



**CAUSEWAY**  
— GEOTECH

## North Irish Sea Array Landfall – Ground Investigation

Client: Statkraft Limited

Client's Representative: Arup

Report No.: 21-1619A

Date: December 2022

Status: Final Report

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Document Control Sheet

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## Document Control Sheet

<b>Report No.:</b>		21-1619			
<b>Project Title:</b>		North Irish Sea Array			
<b>Client:</b>		Statkraft Limited			
<b>Client's Representative:</b>		Arup			
<b>Revision:</b>	A01.	<b>Status:</b>	Final Report	<b>Issue Date:</b>	December 2022
<b>Prepared by:</b>		<b>Reviewed by:</b>		<b>Approved by:</b>	
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The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015+A1:2020, Code of practice for site investigations.

EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

## METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015+A1:2020, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler).
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler).
P	Nominal 100mm diameter undisturbed piston sample.
B	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
C	Core sub-sample (displayed in the Field Records column on the logs).
L	Liner sample from dynamic sampled borehole.
W	Water sample.
ES / EW	Soil sample for environmental testing / Water sample for environmental testing.
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained).
SPT (c)	Standard penetration test using 60 degree solid cone.
(x,x/x,x,x,x)	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.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	In situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength      VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of $N \times 5 = C_u$ is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	Water strike: initial depth of strike.
▼	Water strike: depth water rose to.
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
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.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum) measured in millimetres.

## North Irish Sea Array

### 1 AUTHORITY

On the instructions of Arup, (“the Client’s Representative”), acting on the behalf of Statkraft Limited (“the Client”), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of a proposed onshore cable route.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

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. 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 recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client’s Representative in response to a particular set of 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.

### 2 SCOPE

The extent of the investigation, as instructed by the Client’s Representative, included boreholes, trial pits, soil and rock core sampling, environmental sampling, groundwater monitoring, in-situ and laboratory testing, downhole geophysics and the preparation of a factual report on the findings.

### 3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted on the site of agricultural lands located north of Balbriggan. The landfall site is bordered to the east by the Irish Sea and to the north, south and west by agricultural lands. The R132 and main railway line connecting Dublin northwards also runs through the site.

## 4 SITE OPERATIONS

### 4.1 Summary of site works

Site operations, which were conducted between the 23<sup>rd</sup> of February and the 26<sup>th</sup> of April 2022, comprised:

- eleven boreholes:
  - seven boreholes by light cable percussion extended by rotary follow-on.
  - four boreholes by rotary drilling methods.
- a standpipe installation in five boreholes
- ten machine dug trial pits; and
- downhole geophysics

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

### 4.2 Boreholes

A total of eleven boreholes were put down in a minimum diameter of 150mm through soils and rock strata to their completion depths by a combination of methods, including light percussion boring using light cable percussion boring by Dando 2000 and 3000 rigs, and rotary drilling by Comacchio 205, Comacchio 405 and Comacchio 601 rotary drilling rigs.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

#### 4.2.1 Boreholes by combined percussion boring and rotary follow-on drilling

Seven boreholes (BH03-BH07 and BH15-BH16) were put down by a combination of light cable percussion boring and rotary follow-on drilling techniques with core recovery in overburden and bedrock. Where the cable percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to completion/bedrock. Symmetrix cased full-hole drilling was used, with SPTs carried out at standard intervals as required.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 at standard depth intervals throughout the overburden using the split spoon sampler (SPT<sub>(s)</sub>) or solid cone attachment (SPT<sub>(c)</sub>). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix H.

Where coring was carried out within bedrock strata, Geobor S Coring was used. The core was extracted in up to 1.5m lengths using an SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

#### **4.2.2 Rotary drilled boreholes**

Four boreholes (BH01, BH02, BH17, BH18) were put to their completion by rotary drilling techniques only. The boreholes were completed using tracked Comacchio 405 and Comacchio 601 rotary drilling rigs.

Symmetrix-cased full hole rotary percussive drilling techniques were employed to advance the boreholes to a specified depth, after which rotary coring was employed to recover core samples of the overburden and bedrock. SPTs were carried out at standard intervals throughout the overburden, with small and bulk disturbed samples obtained where possible through the soil strata.

Where coring was carried out within bedrock strata, Geobor S Coring was used. The core was extracted in up to 1.5m lengths using an SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

#### **4.3 Standpipe installations**

A groundwater monitoring standpipe was installed in BH01, BH03, BH06, BH16 and BH17.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

#### **4.4 Trial Pits**

Ten trial pits (TP01-TP05, TP07-TP09 and TP11-TP12) were excavated using a 6t tracked excavator fitted with a 600mm wide bucket, to a maximum depth of 3.0m.

Environmental samples were taken at various depths in each trial pit.

Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix D presents the trial pit logs with photographs of the pits and arising provided in Appendix E.

#### **4.5 Surveying**

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R10 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

#### **4.6 Groundwater monitoring**

Following completion of site works, groundwater monitoring was conducted. Ground water monitoring was carried out using a water interface probe.

The monitoring records are presented in Table 2 of Section 6.3.

### **5 LABORATORY WORK**

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.



## 5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **shear strength (total stress):** unconsolidated undrained triaxial tests (uu)
- **shear strength (effective stress):** consolidated undrained triaxial tests (cu)
- **compaction related:** dry density/moisture content relationship, Moisture Condition Value (MCV), MCV/moisture content relationship
- **soil chemistry:** BRE Suite B, thermal resistivity

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix F.

## 5.2 Geotechnical laboratory testing of rock

Laboratory testing of rock sub-samples comprised:

- point load index
- unconfined compressive strength (UCS) tests

Test	Test carried out in accordance with
Point load index	ISRM Suggested Methods (1985) Suggested method for determining point-load strength. Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 22, pp. 53–60
Uniaxial compression strength tests	ISRM Suggested Methods (1981) Suggested method for determining deformability of rock materials in uniaxial compression, Part 2 and ISRM (2007) Ulusay R, Hudson JA (eds) The complete ISRM suggested methods for rock characterization, testing and monitoring, 2007

The test results are presented in Appendix F.

### 5.3 Environmental laboratory testing of soils

Environmental testing was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out according to Arup Soil Suite E, with all testing scheduled by the client's representative.

Results of environmental laboratory testing are presented in Appendix G.

## 6 GROUND CONDITIONS

### 6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Glacial Till and Alluvium. These deposits are underlain by andesite, pillow breccia and tuff of the Belcamp Formation.

### 6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered a maximum thickness of 450mm across the site.
- **Possible Made Ground (fill):** sandy gravelly clay encountered in BH03, BH15 and BH16 extending to a maximum depth of 2.30m in BH16.
- **Fluvioglacial deposits:** typically medium dense sands interspersed with layers of sandy gravelly clay in BH05, BH06 and BH17.
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.
- **Bedrock (Breccia, Andesite, Greywacke, Mudstone, Tuff, Limestone and Siltstone):** Rockhead was encountered at depths ranging from 3.0m in BH01 to 12.60m in BH05.

### 6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during drilling and trial pit excavations as groundwater strikes as shown in Table 1.

**Table 1: Groundwater strikes encountered during ground investigation.**

Location	Depth (mbgl)
BH03	2.60/7.30
BH04	1.30/2.80/3.50
BH05	4.30
BH06	2.00
BH15	5.00
BH16	5.00/9.90
TP01	1.20
TP03	1.30
TP05	1.70
TP07	2.00
TP08	1.40
TP11	1.00
TP12	1.00

Groundwater was not noted during drilling at any of the other borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out additional groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out.

It should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

**Table 2: Groundwater monitoring records.**

Location	Round 1 (26/05/2022) - mbgl	Round 2 (08/06/2022) - mbgl	Round 3(15/09/2022) - mbgl
BH01	1.10	10.28	2.19
BH06	0.80	0.86	0.72
BH16	1.71	1.79	2.25
BH17	3.90	3.95	4.54

Continued monitoring of the installations will give an indication of the seasonal variations on groundwater level which should be factored into design considerations.

## 7 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland.

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. National Standards Authority of Ireland.

BS 5930: 2015+A1:2020: Code of practice for ground investigations. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.



