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DOCUMENT CONTROL SHEET:

Client:	Rathdrinagh Land ULC, T/a Irish Recycling
Consulting Engineers:	Coyle Civil & Structural Design Ltd
Address:	3 High Street Mullaghmonaghan Co. Monaghan
Project Reference:	22-125
Site Location:	Huntstown Co. Fingal
Document Title:	Site Investigation Report
Prepared by:	Marc Robinson BSc MIEI
Check by:	Thomas Robinson BSc CGeol FGS MIQ
Report Status:	Revision 01
Issue Date:	19th December 2022

Table 7 Field identification and description of soils

SOIL GROUP	Very coarse soils			Coarse soils						Fine soils					
PRINCIPAL SOIL TYPE	BOULDERS		COBBLES	GRAVEL			SAND			SILT			CLAY		
Particle size (mm)	Large boulder	Boulder	Cobble	Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine			
	>630	630–200	200–63	63–20	20–6 3	6 3–2 0	2 0–0 63	0 63–0 2	0 2–0 063	0 063–0 02	0 02–0 0063	0 0063–0 002	<0 002		
Visual identification	Only seen complete in pits or exposures. **Difficult** to recover whole **from** boreholes.			Easily visible to naked eye; particle shape can be described; grading can be described.			Visible to naked eye; no cohesion when dry; grading can be described.			Only coarse silt visible with hand lens; exhibits **little** plasticity and marked dilatancy; slightly granular or silky to **the** touch; disintegrates in water; lumps dry quickly; possesses cohesion but can be powdered easily between fingers.			Dry lumps can be broken but not powdered between the fingers; dry lumps disintegrate under water but more slowly than silt; smooth to **the** touch; exhibits plasticity but no dilatancy; sticks **to** the fingers and dries slowly; shrinks appreciably on drying usually showing cracks.		
Density/ Consistency	No terms defined. Qualitative description of packing by inspection and ease of excavation.			Classification of relative density on the basis of N value (Table 10), or **field** assessment using hand tests may be made (Table 11).						**Term**	Very **soft**	Soft	Firm	Stiff	Very **stiff**
										Field test	Finger easily pushed **in** up **to** 25 mm. Exudes between fingers	Finger pushed **in** up **to** 10 mm. Moulded by **light finger** pressure	Thumb makes impression easily. Cannot be moulded by fingers. Rolls **to** thread.	Can be indented slightly by **thumb.** Crumbles **in rolling thread.** Remoulds	Can be indented by thumb nail. Cannot be moulded; crumbles
Discontinuities	Describe spacing of features such as fissures, shears, partings, isolated beds **or** laminae, desiccation cracks, rootlets, etc. Fissured: Breaks into blocks along unpolished discontinuities. Sheared: Breaks into blocks along polished discontinuities.						**Scale of spacing of discontinuities**	**Term**		very widely	widely	medium	closely	very closely	extremely closely
								Mean spacing (mm)		>2 000	2 000–600	600–200	200–60	60–20	<20
Bedding	Describe thickness of beds in accordance with geological **definition. Alternating** layers of materials are inter-bedded or inter-laminated and should be described by a thickness term **if** in equal proportions, or by a thickness of and spacing between subordinate layers where unequal.						**Scale of bedding thickness**	**Term**		very thickly bedded	thickly bedded	medium bedded	**thinly** bedded	very **thinly** bedded	thickly laminated	**thinly** laminated
								Mean thickness (mm)		>2 000	2 000–600	600–200	200–60	60–20	20–6	<6
Colour	**HUE** can be preceded by **LIGHTNESS** and/or **CHROMA**			Red / Pink / Orange / Yellow / Cream / Brown / Green / Blue / White / Grey / Black Light / - / Dark Reddish / Pinkish / Orange / Yellowish / Brownish / Greenish / Bluish / Greyish						Colours may be **mottled** More than 3 colours is **multi-coloured**					
Secondary constituents	For mixtures involving very coarse soils see **33.4.4.2**			**Term in coarse soils**	slightly (sandy) B)	(sandy) B)	very (sandy) B)	SAND AND GRAVEL		**Term in fine soils**	slightly (sandy) D)	(sandy) D)	very (sandy) F)	Silty CLAY Clayey SILT	Terms used to reflect secondary **fine** constituents where this is **important**
				Proportion secondary A)	<5%	C)	C)	About 50%		**Proportion secondary** A)	<35%	E)	E)		
Mineralogy	Terms can include: glauconitic / micaceous / shelly / organic / calcareous. For example: slightly (glauconitic) / (glauconitic) / very (glauconitic) Carbonate content: slightly calcareous – weak or sporadic effervescence from HCl / calcareous – clear but not sustained effervescence from HCl / highly calcareous – strong, sustained effervescence from HCl. Organic soils contain secondary finely divided or discrete particles of organic matter, often with distinctive smell, might oxidize rapidly. For example: slightly organic – grey / organic – dark grey / very organic – black.														
Particle shape	Very angular/Angular/Sub-angular/Sub-rounded/Rounded/Well-rounded A **dominant** shape can be described, for example: Cubic/Flat/Elongate														
PRINCIPAL SOIL TYPE	LARGE BOULDERS	BOUL-DERS	COBBLES	GRAVEL			SAND			SILT			CLAY		
Tertiary constituents	Example terms include: shell fragments / pockets of peat / gypsum crystals / pyrite nodules / calcareous concretions / **flint** gravel / brick fragments / rootlets / plastic bags. Qualitative proportions can be given: with rare / with occasional / with numerous/ frequent/ abundant. Proportions are defined on a site or material specific basis, or subjectively.														
Geological unit	Name in accordance with published geological maps, memoirs or sheet explanations. For example: RIVER TERRACE DEPOSITS / GLACIAL SAND AND GRAVEL / MADE GROUND / LANGLEY SILT MEMBER / WEATHERED CHARMOUTH MUDSTONE FORMATION / CLAY-WITH-FLINTS / LOWESTOFT FORMATION / EMBANKMENT FILL / ALLUVIUM / TOPSOIL / LAMINATED BEDS, WOOLWICH FORMATION / SHERWOOD SANDSTONE GROUP.														

A) Percentage coarse or fine soil type assessed excluding cobbles and boulders. B) Gravelly or sandy and/or silty or clayey. C) Can be described as fine soil depending on mass behaviour. D) Gravelly and/or sandy. E) Can be described as coarse soil depending on mass behaviour. F) Gravelly or sandy.

Abbreviations relating to exploratory hole logs

D	Small disturbed sample
B	Bulk disturbed sample
W	Water sample
E	Environmental Sample
U	Nominal 100mm diameter undisturbed open tube sample
UT	Nominal 100mm diameter undisturbed thin wall open tube sample
P	Nominal 100mm diameter undisturbed piston sample
S	Shelby tube
SPT(S)	Standard penetration test using a split spoon sampler
SPT(C)	Standard penetration test using a 60 degree solid cone sampler
2,4/5,6,8,6	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length (N value). The length achieved is stated (mm) for any test increment less than 75mm
SPT N = 25	SPT blow count 'N' given by the summation of the blows required to drive the full test length (300mm)
SPT B/L	Incomplete standard penetration test where the full test length was not achieved. The blows 'B' represent the total blows for the given test length 'L' (mm). Refusal when seating blows => 25 and N value => 50 (Extended to 100 in rock)
PID	Photoionization detector (measures volatile Organic Compounds results in ppm)
V	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa
dd/mm/yy: 1.00m	Date & water level at the borehole depth at the end of shift or the start of the following shift
Seepage (1) at 2.00m	Water flow rate and depth struck. Number in brackets is an individual water strike
Slight flow (2) at 3.00m	▽ 1 Depth water struck in borehole
Moderate flow (3) at 5.00m	▼ 1 Depth water rose in borehole
Strong flow (4) at 6.00m	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.

1.0 INTRODUCTION

1.1 General

Hanmar Site Investigation Services Ltd was appointed by the client Rathdrinagh Land ULC T/a Irish Recycling in September 2022 to undertake an exploratory ground investigation for Proposed Industrial Units at Huntstown Tc, Co. Fingal. A site location map is presented in Figure 1 and an exploratory borehole location map for the site is shown in Figure 2.

It is proposed to construct a range of industrial units (portal frame structures) along with drainage, hard standings and soft landscaping. This report provides a summary of the ground conditions as encountered by the intrusive exploratory investigations and provides guidance on the geotechnical issues regarding the design of the proposed new development.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. The recommendations and conclusions in this report are based on the assumptions that the exploratory holes and test results are representative of overall site conditions.

However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those measured during the investigation.

This report was prepared by Hanmar Site Investigation Services Ltd for the use of the Client and the Client's Representative in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

1.2 Scope of Works

The initial scope of the ground investigation was designed by the Client/Engineer and was as follows:

- 2 No. boreholes in order to establish the rock, soil and groundwater conditions beneath the site.
- 3 No. trial pits in order to establish the rock, soil and groundwater conditions beneath the site.
- Install groundwater monitoring standpipes.
- 1 No. permeability tests to BRE Digest 365, in order to establish the infiltration rate beneath the site.
- To complete in-situ testing to characterise the encountered strata's properties at the proposed site.
- To complete Laboratory testing on samples to characterise the encountered strata's properties at the proposed site.
- To prepare a report of the site investigation findings.

2.0 METHODOLOGY

2.1 Fieldwork

This report has been prepared following as best as possible with the client's restrictions in scope the guidelines set out in the following: -

- UK Specification for ground Investigation, 2nd edition, Site Investigation Steering Group, published by ICE (2011).
- Site investigation in Construction Part 3: Specification for ground Investigation, Site Investigation Steering Group, published by Thomas Telford Ltd (1993).
- BS5930:2015 Code of Practice for Site Investigation and testing.

It was also undertaken as best as possible in accordance with the guidelines set-out in British Standards Institute (2010), *BS 5930:1999 + A2:2010 Code of Practice for Site Investigations.* Incorporating Amendment Nos. 1 and 2, as partially replaced by:

- *BS EN 1997-2:2007: Eurocode 7. Geotechnical design. Ground Investigation and testing.*
- *BS EN ISO 22475-1:2006: Geotechnical investigation and testing. Sampling methods and groundwater measurements. Technical principles for execution.*
- *BS EN ISO 14688-1:2002: Geotechnical investigation and testing. Identification and classification of soil. Identification and description.*
- *BS EN ISO 14689-1:2004: Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.*
- *BS EN ISO 14689-1:2003: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.*
- *BS EN ISO 22476-2:2005: Geotechnical investigation and testing. Field testing. Dynamic probing.*
- *BS EN ISO 22476-3:2005: Geotechnical investigation and testing. Field testing. Standard penetration test.*

The fieldworks were completed between the 18th and 19th October 2022 with works being completed under dry sunny conditions and downpour conditions.

2.1.1 Boreholes

2 No. rotary percussive boreholes were excavated using a Massenza MI5 Drilling Rig boring a nominal 200mm borehole supported by a temporary casing system as drilling

progressed. Boreholes extended to a maximum depth of 7.50m below existing ground level.
Borehole locations are as indicated by the exploratory borehole location map presented in Figure 2 and detailed borehole logs are presented in Appendix A.

Borehole BH 01 was dropped from the original scope of works by the client.

2.1.2 Rotary Boreholes

1 No. rotary cored borehole BH 03 was drilled using a Massenza MI5 Rotary coring rig using a T2 101 core barrel and water flush.

Borehole locations are as indicated by the exploratory borehole location map presented in Figure 2 and detailed borehole logs are presented in Appendix A.

2.1.3 Trial Pits

3 No. Machine Excavated Trial Pits were excavated using a 3 ton Bobcat Excavator using a 400mm toothed bucket.

Trial Pit locations are as indicated by the exploratory borehole location map presented in Figure 2 and detailed borehole logs are presented in Appendix B.

2.1.4 Sampling

Small disturbed jar samples were collected at intervals as drilling progressed.
U100 undisturbed samples were attempted but met refusal within the stiff clays.

2.1.5 In-situ testing

Standard Penetration Tests (SPT's) were taken at 1.00m depth intervals in accordance with BS 1377:1990 Code of Practice: Methods of Test for Soils for Engineering Purposes – Part 9 In-Situ Tests.

1 no. infiltration tests were completed at location Per 01. The infiltration pits extended to a maximum depth of 1.00m below existing ground level and trimmed square to allow for the actual measurement of the volume. These were filled with water and monitored in accordance with BRE digest 365 to establish the infiltration rate. Results are given in Appendix C.

2.1.6 Installations

Groundwater monitoring standpipes were installed in all boreholes BH 02 – 03 to a maximum depth of 4.00m. These consisted of slotted 50mm HDPE pipe with a gravel surround and plain 50mm HDPE pipe with a bentonite seal which was topped with a upright cover. Installation details are given on the Borehole installation sheet that accompanies the Borehole logs in Appendix A.

2.1.7 Monitoring

Groundwater level monitoring was completed over 21st October – 19th December 2022. Results are given on the Borehole installation sheet that accompanies the Borehole logs.

2.2 Laboratory Work

Selected soil samples were scheduled for the following range of laboratory tests:

- 2:1 Soil Water Extract
- pH
- Water Soluble Chloride content
- Particle Size Distribution - Sieve
- Particle Size Distribution - Sedimentation
- Moisture Content
- Point Load Testing

All tests were undertaken in accordance with the methods set-out in *BS 1377:1990 Code of Practice: Methods of test for soils for civil engineering purposes.* Test results are included in Appendix D.

Selected soil & water samples were scheduled for environmental testing and comprised of:-

- Waste Acceptance Criteria
- 10 Metals including Cr VI
- Speciated (16) PAHs
- Phenols
- TPH-CWG

- BTEX
- Cyanide (free & total)
- pH
- SOM
- sulphates
- Asbestos
- WAC testing

Test results are included in Appendix E.

