Large Scale Residential Development at Dunboyne North, Co. Meath

CHAPTER 5 Land, Soils & Geology

Appendix 5.1 Ground Investigation Reports 2022 and 2023
Appendix 5.2 Environmental Soil Sample Results

August 2023

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 5.1 Ground Investigation Reports 2022 and 2023

August 2023

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

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Ground Investigations Ireland

SI Dunboyne

Paul McGrail

Ground Investigation Report

February 2022

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DOCUMENT CONTROL SHEET

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Engineer	Paul McGrail
Client	Glenveagh Homes
Project No	11412-02-22
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APPENDICES

1.0 Preamble

On the instructions of Paul McGrail Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between February and April 2022 at the site of the proposed residential development adjacent to the M3 Parkway.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 5 No. Trial Pits to a maximum depth of 4.50m BGL
- Carry out 5 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 1 No. Cable Percussion borehole to a maximum depth of 5.00m BGL
- Installation of 1 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a 8T tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 4 of this Report.

3.4. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.
The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.
Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60º cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 3 of this Report.

3.5. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.6. Groundwater Monitoring Installations

A Groundwater Monitoring Installation was installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.7. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Chemical testing as required by the specification, including pH and sulphate testing was carried out by Prosoils Laboratory in the UK.
Geotechnical testing consisting of moisture content, Atterberg limits, and Particle Size Distribution (PSD) tests were carried out in Prosoils Geotechnical Laboratory in Hexthorpe.
The results of the laboratory testing are included in Appendix 5 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally comprised;

- Topsoil
- Cohesive Deposits

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.45m BGL.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil and were described typically as *grey/brown sandy gravelly CLAY with occasional cobbles and boulders* overlying a *stiff dark grey sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.40m BGL in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible digging was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, a standpipe were installed in BH01 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 6 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 18% and 42% generally with fines contents of 29 to 55%.

4.3.1. Chemical Laboratory Testing

The pH testing carried out indicate that pH results are near neutral.

The results from the completed laboratory testing are included in Appendix 5 of this report.

5.0 Recommendations & Conclusions

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Foundations

An allowable bearing capacity of 150 kN/m^2 is recommended for conventional strip or pad foundations on the stiff cohesive deposits at a depth of 1.10m to 2.00m BGL.

5.3. Soakaway Design

At all the locations the water level dropped too slowly to allow calculation of 'f' the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan

Legend

- Borehole
- Trial Pit

Client:

PAUL McGRAIL CONSULTING ENGINEERS

Project Code:

11412-01-22

Project Title:

Site Investigations Dunboyne

Drawing Title:

SI Locations

RECEIVED: 21/09/2023

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0 20 40 60 m

Drawn By:	Date:
SK	17/02/2022

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
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Site	Trial Pit Number
SI Dunboyne	TP01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
	3.80 x 0.40 x 4.50m		Glenveagh	11412-01-22
	Location	**Dates**	**Engineer**	**Sheet**
		11/02/2022	Paul McGrail	1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly gravelly TOPSOIL		
					0.40			
0.50	B					Firm to stiff grey brown slightly sandy slightly gravelly CLAY with occasional angular cobbles		
					(1.60)			
1.50	B							
					2.00			
			Slow seepage(1) at 2.10m.			Stiff dark grey slightly sandy slightly gravelly CLAY with some subangular to angular cobbles		▽1
2.50	B							
					(2.50)			
3.50	B							

Plan

Remarks

Trial Pit spalling from 2.50m BGL
Slow groundwater encountered from 2.10m BGL as slow seepage
Soakaway test conducted at 2.50m BGL, on 10/02/22
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP01

Ground Investigations Ireland Ltd
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Site	Trial Pit Number
SI Dunboyne	TP01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
	3.80 x 0.40 x 4.50m		Glenveagh	11412-01-22
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					4.50 (4.50)	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP01

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Site SI Dunboyne			**Trial Pit Number** TP02
Machine : 4.5T Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.70 x 0.40 x 4.50m	**Ground Level (mOD)**	**Client** Glenveagh
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22
			Sheet 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.45)	Brown slightly gravelly TOPSOIL		
					0.45	Firm grey/brown slightly sandy gravelly CLAY		
			Slow seepage(1) at 1.00m.		(0.70)			▽1
					1.15	Firm to stiff grey brown slightly sandy slightly gravelly CLAY with occasional angular cobbles		
					(0.55)			
					1.70	Stiff dark grey slightly sandy slightly gravelly CLAY with some subangular to angular cobbles		
					(2.80)			

Plan

Remarks

Trial Pit stable
Slow groundwater encountered from 1.00m BGL as slow seepage
Soakaway test conducted at 2.50m BGL, on 10/02/22
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP02

Ground Investigations Ireland Ltd
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Site SI Dunboyne			**Trial Pit Number** TP02
Machine : 4.5T Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.70 x 0.40 x 4.50m	**Ground Level (mOD)**	**Client** Glenveagh
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22
			Sheet 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP02

Ground Investigations Ireland Ltd
www.gii.ie

Site SI Dunboyne			**Trial Pit Number** TP03
Machine : 4.5T Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.70 x 0.40 x 4.50m	**Ground Level (mOD)**	**Client** Glenveagh
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22
			Sheet 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly gravelly TOPSOIL		
					0.40	Firm grey/brown slightly sandy gravelly CLAY		
					(1.00)			
					1.40	Stiff dark grey slightly sandy slightly gravelly CLAY with some subangular to angular cobbles		
					(3.10)			

Plan

Remarks

Trial Pit stable
No groundwater encountered
Soakaway test conducted at 2.50m BGL, on 10/02/22
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP03

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www.gii.ie

Site SI Dunboyne			**Trial Pit Number** TP03
Machine : 4.5T Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.70 x 0.40 x 4.50m	**Ground Level (mOD)**	**Client** Glenveagh
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22
			Sheet 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP03

Ground Investigations Ireland Ltd
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Site SI Dunboyne			**Trial Pit Number** TP04
Machine : 4.5T Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.60 x 0.40 x 4.50m	**Ground Level (mOD)**	**Client** Glenveagh
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22
			Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.45)	Brown slightly gravelly TOPSOIL		
0.50	B				0.45	Firm grey slightly sandy gravelly CLAY		
					(0.65)			
					1.10	Stiff dark grey slightly sandy slightly gravelly CLAY with some subangular to angular cobbles		
1.50	B							
			Fast ingress(1) at 2.00m.					▽1
					(2.40)			
					3.50	Terminated at 3.50m		

Plan

Remarks

Trial Pit continual collapse from surface
Groundwater encountered at 2.00m BGL as fast ingress
No soakaway test conducted due to Pit instability
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP04

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Site SI Dunboyne			**Trial Pit Number** TP05
Machine : 4.5T Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.70 x 0.40 x 4.50m	**Ground Level (mOD)**	**Client** Glenveagh
	Location	**Dates** 11/02/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22
			Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly gravelly TOPSOIL		
0.50	B				0.40	Firm to stiff grey/brown slightly sandy gravelly CLAY		
					(1.30)			
1.50	B				1.70	Stiff dark grey slightly sandy slightly gravelly CLAY with some subangular to angular cobbles		
2.50	B				(2.30)			
3.50	B				4.00			

Plan

Remarks

Trial Pit stable
No groundwater encountered
Soakaway test conducted at 2.50m BGL, on 10/02/22
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	SK	11412-01-22.TP05

Site Investigations Dunboyne – Trial Pit Photographs

TP01

Site Investigations Dunboyne – Trial Pit Photographs

TP02

Site Investigations Dunboyne – Trial Pit Photographs

TP03

Site Investigations Dunboyne – Trial Pit Photographs

TP04

Site Investigations Dunboyne – Trial Pit Photographs

TP05

APPENDIX 3 – Soakaway Records

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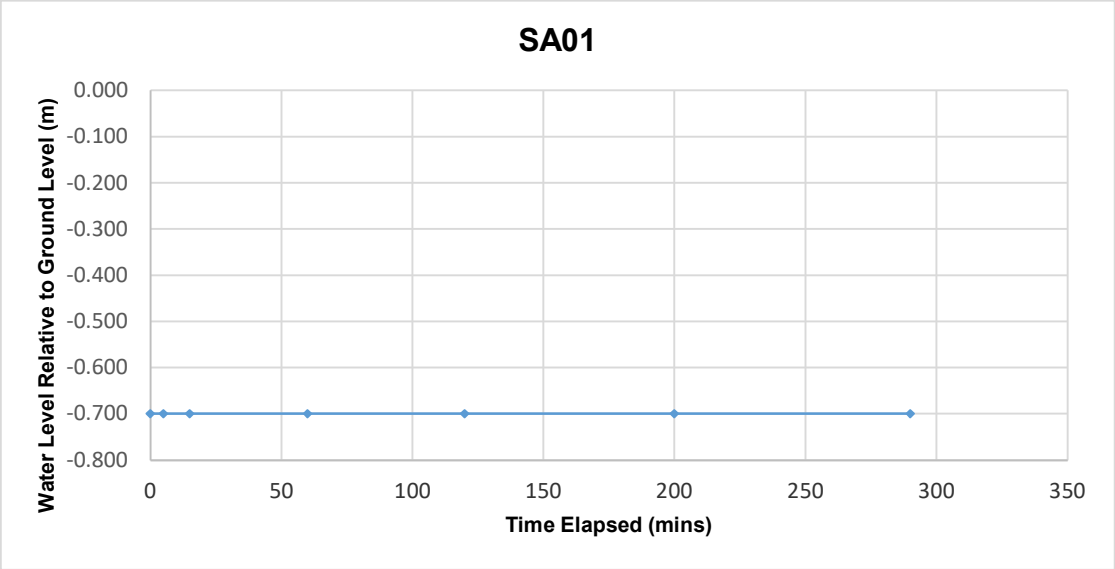
SA01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.0m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)
11/02/2022	0	-0.700
11/02/2022	5	-0.700
11/02/2022	15	-0.700
11/02/2022	60	-0.700
11/02/2022	120	-0.700
11/02/2022	200	-0.700
11/02/2022	290	-0.700

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.70	2.500	1.800	1.15	2.05



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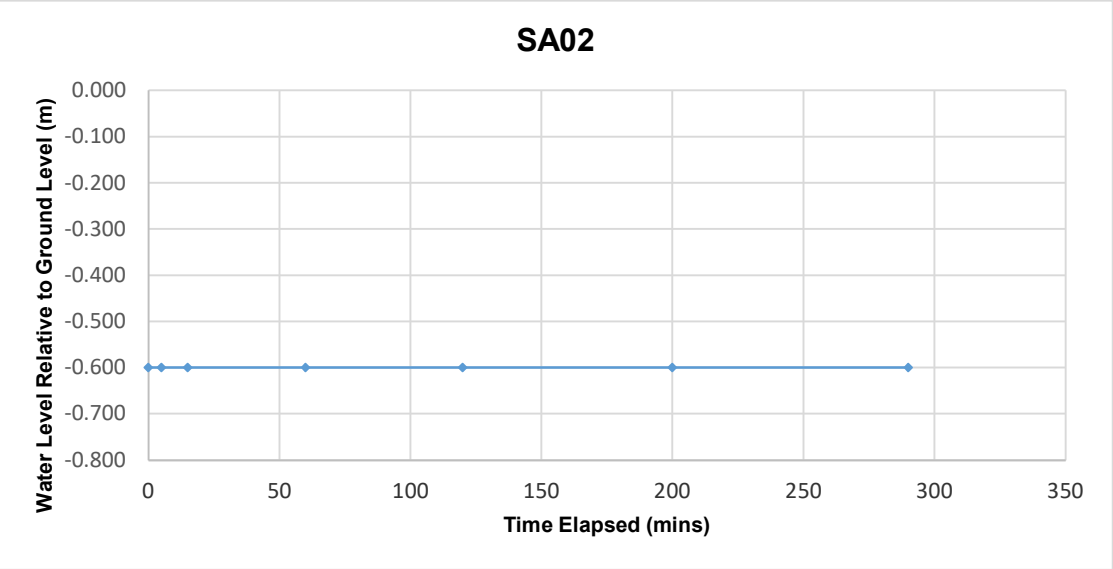
SA02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.00m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)
11/02/2022	0	-0.600
11/02/2022	5	-0.600
11/02/2022	15	-0.600
11/02/2022	60	-0.600
11/02/2022	120	-0.600
11/02/2022	200	-0.600
11/02/2022	290	-0.600