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**APPENDIX A**  
**SITE AND EXPLORATORY HOLE LOCATION PLANS**







**Project No.:** 21-1619A  
**Project Name:** North Irish Sea Array Landfall

**Client:** Statkraft Limited  
**Client's Representative:** Arup

Legend Key



**Title:**  
Site Location Plan

**Last Revised:**  
02/12/2022

**Scale:**  
1:20000



Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

1 Kilometres  
3000 Feet

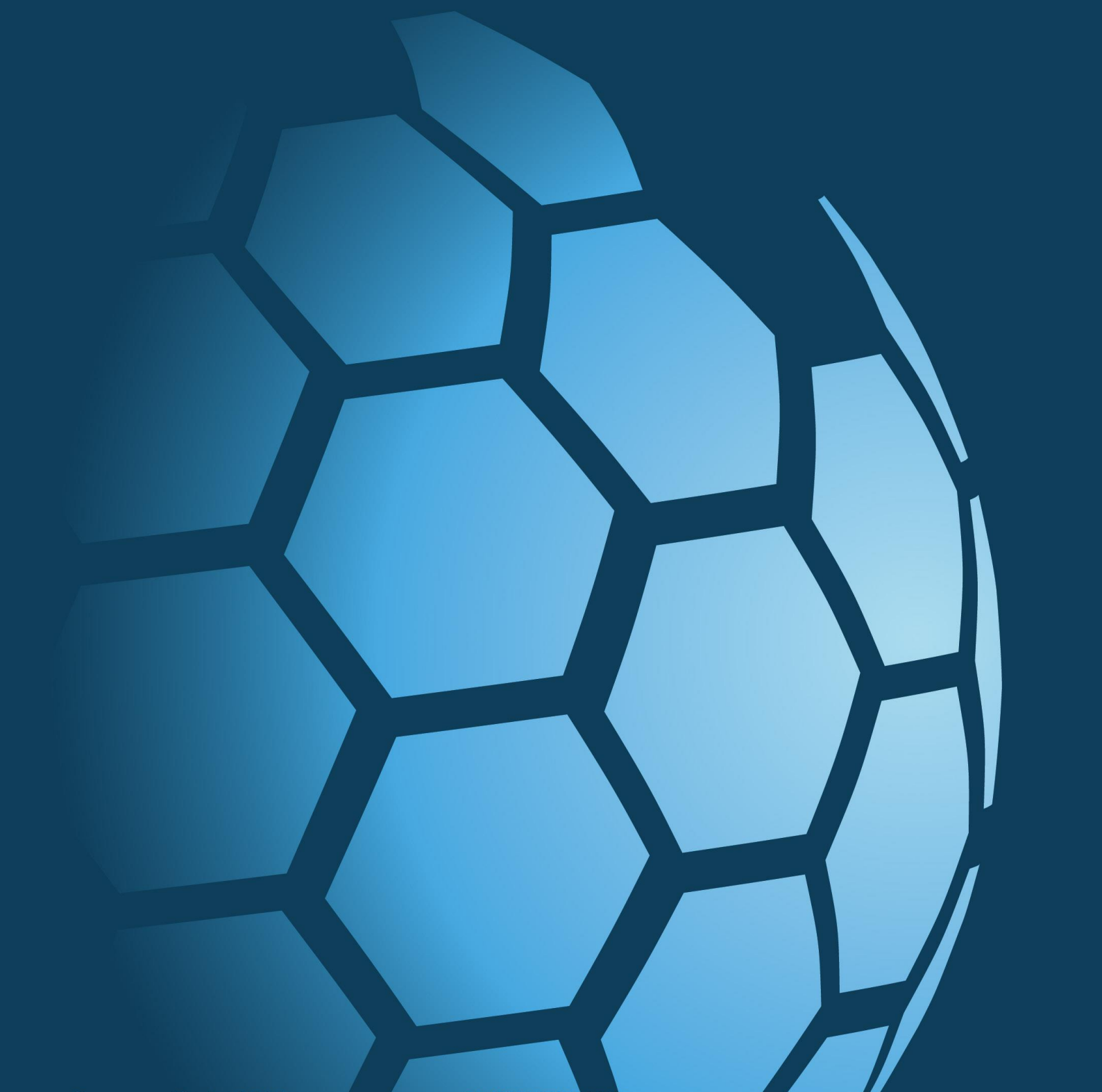


200 Metres
900 Feet




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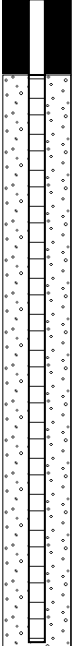

**APPENDIX B**  
**BOREHOLE LOGS**














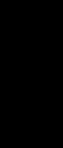



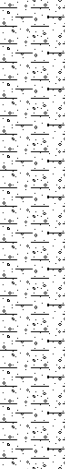


<div><div>CAUSEWAY GEOTECH</div></div>										Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH01					
Method Rotary Drilling Rotary Coring		Plant Used Comacchio 405 Comacchio 405		Top (m) 0.00 2.70		Base (m) 2.70 30.00		Coordinates 719758.67 E 765371.97 N		Client: Statkraft Limited		Client's Rep Arup		Final Depth: 30.00 m		Start Date: 21/04/2022		Driller: MW		Sheet 2 of 5 Scale: 1:40	
										Elevation: 3.53 mOD		End Date: 25/04/2022		Logger: DM		FINAL					
Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill								
8.20		100	100	90							Medium strong grey ANDESITE with white calcite veins (up to 50mm thick) at various orientations. Partially weathered: slightly reduced strength, slightly closer fracture spacing with discolouration on joint surfaces. Discolouration: 1. 10-20 degree joints, medium spaced (40/300/740), undulating, rough with orangish brown discolouration on joint surfaces. 2. 30-40 degree joints, widely spaced (130/1950/6500), undulating, rough with brown discolouration on joint surfaces. 3. 80-90 degree joints, very widely spaced (3200/6000/10000), undulating, rough with yellowish brown discolouration on fracture surfaces.			7.5							
9.70		100	100	97											8.0						
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<div></div>										Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH01			
Method Rotary Drilling Rotary Coring		Plant Used Comacchio 405 Comacchio 405		Top (m) 0.00 2.70		Base (m) 2.70 30.00		Coordinates 719758.67 E 765371.97 N		Final Depth: 30.00 m		Start Date: 21/04/2022		Driller: MW		Sheet 3 of 5 Scale: 1:40			
										Elevation: 3.53 mOD		End Date: 25/04/2022		Logger: DM		FINAL			
Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description					Water	Backfill		
15.70		100	100	97							<p>Medium strong grey ANDESITE with white calcite veins (up to 50mm thick) at various orientations. Partially weathered: slightly reduced strength, slightly closer fracture spacing with discolouration on joint surfaces.</p> <p>Discolouration:</p> <ol style="list-style-type: none"><li>10-20 degree joints, medium spaced (40/300/740), undulating, rough with orangish brown discolouration on joint surfaces.</li><li>30-40 degree joints, widely spaced (130/1950/6500), undulating, rough with brown discolouration on joint surfaces.</li><li>80-90 degree joints, very widely spaced (3200/6000/10000), undulating, rough with yellowish brown discolouration on fracture surfaces.</li></ol>								
17.20		100	100	97															


<div></div>										Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH01																																																																																																																																																																																																																																																																																											
Method		Plant Used		Top (m)		Base (m)		Coordinates		Final Depth: 30.00 m		Start Date: 21/04/2022		Driller: MW		Sheet 4 of 5 Scale: 1:40																																																																																																																																																																																																																																																																																											
Rotary Drilling Rotary Coring		Comacchio 405 Comacchio 405		0.00 2.70		2.70 30.00		719758.67 E 765371.97 N		Elevation: 3.53 mOD		End Date: 25/04/2022		Logger: DM		FINAL																																																																																																																																																																																																																																																																																											
<table><tr><td>Depth (m)</td><td>Samples / Field Records</td><td>TCR</td><td>SCR</td><td>RQD</td><td>FI</td><td>Casing Depth (m)</td><td>Water Depth (m)</td><td>Level mOD</td><td>Depth (m)</td><td>Legend</td><td>Description</td><td>Water</td><td>Backfill</td><td></td></tr><tr><td>23.20</td><td></td><td>100</td><td>100</td><td>93</td><td></td><td></td><td></td><td></td><td></td><td rowspan="4"></td><td rowspan="4">Medium strong grey ANDESITE with white calcite veins (up to 50mm thick) at various orientations. Partially weathered: slightly reduced strength, slightly closer fracture spacing with discolouration on joint surfaces. Discolouration: 1. 10-20 degree joints, medium spaced (40/300/740), undulating, rough with orangish brown discolouration on joint surfaces. 2. 30-40 degree joints, widely spaced (130/1950/6500), undulating, rough with brown discolouration on joint surfaces. 3. 80-90 degree joints, very widely spaced (3200/6000/10000), undulating, rough with yellowish brown discolouration on fracture surfaces.</td><td></td><td></td><td>22.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>22.5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>23.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>23.5</td></tr><tr><td>24.70</td><td></td><td>93</td><td>85</td><td>70</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24.5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>25.0</td></tr><tr><td>26.20</td><td></td><td>100</td><td>100</td><td>97</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>25.5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>26.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>26.5</td></tr><tr><td>27.70</td><td></td><td>90</td><td>85</td><td>80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>27.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>27.5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>28.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>28.5</td></tr><tr><td>29.20</td><td></td><td>100</td><td>95</td><td>90</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>29.0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td>TCR</td><td>SCR</td><td>RQD</td><td>FI</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																		Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill		23.20		100	100	93							Medium strong grey ANDESITE with white calcite veins (up to 50mm thick) at various orientations. Partially weathered: slightly reduced strength, slightly closer fracture spacing with discolouration on joint surfaces. Discolouration: 1. 10-20 degree joints, medium spaced (40/300/740), undulating, rough with orangish brown discolouration on joint surfaces. 2. 30-40 degree joints, widely spaced (130/1950/6500), undulating, rough with brown discolouration on joint surfaces. 3. 80-90 degree joints, very widely spaced (3200/6000/10000), undulating, rough with yellowish brown discolouration on fracture surfaces.			22.0														22.5															23.0															23.5	24.70		93	85	70											24.0																24.5																25.0	26.20		100	100	97											25.5																26.0																26.5	27.70		90	85	80											27.0																27.5																28.0																28.5	29.20		100	95	90											29.0																			TCR	SCR	RQD	FI										
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<table><tr><td colspan="4">Water Strikes</td><td colspan="4" rowspan="3">Remarks Hand dug inspection pit excavated to 1.20m. Location: Landfall. Televviewer completed.</td></tr><tr><td>Struck at (m)</td><td>Casing to (m)</td><td>Time (min)</td><td>Rose to (m)</td></tr><tr><td>2.80</td><td></td><td></td><td></td></tr></table>										Water Strikes				Remarks Hand dug inspection pit excavated to 1.20m. Location: Landfall. Televviewer completed.				Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	2.80																																																																																																																																																																																																																																																																																					
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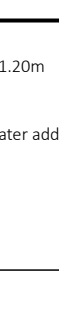

<div><div>CAUSEWAY GEOTECH</div></div>										Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH01								
Method Rotary Drilling Rotary Coring		Plant Used Comacchio 405 Comacchio 405		Top (m) 0.00 2.70		Base (m) 2.70 30.00		Coordinates 719758.67 E 765371.97 N		Client: Statkraft Limited		Client's Rep Arup		Final Depth: 30.00 m		Start Date: 21/04/2022		Driller: MW		Sheet 5 of 5 Scale: 1:40				
										Elevation: 3.53 mOD		End Date: 25/04/2022		Logger: DM		FINAL								
Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description										Water	Backfill		
30.00		100	90	70				-26.47	30.00		<div>Medium strong grey ANDESITE with white calcite veins (up to 50mm thick) at various orientations. Partially weathered: slightly reduced strength, slightly closer fracture spacing with discolouration on joint surfaces.</div> <div>Discolouration:</div> <div>1. 10-20 degree joints, medium spaced (40/300/740), undulating, rough with orangish brown discolouration on joint surfaces.</div> <div>2. 30-40 degree joints, widely spaced (130/1950/6500), undulating, rough with brown discolouration on joint surfaces.</div> <div>3. 80-90 degree joints, very widely spaced (3200/6000/10000), undulating, rough with yellowish brown discolouration on fracture surfaces.</div> <div>End of Borehole at 30.00m</div>													