3.0 SITE CHARACTERISATION

3.1 Site Location and Description

The works site is located from the North Road and is located within lands run by Roadstone Ltd at Huntstown, Co. Fingal. The site is an agricultural green field site with several electricity pylons running through it. The site is bounded to the north by the North Road, to the east by a major electricity substation, on the southern boundary by agricultural fields and on the western boundary by an industrial complex. The levels across the site rise and fall from the centre.

Table 1 summarises the site details, while Plates 1 – 5 show an overview of the locations.

Table 1: General Site Details

Site Address	Huntstown Tc, Co. Fingal
Irish Grid Reference	711777E 740928N
OS Plans (1:50,000)	Sheet No. 50 Dublin
Current Land Use	Agricultural Field

Plate 1: Site Location (Approximate Locations)

Plate 2: Borehole Location (BH 02)

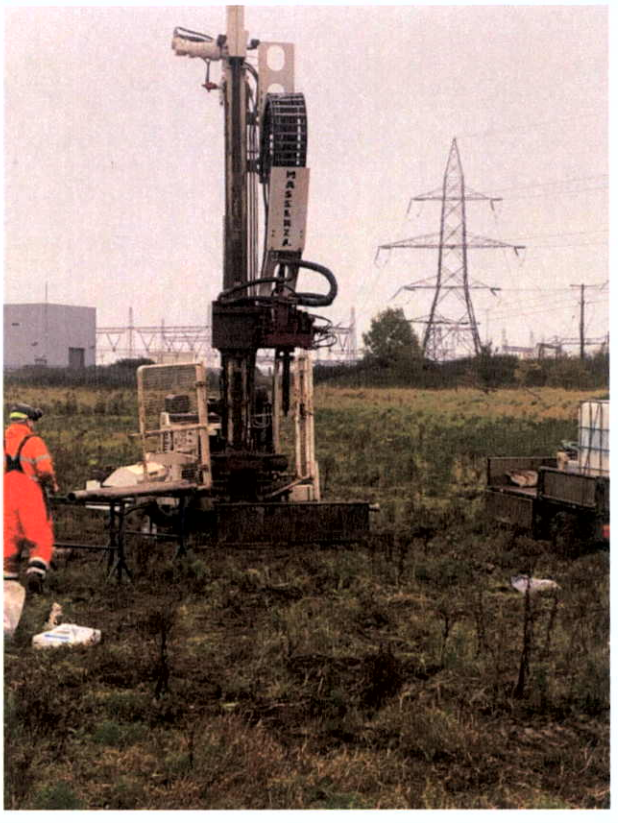


Plate 3: Borehole Location (BH 03)

Plate 4: Percolation Test Start

Plate 5: Percolation Test Finish

4.0 GEOLOGY

4.1 Geology of site from published records

Geological information was obtained for the site using the following sources of information:

- GSI Geological Map of Ireland Quaternary (1:100,000).
- GSI Geological Map of Ireland Bedrock (1:100,000).

A reproduction of the geology maps for the site are presented as Figures 3 & 4. The maps indicate that the underlying geology of the site is likely to be as follows:

Drift Geology

- Glacial Till – Clay
- Rock at or near surface

Solid Geology

- Carboniferous: Tober Collen Formation – Calcareous Shale, Limestone Conglomerate

4.2 Ground Conditions

The geological context of the site was verified by the sinking of exploratory boreholes, which were excavated to a maximum 7.50m below existing ground level. The ground conditions that were recorded during the investigation are summarised in Table 2, and followed by a general description of the strata encountered.

Table 2: Ground Conditions Summary

Exploratory Hole Reference	Completion Depth (m)	Stratum thickness (m)					
		Topsoil	Made Ground	Recent	Fluvial Glacial	Glacial Till - Clays	Rock mbgl
BH 02	7.50 (Refusal)	0.20	-	-	-	>7.30	-
BH 03	3.70 (Complete)	0.10	-	-	-	1.00	1.10
TP 01	2.50 (Complete)	0.30	-	-	-	>2.20	-

Exploratory Hole Reference	Completion Depth (m)	Stratum thickness (m)					
		Topsoil	Made Ground	Recent	Fluvial Glacial	Glacial Till - Clays	Rock mbgl
TP 02	2.50 (Complete)	0.30	-	-	-	>2.20	-
TP 03	0.75 (Refusal)	0.20	-	-	-	0.55	0.75

Notes: ~ Groundwater strike: S=Seepage, SF= Slight Flow, MF = Moderate Flow, ST = Strong Flow

4.2.1 Made Ground

No Made ground was encountered within all boreholes and trial pits during excavations.

4.2.2 Glacial Till Deposits

Glacial Till deposits were found within all boreholes and trial pits and consisted of a very stiff greyish brown gravelly sandy silty CLAY containing frequent cobbles and boulders. Glacial Till deposits extended to maximum depth of 7.50m below existing ground levels.

4.2.3 Fluvial Glacial Deposits

No Fluvial Glacial Deposits were encountered within boreholes or trial pits during excavations.

4.2.4 Bedrock

Bedrock was encountered within the borehole BH 06 consisting of medium strong highly fractured dark grey fine grained LIMESTONE with thin layers of MUDSTONE close to very close smooth planar moderately open to tight clean dry fractures (CARBONIFEROUS – TOBER COLLEEN FORMATION).

4.3 Groundwater

All boreholes and trial pits were dry during excavations.

5.0 DESIGN CONSIDERATIONS

5.1 Introduction

The foundation requirements would depend on the structural loadings that would be imposed by the proposed structure on the ground, which would need to be calculated by the Structural Engineer for the proposed scheme. However, the following general advice on foundation options can be provided for design purposes.

5.1 Shallow Foundations

The borehole investigation indicates that the glacial soils that underlie the site represent a potential bearing strata for supporting the lightly loaded foundations (eg raft, pad, strip footings). It is estimated that the deposits would have the following net allowable bearing pressures which are listed in table 3.

Table 3: Estimated Allowable Bearing Pressures

Exploratory Hole Reference	Foundation Depth (m)	Estimated Allowable Bearing Capacity (KPa)
BH 02	1.00	250
BH 03	1.00	250

The exploratory holes scoped by the Engineer are far apart and a more detailed site investigation scope of works should be undertaken to gain a better understand of the rises and falls in the bedrock geology below the site.

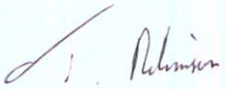
5.2 Soil Aggressiveness

The chemical analysis of the sulphate ion (SO4) content of soil samples (2:1 soil water extract), was between 0.044 – 0.052 g/l; with a pH values of 7.7 – 7.9. The results indicate that the soils are of a non-aggressive nature and are suitable for use of design Sulphate class DS-1, ACEC Class AC-1s (BRE Special Digest 1) for buried concrete.

Report Prepared By: -

Marc Robinson BSc (Hons) MIEI
Geotechnical Engineer

Report Approved By: -



Thomas Robinson BSc (Hons) C.Geol, FGS, MIQ
Chartered Engineering Geologist

FIGURES

Client	Title	
Rathdrinagh Land ULC, T/a Irish Recycling	**Figure 1 Site Location Plan**	
Project: **Proposed Industrial Units at Hunstown Tc, Co. Fingal**	Engineer: **Coyle Civil & Structural Design Ltd**	
Job Ref: 22-125	Scale: As Shown	Drawing No: 22-125/01
		Date: Oct 22

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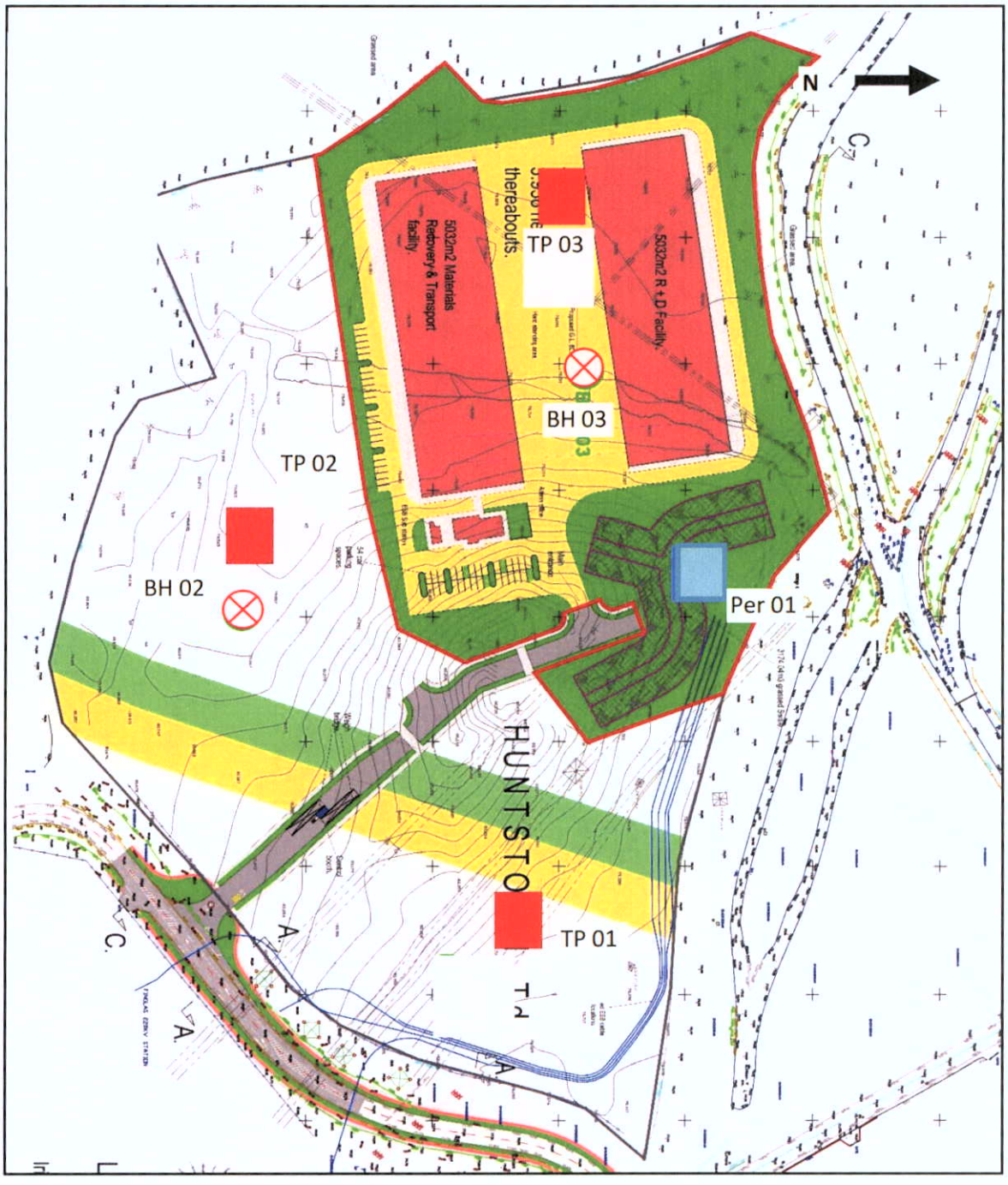

Client **Rathdrinagh Land ULC, T/a Irish Recycling**		Title **Figure 2 Borehole Location Plan**	
Project **Proposed Industrial Units at Hunstown Tc, Co. Fingal**		Engineer **Coyle Civil & Structural Design Ltd**	
Job Ref 22-125	Scale As Shown	Drawing No 22-125/02	Date Oct 22

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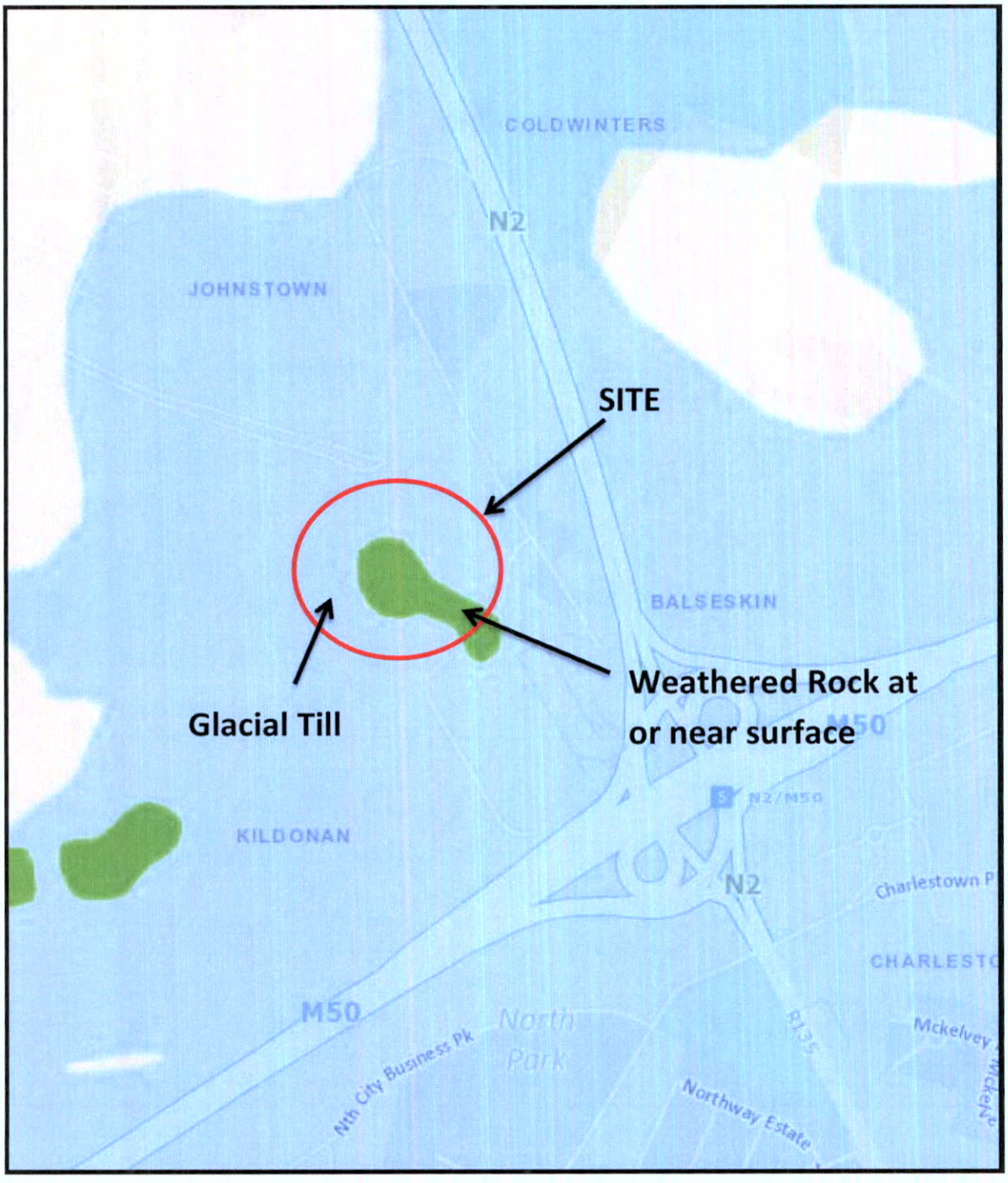