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.70	2.500	1.800	1.15	2.05



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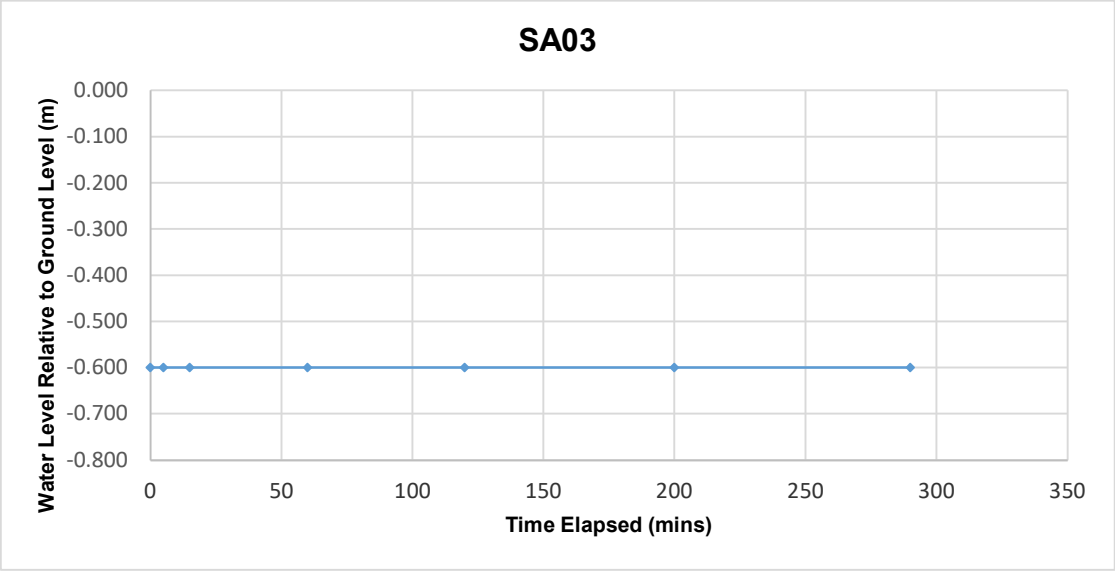
SA03

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.80m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)
11/02/2022	0	-0.600
11/02/2022	5	-0.600
11/02/2022	15	-0.600
11/02/2022	60	-0.600
11/02/2022	120	-0.600
11/02/2022	200	-0.600
11/02/2022	290	-0.600

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.70	2.500	1.800	1.15	2.05



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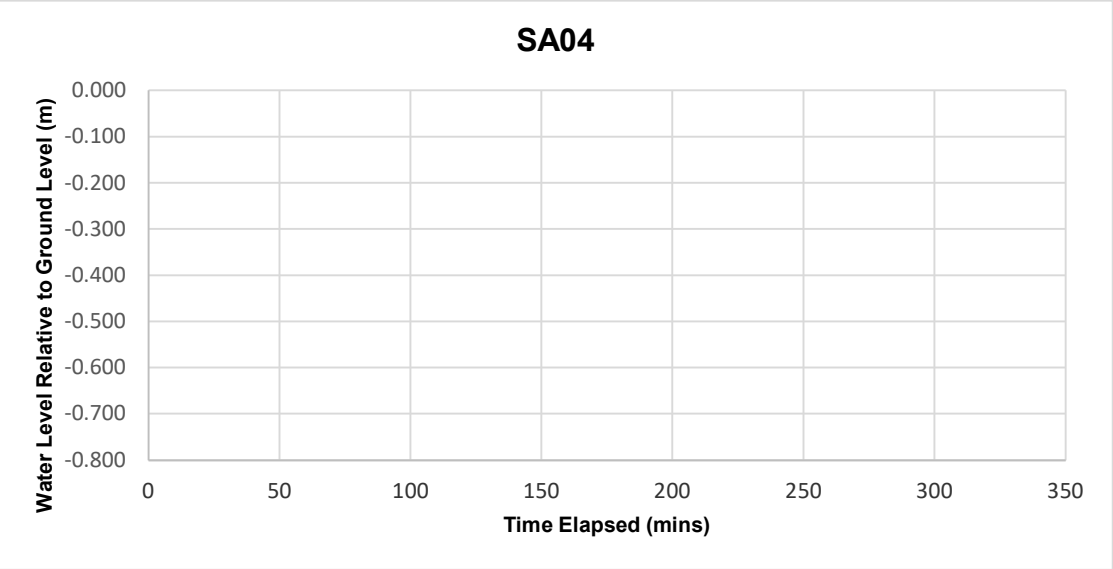
SA04

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.80m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)

Pit too dangerous to fill

Start depth	Depth of Pit	Diff	75% full	25%full
0.70	2.500	1.800	1.15	2.05



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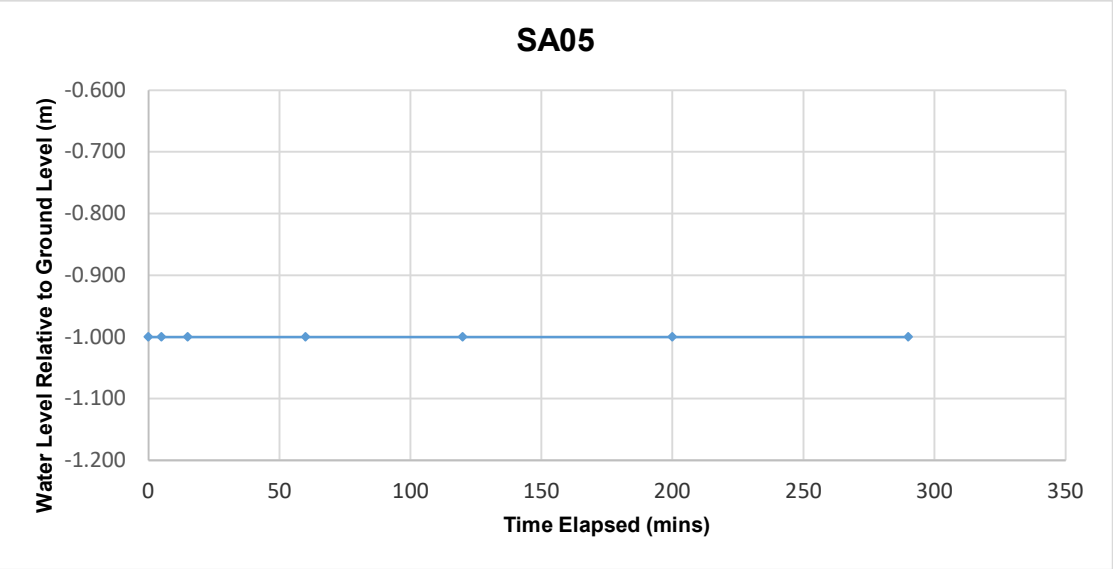
SA05

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.90m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)
11/02/2022	0	-1.000
11/02/2022	5	-1.000
11/02/2022	15	-1.000
11/02/2022	60	-1.000
11/02/2022	120	-1.000
11/02/2022	200	-1.000
11/02/2022	290	-1.000

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.70	2.500	1.800	1.15	2.05



APPENDIX 4 - Cable Percussion Borehole Records

Ground Investigations Ireland Ltd
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Site SI Dunboyne			**Borehole Number** BH01
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 0.20m to 5.00m	**Ground Level (mOD)**	**Client** Glenveagh
	Location 701524.1 E 743429.9 N	**Dates** 08/04/2022	**Engineer** Paul McGrail
			Job Number 11412-01-22 **Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.40) 0.40	TOPSOIL			
							Firm to stiff brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles			
1.00-1.45 1.00	SPT(C) N=14 B			5,2/4,3,3,4		(1.40)				
						1.80	Very stiff dark grey slightly sandy gravelly CLAY with occasional subangular to to subrounded cobbles and boulders.			
2.00-2.38 2.00	SPT(C) 50/230 B			6,8/10,12,20,8						
3.00-3.33 3.00	SPT(C) 50/180 B			5,11/10,19,21		(3.10)				
4.00-4.24 4.00	SPT(C) 50/90 B			19,21/25,25						
4.90 5.00-5.00	B SPT(C) 50*/0			50/		4.90 5.00	Very stiff brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse			
							Complete at 5.00m			

Remarks
No groundwater encountered during driling
Borehole backfilled upon completion
Cable percussion complete at 5.00m BGL
Slotted standpipe installed from 5.00m BGL to 1.00m BGL with a pea gravel surround with a plain standpipe installed from 1.00m BGL to GL with a bentonite seal and raised cover
Chiselling from 5.00m to 5.00m for 1 hour.

Scale (approx)	Logged By
1:50	NG

Figure No. 11412-01-22.BH01

APPENDIX 5 – Laboratory Testing

LABORATORY REPORT

4043

Contract Number: PSL22/1282

Report Date: 24 March 2022

Client's Reference: 11412-01-22

Client Name: Ground Investigations Ireland Ltd
Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: Eoin Byrne

Contract Title: SI Dunboyne

Date Received: 17/2/2022
Date Commenced: 17/2/2022
Date Completed: 24/3/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)
R Berriman (Quality Manager)
S Royle (Laboratory Manager)

L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technician)
M Fennell (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
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tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP01		B	0.50		Brown slightly sandy gravelly CLAY with cobbles.
TP01		B	1.50		Brown slightly sandy gravelly CLAY.
TP04		B	0.50		Brown slightly sandy gravelly CLAY.
TP05		B	0.50		Brown slightly sandy slightly gravelly CLAY.

UKAS TESTING
4043

PSL
Professional Soils Laboratory

SI Dunboyne

Contract No:
PSL22/1282
Client Ref:
11412-01-22

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP01		B	0.50		12			32	15	17	40	Low Plasticity CL
TP01		B	1.50		16			30	15	15	48	Low Plasticity CL
TP04		B	0.50		15			36	21	15	48	Intermediate Plasticity CI
TP05		B	0.50		29			47	24	23	68	Intermediate Plasticity CI

SYMBOLS : NP : Non Plastic * : Liquid Limit and Plastic Limit Wet Sieved.