										<b>Project No.</b> 21-1619A		<b>Project Name:</b> North Irish Sea Array Landfall <b>Client:</b> Statkraft Limited <b>Client's Rep</b> Arup			<b>Borehole ID</b> BH02	
<b>Method</b> Rotary Drilling Rotary Coring		<b>Plant Used</b> Comacchio 405 Comacchio 405		<b>Top (m)</b> 0.00 2.50		<b>Base (m)</b> 2.50 30.00		<b>Coordinates</b> 719788.43 E 765520.35 N		<b>Final Depth:</b> 30.00 m <b>Start Date:</b> 13/04/2022 <b>Driller:</b> RS		Sheet 1 of 5 Scale: 1:40				
										<b>Elevation:</b> 5.43 mOD <b>End Date:</b> 21/04/2022 <b>Logger:</b> EM		FINAL				
Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill			
4.00		63			AZCL			2.93	2.50		Soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.					
											Soft brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular of various lithologies predominantly andesite.					
											2.50-3.05m: AZCL					
5.50		90	76	13	NI			0.78	4.65		Weak (locally very weak) brownish grey GREYWACKE. Distinctly weathered: reduced strength, much closer fracture spacing with discolouration and clay deposits on fracture surfaces and clay infill. Discontinuities: 1. 20-30 degree bedding fractures, medium spaced (130/357/750), planar, smooth to rough, with dark reddish brown and orangish brown staining on most fracture surfaces and brown clay deposits (up to 3mm thick) on most fracture surfaces. 2. 50-60 degree joints at 5.90-6.00m and 6.10-6.20m, planar, smooth to rough with patchy brown staining and patchy brown clay deposits (<1mm thick) on most joint surfaces.					
7.00		100	88	36	12						7.00-7.10m: Soft light brown slightly sandy silty clay infill					

<b>Water Strikes</b>				<b>Remarks</b> Hand dug inspection pit excavated to 1.20m Location: Landfall Televiewer completed. No noticeable groundwater strikes- water added during drilling.
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	
<b>Casing Details</b>		<b>Core Barrel</b>		
To (m)	Diam (mm)	SK6L		
2.50	200			
30.00	150			
<b>Flush Type</b>		<b>Termination Reason</b>		
Water		Terminated at scheduled depth		
<b>Last Updated</b>				
02/12/2022				



				<b>Project No.</b> 21-1619A		<b>Project Name:</b> North Irish Sea Array Landfall <b>Client:</b> Statkraft Limited <b>Client's Rep</b> Arup			<b>Borehole ID</b> BH02				
<b>Method</b> Rotary Drilling Rotary Coring		<b>Plant Used</b> Comacchio 405 Comacchio 405		<b>Top (m)</b> 0.00 2.50		<b>Base (m)</b> 2.50 30.00		<b>Coordinates</b> 719788.43 E 765520.35 N		<b>Final Depth:</b> 30.00 m <b>Start Date:</b> 13/04/2022 <b>Driller:</b> RS		Sheet 2 of 5 Scale: 1:40	
								<b>Elevation:</b> 5.43 mOD <b>End Date:</b> 21/04/2022 <b>Logger:</b> EM		<b>FINAL</b>			
<b>Depth (m)</b>	<b>Samples / Field Records</b>	<b>TCR</b>	<b>SCR</b>	<b>RQD</b>	<b>FI</b>	<b>Casing Depth (m)</b>	<b>Water Depth (m)</b>	<b>Level mOD</b>	<b>Depth (m)</b>	<b>Legend</b>	<b>Description</b>	<b>Water</b>	<b>Backfill</b>
8.50		98	65	30				-2.22	7.65	.....	Weak (locally very weak) brownish grey GREYWACKE. Distinctly weathered: reduced strength, much closer fracture spacing with discolouration and clay deposits on fracture surfaces and clay infill. Discontinuities: 1. 20-30 degree bedding fractures, medium spaced (130/357/750), planar, smooth to rough, with dark reddish brown and orangish brown staining on most fracture surfaces and brown clay deposits (up to 3mm thick) on most fracture surfaces. 2. 50-60 degree joints at 5.90-6.00m and 6.10-6.20m, planar, smooth to rough with patchy brown staining and patchy brown clay deposits (<1mm thick) on most joint surfaces.		
					>20					.....	Weak (locally very weak) grey GREYWACKE. Distinctly weathered: much closer fracture spacing, reduced strength with clay deposits and discolouration on fracture surfaces. Discontinuities: 1. 35-45 degree bedding fractures, medium spaced (200/375/700), planar, smooth to rough with strong dark brown and reddish brown staining on most fracture surfaces 2. 50-60 degree joints at 7.83-8.05m, planar, smooth to rough with brown staining and light brown clay deposits (up to 3mm thick) on joint surface.		
10.00		100	55	13						.....			
					NI					.....			
		100	60	46	13			-5.37	10.80	.....			
11.50										.....	Medium strong grey ANDESITE with white calcite veins (up to 90mm thick) at various orientations. Partially weathered: slightly reduced strength with discolouration and clay deposits on fracture surfaces. Discontinuities: 1. 5-15 degree joints, medium spaced (150/428/960), slightly undulating, rough with orangish brown and brown staining on most joint surfaces and patchy brown clay deposits (up to 5mm thick) on some joint surfaces 2. 50-60 degree joint at 11.05-11.16m, undulating, rough with orangish brown and brown staining, patchy greyish brown clay deposits (<1mm thick) and white calcite mineralisation on joint surface 3. 70 degree joint at 13.00-13.30m, undulating, rough with rare patchy orangish brown staining and white calcite mineralisation on joint surface <i>12.40-12.80m: recovered as subangular medium to coarse gravel</i>		
		100	53	46						.....			
13.00					NI					.....			
					4					.....			
								-7.87	13.30	.....	Medium strong grey ANDESITE with white calcite veins (up to 25mm thick) at various orientations. Largely unweathered: slightly closer fracture spacing. Discontinuities: 1. 20-30 degree joints, widely spaced (450/1300/1300), planar, rough, clean 2. 50-60 degree joints at 16.70-16.85m and 17.15-17.30m, planar, rough, clean 3. 5 degree joint at 14.33m, planar, rough, clean		
14.50		100	96	96						.....			
										.....			
		TCR	SCR	RQD	FI								
<b>Water Strikes</b> Struck at (m) Casing to (m) Time (min) Rose to (m)						<b>Remarks</b> Hand dug inspection pit excavated to 1.20m Location: Landfall Televiewer completed. No noticeable groundwater strikes- water added during drilling.							
<b>Casing Details</b> To (m) Diam (mm) 2.50 200 30.00 150						<b>Core Barrel</b> SK6L							
<b>Flush Type</b> Water						<b>Termination Reason</b> Terminated at scheduled depth							
						<b>Last Updated</b> 02/12/2022							
													



















						Project No. 21-1619A			Project Name: North Irish Sea Array Landfall Client: Statkraft Limited Client's Rep Arup					Borehole ID BH02							
Method Rotary Drilling Rotary Coring		Plant Used Comacchio 405 Comacchio 405		Top (m) 0.00 2.50		Base (m) 2.50 30.00		Coordinates 719788.43 E 765520.35 N		Final Depth: 30.00 m		Start Date: 13/04/2022		Driller: RS		Sheet 3 of 5 Scale: 1:40					
										Elevation: 5.43 mOD		End Date: 21/04/2022		Logger: EM		FINAL					
Depth (m)	Samples / Field Records			TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description				Water	Backfill			
16.00				100	100	100							Medium strong grey ANDESITE with white calcite veins (up to 25mm thick) at various orientations. Largely unweathered: slightly closer fracture spacing. Discontinuities: 1. 20-30 degree joints, widely spaced (450/1300/1300), planar, rough, clean 2. 50-60 degree joints at 16.70-16.85m and 17.15-17.30m, planar, rough, clean 3. 5 degree joint at 14.33m, planar, rough, clean								
17.50				100	100	100	2						Medium strong grey ANDESITE with white calcite veins (up to 5mm thick) at various orientations. Largely unweathered: slightly closer fracture spacing Discontinuities: 1. 5-10 degree joints at 24.25m, 25.15m, and 25.40m, planar, rough, clean 2. 30-40 degree joints at 21.55m and 27.35m, planar, rough with white calcite mineralisation on joint surfaces, otherwise clean 3. 60-70 degree joint at 19.5-19.85m, undulating, rough, clean 4. 70-80 degree joint at 24.60-25.00m, undulating, rough with orangish brown staining on joint surface, otherwise clean								
19.00				100	100	100															
20.50				100	100	100															
Water Strikes				Remarks																	
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		Hand dug inspection pit excavated to 1.20m Location: Landfall Televiwer completed. No noticeable groundwater strikes- water added during drilling.													
Casing Details				Core Barrel																	
To (m)		Diam (mm)		SK6L																	
2.50		200																			
30.00		150		Flush Type				Termination Reason								Last Updated		AGS			
				Water				Terminated at scheduled depth								02/12/2022					









<div></div> <div>CAUSEWAY GEOTECH</div>				Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH03											
						Client: Statkraft Limited															
						Client's Rep: Arup															
Method		Plant Used		Top (m)	Base (m)	Coordinates		Final Depth: 20.00 m		Start Date: 15/03/2022		Driller: BM+RS		Sheet 1 of 3 Scale: 1:50							
Cable Percussion Rotary Coring		Dando 2000 Comacchio 405		0.00 5.50	5.50 20.00	719414.12 E 765319.80 N		Elevation: 8.63 mOD		End Date: 12/03/2022		Logger: CH+TH		FINAL							
Depth (m)	Sample / Tests	Field Records			Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description				Water	Backfill						
0.30 - 0.50	B1	N=15 (2,3/3,3,4,5) Hammer SN = 0199			1.00	Dry	8.33	0.30		MADE GROUND: Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.						0.5					
0.50	ES								Firm brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.												
0.80 - 1.00	B2																				
1.00	ES																				
1.20	D7																				
1.20 - 1.65	SPT (S)	Ublow=20 90%			1.50	Dry	6.63	1.50		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.						1.5					
1.80 - 2.00	B3	Slow seepage at 2.60m																			
2.00	U13							2.00	Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.												
2.80 - 3.00	B4	N=13 (2,3/3,3,3,4) Hammer SN = 0199			3.00	Dry	4.13	4.50		Very stiff brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.						4.5					
3.00	D8																				
3.00 - 3.45	SPT (S)																				
3.80 - 4.00	B5	N=15 (3,3/3,3,4,5) Hammer SN = 0199			3.00	Dry	4.13	4.50		Very stiff brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.						4.5					
4.00	D9																				
4.00 - 4.45	SPT (S)																				
5.00 - 5.45	U14	Ublow=30 100%			3.00	Dry	3.13	5.50		Stiff becoming very stiff brownish grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies.						5.5					
5.50	D10	80																			
5.50 - 6.80	C1																				
6.00	D11																				
6.00 - 7.00	B6	73	AZCL				3.00	Dry	1.18	7.45		Very stiff greyish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of mudstone and sandstone.						7.5			
6.00 - 7.00	SPT(S) N=43 (5,7/9,9,11,14) Hammer SN = 0199																				
6.00 - 6.45																					
7.00		100					3.00	Dry	0.13	8.50		Very stiff dark grey slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is subangular fine to coarse.						8.5			
7.30 - 7.52	SPT(S) N=50 (15,25/50 for 75mm) Hammer SN = 0199 Slow seepage at 7.30m																				
7.50	D12																				
8.50							-0.52			9.15		Dark grey subangular fine to coarse GRAVEL of mudstone and sandstone.						9.0			
8.50 - 9.15	C2																				
8.50 - 8.68	SPT(C) N=50 (7,15/50 for 25mm) Hammer SN = 1376																				
9.15 - 9.55	C3	TCR SCR RQD FI																			
Water Strikes				Chiselling Details				Remarks													
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		From (m)		To (m)		Time (hh:mm)		Hand dug inspection pit excavated to 1.20m Location: Landfall.							
2.60		2.60																			
7.30		7.30																			
Casing Details				Water Added				Core Barrel SK6L		Flush Type Water		Termination Reason Terminated at scheduled depth.						Last Updated 02/12/2022			
To (m)		Diam (mm)		From (m)		To (m)															
3.00		200																			
5.50		200																			
20.00		150																			