Client **Rathdrinagh Land ULC, T/a Irish Recycling**		Title **Figure 4 Geology Map Drift**	
Project **Proposed Industrial Units at Hunstown Tc, Co. Fingal**		Engineer **Coyle Civil & Structural Design Ltd**	
Job Ref 22-125	Scale As Shown	Drawing No 22-125/04	Date Oct 22

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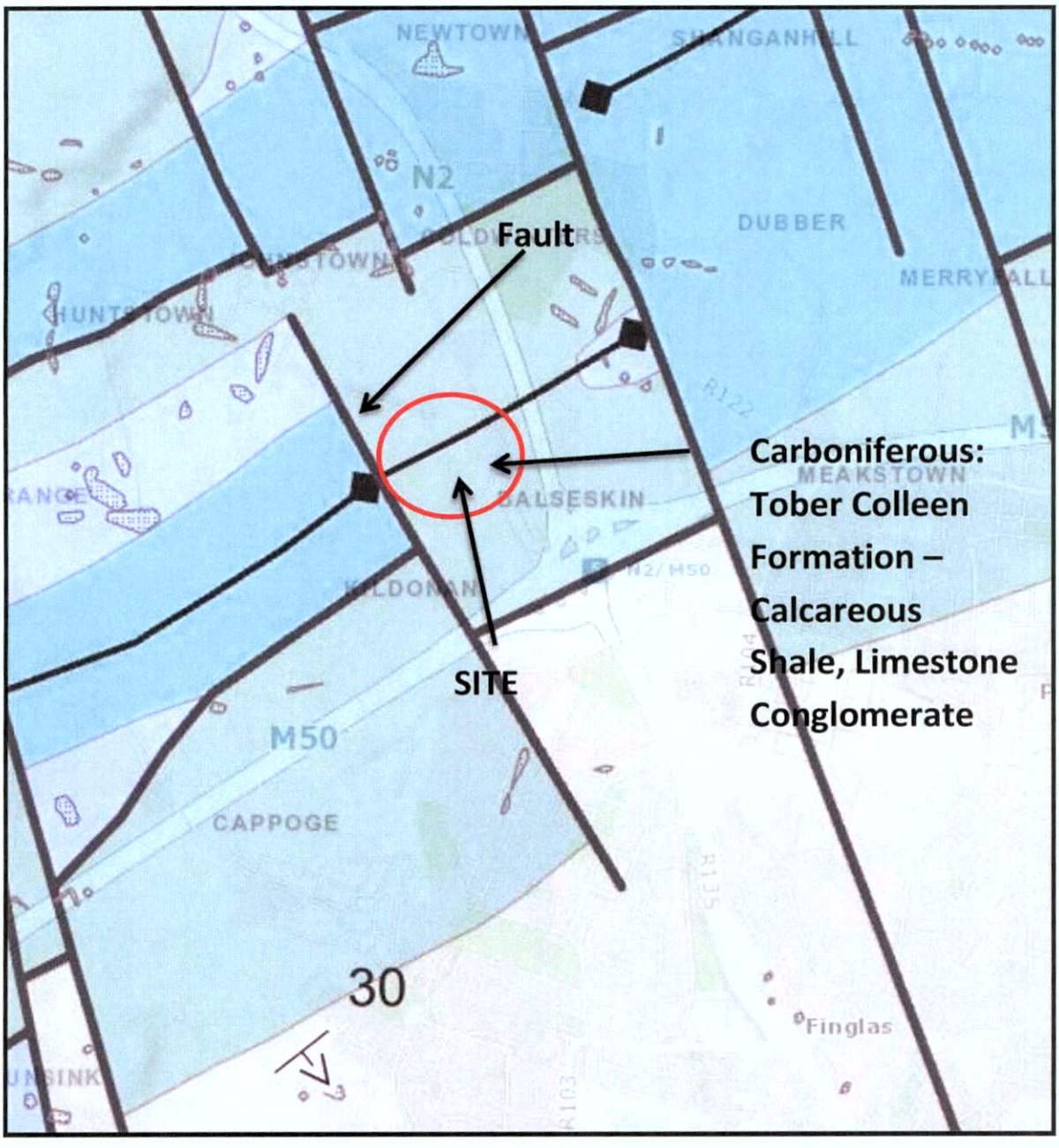

Client **Rathdrinagh Land ULC, T/a Irish Recycling**		Title **Figure 4 Geology Map Solid**	
Project **Proposed Industrial Units at Hunstown Tc, Co. Fingal**		Engineer **Coyle Civil & Structural Design Ltd**	
Job Ref 22-125	Scale As Shown	Drawing No 22-125/04	Date Oct 22

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Appendix A

Borehole Logs

HANMAR Site Investigation Services

Site	Borehole Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	02

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Massenza MI5 Rotary rig using hollow stem augers and dynamic sampling.	150mm cased to 3.00m	79.71	Rathdrinagh Land ULC, T/a Irish Recycling	22-125
	Location (Handheld GPS) 711777 E 740928 N	**Dates** 19/10/2022	**Engineer** Coyle Civil & Structural Design	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				E:Environmantal Sample Consists of 2 x plastic tubs, amber glass jar & vial	79.51	(0.20) 0.20	Topsoil		
0.50	E1						Very Stiff greyish brown gravelly sandy silty CLAY containing frequent cobbles and boulders (GLACIAL TILL)		
1.00-1.45	SPT N=32			4,5/8,8,8,8					
1.00	D1								
1.00	E2								
1.50	B1								
2.00-2.25	SPT 50/100			4,5/7,43					
2.00	D2								
2.00	E3								
	B2								
3.00-3.45	SPT N=38			5,7/8,9,9,12					
3.00	D3								
3.50	B3								
						(7.30)			
4.00-4.30	SPT 50/150			10,15/25,25					
4.00	D4								
4.50	B4								
5.00-5.24	SPT 25*/90 50/150			21,4/28,22					
5.00	D5								
5.50	B5								
6.00-6.10	SPT 25*/50 50/50			25/50					
6.00	D6								
	B6								
7.00-7.31	SPT 50/160			7,18/20,22,8					
7.00	D7								
				19/10/2022:DRY	72.21	7.50	Complete at 7.50m		

Remarks
50mm diameter standpipe unstalled
Unable to get casing past 3.00m depth and borehole not staying out due to boulders moving
Virtural refusal met at 7.50m on Obstruction
Chiselling from 6.10m to 6.20m for .5 hours. Excavating from 0.00m to 1.00m for .5 hours.

Scale (approx)	Logged By
1:50	MR

Figure No. 22-125.02

HANMAR Site Investigation Services

Site	Borehole Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	02

Installation Type	Dimensions	Client	Job Number
Standpipe	Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 150 mm	Rathdrinagh Land ULC, T/a Irish Recycling	22-125

Location	Ground Level (mOD)	Engineer	Sheet
711777 E 740928 N	79.71	Coyle Civil & Structural Design	1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description
			79.41	0.30	Concrete
					Bentonite Seal
			78.81	0.90	
			78.71	1.00	Gravel Filter
					Slotted Standpipe
			75.71	4.00	
					Bentonite Seal
			72.21	7.50	

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)
19/10/22						pm	7.50	3.00	DRY	

Instrument Groundwater Observations

Inst. [A] Type : Standpipe

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks
21/10/22		3.70	76.01	
19/12/22		3.10	76.61	
21/12/22		3.50	76.21	

Remarks
Upright cover fitted

HANMAR Site Investigation Services

Site	Borehole Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	03

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Massenza MI5 Rotary rig using hollow stem augers and dynamic sampling. Rotary cored using T2 116 barrel	150mm cased to 1.50m	78.32	Rathdrinagh Land ULC, T/a Irish Recycling	22-125
	Location (Handheld GPS) 711698 E 741060 N	**Dates** 18/10/2022	**Engineer** Coyle Civil & Structural Design	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				E:Environmantal Sample Consists of 2 x plastic tubs, amber glass jar & vial	78.22	0.10	Topsoil		
0.50	E1					(1.00)	Very Stiff greyish brown gravelly sandy silty CLAY containing frequent cobbles and boulders (GLACIAL TILL)		
1.00	E2								
1.00	D1								
1.00-1.15	SPT 25*/100 50/50			9,16/50	77.22	1.10			
1.50	TCR / SCR / RQD / FI			B1			Medium Strong highly fractured dark grey fine grained LIMESTONE with thin layers of MUDSTONEclose to very close smooth planar moderately open to tight clean dry fractures (CARBONIFEROUS - TOBER COLLEEN FORMATION)		
1.50	100 / 100	46	NI			(2.60)			
3.00	100 / 100	42	NI	18/10/2022:DRY					
3.70					74.62	3.70	Complete at 3.70m		

Remarks
Broken rock jaming in core barrel at 3.70m depth
50mm diameter standpipe unstalled
Rotary cored from 1.50m to 3.70m
Virtural refusal met at 1.50m on Obstruction or possible rockhead
Excavating from 0.00m to 1.00m for .5 hours.

Scale (approx)	Logged By
1:50	MR

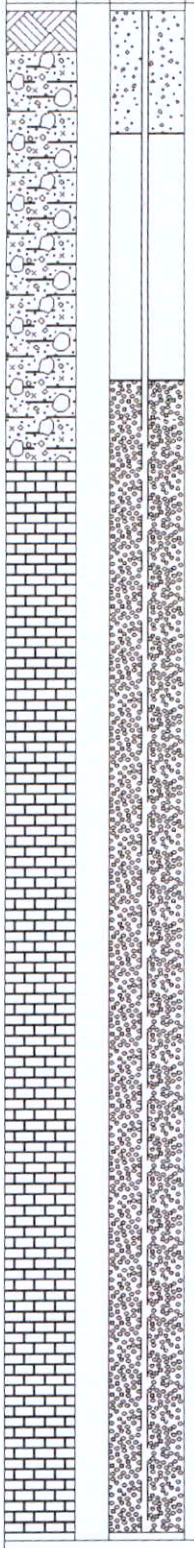
Figure No. 22-125.03

HANMAR Site Investigation Services

Site	Borehole Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	03

Installation Type	Dimensions	Client	Job Number
Standpipe	Internal Diameter of Tube [A] = 150 mm Diameter of Filter Zone = 50 mm	Rathdrinagh Land ULC, T/a Irish Recycling	22-125

Location	Ground Level (mOD)	Engineer	Sheet
711698 E 741060 N	78.32	Coyle Civil & Structural Design	1/1



Level (mOD)	Depth (m)	Description
78.02	0.30	Concrete
		Bentonite Seal
77.42	0.90	Gravel Filter
77.32	1.00	
		Slotted Standpipe
74.62	3.70	

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

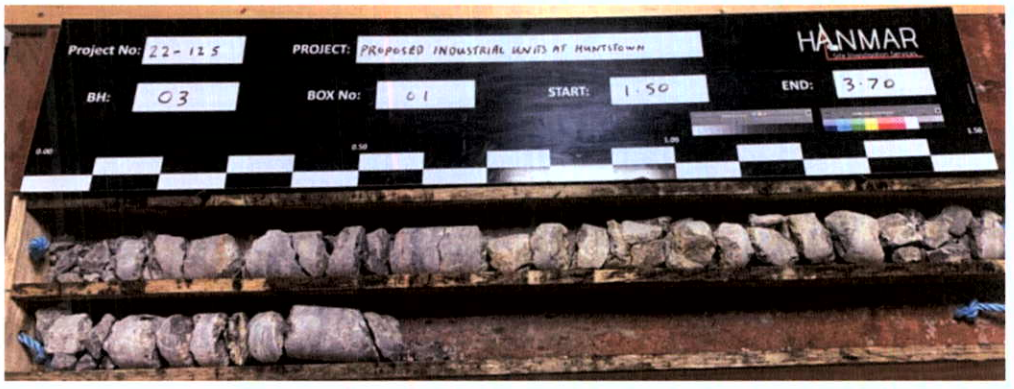
Date	Start of Shift Time	Start of Shift Depth Hole (m)	Start of Shift Casing Depth (m)	Start of Shift Water Depth (m)	Start of Shift Water Level (mOD)	End of Shift Time	End of Shift Depth Hole (m)	End of Shift Casing Depth (m)	End of Shift Water Depth (m)	End of Shift Water Level (mOD)
18/10/22						pm	3.70	1.50	DRY	

