9	16.3 12.4
BH/TP No.	BH 12	% Passing 20mm Sieve 84	12.	10.2 .
Sample Type	9 D	Moisture Condition Value	16 24	ന
	6776	Comments	32 48 64 64	
		No. of Blows		
, c	2 3 4	9	32 48	64 96
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	2 4 6	8 10 12 14 MCV Value	16	18
		- Test Plot No. of Blows 5mm line MCV Values	န	

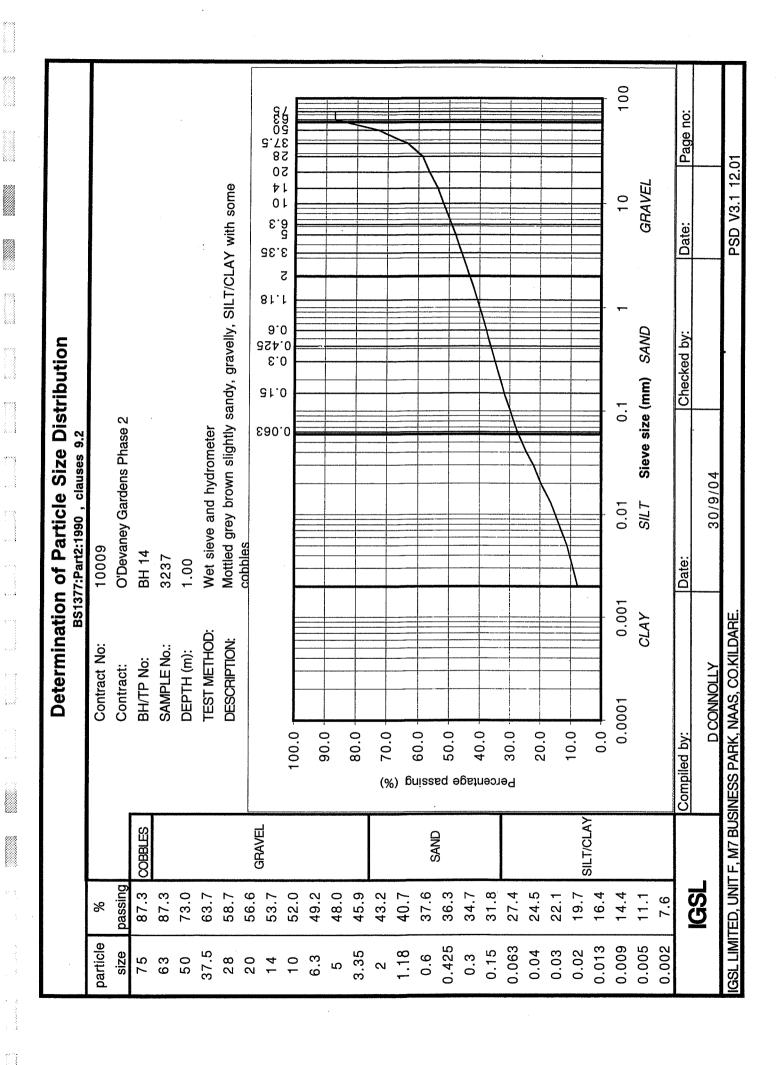
REPORT NO.		SULF	SULPHATE ANALYSIS	ALYSIS					IGSL
CONTRACT:	O'Devaney	O'Devaney Gardens Phase 2	lase 2					CONTRACT NO	10009
BH/TP	DEPTH	SAMPLE	SAMPLE	TEST	%	SULPHUR	SULPHURTRIOXIDE	(so3 X 1.2)	표
O	∑	Ö	IJ À	ш 88	Passing 2mm	WATER SO3	TOTAL SOIL so3 %	TOTAL	VALUE
BH 12	2.10	3224	Q	ဟ	37.7		0.037	0.044	8.2
BH 14	4.00	3240	۵	တ	55.3		0.209	0.251	7.5
BH 15	3.00	3247	۵	တ	60.1		0.218	0.262	7.7
TEST CODE:	W = WATER	TER	S = SOIL	A = AQUEC	A = AQUEOUS SOIL EXTRACT(2:1)	TRACT(2:1)			

(30) (3)