<div> <b>CAUSEWAY</b> GEOTECH</div>						<b>Project No.</b> 21-1619A		<b>Project Name:</b> North Irish Sea Array Landfall <b>Client:</b> Statkraft Limited <b>Client's Rep:</b> Arup					<b>Borehole ID</b> BH03																
<b>Method</b>		<b>Plant Used</b>		<b>Top (m)</b>		<b>Base (m)</b>		<b>Coordinates</b>		<b>Final Depth:</b> 20.00 m		<b>Start Date:</b> 15/03/2022		<b>Driller:</b> BM+RS		Sheet 2 of 3 Scale: 1:50													
Cable Percussion Rotary Coring		Dando 2000 Comacchio 405		0.00 5.50		5.50 20.00		719414.12 E 765319.80 N		<b>Elevation:</b> 8.63 mOD		<b>End Date:</b> 12/03/2022		<b>Logger:</b> CH+TH		FINAL													
Depth (m)	Samples / Field Records			TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description				Water	Backfill											
9.55 - 10.00	C4									-0.92	(0.40) 9.55		Dark grey subangular fine to coarse GRAVEL of mudstone and sandstone.						9.5										
10.00										-1.37	10.00		Very stiff brown slightly sandy very gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse.						10.0										
10.00 - 10.25	C5									-1.62	(0.25) 10.25		Very stiff dark brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.						10.5										
10.00 - 10.16	SPT(C) N=50 (12,13/50 for 10mm) Hammer SN = 1376			100									Grey slightly gravelly clayey fine to coarse SAND. Gravel is subangular fine to coarse.						11.0										
10.25 - 11.05	C6									-2.42	11.05		Very stiff dark brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse.						11.5										
11.05 - 11.50	C7										(0.70)								12.0										
11.50										-3.12	11.75		Weak massive greyish brown MUDSTONE with medium spaced thin beds of weak yellowish brown fine grained SANDSTONE. Partially weathered: reduced strength, closer fracture spacing, dark brown discolouration and clay infill on fracture surfaces.						12.5										
11.50 - 11.61	SPT(C) N=50 (35 for 90mm/50 for 20mm) Hammer SN = 1376			100	55	33	12						Discontinuities: 1. 20 to 30 degree joints, closely spaced (30/140/370) planar to rough, dark brown staining on joint surfaces, brown slightly sandy clay infill on most joint surfaces (2 to 20mm thick). 2. ~60 degree joint at 12.25m to 12.40m, planar, rough, dark brown staining on joint surface. 3. 70 to 80 degree joints at 11.80m to 11.95m and 12.6m to 12.45m, planar, rough, dark brown staining on joint surfaces. 4. ~90 degree joint at 14.65m to 14.90m, undulating, rough, dark orangish brown staining on joint surface.						13.0										
13.00				33	4	0	AZCL				(3.15)		13.00m to 13.50m: Recovered as clayey subangular fine to coarse GRAVEL 13.50m to 14.50m: AZCL due to disturbance difficulties.						13.5										
14.50										-6.27	14.90		Weak massive dark grey MUDSTONE. Partially weathered: slightly reduced strength, closer fractures spacing, orangish brown discolouration on fracture surfaces.						14.5										
				87	42	27	>20				(0.65)		Discontinuities: 1. 20 to 40 degree joints, very closely spaced (20/43/60) planar, rough, orangish brown staining on joint surfaces.						15.0										
										-6.92	15.55		Medium strong massive grey GREYWACKE with rare greyish white calcite veins of various orientations (1 to 3mm thick). Partially weathered: slightly reduced strength, closer fracture spacing, dark orangish brown discolouration on most fracture surfaces.						15.5										
16.00				83	63	41	8				(2.35)		Discontinuities: 1. 20 to 40 degree joints, closely spaced (50/180/500) planar, rough, orangish brown staining on most joint surfaces. 2. 50 to 60 degree joints, medium spaced (55/470/600) slightly undulating, rough, dark brown staining on joint surfaces.						16.0										
													Weak thickly laminated dark grey MUDSTONE with frequent calcite mineralisation parallel to bedding (up to 30mm thick). Partially weathered: slightly reduced strength, closer fracture spacing, orangish brown discolouration on most fracture surfaces, some clay infill.						16.5										
										-9.27	17.90		Discontinuities: 1. 10 to 20 degree bedding fractures, closely spaced (30/80/110) planar rough, orangish brown staining on most fracture surfaces, dark brown gravelly infill on some fractures up to 45mm thick. 2. ~ 50 degree joint at 18.00m to 18.07m, planar, rough, patchy brown staining on joint surface.						17.0										
17.50				60	37	15	14			-9.77	18.40		18.10m to 18.16m: Firm dark brown gravelly clay infill- 20 degree bedding fractures 45mm thick.						17.5										
													No recovery						18.0										
																			18.5										
				TCR	SCR	RQD	FI																						
<b>Water Strikes</b>										<b>Chiselling Details</b>										<b>Remarks</b> Hand dug inspection pit excavated to 1.20m Location: Landfall.									
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		From (m)		To (m)		Time (hh:mm)																	
2.60		2.60																											
7.30		7.30																											
<b>Casing Details</b>				<b>Water Added</b>				<b>Core Barrel</b>																					
To (m)		Diam (mm)		From (m)		To (m)																							
3.00		200																											
5.50		200						<b>Flush Type</b>																					
20.00		150																											
										SK6L		Water		<b>Termination Reason</b> Terminated at scheduled depth.															
																				<b>Last Updated</b> 02/12/2022									




<div><div>CAUSEWAY GEOTECH</div></div>										Project No. 21-1619A		Project Name: North Irish Sea Array Landfall Client: Statkraft Limited Client's Rep: Arup				Borehole ID BH03		
Method Cable Percussion Rotary Coring		Plant Used Dando 2000 Comacchio 405		Top (m) 0.00 5.50		Base (m) 5.50 20.00		Coordinates 719414.12 E 765319.80 N		Final Depth: 20.00 m Elevation: 8.63 mOD		Start Date: 15/03/2022 End Date: 12/03/2022		Driller: BM+RS Logger: CH+TH		Sheet 3 of 3 Scale: 1:50 FINAL		
Depth (m)	Samples / Field Records			TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description				Water	Backfill
19.00							AZCL			-11.37	(1.60) 20.00		No recovery					
20.00				0	0	0	NR						End of Borehole at 20.00m					
				TCR	SCR	RQD	FI											
Water Strikes				Chiselling Details				Remarks										
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		From (m)		To (m)		Time (hh:mm)		Hand dug inspection pit excavated to 1.20m Location: Landfall.				
2.60		2.60																
7.30		7.30																
Casing Details				Water Added				Termination Reason Terminated at scheduled depth.										
To (m)		Diam (mm)		From (m)		To (m)												
3.00		200																
5.50		200																
20.00		150						Core Barrel SK6L		Flush Type Water		Last Updated 02/12/2022						



**Client's Rep:** Arup

**Borehole ID**  
**BH04**

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 1 of 3
Cable Percussion	Dando 2000	0.00	3.00	719338.60 E	20.00 m	16/03/2022	RS+BM	Scale: 1:50
Rotary Drilling	Comacchio 405	3.00	4.00		765263.53 N	13.04 mOD	25/03/2022	EM+CH
Rotary Coring	Comacchio 405	4.00	20.00					

Depth (m)	Sample / Tests	Field Records				Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill			
0.30 - 0.50	B1	N=9 (1,1/2,2,2,3) Hammer SN = 0199 Slow seepage at 1.30m				1.00	Dry	12.74	0.30		TOPSOIL- Soft brown sandy gravelly CLAY.					
0.80 - 1.00	B2								N=26 (3,5/5,6,7,8) Hammer SN = 0199	1.50	Dry			10.74	2.30	Very stiff brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.
1.20	D4															
1.20 - 1.65	SPT (S)															
1.80 - 2.00	B3								N=50 (25 for 75mm/50 for 50mm) Hammer SN = 0199	3.00	2.70			10.04	3.00	Brown sandy gravelly CLAY (Driller's description)
2.00	D5															
2.00 - 2.45	SPT (S)	Slow seepage at 2.80	3.00	2.70	9.04	4.00		Stiff brown slightly sandy gravelly CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subrounded of various lithologies predominantly limestone and mudstone.								
3.00 - 3.12	SPT (S)	Water strike at 3.50m														
4.00 - 5.00	C	73							AZCL							
5.50		73							AZCL							
7.00	C	100							15	6						
7.00 - 8.25		100	87	6												
8.50		TCR	SCR	RQD	FI											

Water Strikes				Chiselling Details			Remarks		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall. Televiewer completed.		
1.30	1.30								
2.80	2.80								
3.50	3.50								
Casing Details		Water Added					Core Barrel	Flush Type	Termination Reason
To (m)	Diam (mm)	From (m)	To (m)						
3.00	200								
4.00	200								
20.00	150								
				SK6L	Water	Terminated at scheduled depth	02/12/2022		