Instrument Groundwater Observations

Inst. [A] Type : Standpipe

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks
21/10/22		2.80	75.52	
19/12/22		2.10	76.22	
21/12/22		2.50	75.82	

Remarks
Upright cover fitted



BH 03 1.50m – 3.70m

Appendix B

Trial Pit Logs

HANMAR Site Investigation Services

Site	Trial Pit Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	TP 01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
3 ton tracked excavator	0.50m x 2.00m	81.67	Rathdrinagh Land ULC, T/a Irish Recycling	22-125
	Location (Handheld GPS) 711926 E 741045 N	**Dates** 19/10/2022	**Engineer** Coyle Civil & Structural Design	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Environmental Sample consists of 2x plastic tubs, amber glass jar & glass vial		(0.30)	Topsoil		
				81.37	0.30			
					(0.30)	Orange brown slightly gravelly sandy silty CLAY containing occasional smooth subrounded cobbles (GLACIAL TILL)		
0.50	B1			81.07	0.60			
0.50	E1					Dark greyish brown gravelly sandy silty CLAY containing occasional cobbles and boulders (GLACIAL TILL)		
1.00	B2							
1.00	E2							
1.50	B3				(1.90)			
2.00	B4							
2.00	E3							
	B5		19/10/2022:DRY	79.17	2.50	Complete at 2.50m		

Plan

Remarks

Pit dry and stable on completion

Scale (approx)	Logged By	Figure No.
1:50	MR	22-125.TP 01

TP 01

TP 01

HANMAR Site Investigation Services

Site	Trial Pit Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	TP 02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
3 ton tracked excavator	0.50m x 2.00m	79.38	Rathdrinagh Land ULC, T/a Irish Recycling	22-125
	Location (Handheld GPS) 711744 E 740935 N	**Dates** 19/10/2022	**Engineer** Coyle Civil & Structural Design	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Environmental Sample consists of 2x plastic tubs, amber glass jar & glass vial	79.08	(0.30) 0.30	Topsoil		
0.50	B1					Orange brown slightly gravelly sandy silty CLAY containing occasional smooth subrounded cobbles (GLACIAL TILL)		
0.50	E1				(0.60)			
				78.48	0.90			
1.00	B2					Dark greyish brown gravelly sandy silty CLAY containing occasional cobbles and boulders (GLACIAL TILL)		
1.00	E2							
1.50	B3				(1.60)			
2.00	B4							
2.00	E3							
	B5		19/10/2022:DRY	76.88	2.50	Complete at 2.50m		

Plan

Remarks

Pit dry and stable on completion

Scale (approx)	Logged By	Figure No.
1:50	MR	22-125.TP 02

TP 02

TP 02

HANMAR Site Investigation Services

Site	Trial Pit Number
Proposed Industrial Units at Huntstown Tc, Co Fingal	TP 03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
3 ton tracked excavator	0.50m x 2.00m	78.31	Rathdrinagh Land ULC, T/a Irish Recycling	22-125
	Location (Handheld GPS) 711660 E 741073 N	**Dates** 19/10/2022	**Engineer** Coyle Civil & Structural Design	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Environmental Sample consists of 2x plastic tubs, amber glass jar & glass vial	78.11	(0.20) 0.20	Topsoil		
					(0.55)	Orange brown slightly gravelly sandy silty CLAY containing occasional smooth subrounded cobbles (GLACIAL TILL)		
0.50	B1							
0.50	E1		19/10/2022:DRY	77.56	0.75	Complete at 0.75m		

Plan

Remarks

Virtural refusal met at 0.75m on possible rockhead
Pit dry and stable on completion

Scale (approx)	Logged By	Figure No.
1:50	MR	22-125.TP 03

TP 03

TP 03

Appendix C

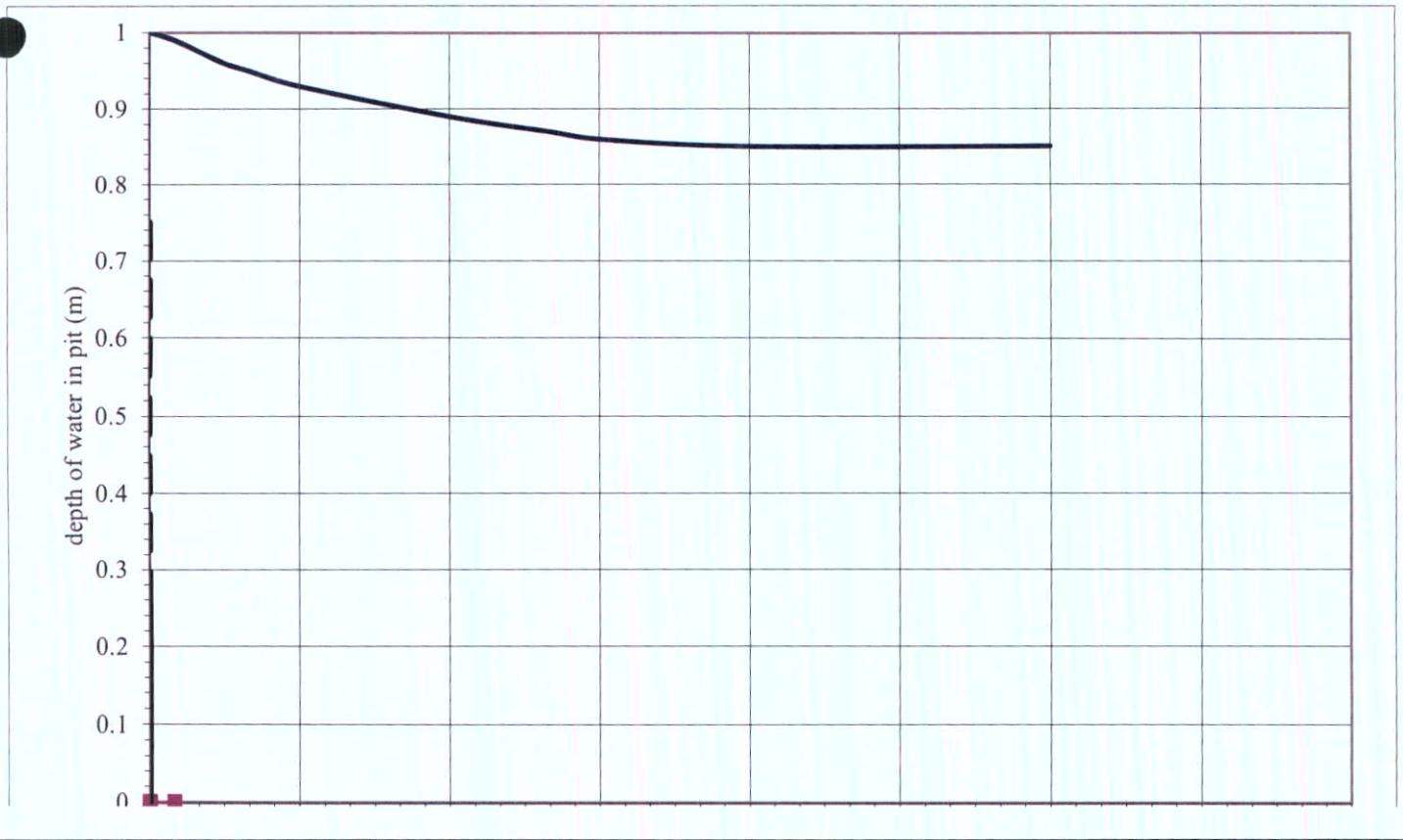
In-situ Test Results

	width (m)	length (m)	
test pit top dimensions	0.4	1.2	test infiltration rate (q) = ####### m/h
test pit base dimensions	0.4	1.2	depth to groundwater before adding water = Dry
test pit depth	1 m		depth to water surface at start of test 0 m

time (mins)	depth to water surface (m)	depth of water in pit (m)	time elapsed from test start (mins)	volume of water lost from test start (m3)	Area of walls and base at 50% drop from test start (m2)	q from start of test (m/min)	q from start of test (m/h)
0	0	1	0	0	3.68		
5	0.01	0.99	5	0.0048	3.664		
10	0.025	0.975	10	0.012	3.64		
15	0.04	0.96	15	0.0192	3.616		
20	0.05	0.95	20	0.024	3.6		
30	0.07	0.93	30	0.0336	3.568		
60	0.11	0.89	60	0.0528	3.504		
80	0.13	0.87	80	0.0624	3.472		
90	0.14	0.86	90	0.0672	3.456		
120	0.15	0.85	120	0.072	3.44		
180	0.15	0.85	180	0.072	3.44		

From graph:

test start - 75% depth at		test end - 25% depth at					
0.75 m water depth				0.25 m water depth			
time is - minutes				time is - minutes			
-	0.25	0.75	#VALUE!	0	2.8800		
-	0.75	0.25	#VALUE!	0.2400	2.0800	#######	#VALUE!



Appendix D

Geotechnical Laboratory Test Results

Huntstown

CHEMICAL TESTS

Job No. 22-125

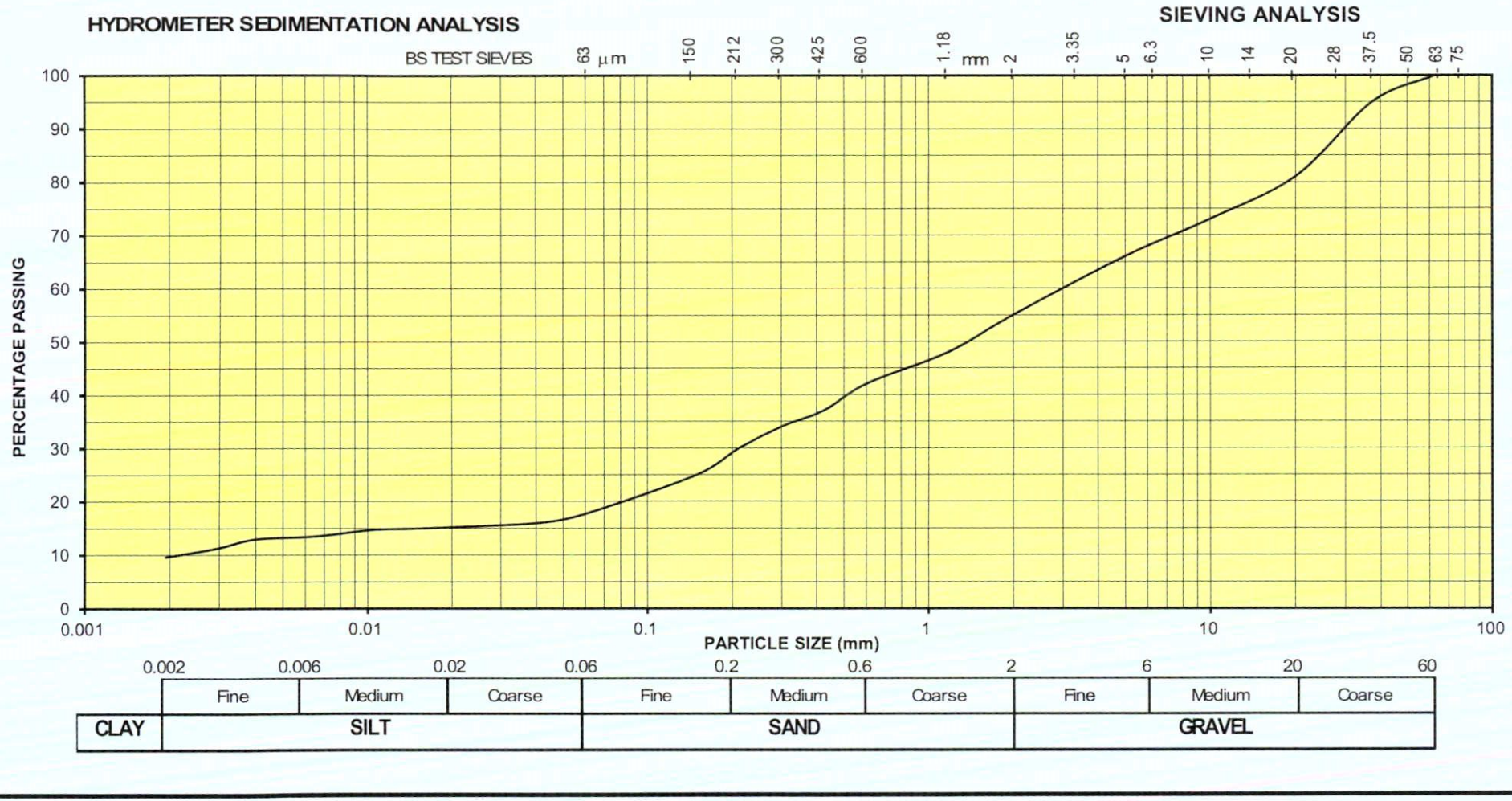
BH No.	Sample Type	Sample No.	Sample Depth (m)	Chloride 2:1 extract (mg/kg)	Organic Matter Content * (%)	Total Sulphate Acid (mg/kg)	Sulphate Content SO_4		pH Value φ
							Soil/water extract (g/l)	Groundwater (g/l)	
BH 02	D	2	2.00	3.8			0.044		7.7
BH 03	D	1	1.00	4.2			0.052		7.9