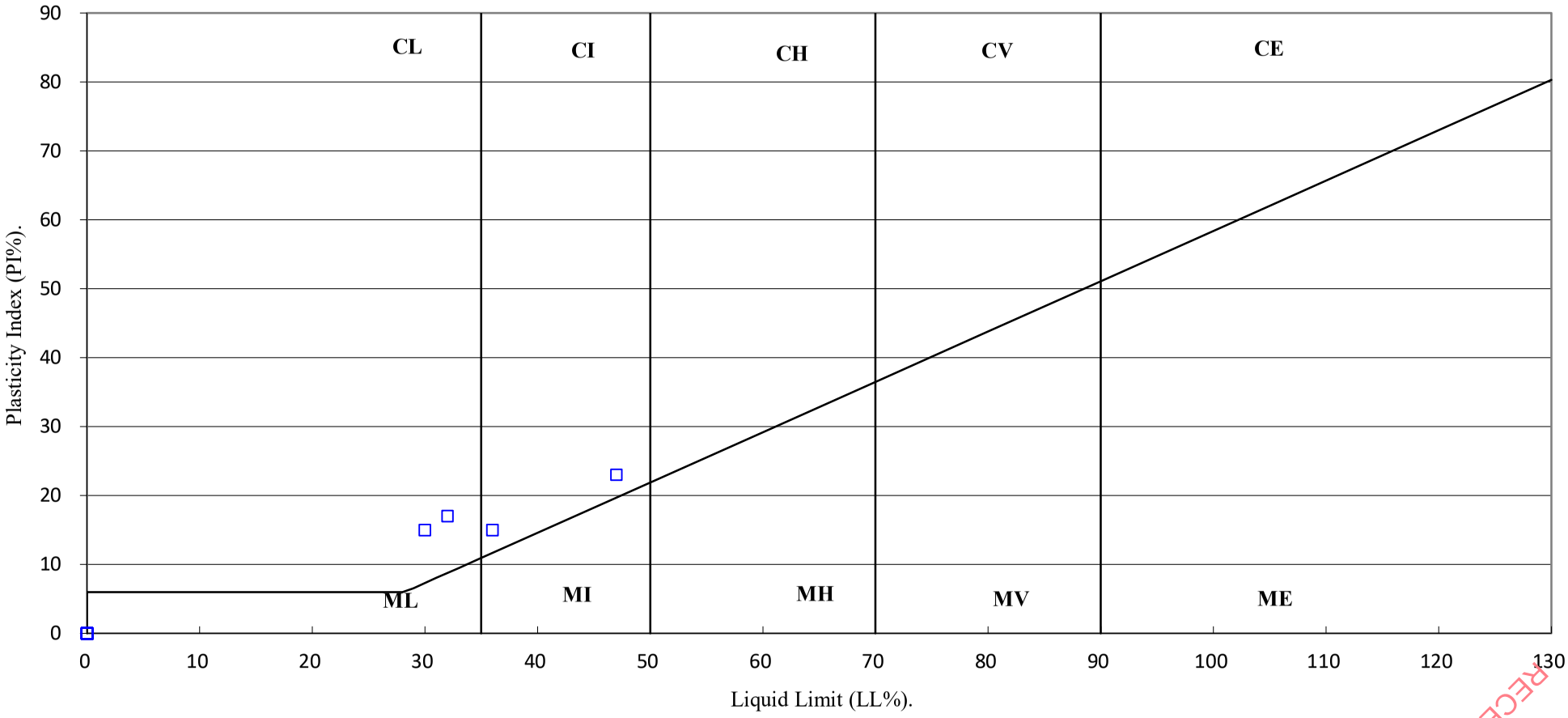
UKAS TESTING 4043

PSL Professional Soils Laboratory

SI Dunboyne

Contract No:
PSL22/1282
Client Ref:
11412-01-22

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	SI Dunboyne	Contract No: PSL22/1282
			Client Ref: 11412-01-22

PARTICLE SIZE DISTRIBUTION TEST

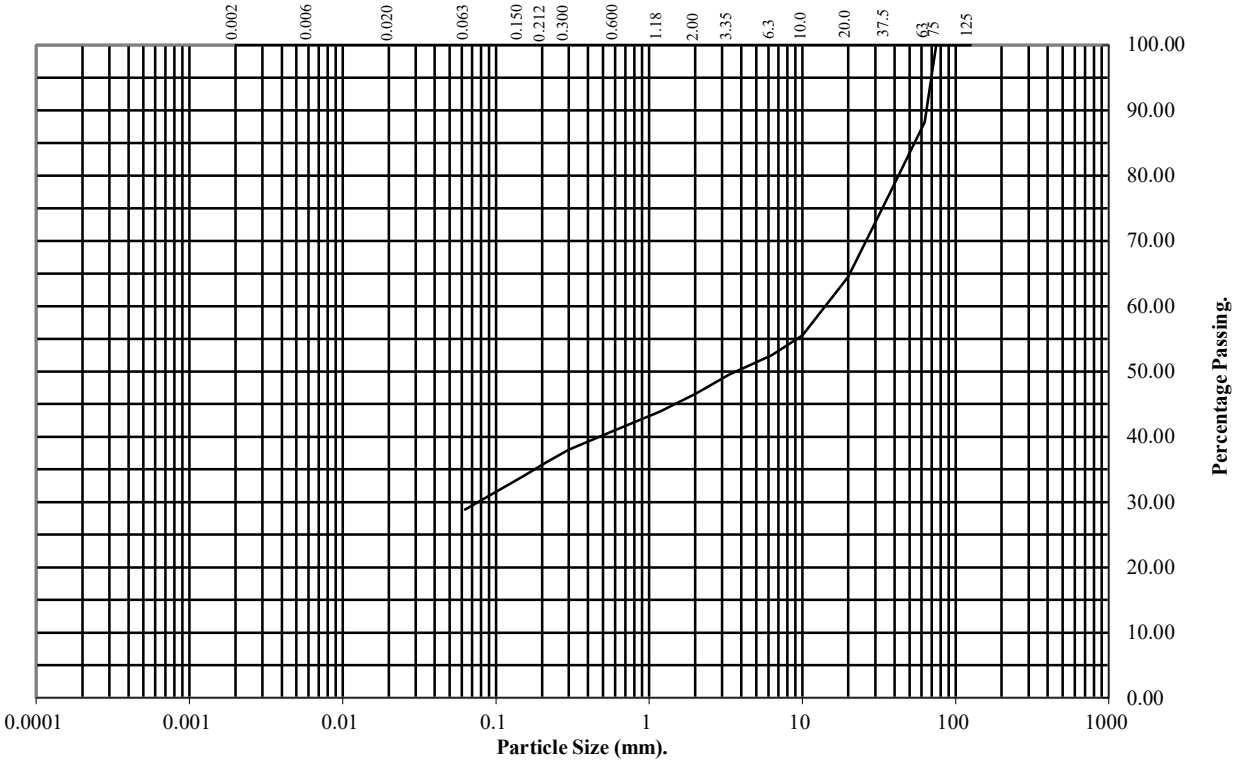
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP01 **Top Depth (m):** 0.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	88
37.5	77
20	65
10	56
6.3	52
3.35	50
2	47
1.18	44
0.6	41
0.3	38
0.212	36
0.15	34
0.063	29

Soil Fraction	Total Percentage
Cobbles	12
Gravel	41
Sand	18
Silt/Clay	29

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

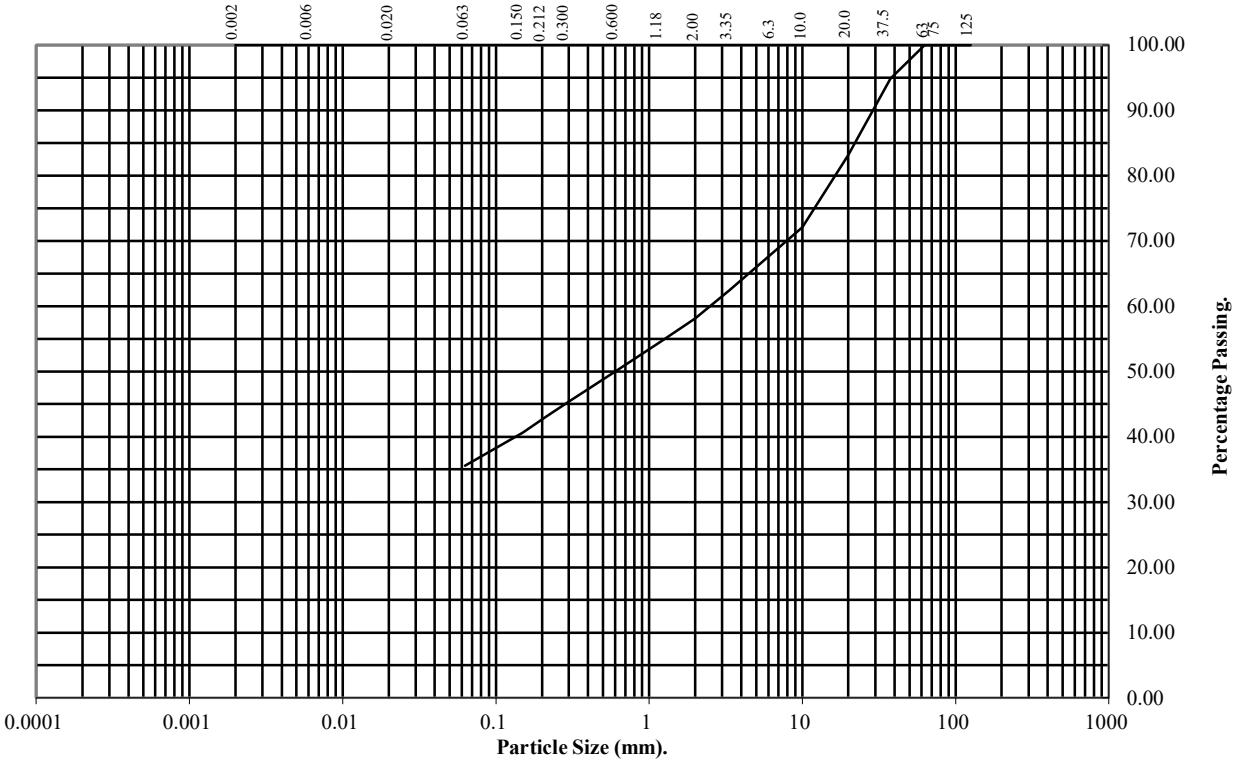
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP01 **Top Depth (m):** 1.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	83
10	72
6.3	68
3.35	62
2	58
1.18	54
0.6	50
0.3	45
0.212	43
0.15	41
0.063	36