**Client's Rep:** Arup

**Borehole ID**  
**BH04**

Method
Cable Percussion
Rotary Drilling
Rotary Coring

Plant Used
Dando 2000
Comacchio 405
Comacchio 405

Top (m)
0.00
3.00
4.00

Base (m)
3.00
4.00
20.00

Coordinates
719338.60 E
765263.53 N

<b>Final Depth:</b>	20.00 m
<b>Elevation:</b>	13.04 mOD

<b>Start Date:</b>	16/03/2022
<b>End Date:</b>	25/03/2022

<b>Driller:</b>	RS+BM
<b>Logger:</b>	EM+CL

Sheet 2 of 3

Scale: 1:50

FINAI

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.65 - 9.75	C									Weak (locally very weak) thinly laminated grey SILTSTONE. Partially weathered : much closer fracture spacing, further weakened with clay deposits, clay infill and discolouration in fracture surfaces.			
10.00										Discontinuities:			
10.35 - 10.45	C									1. 35 to 45 degree bedding fractures, closely spaced (10/214/300) planar, smooth with orangish brown staining and light brown clay deposits and clay infill (up to 80mm thick) on most fracture surfaces.			
		100	26	0						2. 70 degree joint at 8.70m to 8.90m, 12.30m to 12.60m, slightly undulating, rough with brown clay infill (up to 90mm thick) on joint surface.			
11.50													
					>20				(6.35)				
		100	10	0									
13.00													
		100	60	13									
14.50													
								-1.56	14.60		Medium strong indistinctly thinly laminated grey GREYWACKE. Partially weathered: discolouration and clay deposits on fracture surfaces, pyrite speckled throughout.		
										Discontinuities:			
		100	98	90	4					1. 45 degree bedding fractures medium spaced (150/280/800) planar, rough with dark discolouration and patchy grey clay deposits on fracture surfaces.			
15.50 - 15.70	C								(1.40)		2. 60 to 70 degree joints at 15.20m to 15.50m, 15.85m to 16.00m with patchy brown staining and patchy grey clay deposits on fractures surfaces.		
16.00											Weak thinly laminated grey MUDSTONE. Partially weathered: reduced strength, closer fracture spacing, with discolouration and clay deposits on fracture surfaces and occasional white mineralisation.		
								-2.96	16.00		Discontinuities:		
											1. 5 to 15 degree bedding fractures closely spaced (50//210) planar, smooth, with orangish brown staining and grey clay deposits on most fracture surfaces.		
16.70 - 16.80	C	100	65	0							16.00m to 16.20m: Soft greyish brown slightly sandy clay infill		
					5				(1.80)		Medium strong indistinctly thickly laminated grey GREYWACKE with white quartz veins at 45 degree angles (up to 40mm thick). Partially weathered: closer fracture spacing, with clay deposits and discolouration on fracture surfaces.		
17.50											Discontinuities:		
								-4.76	17.80		1. 35 to 45 degree bedding fractures closely spaced (12//600) planar, smooth with grey clay deposits (up to 4mm thick) and orangish brown staining on fracture surfaces.		
18.15 - 18.50	C	100	99	80							2. 80- to 90 degree joint at 18.00m to 18.60m, slightly undulating, rough with strong dark brown and dark orangish brown staining on joint surfaces, otherwise clean.		
											3. 60 to 70 degree joint at 19.85m to 20.00m, undulating, rough, with patchy orangish brown staining on joint surface, otherwise clean.		
		TCR	SCR	RQD	FI								

## Water Strikes

### Chiselling Details

Remarks

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
1.30	1.30					
2.80	2.80					
3.50	3.50					

Hand dug inspection pit excavated to 1.20m  
Location: Landfall.  
Televiewer completed.

### Casing Details

Water Added

To (m)	Diam (mm)	From (m)	To (m)
3.00	200		
4.00	200		
20.00	150		

**Core Barrel**

SK6L

Flush Type	Water
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Termination Reason

Terminated at scheduled depth

Last Updated

02/12/2022





**Client's Rep:** Arup

**Borehole ID**  
**BH04**

Method
Cable Percussion
Rotary Drilling
Rotary Coring

Plant Used
Dando 2000
Comacchio 405
Comacchio 405

Top (m)
0.00
3.00
4.00

Base (m)
3.00
4.00
20.00

Coordinates
719338.60 E
765263.53 N

**Final Depth:** 20.00 m

**Start Date:** 16/03/2022

**Driller:** RS+BM

Sheet 3 of 3

Scale: 1:50





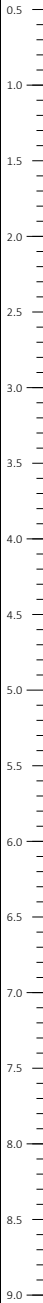
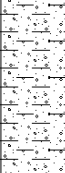
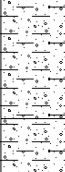
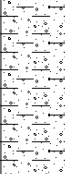
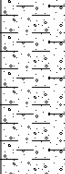


**Elevation:** 13.04 mOD

End Date: 25/03/2022

**Logger:** EM+CH

FINAL

Water Strikes				Chiselling Details			Remarks		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall. Televiwer completed.		
1.30	1.30								
2.80	2.80								
3.50	3.50								
Casing Details		Water Added					Core Barrel	Flush Type	Termination Reason
To (m)	Diam (mm)	From (m)	To (m)						
3.00	200								
4.00	200								
20.00	150								
				SK6L	Water	Terminated at scheduled depth	02/12/2022		

<div>CAUSEWAY GEOTECH</div>				Project No. 21-1619A		Project Name: North Irish Sea Array Landfall Client: Statkraft Limited Client's Rep: Arup				Borehole ID BH05					
Method Cable Percussion Rotary Coring		Plant Used Dando 2000 Comacchio 601		Top (m) 0.00 6.00		Base (m) 6.00 20.00		Coordinates 719530.91 E 765155.28 N		Final Depth: 20.00 m Start Date: 22/03/2022 Driller: BM+JG		Sheet 1 of 3 Scale: 1:50			
								Elevation: 10.24 mOD End Date: 30/03/2022 Logger: CH+RC		FINAL					
Depth (m)	Sample / Tests	Field Records			Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill			
0.30 - 0.50 0.50	B3 ES1	N=14 (2,2/3,3,4,4) Hammer SN = 0199			1.00	Dry	9.24	1.00		TOPSOIL-Soft brown sandy gravelly CLAY.					
0.80 - 1.10 1.00	B4 ES2								Firm brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.						
1.20 1.20 - 1.65	D10 SPT (S)														
1.80 - 2.00 2.00	B5 D11														
2.00 - 2.45	SPT (S)														
		N=25 (4,4/4,7,7,7) Hammer SN = 0199			1.50	Dry	8.04	2.20		Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.					
2.80 - 3.00 3.00 - 3.45	B6 U14	Ublow=25 100%			3.00	Dry	7.24	3.00							
3.80 - 4.00 4.00	B7 D12	N=22 (4,4/5,5,6,6) Hammer SN = 0199 Slow seepage 4.30			3.00	Dry		4.00							
4.00 - 4.45	SPT (S)														
4.80 - 5.00 5.00	B8 D13														
5.00 - 5.45	SPT (S)														
6.00 - 6.45	U15 Ublow=25 80%				3.00	Dry	4.24	6.00		Stiff greyish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.					
		57	0	0				(1.50)							
7.30 - 7.50 7.50	B9							7.50							
7.50 - 8.50 7.50 - 7.63	C8 SPT(S) N=50 (31 for 105mm/50 for 25mm) Hammer SN = 0199	100	0	0				(1.00)							
8.50 - 9.00 8.50 - 8.76	C9 SPT(C) N=43 (5,11/43 for 110mm) Hammer SN = 0209							8.50							
9.00								9.10		Dark grey slightly sandy slightly clayey subangular fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.					
Water Strikes				Chiselling Details			Remarks								
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall								
4.30	4.30														
Casing Details		Water Added													
To (m)	Diam (mm)	From (m)	To (m)												
6.00	200														
20.00	150														
				Core Barrel		Flush Type	Termination Reason				Last Updated				
				SK6L		Water	Terminated at scheduled depth.				02/12/2022				





**Borehole ID**  
**BH05**

Sheet 2 of 3

Scale: 1:50

Scale: 1:50

FINAL

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Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
10.00 - 10.45	SPT(C) N=42 (4,6/9,9,13,11) Hammer SN = 0209	39	0	0	AZCL			-0.26	(1.40)	[Pattern]	Dark grey slightly sandy slightly clayey subangular fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse. <i>9.60m to 10.50m: AZCL</i>		
10.50 10.50 - 11.40	C10								10.50	[Pattern]	Dark greyish brown gravelly silty fine to coarse SAND. Gravel is angular to subangular of mixed lithologies.		
11.50 - 11.95	SPT(C) N=50 (4,9/10,13,12,15) Hammer SN = 0209	73	0	0	AZCL			-1.16	11.40	[Pattern]	Stiff dark greyish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mixed lithologies. Cobbles are of greywacke.		
12.00								-1.76	12.00	[Pattern]	Greyish brown slightly sandy angular fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.		
		77	0	0	>20			-2.36	12.60	[Pattern]	Weak (locally very weak) greyish brown TUFF. Partially weathered: significantly reduce strength, much closer fracture spacing frequent blackish brown discolouration on fracture surfaces. Discontinuities: 1. 45 to 55 degree joints closely spaced (10/90/150) planar rough and frequent pervasive blackish brown staining on joints.		
13.50										[Pattern]			
		100	24	0						[Pattern]			
15.00					20				(4.50)	[Pattern]			
		100	19	0						[Pattern]			
16.50								-6.86	17.10	[Pattern]	Medium strong indistinctly thinly laminated dark grey GREYWACKE. Partially weathered: reduced strength, closer fracture spacing and frequent heavy blackish brown discolouration on fracture surfaces. Discontinuities: 1. 20 to 45 degree joints closely spaced (30/130/200) planar, rough and frequent blackish brown staining on joint surfaces up to 5mm deep. 2.0 65 to 75 degree joint from 17.50m to 18.00m, planar, rough and frequent heavy blackish brown staining on joint surfaces p to 5mm deep.		
		100	36	0	16				(0.90)	[Pattern]			
18.00								-7.76	18.00	[Pattern]	Medium strong (locally weak) dark brownish grey TUFF. Partially weathered: reduced strength, much closer fracture spacing and frequent pervasive blackish brown discolouration on fracture surfaces. Discontinuities: 1. 45 to 55 degree joints closely spaced (10/65/100) planar, rough and frequent pervasive blackish brown staining on joint surfaces.		
										[Pattern]			

02/12/2022






**Client's Rep:** Arup








**Borehole ID**  
**BH05**








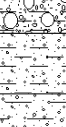




Sheet 3 of 3  
Scale: 1:50

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FINAL

Water Strikes				Chiselling Details			Remarks		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall		
4.30	4.30								
Casing Details		Water Added							
To (m)	Diam (mm)	From (m)	To (m)						
6.00	200			Core Barrel	Flush Type	Termination Reason	Last Updated		
20.00	150								SK6L