BS 1377 : Part 3 : 1990: Tests 3, 4, 5 & 9

PARTICLE SIZE DISTRIBUTION

CONTRACT: Huntstown
EXP HOLE No.: BH 02
JOB No.: 22-125
SAMPLE : B2
SAMPLE DEPTH: 2.50 m

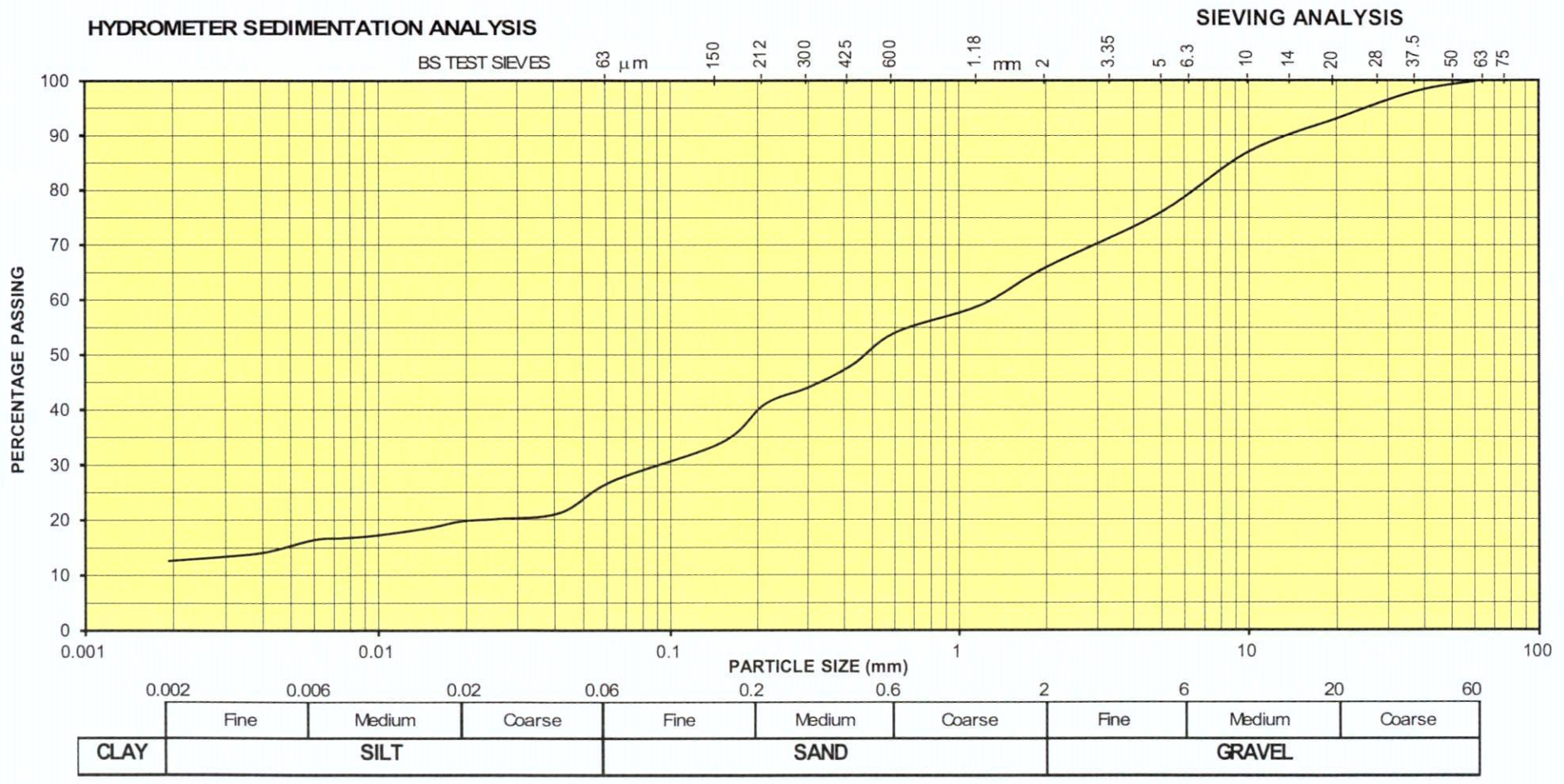
Tests 9.2 & 9.5 of BS1377 : Part 2 : 1990



PARTICLE SIZE DISTRIBUTION

CONTRACT: Huntstown
EXP HOLE No.: TP 01
JOB No.: 22-125
SAMPLE : B2
SAMPLE DEPTH: 1.00 m

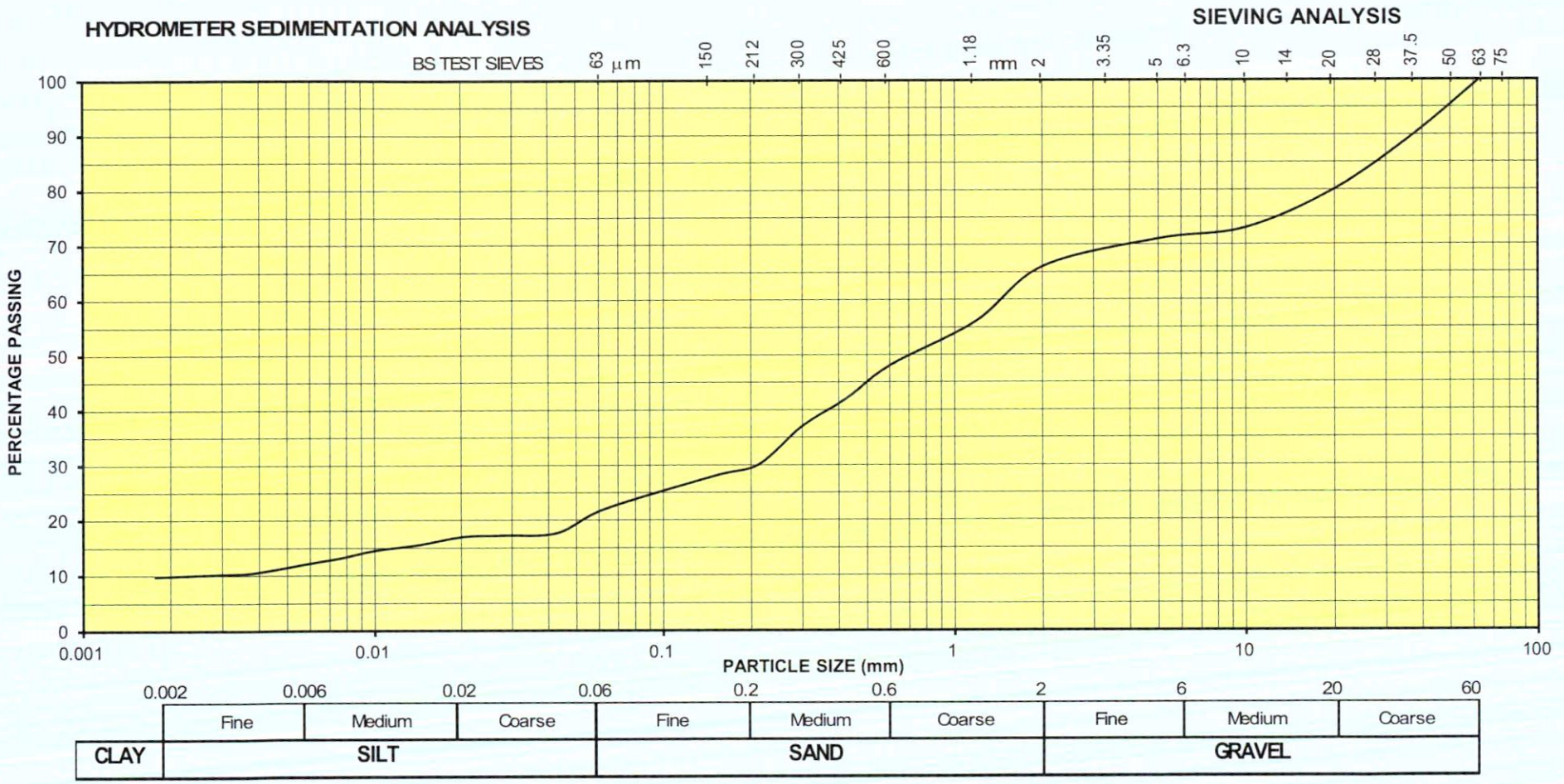
Tests 9.2 & 9.5 of BS1377 : Part 2 : 1990



PARTICLE SIZE DISTRIBUTION

CONTRACT: Huntstown
EXP HOLE No.: TP 02
JOB No.: 22-125
SAMPLE : B3
SAMPLE DEPTH: 1.50 m

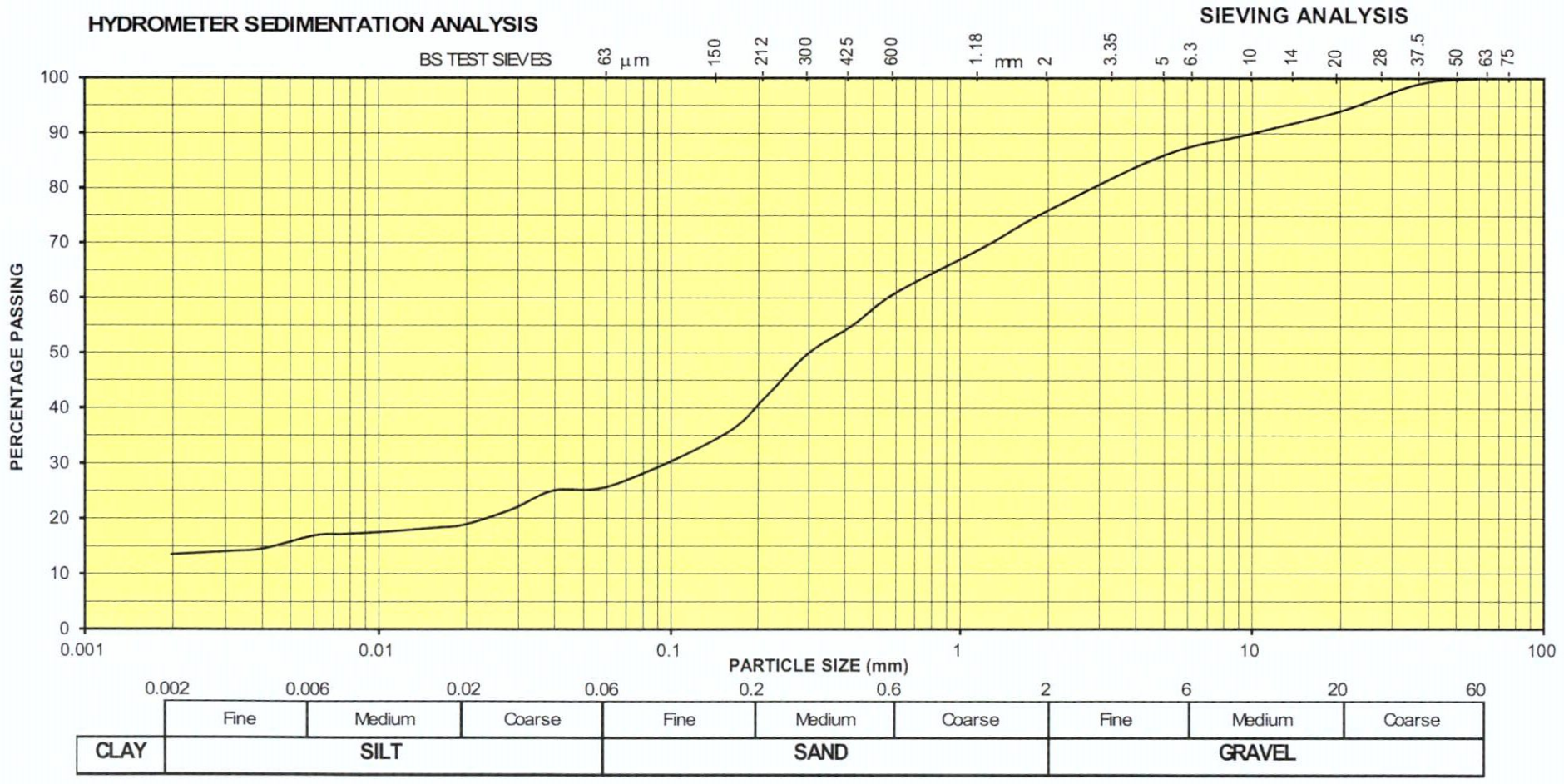
Tests 9.2 & 9.5 of BS1377 : Part 2 : 1990



PARTICLE SIZE DISTRIBUTION

CONTRACT: Huntstown
EXP HOLE No.: TP 03
JOB No.: 22-125
SAMPLE : B1
SAMPLE DEPTH: 0.50 m

Tests 9.2 & 9.5 of BS1377 : Part 2 : 1990



Sample Type	Sample No.	Sample Depth (m)	Chloride 2:1 extract (mg/kg)	Organic Matter Content * (%)	Total Sulphate Acid (mg/kg)	Sulphate Content SO_4	
						Soil/water extract (g/l)	Groundwater (g/l)
D	2	2.00	3.8			0.044	
D	1	1.00	4.2			0.052	

Contract: Huntstown

Job No.: 22-125

POINT LOAD STRENGTH TEST RESULTS

W = core diameter (Axial test) or specimen width (Irregular lump test)
D = core diameter (Diametral test) or specimen length (Axial test / Irregular lump test)
L = measured applied load for failure
P = actual applied load for failure (L x calibration factor)
D' = distance between platens at point of failure