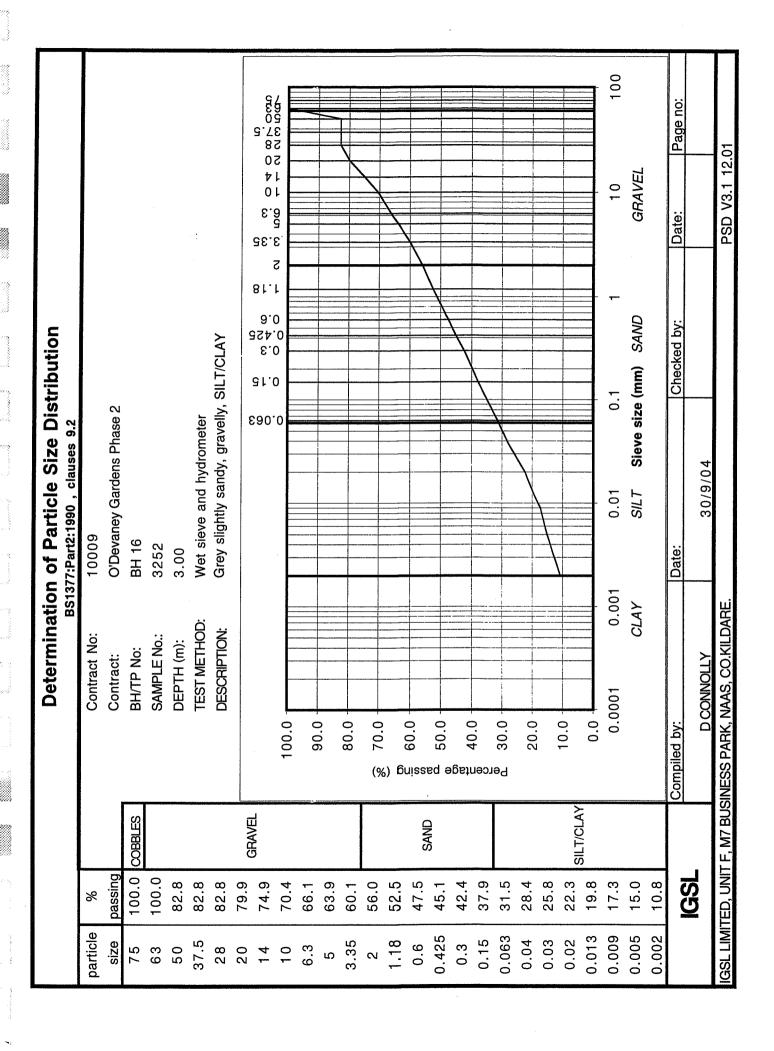








100 28. 37.5 50 63 7 Page no: PSD V3.1 12.01 50 GRAVE ħ١ 10 5.8 Date: Black grey clayey/silty, sandy, GRAVEL with many cobbles 3.36 5 81.1 Sieve size (mm) SAND 9.0 Checked by: 924.0 Determination of Particle Size Distribution 8.0 31.0 O'Devaney Gardens Phase 2 £90.0 Wet sieve and hydrometer BS1377:Part2:1990, clauses 9.2 30/9/04 SILT 0.01 10009 Date: BH 14 3241 5.00 0.001 CLAY IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. TEST METHOD: DESCRIPTION: Contract No: SAMPLE No.: DEPTH (m): **DCONNOLLY** BH/TP No: Contract: 0.0001 0.0 30.0 10.0 20.0 50.0 40.0 0.06 80.0 70.0 0.09 Compiled by: 100.0 Percentage passing SILT/CLAY GRAVEL SAND COBBLES 12.0 10.4 28.8 25.0 20.6 17.7 15.5 12.9 9.7 9.9 5.2 3.6 passing 33.5 19.1 9.1 38.2 58.6 53.9 48.2 76.0 72.2 69.8 63.7 41.1 76.1 0.009 0.005 0.425 0.063 0.013 particle 0.15 0.04 0.03 0.02 2 1.18 0.6 0.3 3.35 20 14 10 6.3 28 50



Report No.			CALIFORNIA BEARING RATIO	<u>0</u> .						9.	1.G.S.L	
Contract:		O'Dev	O'Devaney Gardens Phase 2	DATE		30/9/04	0.4			CONTRACT No 10009	CT NO	10009
	Sample	Depth		Water	Test	Water Content	ontent			Ŭ	C.B.R.	
Location	o.	of Sample	Sample Description	Content %	t Code	Top %	Bottom %	Bulk Density.	% Passing	Top %		Average %
BH 13	3229	1.00	Brown slightly sandy slightly gravelly CLAY	80.	L/St	8.7	ø. ø	2.07	91.1	33.4	23.5	28.5
BH 14	3237	1.00	Mottled grey brown slightly sandy gravelly SILT/CLAY	11.5	L/St	11.5	11.6	2.18	56.6	17.0	10.7	13.8
BH 15	3244	1.00	with some copples Brown slightly sandy slightly gravelly SILT/CLAY	10.7	L/St	11.5	9.7	2.21	81.8	13.7	12.3	13.0
Test Code:	UUndisturbed Sample DDynamic Compaction StStatic compaction	thed Sami Compaction	ple L2.5Kg. Rammer A/55% Air Voids Ratio V stion H4.5Kg. Rammer A1010% Air Voids Ratio M RN29 Road Note 29 (St. 95% H.)	Ratio Is Ratio Note 29 (St.	V M 95% H.)	V Vibrating Hammer M Method Number H.)	Hammer Iumber		-			

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Appendix IV

Laboratory Test Records (Environmental)



Leaders in Environmental Testing

Mr Keogh
IRISH GEOTECHNICAL SURVEYS
Unit F
M7 Business Park
Naas
Co Kildare
Ireland

11 November 2004

Test Report: TH/24

TH/248933/2004

Dear Mr Keogh,

Analysis of your sample(s) submitted on 29/09/2004 is now complete and we have pleasure in enclosing the appropriate test report(s).