				Project No. <b>21-1619A</b>		Project Name: North Irish Sea Array Landfall Client: Statkraft Limited Client's Rep: Arup			Borehole ID <b>BH06</b>																						
Method Cable Percussion Rotary Coring		Plant Used Dando 2000 Comacchio 205		Top (m) 0.00 4.00		Base (m) 4.00 20.00		Coordinates 719454.92 E 765155.97 N		Final Depth: 20.00 m Start Date: 21/03/2022 Driller: BM+RS Elevation: 11.95 mOD End Date: 29/03/2022 Logger: CH+EM		Sheet 1 of 3 Scale: 1:50  FINAL																			
Depth (m)		Sample / Tests		Field Records		Casing Depth (m) Water Depth (m)		Level mOD		Depth (m)		Legend		Description		Water		Backfill													
0.30 - 0.50 0.50		B3 ES1		N=16 (1,2/3,5,5,3) Hammer SN = 0199  Ublow=20 90% Slow seepage at 2.00m		1.00 Dry		10.95		1.00				TOPSOIL-Soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.																	
0.80 - 1.00 1.00		B4 ES2												Stiff brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.																	
1.20 1.20 - 1.65		D8 SPT (S)												10.15						1.80		Stiff brownish slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.									
1.80 - 2.00 2.00 - 2.45		B5 U11												3.00						Dry		Dark greyish brown very clayey fine to medium SAND. <i>4.00m to 4.93m: AZCL due to disturbance by SPT</i>									
2.80 - 3.00 3.00 - 3.45		B6 D9 SPT (S)												3.00						Dry		Very stiff dark greyish brown slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are sub angular of various lithologies. <i>5.75m to 5.90m: Bed of clayey sandy gravel</i>									
3.80 - 4.00		B7		N=16 (2,3/3,4,4,5) Hammer SN = 0199		3.00		Dry		7.95		4.00				4.00															
4.00 4.00 - 4.45		D10 SPT(S) N=21 (3,4/4,5,6,6) Hammer SN = 0199																		5.15		5.50		5.50 - 6.13 5.75 - 5.90		C C		C		C	
5.50 5.50 - 6.13 5.75 - 5.90		C C																		5.82		6.13		6.13 - 7.00		C		C		C	
6.13 - 7.00		C																		4.95		7.00		7.00 7.00 - 7.35		C12		C		C	
7.00 7.00 - 7.35		C12																		5.82		6.13		6.13 - 7.00		C		C		C	
8.50 8.50 - 9.50		C		65		3.45		8.50		8.50		8.50		8.50		8.50		8.50													
				TCR		SCR		RQD		FI																					
Water Strikes				Chiselling Details				Remarks																							
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		From (m)		To (m)		Time (hh:mm)		Hand dug inspection pit excavated to 1.20m Location: Landfall.																	
2.00		2.00																													
Casing Details				Water Added																											
To (m)		Diam (mm)		From (m)		To (m)																									
3.00		200																													
20.00		150																													
								Core Barrel		Flush Type		Termination Reason				Last Updated															
								SK6L		Water		Terminated at scheduled depth.				02/12/2022															

<div>CAUSEWAY GEOTECH</div>						Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH06					
Method Cable Percussion Rotary Coring		Plant Used Dando 2000 Comacchio 205		Top (m) 0.00 4.00		Base (m) 4.00 20.00		Coordinates 719454.92 E 765155.97 N		Client: Statkraft Limited		Client's Rep: Arup					
										Final Depth: 20.00 m		Start Date: 21/03/2022		Driller: BM+RS			
										Elevation: 11.95 mOD		End Date: 29/03/2022		Logger: CH+EM		Sheet 2 of 3 Scale: 1:50	
														FINAL			
Depth (m)		Samples / Field Records		TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description		Water	Backfill	
10.00		C								2.45	9.50		Very stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies				9.5
10.00 - 10.15											(0.65)		Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.				10.0
11.50				73						1.80	10.15		Very stiff brown slightly sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies.				10.5
11.00 - 11.15													11.10m to 11.50m: AZCL possibly washed out due to flush				11.0
13.00				0			NR				(4.35)						11.5
13.00 - 13.15																	12.0
14.50		C															12.5
14.50 - 14.90																	13.0
14.50 - 14.90		C13															13.5
14.90 - 15.45		C															14.0
14.90 - 15.45		C14		96													14.5
15.45 - 15.90		C															15.0
15.45 - 15.90		C15															15.5
16.00																	16.0
17.50				73							(2.05)						16.5
17.00 - 17.15																	17.0
17.50 - 17.65																	17.5
17.65 - 17.80																	17.5
17.80 - 17.95				44													18.0
17.95 - 18.10																	18.0
18.10 - 18.25																	18.5
18.25 - 18.40																	18.5
18.40 - 18.55																	19.0
18.55 - 18.70																	19.5
18.70 - 18.85																	20.0
18.85 - 19.00																	20.5
19.00 - 19.15																	21.0
19.15 - 19.30																	21.5
19.30 - 19.45																	22.0
19.45 - 19.60																	22.5
19.60 - 19.75																	23.0
19.75 - 19.90																	23.5
19.90 - 20.00																	24.0
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																	77.5



**Client's Rep:** Arup

**Borehole ID**  
**BH06**

Sheet 3 of 3

Scale: 1:50

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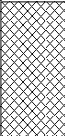


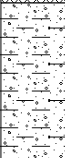


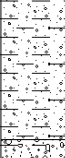


Backfill

End of Borehole at 20.00m










Terminated at scheduled depth.

02/12/2022

 <b>CAUSEWAY</b> GEOTECH				<b>Project No.</b> 21-1619A		<b>Project Name:</b> North Irish Sea Array Landfall <b>Client:</b> Statkraft Limited <b>Client's Rep:</b> Arup				<b>Borehole ID</b> BH07								
<b>Method</b>		<b>Plant Used</b>		<b>Top (m)</b>	<b>Base (m)</b>	<b>Coordinates</b>		<b>Final Depth:</b> 15.50 m	<b>Start Date:</b> 21/03/2022	<b>Driller:</b> JG+BM	Sheet 1 of 2 Scale: 1:50							
Cable Percussion Rotary Coring		Dando 2000 Comacchio 601		0.00 4.00	4.00 15.50	719317.44 E 765079.09 N		<b>Elevation:</b> 19.70 mOD	<b>End Date:</b> 28/03/2022	<b>Logger:</b> RC+CH	FINAL							
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Field Records</b>			<b>Casing Depth (m)</b>	<b>Water Depth (m)</b>	<b>Level mOD</b>	<b>Depth (m)</b>	<b>Legend</b>	<b>Description</b>		<b>Water</b>	<b>Backfill</b>					
0.30 - 0.50 0.50	B3 ES1	Ublow=15 90%			1.00	Dry	18.80	0.90		MADE GROUND: Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.								
0.80 - 1.00 1.00	B4 ES2									Firm becoming stiff brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.								
1.20 - 1.65	U11								N=11 (2,2/2,3,3,3) Hammer SN = 0199		1.50			Dry		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
1.80 - 2.00 2.00	B5 D8																	
2.00 - 2.45	SPT (S)	N=16 (2,3/3,4,4,5) Hammer SN = 0199		3.00	Dry	16.30										3.40	Stiff light brownish grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse of limestone and mudstone. Cobbles are angular of limestone and mudstone.	
2.80 - 3.00 3.00	B6 D9																	
3.00 - 3.45	SPT (S)																	
3.80 - 4.00	B7																	
4.00 4.00 - 4.45 4.00 - 4.05	D10 U12 Ublow=50 0% SPT(S) N=50 (25 for 25mm/50 for 25mm) Hammer SN = 0199	92	0	0	3.00 3.00	Dry Dry	15.70	4.00		Stiff light brownish grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse of limestone and mudstone. Cobbles are angular of limestone and mudstone.								
								(1.70)										
5.50 5.50 - 5.95	SPT(C) N=31 (3,4/6,6,9,10) Hammer SN = 0209 C				5.50	Dry	14.00	5.70		Stiff brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to medium of limestone and mudstone.								
5.70		100	0	0												(1.30)		
7.00 7.00 7.00 - 7.45	C SPT(C) N=36 (4,4/7,8,10,11) Hammer SN = 0209 C				7.00	Dry	12.70	7.00		Stiff light greyish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to medium of sandstone, mudstone and limestone.								
7.30 - 8.00		100	0	0												(0.80)		
8.50							11.90	7.80		Extremely weak light greyish brown BRECCIA. Destructured: greatly weakened, matrix weakened and disturbed with frequent clay infill on fracture surfaces. Recovered as: (stiff light greyish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of breccia. Cobbles are angular of breccia.								
		TCR	SCR	RQD	FI													
<b>Water Strikes</b>				<b>Chiselling Details</b>				<b>Remarks</b>										
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall. No groundwater encountered- water added during drilling.											
<b>Casing Details</b>		<b>Water Added</b>																
To (m)	Diam (mm)	From (m)	To (m)															
4.00	200																	
15.50	150																	
				<b>Core Barrel</b>		<b>Flush Type</b>	<b>Termination Reason</b>				<b>Last Updated</b>							
				SK6L		Water	Terminated at scheduled depth				02/12/2022							











<div>CAUSEWAY GEOTECH</div>						Project No. 21-1619A		Project Name: North Irish Sea Array Landfall Client: Statkraft Limited Client's Rep: Arup					Borehole ID BH07			
Method Cable Percussion Rotary Coring		Plant Used Dando 2000 Comacchio 601		Top (m) 0.00 4.00		Base (m) 4.00 15.50		Coordinates 719317.44 E 765079.09 N		Final Depth: 15.50 m Start Date: 21/03/2022 Driller: JG+BM		Sheet 2 of 2 Scale: 1:50				
										Elevation: 19.70 mOD End Date: 28/03/2022 Logger: RC+CH		FINAL				
Depth (m)	Samples / Field Records			TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill	
10.00				83	0	0				10.00	9.70		Extremely weak light greyish brown BRECCIA. Destructured: greatly weakened, matrix weakened and disturbed with frequent clay infill on fracture surfaces. Recovered as: (stiff light greyish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of breccia. Cobbles are angular of breccia.			9.5
											(2.30)					
11.50				86	0	0				7.70	12.00		Extremely weak light brown BRECCIA. Destructured: greatly weakened, matrix weakened and disturbed with frequent clay infill on fracture surfaces.. Recovered as: (stiff light greyish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of breccia. Cobbles are angular of breccia.			10.5
13.00							>20			6.35	13.35		Extremely weak dark brown TUFF. Partially weathered: significantly reduced strength, much closer fracture spacing with frequent strong dark orangish brown discolouration and gravelly clay infill on fracture surfaces. Discontinuities: 1. 0-20 degree joints closely spaced (50/150/300), planar, rough with frequent heavy orangish brown staining on joint surface up to the whole diameter of the core			11.5
14.50				100	0	0	18				(2.15)		Very weak dark brown TUFF. Distinctly weathered: significantly reduced strength, closer fracture spacing with frequent heavy orangish brown discolouration on fracture surfaces. Discontinuities: 1. 0 to 15 degree joints closely spaced (50/150/400) planar, rough with frequent heavy dark orangish brown staining penetrating up to entire diameter of the core. 2. 55 to 75 degree joints from 13.50m to 13.70m, 13.70m to 13.80m, 14.10m to 14.20m and 14.50m to 14.60m, planar, rough and frequent heavy dark orangish brown staining penetrating up to entire diameter of core.			12.5
15.25				100	100	0	11			4.20	15.50					13.5
													End of Borehole at 15.50m			14.5
																15.0
																15.5
																16.0
																16.5
																17.0
																17.5
																18.0
																18.5
Water Strikes				Chiselling Details				Remarks								
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall. No groundwater encountered- water added during drilling.									
Casing Details		Water Added														
To (m)	Diam (mm)	From (m)	To (m)													
4.00	200															
15.50	150															
				Core Barrel		Flush Type		Termination Reason					Last Updated			
				SK6L		Water		Terminated at scheduled depth					02/12/2022			