D_e^2 = D x D' (Diametral test)
D_e^2 = 4/p (W x D') (Axial test / Irregular lump test)
I_s = Uncorrected point load strength (P/D_e^2)
$I_{s(50)}$ = Size corrected point load strength (I_s x F)
F = $(D_e/50)^{0.45}$ Size correction factor for core other than 50mm diameter

Borehole	Specimen Depth (m bgl)	Test Type A = Axial D = Diametral I = Irregular	W (mm)	D (mm)	D' (mm)	L (kN)	P (kN)	De^2 (mm2)	De (mm)	Is (MPa)	F	Is(50) (MPa)	Correlated UCS (MPa)	Remarks
BH 03	1.80	A	82	74	74	9.25	8.3	7726	87.90	1.08	1.29	1.39	27.85	Medium Strong
BH 03	2.10	A	82	76	76	10.44	9.4	7935	89.08	1.19	1.30	1.54	30.79	Medium Strong
BH 03	2.80	A	82	77	77	9.01	8.1	8039	89.66	1.01	1.30	1.32	26.30	Medium Strong
BH 03	3.60	A	82	70	70	9.34	8.4	7308	85.49	1.15	1.27	1.47	29.36	Medium Strong

Appendix E

Environmental Laboratory Test Results

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Final Report

Report No.:	22-43568-1
Initial Date of Issue:	05-Jan-2023
Client	Hanmar Site Investigation Services Ltd
Client Address:	Unit 57 Ledcom Industrial Estate Bank Road Larne County Antrim BT40 3AW
Contact(s):	Thomas Robinson
Project	22-125 Proposed Industrial Units at Huntstown Tc, Co Fingal

Quotation No.:		**Date Received:**	11-Nov-2022
Order No.:		**Date Instructed:**	11-Nov-2022
No. of Samples:	3		
Turnaround (Wkdays):	10	**Results Due:**	24-Nov-2022
Date Approved:	03-Jan-2023		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: 22-125 Proposed Industrial Units at Huntstown Tc, Co Fingal

Client: Hanmar Site Investigation Services Ltd			Chemtest Job No.:		22-43568	22-43568	22-43568
Quotation No.:			Chemtest Sample ID.:		1544395	1544396	1544397
Order No.:			Client Sample Ref.:		3	2	2
			Sample Location:		2	TP 01	TP 02
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		2.00	1.00	1.00
			Date Sampled:		19-Oct-2022	19-Oct-2022	19-Oct-2022
			Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	8.9	11	12
pH	M	2010		4.0	6.9	8.2	6.8
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.0	0.79	0.90
Total Sulphur	M	2175	%	0.010	0.088	0.045	0.036
Cyanide (Free)	M	2300	mg/kg	0.50	[B] < 0.50	[B] < 0.50	[B] < 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	[B] < 0.50	[B] < 0.50	[B] < 0.50
Thiocyanate	M	2300	mg/kg	5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	2.3	3.7	7.8
Sulphate (Total)	U	2430	mg/kg	100	1400	550	260
Arsenic	M	2455	mg/kg	0.5	4.1	5.3	2.7
Cadmium	M	2455	mg/kg	0.10	0.70	1.0	0.45
Chromium	M	2455	mg/kg	0.5	7.5	9.5	4.2
Mercury	M	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Nickel	M	2455	mg/kg	0.50	15	23	11
Lead	M	2455	mg/kg	0.50	17	9.8	5.1
Selenium	M	2455	mg/kg	0.25	0.48	0.47	< 0.25
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	N	2780	mg/kg	0.05	[B] 0.31	[B] 0.29	[B] 0.30
Aliphatic VPH >C6-C7	N	2780	mg/kg	0.05	[B] < 0.05	[B] < 0.05	[B] < 0.05
Aliphatic VPH >C7-C8	N	2780	mg/kg	0.05	[B] < 0.05	[B] < 0.05	[B] < 0.05
Aliphatic VPH >C8-C10	N	2780	mg/kg	0.05	[B] < 0.05	[B] < 0.05	[B] < 0.05
Total Aliphatic VPH >C5-C10	N	2780	mg/kg	0.25	[B] < 0.25	[B] < 0.25	[B] < 0.25
Aliphatic EPH >C10-C12	N	2690	mg/kg	2.00	[B] < 2.0	[B] < 2.0	[B] < 2.0
Aliphatic EPH >C12-C16	N	2690	mg/kg	1.00	[B] < 1.0	[B] < 1.0	[B] < 1.0
Aliphatic EPH >C16-C21	N	2690	mg/kg	2.00	[B] < 2.0	[B] < 2.0	[B] < 2.0
Aliphatic EPH >C21-C35	N	2690	mg/kg	3.00	[B] < 3.0	[B] < 3.0	[B] < 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	1.00	[B] < 1.0	[B] < 1.0	[B] < 1.0
Total Aliphatic EPH >C10-C35	N	2690	mg/kg	5.00	[B] < 5.0	[B] < 5.0	[B] < 5.0
Aromatic VPH >C5-C7	N	2780	mg/kg	0.05	[B] < 0.05	[B] < 0.05	[B] < 0.05
Aromatic VPH >C7-C8	N	2780	mg/kg	0.05	[B] < 0.05	[B] < 0.05	[B] < 0.05
Aromatic VPH >C8-C10	N	2780	mg/kg	0.05	[B] < 0.05	[B] < 0.05	[B] < 0.05
Total Aromatic VPH >C5-C10	N	2780	mg/kg	0.25	[B] < 0.25	[B] < 0.25	[B] < 0.25
Aromatic EPH >C10-C12	N	2690	mg/kg	1.00	[B] < 1.0	[B] < 1.0	[B] < 1.0

Results - Soil

Project: 22-125 Proposed Industrial Units at Huntstown Tc, Co Fingal

Client: Hanmar Site Investigation Services Ltd		Chemtest Job No.:			22-43568	22-43568	22-43568
Quotation No.:		Chemtest Sample ID.:			1544395	1544396	1544397
Order No.:		Client Sample Ref.:			3	2	2
		Sample Location:			2	TP 01	TP 02
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			2.00	1.00	1.00
		Date Sampled:			19-Oct-2022	19-Oct-2022	19-Oct-2022
		Asbestos Lab:			DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic EPH >C12-C16	N	2690	mg/kg	1.00	[B] < 1.0	[B] < 1.0	[B] < 1.0
Aromatic EPH >C16-C21	N	2690	mg/kg	2.00	[B] < 2.0	[B] < 2.0	[B] < 2.0
Aromatic EPH >C21-C35	N	2690	mg/kg	2.00	[B] < 2.0	[B] < 2.0	[B] < 2.0
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00	[B] < 1.0	[B] < 1.0	[B] < 1.0
Total Aromatic EPH >C10-C35	N	2690	mg/kg	5.00	[B] < 5.0	[B] < 5.0	[B] < 5.0
Total VPH >C5-C10	N	2780	mg/kg	0.50	[B] < 0.50	[B] < 0.50	[B] < 0.50
Total EPH >C10-C35	N	2690	mg/kg	10.00	[B] < 10	[B] < 10	[B] < 10
Organic Matter	M	2625	%	0.40	2.8	2.2	0.60
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Project: 22-125 Proposed Industrial Units at Hunt[redacted]wn Tc, Co Fingal

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-43568						
Chemtest Sample ID:	1544395						
Sample Ref:	3						
Sample ID:							
Sample Location:	2						
Top Depth(m):	2.00						
Bottom Depth(m):							
Sampling Date:	19-Oct-2022						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	1.6	3	5	6
Loss On Ignition	2610	M	%	3.0	--	--	10
Total BTEX	2760	M	mg/kg	[B] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	[B] < 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	M		6.9	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0020	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0050	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0044	0.044	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.025	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.33	3.3	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	66	650	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	2.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	8.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Project: 22-125 Proposed Industrial Units at Huntstown Tc, Co Fingal

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-43568						
Chemtest Sample ID:	1544396						
Sample Ref:	2						
Sample ID:							
Sample Location:	TP 01						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:	19-Oct-2022						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	1.3	3	5	6
Loss On Ignition	2610	M	%	2.4	--	--	10
Total BTEX	2760	M	mg/kg	[B] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	[B] < 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.012	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0020	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0050	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0038	0.038	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.025	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.23	2.3	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	63	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	2.9	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Project: 22-125 Proposed Industrial Units at Huntstown Tc, Co Fingal

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-43568						
Chemtest Sample ID:	1544397						
Sample Ref:	2						
Sample ID:							
Sample Location:	TP 02						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:	19-Oct-2022				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	0.35	3	5	6
Loss On Ignition	2610	M	%	2.6	--	--	10
Total BTEX	2760	M	mg/kg	[B] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	[B] < 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	M		6.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.0050	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0020	0.5	2	25
Barium	1455	U	< 0.005	< 0.050	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	0.0007	0.0066	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0050	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0039	0.039	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	0.008	0.081	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.35	3.5	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	67	670	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	3.4	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1544395	3		2	19-Oct-2022	B	Amber Glass 250ml
1544395	3		2	19-Oct-2022	B	Amber Glass 60ml
1544395	3		2	19-Oct-2022	B	Plastic Tub 500g
1544396	2		TP 01	19-Oct-2022	B	Amber Glass 250ml
1544396	2		TP 01	19-Oct-2022	B	Amber Glass 60ml
1544396	2		TP 01	19-Oct-2022	B	Plastic Tub 500g
1544397	2		TP 02	19-Oct-2022	B	Amber Glass 250ml
1544397	2		TP 02	19-Oct-2022	B	Amber Glass 60ml
1544397	2		TP 02	19-Oct-2022	B	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

APPENDIX 7.1

WATER

Dublin GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km^2)
Dublin Co. Co. Kildare Co. Co. Meath Co. Co. Hydrometric Area 9	**Rivers** - Ballough Stream, Broadmeadow, Clonshanbo, Dodder, Fairyhouse Stream, Liffey, Lyreen, Mayne, Rye Water, Santry, Tolka, Ward	Dodder Valley (991), Sluice River Marsh (1763), Santry Demesne (178), Liffey Valley (128), Booterstown Marsh (1205) Donadea Wood (1391), Hodgestown Bog (1393), Liffey Bank Above Athgarvan (1396), Mouds Bog (SAC 395), Rye Water Valley (1398)	837

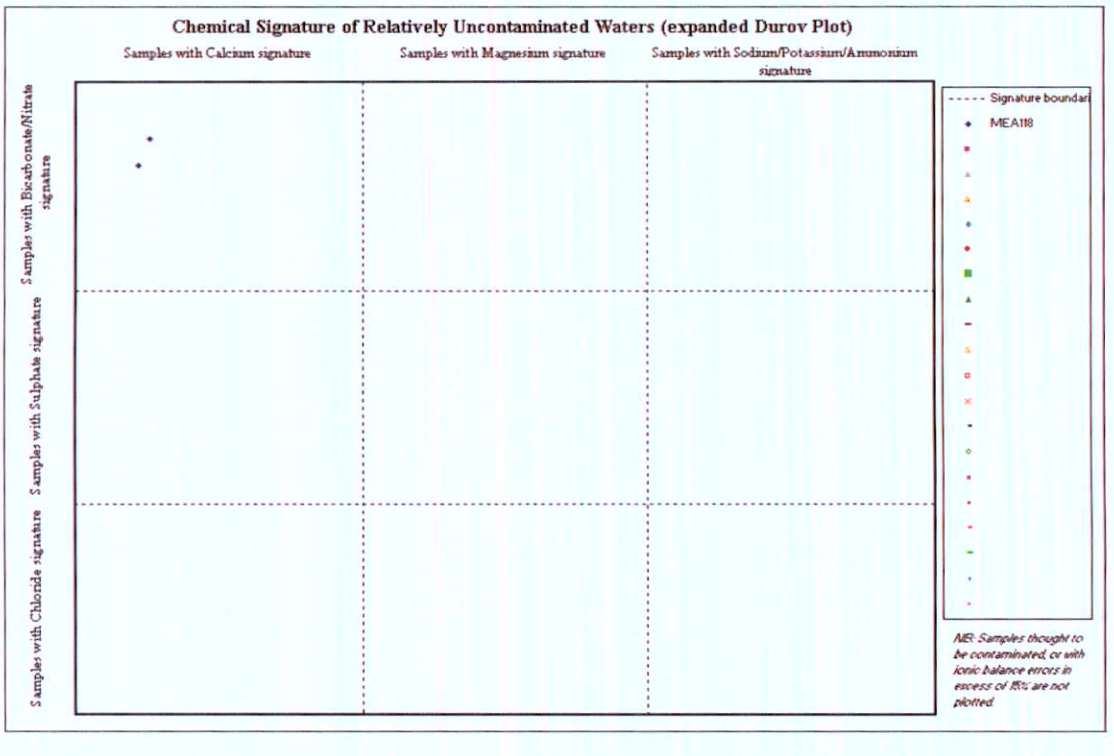
Topography		This GWB is located in the Greater Dublin City area and extends southwest towards Kildare. The area is generally low-lying, with areas of higher elevation surrounding to the south and to a lesser extent to the north. Elevations decrease towards the various river estuaries around Dublin city. At the boundaries of the GWB the highest elevations are to the south at the foothills of the Dublin Mountains and to the northwest where the Namurian rocks form an area of higher elevation to the southwest of Dunshaughlin.
Geology and Aquifers	Aquifer type(s)	**Ll:** Locally important aquifer, moderately productive only in local zones **Pl:** Poor aquifer, generally unproductive except for local zones
	Main aquifer lithologies	Dinantian Upper Impure Limestones Dinantian Lower Impure Limestones Dinantian Pure Unbedded Limestones Dinantian Mixed Sandstones, Shales and Limestones. Namurian Undifferentiated rock.
	Key structures.	In the Dublin Basin minor open NE/SW folds cause strike swings in otherwise predominantly E-W striking moderate to shallow dipping strata. A parallel anticline is present to the south in the core of which the Portraine and Lambay inliers are exposed and which continues SW towards Hermitage, exposing the Boston Hill formation along its axis. At the southern margin of the basin the Donnybrook-Tallaght syncline is present. The structure of the area south of Portmarnock is uncertain owing to the drift cover, but a further pair of major folds may occur, with the reef limestone plunging and or being faulted out west of the Balgriffin-Raheny area (Crieghton *et al* 1979).
	Key properties	In general permeability in these rock units are likely to be low (1-10m^2/d) (Creighton *et al*). Secondary dolomitisation along faults in the Dublin area suggests that they have been, and may still be, open to allow fluid migration. (ERA 1991). Pumping test analysis at the public supply boreholes at Dunboyne, Co. Meath provided transmissivity values between 10 and 150 m^2/d. (Woods 1996) A series of hydrogeological tests were carried out in the Barrockstown area around 4.5km north of Maynooth. Double Packer tests carried out on two boreholes in the area gave permeabilities ranging from 1.4×10^{-6} to 6.1×10^{-7} m/s. In situ Rising/Falling Head tests in eight of the bedrock wells gave similar results but more diverse than the packer test results, varying from 5.04×10^{-5} to 7.39×10^{-9} m/s (Cullen 1998).
	Thickness	There is a distinct reduction in the permeabilities of these rocks with depth. Packer tests show permeabilities reduce an order of magnitude for each five metres of depth in the limestone (Aspinwall & Company, 1979). Most groundwater flow will take place close to the surface with additional isolated flow along fractures and fissures located at depths up to 50 m.b.g.l.
Overlying Strata	Lithologies	There are a number of subsoil types. Their distribution is related to ice flow directions during the last ice age. To the south we find till derived from Granite and Lower Paleozoic rocks in the Dublin Mountains. Along the coast and some distance inshore there are deposits of Irish Sea Till, which is the least permeable of the subsoils. The majority of the aquifer is overlain by limestone-derived till which came from the limestone expanses around Dublin. There are smaller gravel deposits in the area, which will be the most permeable of the subsoils, including glacial deposits and alluvial gravels. To the very southwest of the GWB, in Kildare, there are major gravel deposits, including the Mid-Kildare Gravel Aquifer (The Curragh).
	Thickness	The thickness of the subsoil, as in all Ireland, is highly variable. There are thick deposits of till along the coast, over 10m thick in places. The thickness reduces further inland. West of Lucan the till deposits are mostly quite thin (<3m), with some exceptions e.g. along the river channels of the Liffey and other streams. The thickness of the overlying till increases west of a line connecting Dunboyne, Co. Meath to Maynooth to Newcastle, Co Kildare.
	% Area aquifer near surface	The area of aquifer close to surface may be quite significant. Thin subsoil areas are located towards the center of the GWB where.
	Vulnerability	The vulnerability of the groundwater is generally Extreme between Maynooth and Phoenix Park in Dublin, to the east and west of this area the general vulnerability is Moderate. It must be remembered that the vulnerability, as with subsoil thickness, is highly variable at all scales.