Should you have any query on the report(s) or any part of our service we will be happy to discuss your requirements.

An invoice for the analysis carried out will be sent under separate cover.

Thank you for using STL and we look forward to receiving your next samples.

To arrange a container delivery or sample collection please ring the direct line to **COURIERS on 024 7685 6562.**

Yours Sincerely,

Signed: Rell

Name: J. Fell

Title: Section Manager







Report Summary





Mr Darren Keogh IRISH GEOTECHNICAL SURVEYS LTD Unit F M7 Business Park Naas Co Kildare

Report Number: TH/248933/2004

Issue 1

Job Description:

Ireland

Irish Geotechnical Surveys Ltd

Job Location:

O Devant Gardens St Brcins Hosp.

Number of Samples

included in report 1 Job Received:

29 September 2004

included in report

Number of test results

24

Analysis Commenced: 30 September 2004

Luquede

Name: H. Quick

Date:

11 November 2004

Title:

Senior Coordinator

STL was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory

Certificate of Analysis







Sample

of

Laboratory Number:

424210

Report Number:

TH/248933/2004

Issue

IRISH GEOTECHNICAL SURVEYS LTD

Sample Source:

Sample Point Description: Irish Geotechnical Surveys

Sample Description:

BH 12 3222

Sample Date: 28 September 2004 Sample Received: 29 September 2004 Analysis Complete: 10 November 2004

Test Description	Result	Units	Accreditation	Method
Antimony, Total as Sb	<0.001	mg/l	С	WAS016
Arsenic , Total as As	0.009	mg/l	С	WAS014
Barium, Total as Ba	0.009	mg/l	С	WAS049
Cadmium , Total as Cd	<0.0005	mg/l	С	WAS049
Chromium , Total as Cr	<0.005	mg/l	С	WAS049
Copper, Total as Cu	<0.005	mg/l	С	WAS049
Lead , Total as Pb	<0.005	mg/l	С	WAS049
Mercury , Total as Hg	<0.1	ug/l	С	WAS013
Molybdenum , Total as Mo	<0.005	mg/l	С	WAS049
Nickel , Total as Ni	<0.005	mg/l	С	WAS049
Selenium , Total as Se	<0.001	mg/l	С	WAS015
Zinc, Total as Zn	0.006	mg/l	С	WAS049
Fluoride as F	0.3	mg/l	С	WAS029
NRA Leachate	Analyst Comment		* C	PREP
Chloride as Cl	3	mg/l	С	WAS036
Sulphate as SO4	<5	mg/l	С	WAS036
Solids, Total diss.at 180c	142	mg/l	* C	WAS010
TOC (Filtered)	6.7	mg/l	С	WAS005
Naphthols BG 2.6/3.0	<0.1	mg/l	* L	PHOHBGW2
Phenol BG 2.6/3.0	< 0.50	ug/l	* L	PHOHBG2.4
Cresols BG 2.6/3.0	< 0.50	ug/l	* L	PHOHBG2.4
Total Phenols BG 2.6/3.0	< 2.5	ug/l	* L	PHOHBG2.4
Trimethylphenol BG 2.6/3.0	< 0.50	ug/l	* L	PHOHBG2.4
Xylenols&EthylphenolsBG2.6/3.0	0.67	ug/l	* L	PHOHBG2.4

Analyst Comment for 424210: NRA Leachate performed on this sample.

Accreditation Codes:

* = Not UKAS accredited B = Analysed at Bridgend C = Analysed at STL Coventry R = Analysed at Runcorn S = Sub-contracted

L = Analysed at STL CAS

For Microbiological determinands 0 or ND = Not Detected, DET = Detected

Signed: fuquede

Name: H. Quick

Date:

11 November 2004

Title:

Senior Coordinator

Report Summary





Mr Darren Keogh IRISH GEOTECHNICAL SURVEYS LTD Unit F M7 Business Park Naas Co Kildare Ireland

Report Number: TH/248936/2004

Issue 1

Job Description:

Irish Geotechnical Surveys Ltd

Job Location:

O Devant Gardens St Bricins Hosp.