**Client's Rep:** Arup

**Borehole ID**  
**BH15**

Depth (m)	Sample / Tests	Field Records				Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill	
0.30 - 0.50	B3	Ublow=15 100%				1.00	Dry	31.72	0.40		MADE GROUND: Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.			
0.50	ES1									N=19 (3,3/4,4,5,6) Hammer SN = 0199				
0.80 - 1.00	B4													
1.00	ES2													
1.20 - 1.65	U17													
1.80 - 2.00	B5	N=24 (5,6/6,6,5,7) Hammer SN = 0199				3.00	Dry	30.12	2.00		Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.			
2.00	D11													
2.00 - 2.45	SPT (S)													
2.80 - 3.00	B6													
3.00	D12													
3.00 - 3.45	SPT (S)	N=23 (4,5/5,6,6,6) Hammer SN = 0199				3.00	Dry							
3.80 - 4.00	B7													
4.00	D13													
4.00 - 4.45	SPT (S)													
4.80 - 5.00	B8													
5.00	D14	N=26 (5,5/6,6,6,8) Hammer SN = 0199 Slow seepage at 5.00m				3.00	Dry							
5.00 - 5.45	SPT (S)													
5.80 - 6.00	B9													
6.00 - 6.45	U18													
6.00 - 6.45	U18													
7.30 - 7.50	B10	N=31 (6,6/7,8,8,8) Hammer SN = 0199				3.00	Dry							
7.50	D15													
7.50 - 7.95	SPT (S)													
8.00	D16													
8.00 - 8.12	SPT (S)													
								23.62	8.50 (0.40)		Weathered rock recovered as: brown slightly sandy very clayey angular fine to coarse GRAVEL of siltstone.			
		100	73	16				23.22	8.90		Weak (locally very weak) thinly laminated grey SILTSTONE. Distinctly weathered: reduced strength, much closer fracture spacing with discolouration, clay deposits and clay infill on fracture surfaces.			
			TCR	SCR	RQD	FI								

Water Strikes				Chiselling Details			Remarks		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall.		
5.00	5.00	20	4.90						
Casing Details		Water Added							
To (m)	Diam (mm)	From (m)	To (m)						
3.00	200			Core Barrel	Flush Type	Termination Reason	Last Updated		
8.50	200								
14.50	150								
				SK6L	Water	Terminated at scheduled depth.	02/12/2022		



**Borehole ID**  
**BH15**



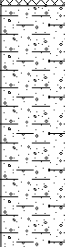
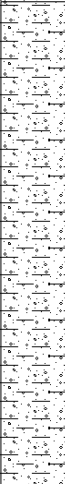
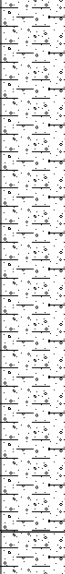

Sheet 2 of 2

Scale: 1:50

FINAL

<p>Weak (locally very weak) thinly laminated grey SILTSTONE. Distinctly weathered: reduced strength, much closer fracture spacing with discolouration, clay deposits and clay infill on fracture surfaces.</p> <p>Discontinuities:</p> <ol style="list-style-type: none"> <li>1. 30-40 degree bedding fractures, medium spaced (150/210/210), planar, smooth with strong orangish brown staining on most fracture surfaces and grey clay deposits and infill (up to 100mm thick) on most fracture surfaces.</li> <li>2. 80-90 degree joint at 10.50-10.60mm, planar, smooth with strong orangish brown staining and grey clay deposits (up to 2mm thick) on joint surface.</li> <li>3. 70-80 degree joint at 11.10-11.50m, undulating, rough with dark brown and orangish brown staining on joint surface.</li> </ol> <p><u>10.90-11.20m: Bed of extremely weak siltstone</u></p>	
<p>Weak thickly laminated grey SILTSTONE with white quartz veins (up to 10mm thick) at various orientations. Partially weathered: slightly reduced strength, closer fracture spacing with clay deposits, clay infill and discolouration on fracture surfaces.</p> <p>Discontinuities:</p> <ol style="list-style-type: none"> <li>1. 20-30 degree bedding fractures, medium spaced (200/266/600), planar, smooth to rough with patchy dark orangish brown staining and patchy grey clay deposits (up to 2mm thick) on fracture surfaces.</li> <li>2. 40-50 degree joints at 13.50-13.70m and 13.60-12.00m, planar, smooth with patchy dark orangish brown staining and grey slightly gravelly clay deposits (up to 10mm thick).</li> <li>3. 75-85 degree joints at 12.40-13.00m, undulating, smooth with dark brown and dark orangish brown staining and patchy dark grey clay deposits (&lt;1mm thick) on joint surface.</li> </ol> <p><u>13.00-13.25m: Soft brownish grey clayey silt infill</u></p>	
<p>End of Borehole at 14.50m</p>	



 <b>CAUSEWAY</b> GEOTECH				<b>Project No.</b> 21-1619A		<b>Project Name:</b> North Irish Sea Array Landfall <b>Client:</b> Statkraft Limited <b>Client's Rep:</b> Arup				<b>Borehole ID</b> BH16		
<b>Method</b>		<b>Plant Used</b>		<b>Top (m)</b>	<b>Base (m)</b>	<b>Coordinates</b>		<b>Final Depth:</b> 15.00 m		<b>Start Date:</b> 23/02/2022	<b>Driller:</b> BM+RS	Sheet 1 of 2 Scale: 1:50
Cable Percussion Rotary Coring		Dando 2000 Comacchio 405		0.00 10.00	10.00 15.00	718796.53 E 764822.39 N		<b>Elevation:</b> 31.97 mOD		<b>End Date:</b> 26/04/2022	<b>Logger:</b> CH+EM	FINAL
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Field Records</b>		<b>Casing Depth (m)</b>	<b>Water Depth (m)</b>	<b>Level mOD</b>	<b>Depth (m)</b>	<b>Legend</b>	<b>Description</b>		<b>Water</b>	<b>Backfill</b>
0.30 - 0.50 0.50	B3 ES1					31.27	0.70		MADE GROUND: Soft brown slightly sandy sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.			
0.80 - 1.00 1.00 1.20 1.20 - 1.65	B4 ES2 D9 SPT (S)	N=14 (2,3/3,3,4,4) Hammer SN = 0199		1.00	Dry				Firm brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.			
1.80 - 2.00 2.00 2.00 - 2.45	B5 D10 SPT (S)	N=20 (4,4/4,5,5,6) Hammer SN = 0199		1.50	Dry	29.67	2.30		Stiff becoming very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.			
2.80 - 3.00 3.00 - 3.45	B6 U13	Ublow=25 80%		3.00	Dry				Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.			
3.80 - 4.00 4.00 4.00 - 4.45	B7 D11 SPT (S)	N=20 (4,4/5,5,5,5) Hammer SN = 0199		3.00	Dry							
4.80 - 5.00 5.00 5.00 - 5.45	B8 D12 SPT (S)	N=21 (5,7/5,5,5,6) Hammer SN = 0199 Slow seepage at 5.00m		3.00	Dry							
6.00 - 6.45	U14	Ublow=25 100%		3.00	Dry							
7.50 - 7.95	SPT (S)	N=36 (5,5/6,7,8,15) Hammer SN = 0199		3.00								
9.00 - 9.45	U15	Ublow=30 90%		3.00		22.97	9.00					
<b>Water Strikes</b>				<b>Chiselling Details</b>			<b>Remarks</b>					
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall					
5.00 9.90	5.00 9.90	20 20	4.90 4.20									
<b>Casing Details</b>		<b>Water Added</b>										
To (m)	Diam (mm)	From (m)	To (m)									
				<b>Core Barrel</b>		<b>Flush Type</b>	<b>Termination Reason</b>				<b>Last Updated</b>	
				SK6L		Water	Terminated at scheduled depth.				02/12/2022	

























**Borehole ID**  
**BH16**



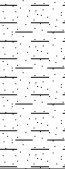
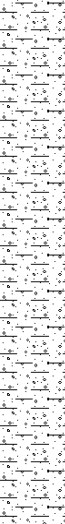




Sheet 2 of 2  
Scale: 1:50

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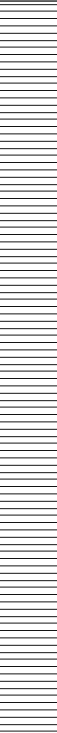