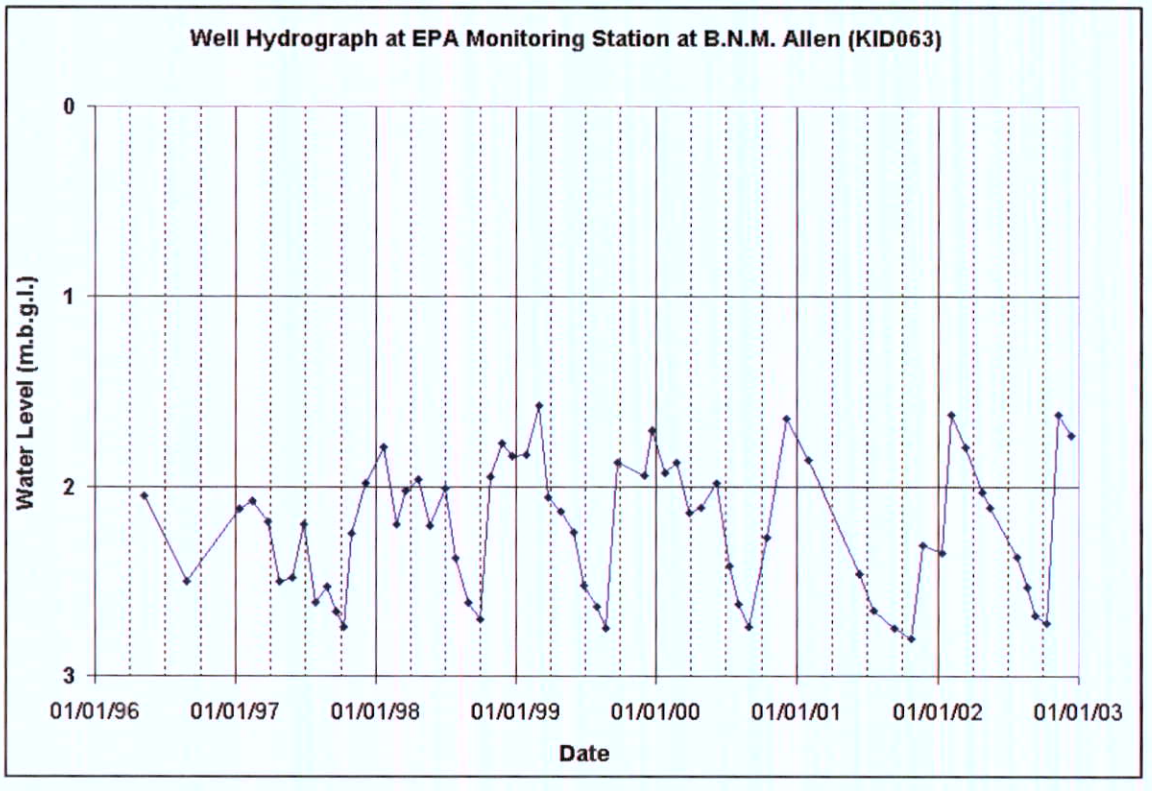
Recharge	Main recharge mechanisms	The area of the GWB beneath Dublin City will have completely different recharge processes than the rest of the GWB in rural areas. Dublin City is essentially a cement cap on the limestone, which prevents the area from receiving recharge. The only open areas where recharge may occur are at parks, squares and gardens. Conservatively it is estimated that 10% of the city area is available for recharge. Some recharge occurs from leaking sewers, mains and storm drains. To optimize recharge calculations an estimate of the leakage from mains and other water works would be of use. Elsewhere diffuse recharge will occur via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the slope. Due to the generally low permeability of the aquifers within this GWB, a high proportion of the recharge will then discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer.
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	Springs and large known abstractions	GSI Source Reports – Dunboyne (Abstraction is 1160m^3/d from four wells). A number of warm springs are situated in the Lucan and Celbridge areas. Typical spring temperatures range from 12.5-25°C, which is significantly above temperatures normally expected for Irish groundwater. It is thought that the groundwater issuing from these springs comes from a much deeper source than most groundwater in Ireland (Burdon, 1983). The presence of warm springs has been associated with deep faults, which would allow deeper, warmer waters to the surface rapidly, and it may be that they are more noticeable in poorer aquifers where the dilution effect of colder, shallower, younger waters is reduced.
	Main discharge mechanisms	The GWB will discharge directly to the Irish Sea along the coast. There will be discharge to the overlying gravel aquifers in places (ERA 1991) and there will also be discharge to the overlying rivers, if they are in hydraulic continuity with the aquifer. Dry Weather Flows vary (0.01 to 3 l/s/km^2) but typical values are quite low (<1 l/s/km^2). This implies the aquifer does not support large baseflows to the rivers during summer time.
	Hydrochemical Signature	The hydrochemical analyses of groundwater from the area indicate a very hard water (350-480 mg/l ($CaCO_3$)), with a high alkalinity (300 - 350 mg/l ($CaCO_3$)). Conductivities are also very high, ranging 550-900 µS/cm. This groundwater is a calcium bicarbonate water, as can be seen from the accompanying Durov Diagram.
Groundwater Flow Paths		The general groundwater flow direction in this aquifer is towards the coast and also towards the River Liffey and Dublin City. This aquifer is not expected to maintain regional groundwater flow paths. Groundwater circulation from recharge to discharge points will more commonly take place over a distance of less than a kilometre. The majority of groundwater flow will be a rapid flow in to upper weathered zone but flow in conduits is commonly recorded at depths of 30 to 50 m b.g.l. . The aquifer is not considered to have any primary porosity and flow will be through fractures, some of which will have been enlarged by karstification and dolomitisation. The fissured nature and the moderate permeability of the bedrock close to the surface imply that water will move at high velocities.
Groundwater & surface water interactions		The will by highly varied groundwater and surface water interaction processes occurring within the large area of this groundwater body. The nature of these interactions will be determined by local factors and it is therefore impossible to generalize over such a large area. Such local influences could include the depths and permeability of subsoil, slope, local permeability of the rock, overlying surface water bodies and human alterations to the environment. Such interactions should be considered on a local scale where the importance of them is most critical e.g. at protected areas.
Conceptual model	This GWB occupies a large area extending across the County Dublin from Malahide to Blackrock west across the whole county and extending into Kildare and Meath as far as Kilcock. The area is mostly low-lying with very little surface topography. The GWB is composed of moderate permeability karstified limestone. Very small areas of low permeability impure limestones are incorporated with this GWB, since they are isolated and do not alter significantly the flow system. The boundaries of this GWB are defined to the south by the contact with the Granites and Lower Paleozoic rocks, to the west and north by the extent of the Liffey catchment to the east by the coast. Groundwater flow occurs along fractures, joints and major faults. There are a number of warm springs located within this GWB, which suggest deep groundwater circulation is possible. Recharge occurs diffusely through the subsoils and via outcrops. Special attention must be paid to recharge assessments for the urban areas, which account for almost a quarter of the area of this GWB. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Most flow in this aquifer will occur near the surface. In general, the effective thickness of this aquifer is likely to be about 10 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep-water strikes are commonly found in more isolated faults/ fractures at depths of 30 – 50 m.b.g.l. Flow path lengths are not considered to be on a regional scale, and are typically less than 1km in length. Groundwater discharges to the numerous streams and rivers crossing the aquifer, and to the springs and seeps towards the coast.	
Attachments		
Instrumentation	Stream gauge: 08001, 08003, 08004, 08005, 08006, 08007, 08008, 08009, 08012, 08013, 09002, 09003, 09004, 09005, 09006, 09009, 09011, 09012, 09015, 09018, 09019, 09022, 09024, 09030, 09035, 09036, 09037, 09041, 09043, 09044, 09048, 09049, 09055, 09101, 09102, 10038 Borehole Hydrograph: Dundrum CMH (DLR 030), B.N.M. Allen (KID063), EPA Representative Monitoring boreholes: Batterstown (MEA118)	

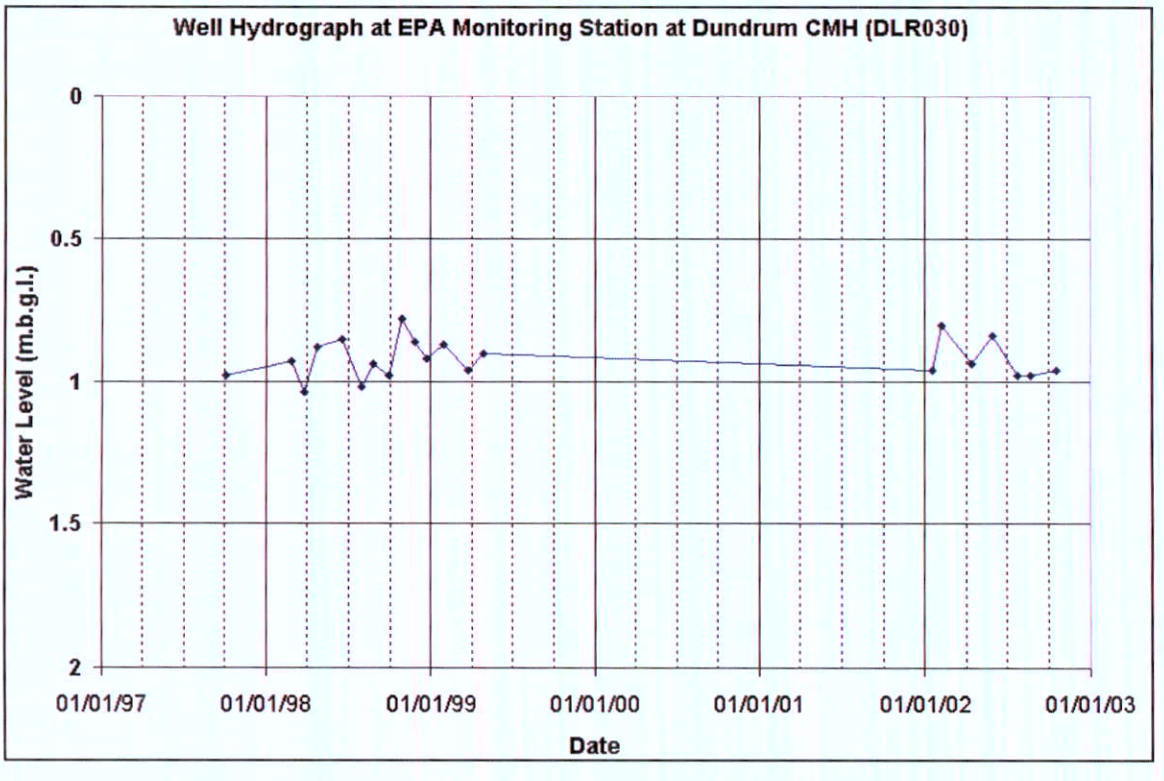
Information Sources	Aspinwall and Company (1979) *Hydrogeological survey of proposed waste disposal site at Gollierstown, Co. Dublin.* Report prepared for Dublin Co. Co. Burdon D J (1983) *Irish Groundwater Resources in Relation to Geothermal Energy Investigations*. Unpublished Report to GSI. 275pp. Creighton J R, Daly D & Reilly T A (1979) *The Geology and Hydrogeology of County Dublin with Particular Reference to the location of Waste Disposal Sites*. Unpublished GSI Report. pp 48 Cullen K T (1998) *Proposed Barrockstown Waste Management Facility*. Kelly C & Fitzsimons V. (2002) *County Kildare Groundwater Protection Scheme*. Main Report. Final report to Kildare County Council. Geological Survey of Ireland 55pp. McConnell B, Philcox M & Geraghty M, 2001. *Geology of Meath: A geological description to accompany the bedrock geology 1:100,000 scale map series, Sheet 13, Meath*. Geological Survey of Ireland. 77 p. McConnell B, Philcox M, Sleeman A G, Stanley G, Flegg A M, Daly E P & Warren W P 1994. *A Geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 16, Kildare-Wicklow*. Geological Survey of Ireland, 70 pp. Woods L (1998) *Dunboyne Public Supply, Groundwater Source protection Zones*. Report to Meath County Council. Geological Survey of Ireland. 54 p. Woods L, Meehan R & Wright G R, 1998. *County Meath Groundwater Protection Scheme*. Report to Meath County Council. Geological Survey of Ireland. 54 p Wright G R & Woods L (2003) *County Wicklow Groundwater Protection Scheme* Report to Wicklow County Council. Geological Survey of Ireland
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