Number of Samples

1

Job Received:

29 September 2004

included in report

Number of test results

44

Analysis Commenced: 30 September 2004

included in report

Signed:

Name: J. Fell

Date:

15 October 2004

Title:

Production Manager

STL was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory

Certificate of Analysis





Sample

Laboratory Number:

424220

1

Report Number:

TH /248936/2004

Sample Source:

IRISH GEOTECHNICAL SURVEYS LTD

Sample Point Description: Irish Geotechnical Surveys

Sample Description:

BH12 3222

Sample Date: 28 September 2004 Sample Received: 29 September 2004 Analysis Complete: 13 October 2004

Test Description	Result	Units	Accreditation	Wethod
Antimony as Sb, dry weight	2.5	mg/kg	L	30C
Arsenic as As, dry weight	13	mg/kg	L	30/30C
Barium as Ba, dry wt.	60	mg/kg	L	52
Cadmium as Cd, dry weight	2.4	mg/kg	L	30
Chromium as Cr, dry weight	14	mg/kg	L	30
Copper as Cu, dry weight	43	mg/kg	L	30
Lead as Pb, dry weight	47	mg/kg	L	30
Mercury as Hg, dry weight	< 0.20	mg/kg	L	30C
Molybdenum as Mo, dry weight	3.5	mg/kg	L	52
Nickel as Ni, dry weight	44	mg/kg	L	30
Selenium as Se, dry weight	0.75	mg/kg	L	30C
Zinc as Zn, dry weight	120	mg/kg	L	30
Sulphate as SO4, water sol dw	< 120	mg/kg	L	46
Total organic carbon	17000	mg/kg	L	36
PCB28	< 1.0	ug/kg	С	312
PCB52	< 1.0	ug/kg	С	312
PCB101	< 1.0	ug/kg	С	312
PCB118	< 1.0	ug/kg	С	312
PCB138	< 1.0	ug/kg	С	312
PCB153	< 1.0	ug/kg	c	312
PCB180	< 1.0	ug/kg	c	312
TPH >C6-C8	< 5.0	mg/kg	С	314
TPH >C8-C10	< 5.0	mg/kg	С	314
TPH >C10-G46	< 10	mg/kg	С	314
TPH >C16-C24	26	mg/kg	С	314
TPH >C24-C40	69	mg/kg	С	314
TPH >C6-C40	95	mg/kg	С	314
Naphthalene	< 0.50	mg/kg	c	313
Acenaphthylene	< 0.50	mg/kg	С	313
Acenaphthene	< 0.50	mg/kg	С	313
Fluorene	< 0.50	mg/kg	С	313
Phenanthrene	< 0.50	mg/kg	С	313
Anthracene	< 0.50	mg/kg	c	313
Fluoranthene	1.4	mg/kg	С	313
Pyrene	1.2	mg/kg	С	313
Benzo(a)anthracene	0.60	mg/kg	С	313
Chrysene	0.73	mg/kg	С	313
Benzo(b)fluoranthene	0.75	mg/kg	С	313
Benzo(k)fluoranthene	0.71	mg/kg	С	313
Benzo(a)pyrene	0.61	mg/kg	С	313

Certificate of Analysis







Sample

of

Laboratory Number:

424220

Report Number:

TH /248936/2004

Issue

Sample Source:

IRISH GEOTECHNICAL SURVEYS LTD

Sample Point Description: Irish Geotechnical Surveys

Sample Description:

BH12 3222

Sample Date: 28 September 2004 Sample Received: 29 September 2004 Analysis Complete: 13 October 2004

Test Description	Result	Units	Accreditation	Wethod
Indeno(123cd)pyrene	< 0.50	mg/kg	С	313
Dibenzo(ah)anthracene	< 0.50	mg/kg	С	313
Benzo(ghi)perylene	< 0.50	mg/kg	С	313
PAH total	5.9	mg/kg	С	313

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L = Analysed at STL CAS

For Microbiological determinands 0 or ND = Not Detected, DET = Detected

Signed: Kell

Name:

J. Fell

Date:

15 October 2004

Title:

Production Manager

Appendix V – Site Plan

IGSL Ltd

Site Investigation Specialists & **Geotechnical Consultants** On-Site Testing Facilities, Concrete, Soils & Tarmacadam Testing

Unit F,

M7 Business Park

Naas,

Co. Kildare,

Republic of Ireland.

Phone No.

045 846176 / 846180

Int. Phone

(Int. Access + 353 45 846180)

Fax. No.

045 846187

E.Mail No.

johnclancy@igsl.ie

Web Site

www.igsl.ie ILAB Accreditation No. 133T

FACSIMILE COVER SHEET

To

Stephen Bradley

Company

Arup

Phone No.

Fax. No.

01 - 6683169

From

John Clancy 28.10.04

Date No. of Pages

26

Contract:

O'Devaney Gardens Phase 2

Message:

Stephen,

Enclosed please find the completed report text and corehole logs.

Report has been dispatched by courier.

Regards