Soil Fraction	Total Percentage
Cobbles	0
Gravel	42
Sand	22
Silt/Clay	36

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

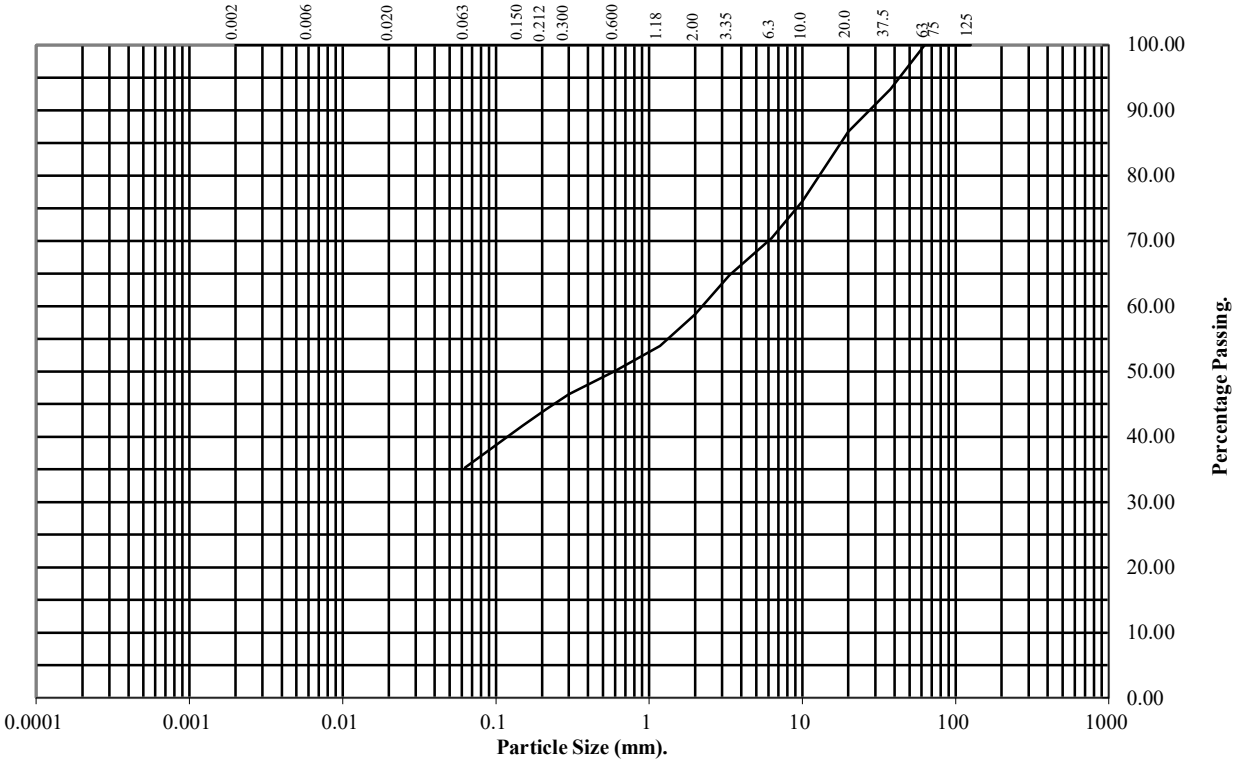
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP04 **Top Depth (m):** 0.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	93
20	87
10	76
6.3	70
3.35	65
2	59
1.18	54
0.6	50
0.3	46
0.212	44
0.15	42
0.063	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	24
Silt/Clay	35

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

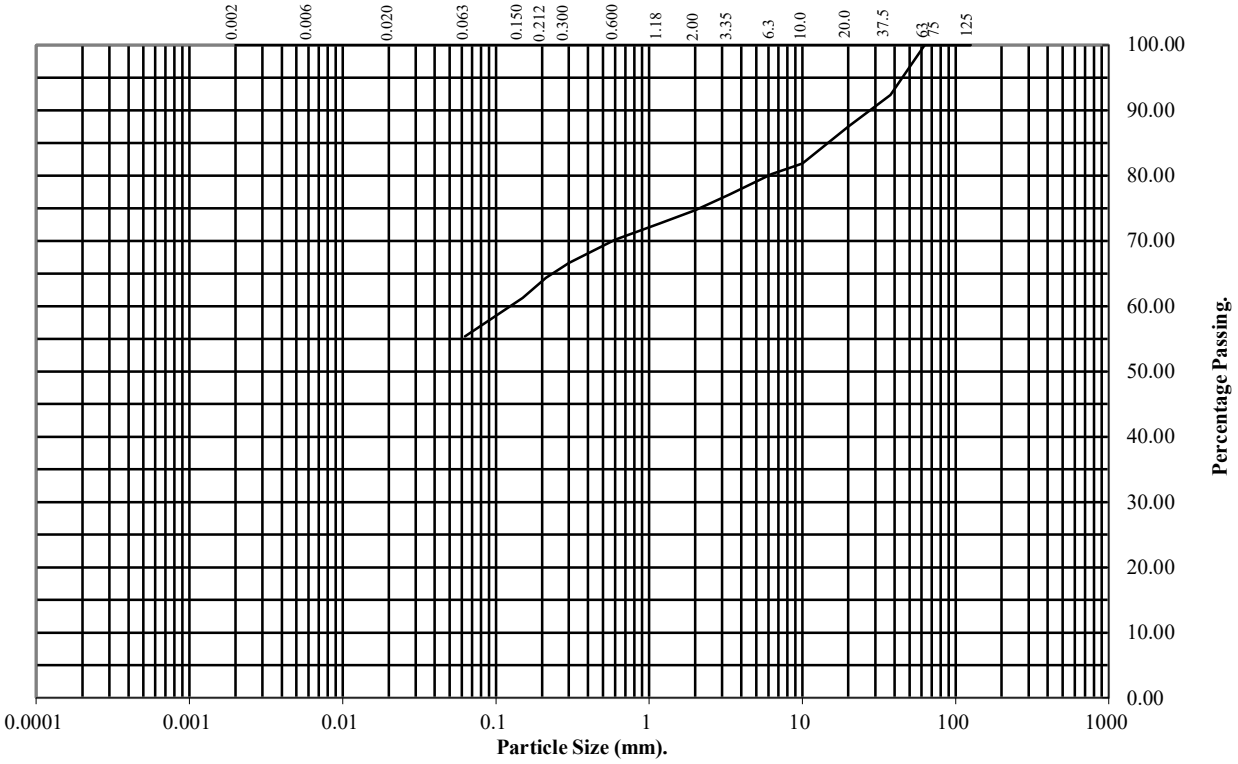
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP05 **Top Depth (m):** 0.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	87
10	82
6.3	80
3.35	77
2	75
1.18	73
0.6	70
0.3	67
0.212	64
0.15	61
0.063	55

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	20
Silt/Clay	55

Remarks:
See Summary of Soil Descriptions

UKAS TESTING
2531

CHEMTECH environmental

ANALYTICAL TEST REPORT

Contract no: 106807

Contract name: SI Dunboyne

Client reference: PSL22/1282

Clients name: Professional Soils Laboratory

Clients address: 5/7 Hexthorpe Road
Doncaster
DN4 0AR

Samples received: 08 March 2022

Analysis started: 08 March 2022

Analysis completed: 14 March 2022

Report issued: 14 March 2022

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing

Approved by: M. Harris

Megan Harris

Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			106807-1	106807-2	106807-3	106807-4
Sample id			TP01	TP01	TP04	TP05
Depth (m)			0.50	1.50	0.50	0.50
Sample Type			B	B	B	B
Date sampled			-	-	-	-
Test	**Method**	**Units**				
pH	CE004 [U]	units	8.6	8.5	8.4	8.4

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
106807-1	TP01	0.50	Y	All (NSD)
106807-2	TP01	1.50	Y	All (NSD)
106807-3	TP04	0.50	Y	All (NSD)
106807-4	TP05	0.50	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones, where applicable.

APPENDIX 6 – Groundwater Monitoring

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
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Web: www.gii.ie

Ground Investigations Ireland

Dunboyne LRD

Paul McGrail

Ground Investigation Report

August 2023

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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DOCUMENT CONTROL SHEET

Project Title	Dunboyne LRD
Client	Paul McGrail
Project No	12954-06-23
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	M Keating	S Kealy	S Kealy	Dublin	22 August 2023

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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Newcastle,
Co. Dublin.
D22 YD52

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Web: www.gii.ie

CONTENTS

APPENDICES

1.0 Preamble

On the instructions of Paul McGrail Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in July 2023 at the site of the proposed residential development.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The proposed construction is envisaged to consist of conventional or piled foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 3 No. Cable Percussion boreholes to a maximum depth of 6.30m BGL
- Installation of 3 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.
The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire

cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.
Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60º cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 2 of this Report.

3.3. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.4. Groundwater Installations

Groundwater Monitoring Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.5. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental & Chemical testing as required by the specification, including the Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.

Geotechnical testing consisting of moisture content, Atterberg limits and Particle Size Distribution (PSD) tests were carried out in NMTL's Geotechnical Laboratory in Carlow.
The results of the laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and generally comprised;

- Topsoil
- Cohesive Deposits

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.3m BGL.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil and were described typically as *brown sandy gravelly CLAY with occasional cobbles and boulders* overlying a *stiff to very stiff black/grey sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm or firm to stiff below 1.0m BGL becoming very stiff with depth in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content, where noted on the exploratory hole logs.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BH01, BH02 and BH03 to allow the equilibrium groundwater level to be determined. Monitoring of an existing well (BH04) was also carried out The groundwater monitoring is included in Appendix 4 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 17.7% and 47% generally with fines contents of 21 to 58.20%.

4.3.1. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

4.3.2. Environmental Laboratory Testing

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.

The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present or the previous site use or location indicate a risk of environmental variation. The waste classification report is included under the cover of a separate report by Ground Investigations Ireland. A waste classification report is recommended to be carried out to provide an interpretation of the laboratory data should any material be required to be disposed of off site.

The results from the completed laboratory testing are included in Appendix 3 of this report.

5.0 Recommendations & Conclusions

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Foundations

An allowable bearing capacity of 250 kN/m^2 for conventional strip or pad foundations on the very stiff cohesive deposits at a depth of 3.0m BGL.

The possibility for variation in the depth of the made ground and strength of the cohesive deposits in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

A ground bearing floor slab is recommended to be based on the firm or firm to stiff deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014 +A1:2016 and/or NRA SRW CL808 Type E granular stone fill. Where the depth of Made Ground/Soft deposits exceeds 0.9m then suspended floor slabs should be considered.

Due to the depth of the very stiff Cohesive deposits beneath the footprint of the proposed structure//high loading anticipated, piled foundations may be more economically advantageous for the proposed building. The type, size and depth of the pile foundations should be confirmed by a specialist piling contractor based on the loading from the proposed building. The floor slab is recommended be suspended and also supported on the building piles.
Should a piled solution be considered it would be prudent to carry out rotary coring to determine the depth to bedrock.