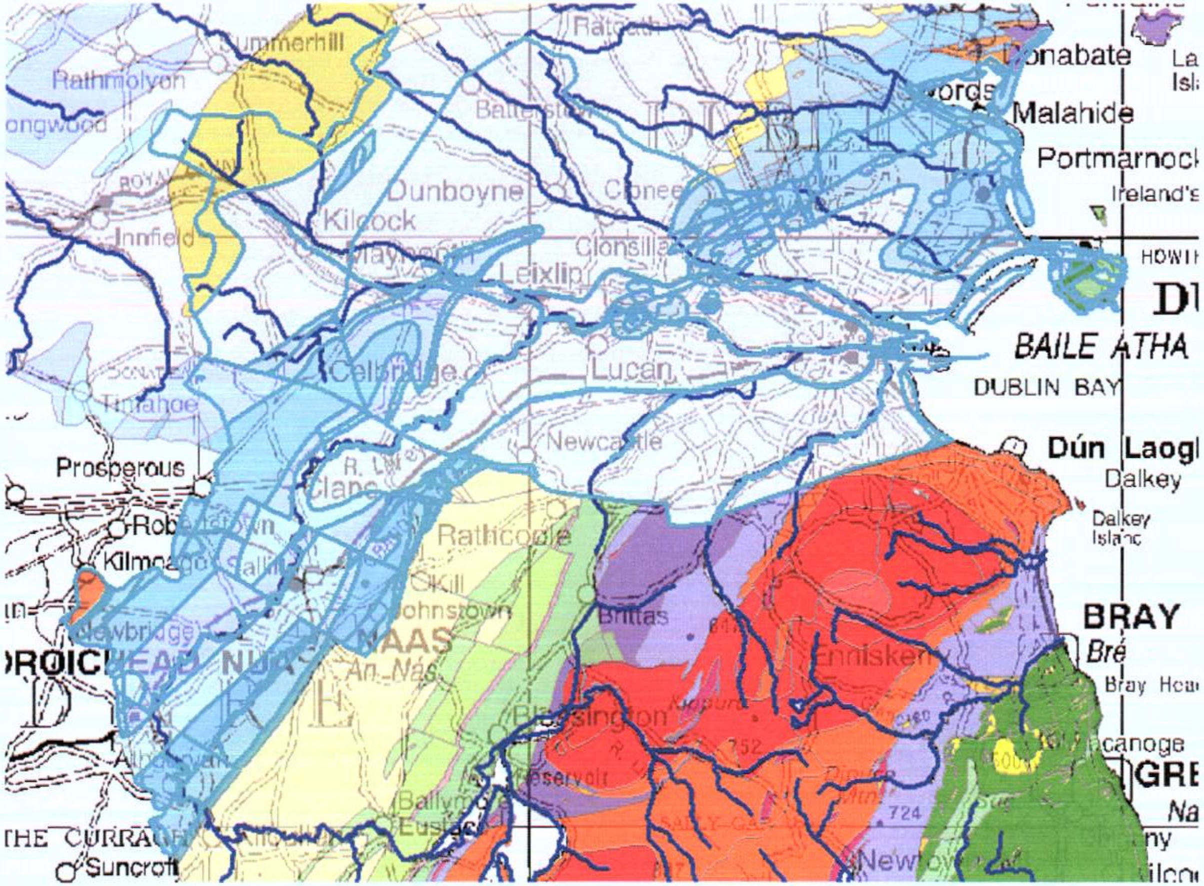
Table 1 Bedrock formations contained within the Dublin GWB

Unit Name	Code	Description
Ballysteen Formation	BA	Fossiliferous dark-gray muddy limestone
Boston Hill Formation	BN	Nodular & muddy limestone & shale
Feighcullen Formation	FE	Skeletal, oolitic & micritic limestone
Lucan Formation	LU	Dark limestone & shale (`Calp)
Namurian (undifferentiated)	NAM	Shale & sandstone
Old Red Sandstone (undifferentiated)	ORS	Red conglomerate, sandstone & mudstone
Rush Conglomerate Formation	RU	Conglomerate, shale, limestone
Tober Colleen Formation	TC	Calcareous shale, limestone conglomerate
Waulsortian Limestones	WA	Massive unbedded fine-grained limestone




Well Hydrograph at EPA Monitoring Station at B.N.M. Allen (KID063)
Water Level (m.b.g.l.)
0
1
2
3
01/01/96
01/01/97
01/01/98
01/01/99
01/01/00
01/01/01
01/01/02
01/01/03
Date


Well Hydrograph at EPA Monitoring Station at Dundrum CMH (DLR030)
Water Level (m.b.g.l.)
0
0.5
1
1.5
2
01/01/97
01/01/98
01/01/99
01/01/00
01/01/01
01/01/02
01/01/03
Date



Rathmolyon
Summerhill
Donabate
Malahide
Portmarnock
Ireland's
Dunboyne
Kilcock
Clonee
Innfield
Clonsilla
Leixlip
HOWTH
Maynooth
BAILE ÁTHA
Celbridge
Lucan
DUBLIN BAY
Timahoe
Newcastle
Dún Laog
Prosperous
Dalkey
Dalkey Island
Robertstown
Rathcoole
Kilmeague
Brittas
BRAY
Bré
NAAS
An Nás
Newbridge
Blessington
Bray Head
Enniskerry
THE CURRAGH
Suncroft

APPENDIX 8.1

TREE SURVEY

DixonBrosnan

environmental consultants

Project	**Tree Survey Report Proposed Circular Economy Hub at Huntstown and Coldwinters, Dublin**
Client	Rathdrinagh Land Limited

Project ref	**Report no**	**Client ref**	
2110.3	2110.3	-	

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Date	**Rev**	**Status**	**Prepared by**	**Reviewed**
15/03/21	1	Issue to client	Mark Donnelly BSc	Carl Dixon MSc.
03/03/23	0	Issue to client		Sorcha Sheehy PhD

v180907

1. Introduction.

The report was prepared for the proposed development at Coldwinters and Huntstown, Co. Dublin.

The aims of the report are:

1) To establish a baseline tree survey and description of the trees on the site with management recommendations and an Arboricultural Method Statement.

2) To provide an Arboricultural Impact Assessment for the site and to specify protection measures where relevant.

2. Statement of Authority

The author, Mark Donnelly, holds a BSc Hons in Forestry from Bangor University, Wales, and is a member of the Institute of Chartered Foresters. He worked as an arboricultural consultant for the National Trust in Wales for 22 years and was a lecturer in Forest Ecology at Bangor University. In Ireland, he has undertaken a range of arboricultural and ecological surveys for local authority's private sector clients in relation to projects including wind farms, quarries, housing developments, roads and pipelines.

Carl Dixon is a senior ecologist who has over 20 years' experience in ecological assessment. He also has experience in tree surveys, woodland assessment, mammal surveys, invasive species surveys and ecological supervision of large-scale projects. Projects in recent years include the Waste to Energy Facility Ringaskiddy, Shannon LNG Project, Great Island Gas Pipeline, supervision of the Fermoy Flood Relief Scheme, the Skibbereen Flood Relief Scheme, the Douglas Flood Relief Scheme, etc.

3. Report Limitations

The statements, findings and recommendations made within the report do not take into account any effects of extreme climate and weather incidences, vandalism, changes in natural and build environment around the trees after the date of this report nor any damage whether physical, chemical, or otherwise. Mark Donnelly cannot accept any liability in connection with the above factors, nor where recommended tree management is not carried out in accordance with modern tree care techniques.

The survey assesses the health and long-term suitability of trees on the site for retention in the context of the proposed development. It also addresses tree safety concerns and their management during the construction phase and subsequent landscaping.

4. Site Description

The site is in the townlands of Huntstown and Coldwinters (GPS Grid Ref: 53.40751, -6.31973) and comprises parts of two agricultural fields bounded by traditional, unmanaged hedgerows with trees. The hedges run along the south western boundaries and between the two fields. It is proposed to retain the hedgerow/treelines along the south western boundary and remove 120m of the dividing hedgerow including several trees. The site is dry with mineral soils over limestone and shale drift. The site occupies level ground rising to the north east and is not unduly exposed.

5. Methodology

The trees were surveyed on 1st March 2021. They were described and recorded as either individual trees or groups. All were marked on the site drawing which is attached as **Appendix 1.** Their locations were not plotted by topographic survey consequently their positions should be regarded as approximate. Assessment follows the standards in BS 5837 (2012), Trees in relation to design, demolition and construction. The key for the survey information is provided in **Table 1.** Root protection areas are specified in **Table 2.**

Table 1. Survey Key

1.	**Tree Numbers**	**Individual trees (prefixed by T) and Tree Groups (prefixed with G), have numbers to facilitate location on the site plan.**		
2.	**Species**	Recorded with common name		
3.	**Age**	**IM**	An immature tree	greater than 150 mm diameter but regarded as a sapling
		SM	Semi mature	a young tree but less than 50 % of its ultimate size
		M	Mature	a tree having attained dimensions typical of a fully-grown specimen of its species
		OM	Over Mature	An old specimen of a species showing signs of decline in health. Usual symptoms include crown starting to break up and decreasing in size.
4.	**Girth**	Stem diameter (at approximately 1.3 m above ground) in mm		
5.	**Height**	Approximate tree height in meters.		
6.	**Spread**	Crown spread in meters.		
7.	**Condition**	**Good**	Full healthy canopy with good form and health	
		Fair	A specimen whose overall condition is typical of the site and may exhibit slightly reduced leaf cover/minor deadwood or may be predisposed to defects, e.g. Coppiced growth, but otherwise in good health.	
		Poor	A specimen which through defect or disease has a limited longevity or may be unsafe.	
8.	**Comments**	Any information relating to trees condition not covered previously and recommendation for removal/retention.		
9.	**Recommendation**	General recommendations for retention, felling/removal and tree surgery.		
10.	**Tree Retention Category**	**A**	Indicates a tree of high quality and a good example of their species and of significant landscape value. Should contribute significantly to their environs for a minimum of 40years.	
		B	Indicates a tree of moderate quality and value. Should contribute significantly for at least 20 years.	
		C	Indicates a tree of low quality and value, that could contribute for at least 10 years.	
		U	Indicates a tree of poor condition that should not be retained for more than 10 years.	
11.	**RPA**	Root Protection Area as a radius measured from the tree centre in meters. RPA is the minimum radial range of tree protection necessary to safeguard trees roots and would normally be the same as the "Construction Exclusion Zone" enclosed by fencing during construction. The RPA is calculated as follows: <u>Single stem tree:</u> RPA radius – stem diameter x .12 (See Root Protection Area Table). <u>Trees with more than one stem arising below 1.50m above ground level:</u> RPA radius – equivalent resultant combined stem diameter for multi-stemmed trees. (RPA calculation is capped at 5 stems)		

Table 2. Root Protection Area

Single stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)	Single stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)
75	0.9	3	675	8.1	206
100	1.2	5	700	8.4	222
125	1.5	7	725	8.7	238
150	1.8	10	750	9	255
175	2.1	14	775	9.3	272
200	2.4	18	800	9.6	290
225	2.7	23	825	9.9	308
250	3	28	850	10.2	327
275	3.3	34	875	10.5	346
300	3.6	41	900	10.8	366
325	3.9	48	925	11.1	387
350	4.2	55	950	11.4	408
375	4.5	64	975	11.7	430
400	4.8	72	1000	12	452
425	5.1	81	1025	12.3	475
450	5.4	92	1050	12.6	499
475	5.7	102	1075	12.9	519
500	6	113	1100	13.2	547
525	6.3	124	1125	13.5	573
550	6.6	137	1150	13.8	598
575	6.9	150	1175	14.1	625
600	7.2	163	1200	14.4	652
625	7.5	177	1225	14.7	679
650	7.8	191	1250	15	707