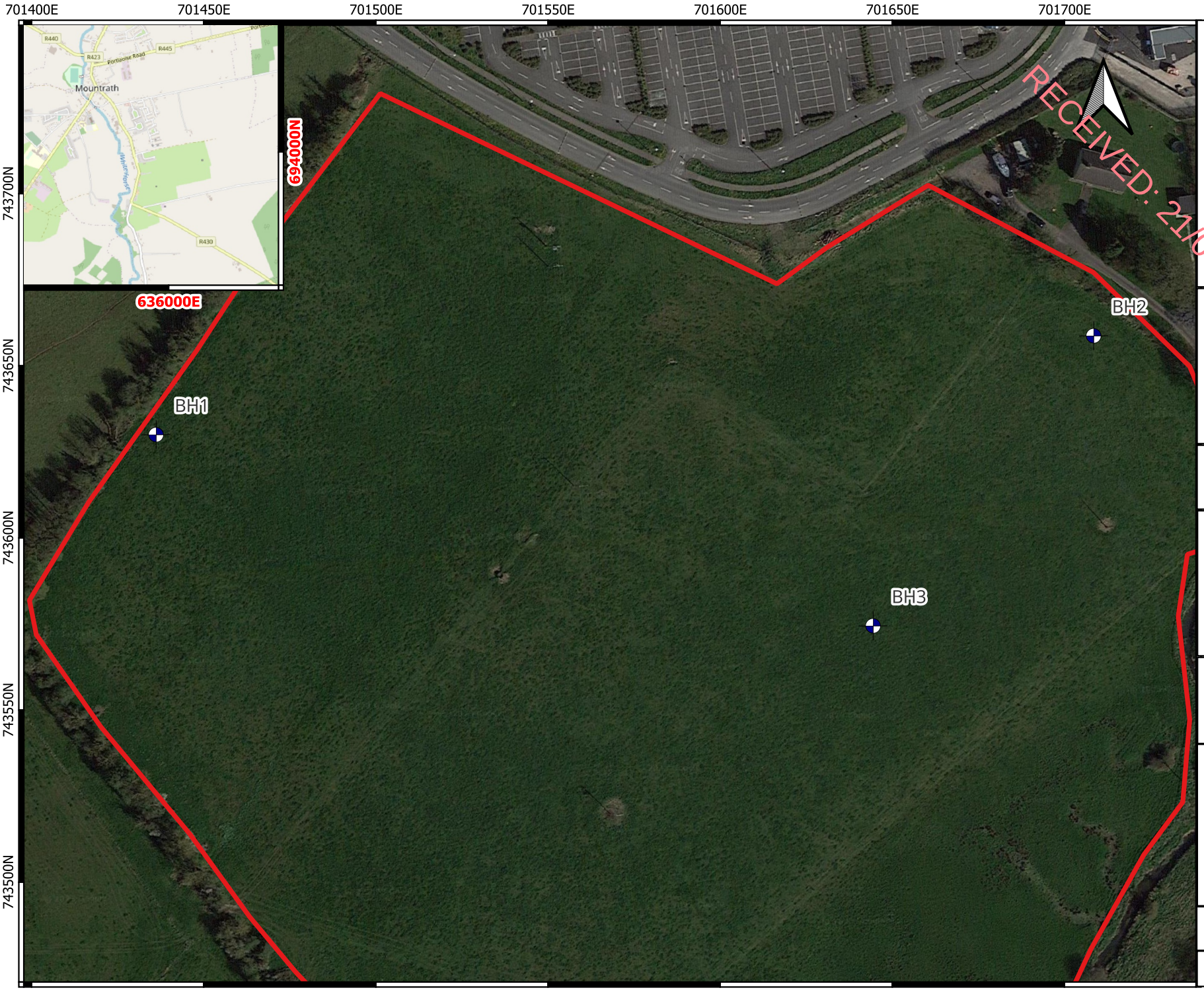
The pH and sulphate testing completed on samples recovered from the exploratory holes indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

5.3. Excavations

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan



Boreholes

Client:

PMG
PAUL McGRAIL
CONSULTING
ENGINEERS

Project Code:
12954-06-23

Project Title:
Dunboybe LRD

Drawing Title:
Appendix 1 - Site Location Plan

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 20 40 m

Drawn By:	Date:
SK	21/08/2023

APPENDIX 2 – Cable Percussion Borehole Records

Ground Investigations Ireland Ltd
www.gii.ie

Site Dunboyne LRD				**Borehole Number** BH01
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 6.00m	**Ground Level (mOD)** 72.20	**Client** Paul McGrail	**Job Number** 12954-06-23
	Location (Observed measurements) 701436.1 E 743629.7 N	**Dates** 17/07/2023	**Engineer** Paul McGrail	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					72.00	(0.20) 0.20	TOPSOIL			
0.50	B1					(0.80)	Brown slightly sandy slightly gravelly CLAY with occasional cobbles			
1.00-1.45 1.00	SPT(C) N=11 B2			1,2/2,3,3,3	71.20	1.00				
						(1.00)	Firm brown slightly sandy slightly gravelly CLAY with occasional cobbles			
2.00-2.45 2.00	SPT(C) N=31 B3			3,4/5,8,9,9	70.20	2.00				
3.00-3.45 3.00	SPT(C) N=55 B4			5,7/11,13,14,17			Very stiff black/dark grey slightly sandy gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse.			
						(3.60)				
4.00-4.40 4.00	SPT(C) 50/250 B5			7,10/13,17,20						
5.00-5.40 5.00	SPT(C) 50/250 B6			8,13/17,23,10						
					66.60 66.50	5.60 5.70	Obstruction - Possible Boulder or Bedrock Complete at 5.70m			

Remarks
Cable percussion drilling techniques carried out from ground level to 6.0 m bGL
Borehole terminated due to obstruction, possible boulders or bedrock
Chiselling from 5.40m to 5.70m for 1 hour.

Scale (approx)	Logged By
1:50	ED

Figure No. 12954-06-23.BH01

Ground Investigations Ireland Ltd
www.gii.ie

Site Dunboyne LRD			**Borehole Number** BH02
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 6.00m	**Ground Level (mOD)** 70.39	**Client** Paul McGrail
	Location (Observed measurements) 701708.4 E 743658.4 N	**Dates** 14/07/2023	**Engineer** Paul McGrail
			Job Number 12954-06-23
			Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					70.19	(0.20) 0.20	TOPSOIL			
0.50	B1					(0.80)	Brown slightly sandy gravelly CLAY			
1.00-1.45 1.00	SPT(C) N=12 B2			2,3/4,3,3,2	69.39	1.00	Firm to stiff brown slightly sandy gravelly CLAY			
2.00-2.45 2.00	SPT(C) N=12 B3			2,3/3,3,3,3		(1.90)				
3.00-3.45 3.00	SPT(C) N=36 B4			3,5/6,9,10,11	67.49	2.90	Stiff black slaightly sandy gravelly CLAY, Gravel is sub angular to sub rounded fine to coarse, low cobble content			
						(1.10)				
4.00-4.45 4.00	SPT(C) N=51 B5			5,9/13,17,21	66.39	4.00	Very stiff black slightly sandy Gravelly CLAY, Gravel is fine to coarse sub angular to sub rounded low cobble content			
5.00-5.45 5.00	SPT(C) N=50 B6			6,8/13,15,19,3		(1.90)				
					64.49	5.90	Obstruction - Possible Boulder or Bedrock			
6.00-6.45 6.00	SPT(C) N=50 B7			25,25/50	64.39	6.00	Complete at 6.00m			

Remarks
Cable percussion drilling techniques carried out from ground level to 6.0 m bGL
Borehole terminated due to obstruction, possible boulders or bedrock
Chiselling from 5.90m to 6.00m for 1 hour.

Scale (approx)	Logged By
1:50	JC

Figure No. 12954-06-23.BH02

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Site Dunboyne LRD			**Borehole Number** BH03
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 6.00m	**Ground Level (mOD)** 70.42	**Client** Paul McGrail
	Location 701644.4 E 743574.1 N	**Dates** 14/07/2023	**Engineer** Paul McGrail
			Job Number 12954-06-23
			Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					70.12	(0.30) 0.30	TOPSOIL			
0.50	B1					(0.70)	Brown to grey slightly sandy gravelly CLAY. Gravel is coarse to medium sub angular to sub rounded.			
1.00-1.45 1.00	SPT(C) N=8 B2			1,2/2,2,2,2	69.42	1.00	Firm brown to grey slightly sandy gravelly CLAY. Gravel is medium to coarse sub angular to sub rounded.			
2.00-2.45 2.00	SPT(C) N=10 B3			1,2/2,3,2,3 Water strike(1) at 2.10m, rose to 1.50m in 20 mins, sealed at 0.05m.		(2.00)			▼1 ▽1	
3.00-3.45 3.00	SPT(C) N=43 B4			4,6/7,11,11,14	67.42	3.00	Very stiff black/dark grey slightly sandy gravelly boulder CLAY. Gravel is fine to coarse with occasional cobbles			
4.00-4.45 4.00	SPT(C) N=59 B5			5,8/11,14,15,19		(2.90)				
5.00-5.45 5.00	SPT(C) N=50 B6			7,11/15,19,16						
6.00-6.45 6.00	SPT(C) N=50 B7			25,25/50	64.52 64.42	5.90 6.00	Obstruction - Possible Boulder or Bedrock Complete at 6.00m			

Remarks
Cable percussion techniques carried out from ground level to 6.0m bGL
Borehole terminated at 6.0m bGL due to obstruction - possible boulder or bedrock
Standpitp installed in borehole upon completion from 6.0m bGL with gravel surround andd plaine from 1.0m bGL to GL with Bentonite seal and flush cover.
Chiselling from 5.70m to 6.00m for 1 hour.

Scale (approx)	Logged By
1:50	JC

Figure No. 12954-06-23.BH03

APPENDIX 3 – Laboratory Testing

National Materials Testing Laboratory Ltd.

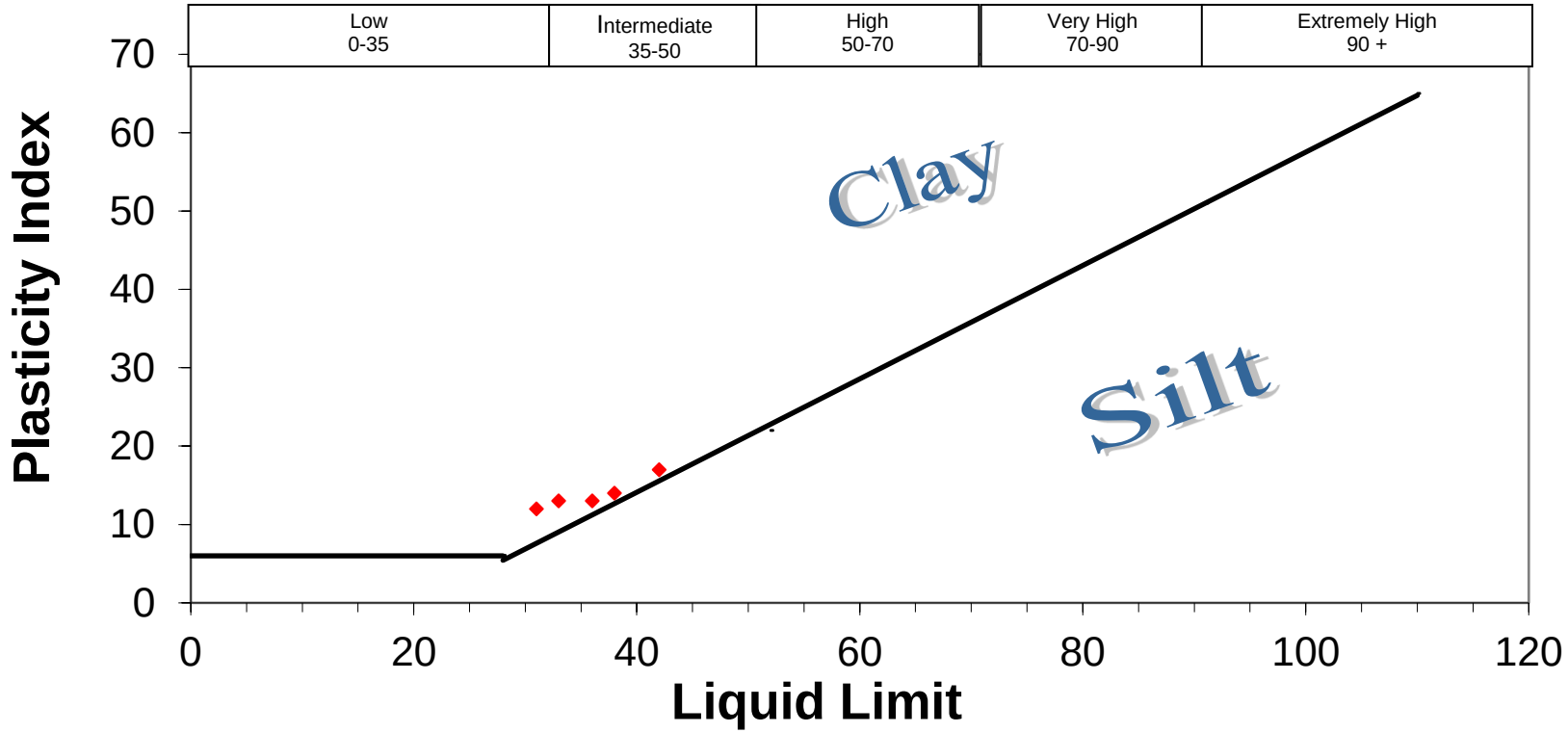
SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
BH01	0.50	B	14.7		39.8	33	20	13						
BH01	1.00	B	15.7		49.4	31	19	12						
BH02	1.00	B	15.9		37.4	36	23	13						
BH02	2.00	B	12.8		32.7	42	25	17						
BH03	1.00	B	17.7		71.6	38	24	14						

NMTL	Notes :	Job ref No.	NMTL 3646	GII Project ID: 12954-06-23
	1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Dunboyne LRD	

NMTL LTD
Unit 18c, Tullow Industrial Estate
Tullow
County Carlow
Tel: 00353 59 9180822
Mob: 00353 872575508
billa@nmtl.ie

Contract:	**Dunboyne LRD**		
Client:	**Ground Investigations Ireland Ltd**		
Engineer:	**Stephen Kealy**		
GII Project ID	**12954-06-23**		
Date:	**18/08/2023**		
Tested By:	**Js**	**Checked:**	**Bc**
Job ref No.	**NMTL 3646**		

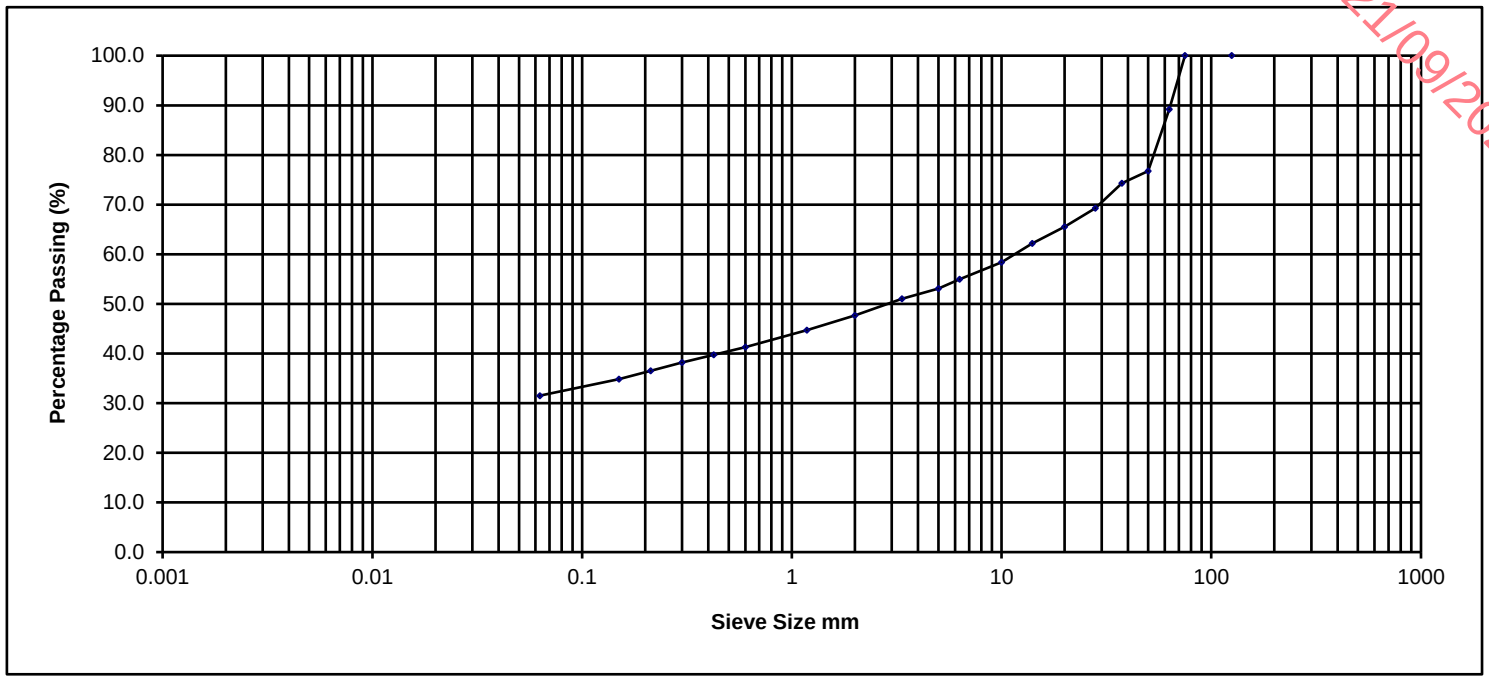


NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	89.2
50.000	76.8
37.500	74.3
28.000	69.3
20.000	65.5
14.000	62.2
10.000	58.4
6.300	55.0
5.000	53.1
3.350	51.0
2.000	47.7
1.180	44.7
0.600	41.3
0.425	39.8
0.300	38.2
0.212	36.5
0.150	34.8
0.063	31.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		31.5			16.2			41.5		10.8	0.0

Sample Description	Brown slightly sandy gravelly silty CLAY.			Project No.	NMTL 3646
				BH/TP No.	BH01
Project	Dunboyne LRD		GII PROJECT ID:12954-06-23	Sample No.	B
Operator Sb	Checked Nc	Approved Bc	Date sample tested 15/08/2023	Depth	0.50m

NMTL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	91.7
50.000	87.1
37.500	82.6
28.000	81.4
20.000	79.4
14.000	77.1
10.000	72.8
6.300	68.9
5.000	66.7
3.350	64.3
2.000	60.1
1.180	55.9
0.600	51.5
0.425	49.4
0.300	47.2
0.212	45.0
0.150	42.8
0.063	38.6

Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		38.6			21.5			31.6		8.3	0.0

Sample Description: Brown/grey slightly sandy slightly gravelly silty CLAY.

Project: Dunboyne LRD

GII PROJECT ID:12954-06-23

Project No.	NMTL 3646
BH/TP No.	BH01
Sample No.	B
Depth	1.00m

Operator	Sb	Checked	Nc	Approved	Bc	Date sample tested	15/08/2023

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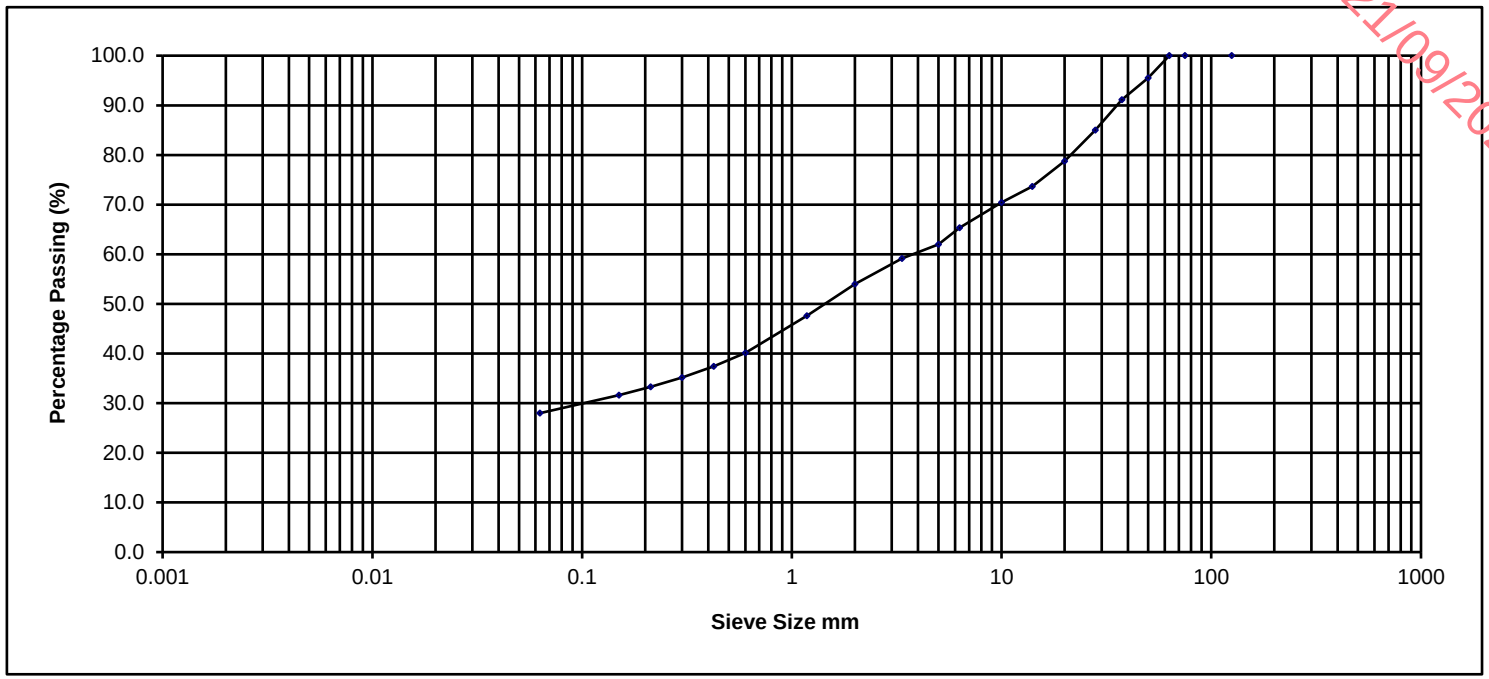
NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	95.5
37.500	91.2
28.000	85.0
20.000	78.7
14.000	73.7
10.000	70.4
6.300	65.3
5.000	62.0
3.350	59.2
2.000	54.0
1.180	47.6
0.600	40.2
0.425	37.4
0.300	35.2
0.212	33.3
0.150	31.6
0.063	28.0



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		28.0			26.0			46.0		0.0	0.0

Sample Description	Brown slightly sandy gravelly silty CLAY.			Project No.	NMTL 3646
				BH/TP No.	BH02
Project	Dunboyne LRD		GII PROJECT ID:12954-06-23	Sample No.	B
Operator Sb	Checked Nc	Approved Bc	Date sample tested 15/08/2023	Depth	1.00m

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Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	95.6
37.500	92.0
28.000	88.5
20.000	84.7
14.000	77.3
10.000	72.7
6.300	65.6
5.000	62.7
3.350	59.3
2.000	53.0
1.180	45.7
0.600	36.2
0.425	32.7
0.300	29.9
0.212	27.8
0.150	26.0
0.063	22.5

Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		22.5			30.5			47.0		0.0	0.0

Sample Description	Brown slightly sandy gravelly silty CLAY.			Project No.	NMTL 3646
				BH/TP No.	BH02
Project	Dunboyne LRD		GII PROJECT ID:12954-06-23	Sample No.	B
Operator Sb	Checked Nc	Approved Bc	Date sample tested 15/08/2023	Depth	2.00m

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Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	98.9
14.000	97.1
10.000	94.3
6.300	89.7
5.000	87.7
3.350	85.9
2.000	82.3
1.180	78.9
0.600	74.1
0.425	71.6
0.300	69.3
0.212	66.9
0.150	64.5
0.063	58.2

Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		58.2			24.1			17.7		0.0	0.0

Sample Description	Brown slightly gravelly slightly sandy silty CLAY.	Project No.	NMTL 3646
		BH/TP No.	BH03
Project	Dunboyne LRD GII PROJECT ID:12954-06-23	Sample No.	B
Operator Sb	Checked Nc Approved Bc Date sample tested 15/08/2023	Depth	1.00m

NM TL Ltd

Element Materials Technology
Unit 3 Deeside Point
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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8

Attention :	Stephen Kealy
Date :	10th August, 2023
Your reference :	12954-06-23
Our reference :	Test Report 23/12530 Batch 1
Location :	Dunboyne LRD
Date samples received :	28th July, 2023
Status :	Final Report
Issue :	1

Five samples were received for analysis on 28th July, 2023 of which five 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.

Authorised By:

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy
EMT Job No: 23/12530

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5	6-9	10	11						LOD/LOR	Units	Method No.
Sample ID	BH01	BH01	BH02	BH02	BH03								
Depth	0.50	1.00	1.00	2.00	1.00								
COC No / misc													
Containers	V J T	T	V J T	T	T								
Sample Date	27/07/2023	27/07/2023	27/07/2023	27/07/2023	27/07/2023								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	28/07/2023	28/07/2023	28/07/2023	28/07/2023	28/07/2023								
Antimony	2	-	1	-	-						<1	mg/kg	TM30/PM15
Arsenic #	11.2	-	9.5	-	-						<0.5	mg/kg	TM30/PM15
Barium #	85	-	61	-	-						<1	mg/kg	TM30/PM15
Cadmium #	2.3	-	1.9	-	-						<0.1	mg/kg	TM30/PM15
Chromium #	29.0	-	39.1	-	-						<0.5	mg/kg	TM30/PM15
Copper #	30	-	24	-	-						<1	mg/kg	TM30/PM15
Lead #	19	-	19	-	-						<5	mg/kg	TM30/PM15
Mercury #	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM30/PM15
Molybdenum #	4.7	-	5.1	-	-						<0.1	mg/kg	TM30/PM15
Nickel #	41.6	-	31.0	-	-						<0.7	mg/kg	TM30/PM15
Selenium #	<1	-	1	-	-						<1	mg/kg	TM30/PM15
Zinc #	87	-	87	-	-						<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	<0.03	-	-						<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	-	<0.05	-	-						<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	-	<0.03	-	-						<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	-	<0.03	-	-						<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	-	<0.03	-	-						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	-	<0.06	-	-						<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	-	<0.02	-	-						<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	-	<0.07	-	-						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
Coronene	<0.04	-	<0.04	-	-						<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	-	<0.22	-	-						<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	-	<0.64	-	-						<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	-	<0.05	-	-						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	-	<0.02	-	-						<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	-	<1	-	-						<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	105	-	110	-	-						<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	-	<30	-	-						<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy
EMT Job No: 23/12530

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5	6-9	10	11						LOD/LOR	Units	Method No.
Sample ID	BH01	BH01	BH02	BH02	BH03								
Depth	0.50	1.00	1.00	2.00	1.00								
COC No / misc													
Containers	V J T	T	V J T	T	T								
Sample Date	27/07/2023	27/07/2023	27/07/2023	27/07/2023	27/07/2023								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	28/07/2023	28/07/2023	28/07/2023	28/07/2023	28/07/2023								
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	-	<0.2	-	-						<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	-	<4	-	-						<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	-	<7	-	-						<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	-	<7	-	-						<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	-	<7	-	-						<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_CU_1D_AL)	<26	-	<26	-	-						<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	-	<10	-	-						<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	-	<10	-	-						<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	-	<0.2	-	-						<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	-	<4	-	-						<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	-	<7	-	-						<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	-	<7	-	-						<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	<7	-	<7	-	-						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_CU_1D_AR)	<26	-	<26	-	-						<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	-	<52	-	-						<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	-	<0.1	-	-						<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	-	<10	-	-						<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	-	<10	-	-						<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	-	<5	-	-						<5	ug/kg	TM36/PM12
Benzene#	<5	-	<5	-	-						<5	ug/kg	TM36/PM12
Toluene#	<5	-	<5	-	-						<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	-	<5	-	-						<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	-	<5	-	-						<5	ug/kg	TM36/PM12
o-Xylene#	<5	-	<5	-	-						<5	ug/kg	TM36/PM12
PCB 28#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
PCB 52#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
PCB 101#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
PCB 118#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
PCB 138#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
PCB 153#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
PCB 180#	<5	-	<5	-	-						<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	-	<35	-	-						<35	ug/kg	TM17/PM8

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy
EMT Job No: 23/12530

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5	6-9	10	11						LOD/LOR	Units	Method No.
Sample ID	BH01	BH01	BH02	BH02	BH03								
Depth	0.50	1.00	1.00	2.00	1.00								
COC No / misc													
Containers	V J T	T	V J T	T	T								
Sample Date	27/07/2023	27/07/2023	27/07/2023	27/07/2023	27/07/2023								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	28/07/2023	28/07/2023	28/07/2023	28/07/2023	28/07/2023								
Natural Moisture Content	17.7	-	19.0	-	-						<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	15.1	-	16.0	-	-						<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	-	<0.3	-	-						<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0247	0.0274	0.0275	0.0150	0.0076						<0.0015	g/l	TM38/PM20
Chromium III	29.0	-	39.1	-	-						<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.74	-	0.62	-	-						<0.02	%	TM21/PM24
pH #	8.37	8.41	8.09	8.33	6.92						<0.01	pH units	TM73/PM11
Asbestos Type*	NAD	-	NAD	-	-							None	Subcontracted

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy
EMT Job No: 23/12530

Report : CEN 10:1 1 Batch

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	6-9									LOD/LOR	Units	Method No.
Sample ID	BH01	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	27/07/2023	27/07/2023											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	28/07/2023	28/07/2023											
Dissolved Antimony #	<0.002	<0.002									<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02									<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025									<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025									<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	0.004									<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	0.04									<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005									<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005									<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015									<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015									<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007									<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07									<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005									<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05									<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.012	0.011									<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.12	0.11									<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002									<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02									<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	0.003									<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03									<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003									<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03									<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001									<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001									<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01									<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1									<0.1	mg/kg	TM26/PM0
Fluoride	0.4	0.4									<0.3	mg/l	TM173/PM0
Fluoride	4	4									<3	mg/kg	TM173/PM0
Sulphate as SO4 #	0.9	7.9									<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	9	79									<5	mg/kg	TM38/PM0
Mass of raw test portion	0.1048	0.1103										kg	NONE/PM17
Chloride #	<0.3	0.7									<0.3	mg/l	TM38/PM0
Chloride #	<3	7									<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09										kg	NONE/PM17
Dissolved Organic Carbon	<2	<2									<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20									<20	mg/kg	TM60/PM0
pH	7.97	8.01									<0.01	pH units	TM73/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy
EMT Job No: 23/12530

Report : CEN 10:1 1 Batch

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	6-9									LOD/LOR	Units	Method No.
Sample ID	BH01	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	27/07/2023	27/07/2023											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	28/07/2023	28/07/2023											
Total Dissolved Solids #	38	60									<35	mg/l	TM20/PM0
Total Dissolved Solids #	380	600									<350	mg/kg	TM20/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy
EMT Job No: 23/12530

Report : **EN12457_2**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	6-9									Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	BH01	BH02														
Depth	0.50	1.00														
COC No / misc																
Containers	V J T	V J T														
Sample Date	27/07/2023	27/07/2023														
Sample Type	Soil	Soil														
Batch Number	1	1														
Date of Receipt	28/07/2023	28/07/2023														
Solid Waste Analysis																
Total Organic Carbon #	0.74	0.62									3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025									6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035									1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30									500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22									-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64									100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025									0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	0.04									20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005									0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015									0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07									2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001									0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.12	0.11									0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02									0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05									0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02									0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03									0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03									4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	380	600									4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	<20									500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1048	0.1103									-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	85.8	81.4									-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.885	0.879									-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	16.6	22.9									-	-	-	<0.1	%	PM4/PM0
pH #	8.37	8.09									-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1									1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	4									10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	9	79									1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	7									800	15000	25000	<3	mg/kg	TM38/PM0

All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
23/12530	1	BH01	0.50	1-4	No interpretation possible
23/12530	1	BH02	1.00	6-9	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 12954-06-23
Location: Dunboyne LRD
Contact: Stephen Kealy

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 23/12530						

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

EMT Job No.: 23/12530

SOILS and ASH

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. Asbestos samples are retained for 6 months.

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. Limits of detection for analyses carried out on as received samples are not moisture content corrected. 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. Ash samples are dried at 37°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.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

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.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

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

ISO17025 accreditation applies to surface water and groundwater and usually 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.

STACK EMISSIONS

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 for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

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

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

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.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

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 requirement of our Accreditation Body 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.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
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.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology 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

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 23/12530

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	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 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of 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 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners 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
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes

EMT Job No: 23/12530

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 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
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes

EMT Job No: 23/12530

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. 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
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 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	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	
Subcontracted	See attached subcontractor report for accreditation status and provider.					AR	

APPENDIX 4 – Groundwater Monitoring

Ground Investigations Ireland Ltd
www.gii.ie

Site	Borehole Number
Dunboyne LRD	BH01

Installation Type	Dimensions	Client	Job Number
		Paul McGrail	12954-06-23

Location	Ground Level (mOD)	Engineer	Sheet
701436.1 E 743629.7 N	72.20	Paul McGrail	1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description
			71.20	1.00	Cement/Bentonite Grout
			66.50	5.70	Slotted Standpipe

Groundwater Strikes During Drilling

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

Groundwater Observations During Drilling

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

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks
18/07/23	15:00	DRY		

Remarks

Ground Investigations Ireland Ltd
www.gii.ie

Site	Borehole Number
Dunboyne LRD	BH02

Installation Type	Dimensions	Client	Job Number
		Paul McGrail	12954-06-23

Location	Ground Level (mOD)	Engineer	Sheet
701708.4 E 743658.4 N	70.39	Paul McGrail	1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description
			69.39	1.00	Cement/Bentonite Grout
			64.39	6.00	Slotted Standpipe

Groundwater Strikes During Drilling

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

Groundwater Observations During Drilling

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

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A]			Remarks
	Time	Depth (m)	Level (mOD)	
18/07/23	15:10	1.74	68.65	

Remarks

Ground Investigations Ireland Ltd
www.gii.ie

Site	Borehole Number
Dunboyne LRD	BH03

Installation Type	Dimensions	Client	Job Number
Standpipe	Internal Diameter of Tube [A] = 50 mm Internal Diameter of Tube [B] = 50 mm	Paul McGrail	12954-06-23

Location	Ground Level (mOD)	Engineer	Sheet
701644.4 E 743574.1 N	70.42	Paul McGrail	1/1

Legend	Water	Instr (A) (B)	Level (mOD)	Depth (m)	Description
			69.42	1.00	Cement/Bentonite Grout
	▼1				
	▽1				
			64.42	6.00	Slotted Standpipe

Groundwater Strikes During Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)
		2.10						1.50	0.05

Groundwater Observations During Drilling

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

Instrument Groundwater Observations

Inst. [A] Type : Slotted Standpipe **Inst. [B] Type :** Standpipe

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Instrument [B] Time	Instrument [B] Depth (m)	Instrument [B] Level (mOD)	Remarks
18/07/23	15:15	1.46	68.96				

Remarks
Raised cover

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

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Web: www.gii.ie

GROUNDWATER MONITORING

Dunboyne LRD

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
BH4 (Pre-existing SP)	18/07/2023	15:25	0.88	

Appendix 5.2 Environmental Soil Sample Results

August 2023

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Ref: 12954-06-23
Project Title: Dunboyne LRD
Project Site: Dunboyne LRD
Client:
Appendix 5.2 - Table 1: Soil Characterisation: Human Health Screening for Residential Landuse with consumption of home-grown vegetables (1% SOM)

			EMT Sample No.	1-4	5	6-9	10	11
			Sample ID	BH01	BH01	BH02	BH02	BH03
			Depth (m)	0.50	1.00	1.00	2.00	1.00
			Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Date	27/07/2023	27/07/2023	27/02/2023	27/07/2023	27/07/2023
			Batch Number	1	1	1	1	1
			Containers	VJT	T	VJT	T	T
			Date of Receipt	28/07/2023	28/07/2023	28/07/2023	28/07/2023	28/07/2023
Parameter	**Units**	**LOD/LOR**	**GENERIC ASSESSMENT CRITERIA (Soil Screening Values) (mg/kg)**					
Asbestos Type	-	-	-	NAD	-	NAD	-	-
Natural Moisture Content	%	<0.1	-	17.7	-	19.0	-	-
Moisture (% wet weight)	%	<0.1	-	15.1	-	16	-	-
pH	pH	<0.01	-	8.37	8.41	8.09	8.33	6.92
Sulphate (2:1 Water Soluble) as SO4	g/l	<1.5	-	0.0247	0.0247	0.0275	0.0150	0.0076
Hexavalent Chromium	mg/kg	-	3.62	<0.3	-	<0.3	-	-
Chromium III	mg/kg	-	14300	29	-	39	-	-
Total Organic Carbon	%	-	-	1	-	1	-	-
Antimony	mg/kg	<1	141	2	-	1	-	-
Arsenic	mg/kg	<0.5	37	11.2	-	9.5	-	-
Barium	mg/kg	<1	56.8	**85**	-	**61**	-	-
Cadmium	mg/kg	<0.1	22.1	2.3	-	1.9	-	-
Chromium	mg/kg	<0.5	-	29.0	-	39.1	-	-
Copper	mg/kg	<1	4730	30	-	24	-	-
Lead	mg/kg	<5	200	19	-	19	-	-
Mercury	mg/kg	<0.1	-	< 0.10	-	< 0.10	-	-
Molybdenum	mg/kg	<0.1	95.2	4.7	-	5.1	-	-
Nickel	mg/kg	<0.7	136	41.6	-	31.0	-	-
Selenium	mg/kg	<1	375	<1	-	1	-	-
Zinc	mg/kg	<5	20000	87	-	87	-	-
PAH MS								
Naphthalene	mg/kg	< 0.04	0.829	< 0.04	-	< 0.04	-	-
Acenaphthylene	mg/kg	< 0.03	-	< 0.03	-	< 0.03	-	-
Acenaphthene	mg/kg	< 0.05	608	< 0.05	-	< 0.05	-	-
Fluorene	mg/kg	< 0.04	735	< 0.04	-	< 0.04	-	-
Phenanthrene	mg/kg	< 0.03	-	< 0.03	-	< 0.03	-	-
Anthracene	mg/kg	< 0.04	10200	< 0.04	-	< 0.04	-	-
Fluoranthene	mg/kg	< 0.03	983	< 0.03	-	< 0.03	-	-
Pyrene	mg/kg	< 0.03	668	< 0.03	-	< 0.03	-	-
Benzo(a)anthracene	mg/kg	< 0.06	-	< 0.06	-	< 0.06	-	-
Chrysene	mg/kg	< 0.02	-	< 0.02	-	< 0.02	-	-
Benzo(bk)fluoranthene	mg/kg	<0.07	-	<0.07	-	<0.07	-	-
Benzo(a)pyrene	mg/kg	< 0.04	1.51	< 0.04	-	< 0.04	-	-
Indeno(1,2,3-c,d)Pyrene	mg/kg	< 0.04	-	< 0.04	-	< 0.04	-	-
Dibenzo(a,h)Anthracene	mg/kg	< 0.04	-	< 0.04	-	< 0.04	-	-
Benzo(g,h,i)perylene	mg/kg	< 0.04	-	< 0.04	-	< 0.04	-	-
Coronene	mg/kg	< 0.04	-	< 0.04	-	< 0.04	-	-
PAH 6 Total	mg/kg	< 0.22	-	< 0.22	-	< 0.22	-	-
PAH 17 Total	mg/kg	< 0.64	-	< 0.64	-	< 0.64	-	-
Benzo[b]fluoranthene	mg/kg	< 0.05	-	< 0.05	-	< 0.05	-	-
Benzo[k]fluoranthene	mg/kg	< 0.02	-	< 0.02	-	< 0.02	-	-
Benzo[j]fluoranthene	mg/kg	<1	-	<1	-	<1	-	-
PAH Surrogate % Recovery	%	0	-	105	-	110	-	-
Mineral Oil(C10-C40)(EH_CU_1D_AL)	mg/kg	<30	-	< 30	-	< 30	-	-
Aliphatics								
Aliphatic >C5-C6	mg/kg	<0.1	42.7	< 0.1	-	< 0.1	-	-
Aliphatic >C6-C8	mg/kg	<0.1	99.3	< 0.1	-	< 0.1	-	-
Aliphatic >C8-C10	mg/kg	<0.1	13.9	< 0.1	-	< 0.1	-	-
Aliphatic >C10-C12	mg/kg	<0.2	81.7	< 0.2	-	<0.2	-	-
Aliphatic >C12-C16	mg/kg	<4	385	< 4	-	< 4	-	-
Aliphatic >C16-C21	mg/kg	<7	-	<7	-	<7	-	-
Aliphatic >C21-C35	mg/kg	<7	-	<7	-	<7	-	-
Aliphatic >C35-C40	mg/kg	<7	-	<7	-	<7	-	-
Total Aliphatic C5-C40	mg/kg	<26	-	<26	-	<26	-	-
Aliphatic TPH>C6-C10	mg/kg	<0.1	-	<0.1	-	<0.1	-	-
Aliphatic TPH>C10-C25	mg/kg	<10	-	<10	-	<10	-	-
Aliphatic TPH>C25-C35	mg/kg	<10	-	<10	-	<10	-	-
Aromatics								
Aromatic >C5-EC7	mg/kg	<0.1	0.137	< 0.1	-	< 0.1	-	-
Aromatic >EC7-EC8	mg/kg	<0.1	113	< 0.1	-	< 0.1	-	-
Aromatic >EC8-EC10	mg/kg	<0.1	20.5	< 0.1	-	< 0.1	-	-
Aromatic >EC10-EC12	mg/kg	< 0.2	70	< 0.2	-	< 0.2	-	-
Aromatic >EC12-EC16	mg/kg	<4	165	< 4	-	< 4	-	-
Aromatic >EC16-EC21	mg/kg	<7	319	< 7	-	< 7	-	-
Aromatic >EC21-EC35	mg/kg	<7	1120	< 7	-	< 7	-	-
Aromatic >EC35-EC40	mg/kg	<7	-	< 7	-	< 7	-	-
Total Aromatics C5-C40	mg/kg	<26	-	<26	-	<26	-	-
Total Aliphatic and Aromatics (C5-40)	mg/kg	<52	-	<52	-	<52	-	-
Aromatic >EC6-EC10	mg/kg	<0.1	-	<0.1	-	<0.1	-	-
Aromatic >EC10-EC25	mg/kg	<10	-	<10	-	<10	-	-
Aromatic >EC25-EC35	mg/kg	<10	-	<10	-	<10	-	-
MTBE	mg/kg	<0.005	27.6	<0.005	-	<0.005	-	-
Benzene	mg/kg	<0.005	0.137	<0.005	-	<0.005	-	-
Toluene	mg/kg	<0.005	113	<0.005	-	<0.005	-	-
Ethylbenzene	mg/kg	<0.005	50.7	<0.005	-	<0.005	-	-
m/p-Xylene	mg/kg	<0.005	24	<0.005	-	<0.005	-	-
o-Xylene	mg/kg	<0.005	26.4	<0.005	-	<0.005	-	-
PCB 28	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
PCB 52	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
PCB 101	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
PCB 118	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
PCB 138	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
PCB 153	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
PCB 180	mg/kg	<0.005	-	<0.005	-	<0.005	-	-
Total 7 PCBs	mg/kg	<0.035	-	<0.035	-	<0.035	-	-

Notes:
Grey shading and bold denotes exceedance of relevant Generic Assessment Criteria (GAC) for Soils
Soils GAC used are based on Atkins ATRISK Soil SSVs for Residential Landuse with consumption of home-grown vegetables (1% SOM Sand) (Ref: 20200407) (sourced Aug. 23)
Solids: V=60g VOC jar , J=250g glass jar, T=plastic tub

Ref: 12954-06-23
Project Title: Dunboyne LRD
Project Site: Dunboyne LRD
Client:
Appendix 5.2 - Table 2: Soil Characterisation: Human Health Screening for Residential Landuse *without* consumption of home-grown vegetables (1% SOM)

	EMT Sample No.			1-4	5	6-9	10	11
	Sample ID			BH01	BH01	BH02	BH02	BH03
	Depth (m)			0.50	1.00	1.00	2.00	1.00
	Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL
	Sample Date			27/07/2023	27/07/2023	27/02/2023	27/07/2023	27/07/2023
	Batch Number			1	1	1	1	1
	Containers			VJT	T	VJT	T	T
	Date of Receipt			28/07/2023	28/07/2023	28/07/2023	28/07/2023	28/07/2023
Parameter	**Units**	**LOD**	**GENERIC ASSESSMENT CRITERIA (Soil Screening Values) (mg/kg)**					
Barium	mg/kg	<1	1340	85	-	61	-	-

Notes:

Soils GAC used are based on Atkins ATRISK Soil SSVs for Residential Landuse **without** consumption of home-grown vegetables (1% SOM Sand) (Ref: 20200407)