FINAL

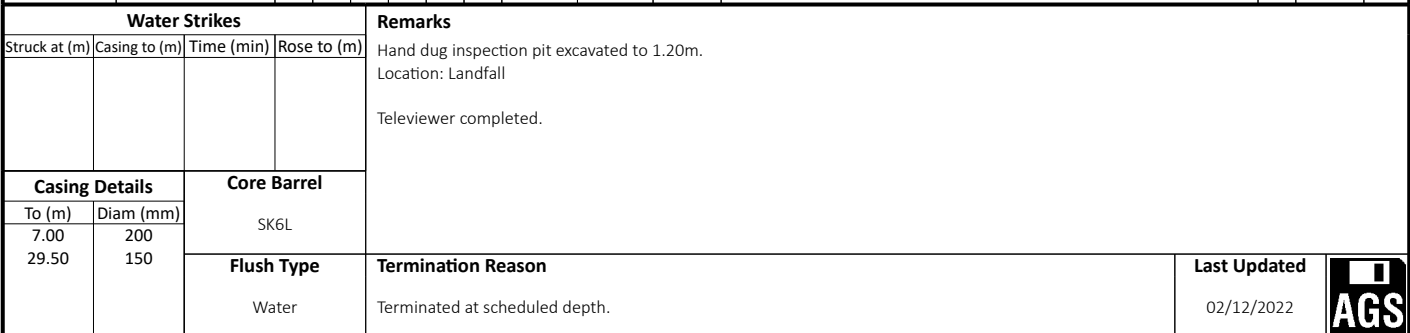
Depth (m)	Sample / Tests	Field Records				Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill	
10.00 - 10.45	SPT(S) N=50 (15,18/15,15,9,11) Hammer SN = 0199	Fast seepage at 9.90m				3.00	8.00	21.97	10.00		Brown slightly sandy very clayey subangular fine to coarse GRAVEL of various lithologies. Sand is fine to coarse.			9.5
		100	56	0	16				21.32	10.65				
80	40					13	2	AZCL	14	(1.75)	(12.40)		Medium strong to weak thinly laminated brownish grey MUDSTONE. Partially weathered: much closer fracture spacing, slightly reduced strength with clay deposits and discolouration on fracture surfaces. Discontinuities: 1. 30-40 degree bedding fractures, closely spaced (100/159/180), planar, smooth with patchy orangish brown and dark brown staining on most fracture surfaces and brown slightly gravelly clay deposits (up to 5mm thick) on some fracture surfaces. 2. 80-90 degree joint at 12.10-12.30m, slightly undulating, smooth with dark brown staining on joint surface.	10.5
		100	80	13	14									(2.60)
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m	11.5		
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	
100	90					40	14	(2.60)	15.00		End of Borehole at 15.00m			
		100	90	40	14							(2.60)	15.00	

Water Strikes				Chiselling Details			Remarks		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)	Hand dug inspection pit excavated to 1.20m Location: Landfall		
5.00	5.00	20	4.90						
9.90	9.90	20	4.20						
Casing Details		Water Added							
To (m)	Diam (mm)	From (m)	To (m)						
				Core Barrel	Flush Type	Termination Reason	Last Updated		
				SK6L	Water	Terminated at scheduled depth.	02/12/2022		

								<b>Project No.</b> 21-1619A		<b>Project Name:</b> North Irish Sea Array Landfall <b>Client:</b> Statkraft Limited <b>Client's Rep</b> Arup				<b>Borehole ID</b> BH17							
<b>Method</b>		<b>Plant Used</b>		<b>Top (m)</b>		<b>Base (m)</b>		<b>Coordinates</b>		<b>Final Depth:</b> 29.50 m		<b>Start Date:</b> 01/04/2022		<b>Driller:</b> JG		Sheet 1 of 5 Scale: 1:40					
Rotary Drilling Rotary Coring		Comacchio 601 Comacchio 601		0.00 7.00		7.00 29.50		719790.17 E 765252.88 N		<b>Elevation:</b> 5.85 mOD		<b>End Date:</b> 04/04/2022		<b>Logger:</b> RC		FINAL					
<b>Depth (m)</b>	<b>Samples / Field Records</b>			<b>TCR</b>	<b>SCR</b>	<b>RQD</b>	<b>FI</b>	<b>Casing Depth (m)</b>	<b>Water Depth (m)</b>	<b>Level mOD</b>	<b>Depth (m)</b>	<b>Legend</b>	<b>Description</b>			<b>Water</b>	<b>Backfill</b>				
1.00 - 1.45	SPT(C) N=21 (3,5/5,5,6,5) Hammer SN = 1387									5.55	0.30		TOPSOIL - Brown sandy gravelly CLAY.								
													Firm brown sandy CLAY (Driller's description)								
2.50 - 2.95	SPT(C) N=50 (5,8/11,11,13,15) Hammer SN = 1387									4.65	1.20		Stiff dark sandy gravelly CLAY (Driller's description)								
4.00 - 4.45	SPT(C) N=46 (4,5/7,10,13,16) Hammer SN = 1387									1.85	4.00		Dense gravelly SAND (Driller's description)								
5.50 - 5.95	SPT(C) N=25 (4,4/6,5,6,8) Hammer SN = 1387									-0.15	6.00		Greenish grey angular weathered ROCK (Driller's description) Weak light greenish grey GREYWACKE with occasional randomly oriented 160mm thick veins of greyish white calcite. Partially weathered: reduced strength, much closer fracture spacing and occasional clay infill on fracture surfaces. Discontinuities: 1. 10 to 30 degree joints closely spaced (50/130/350) planar, rough and occasional greyish brown gravelly clay infill on joint surfaces up to 5mm thick. 2. 30 to 45 degree joints medium spaced (100/310/700) planar, rough and occasional greyish brown gravelly clay infill on joint surfaces up to 20mm thick. 3. 55 to 75 degree joints from 7.20m to 7.80m, 8.40m to 8.80m, 8.80m to 9.10m and 10.00m to 10.50m, undulating, rough and frequent light grey gravelly clay infill on joint surfaces up to 50mm thick.								
										-1.15	7.00										
<b>Water Strikes</b>				<b>Remarks</b>																	
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		Hand dug inspection pit excavated to 1.20m. Location: Landfall  Televiewer completed.													
<b>Casing Details</b>				<b>Core Barrel</b>																	
To (m)		Diam (mm)		SK6L																	
7.00		200																			
29.50		150																			
<b>Flush Type</b>				<b>Termination Reason</b>														<b>Last Updated</b>			
Water				Terminated at scheduled depth.														02/12/2022			
																					

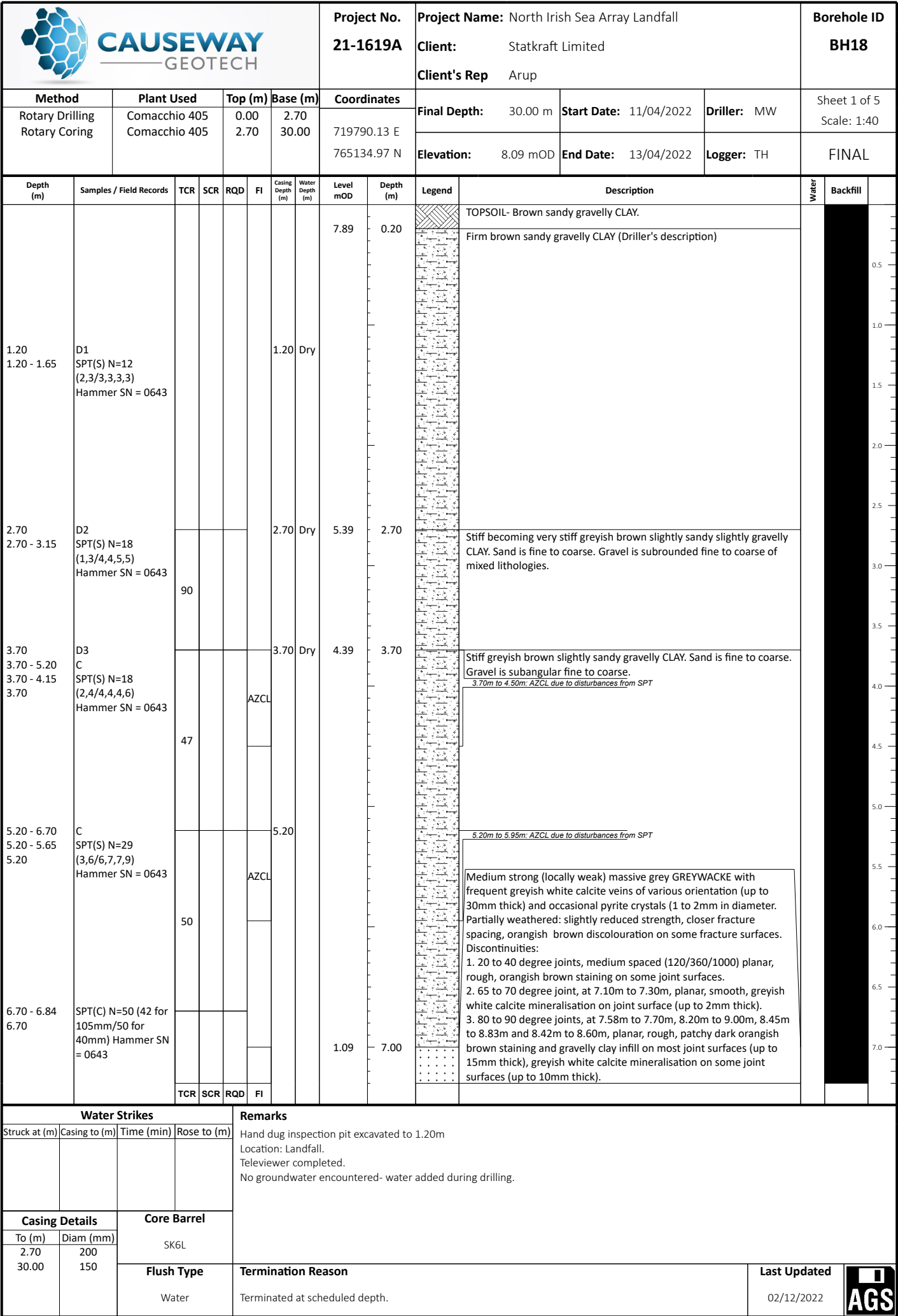





								Project No. 21-1619A		Project Name: North Irish Sea Array Landfall Client: Statkraft Limited Client's Rep Arup					Borehole ID BH17																																																																																																																																
Method Rotary Drilling Rotary Coring		Plant Used Comacchio 601 Comacchio 601		Top (m) 0.00 7.00		Base (m) 7.00 29.50		Coordinates 719790.17 E 765252.88 N		Final Depth: 29.50 m		Start Date: 01/04/2022		Driller: JG		Sheet 2 of 5 Scale: 1:40																																																																																																																															
										Elevation: 5.85 mOD		End Date: 04/04/2022		Logger: RC		FINAL																																																																																																																															
Depth (m)	Samples / Field Records		TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description				Water	Backfill																																																																																																																														
8.50	C1		100	10	0	>20						Weak light greenish grey GREYWACKE with occasional randomly oriented 160mm thick veins of greyish white calcite. Partially weathered: reduced strength, much closer fracture spacing and occasional clay infill on fracture surfaces. Discontinuities: 1. 10 to 30 degree joints closely spaced (50/130/350) planar, rough and occasional greyish brown gravelly clay infill on joint surfaces up to 5mm thick. 2. 30 to 45 degree joints medium spaced (100/310/700) planar, rough and occasional greyish brown gravelly clay infill on joint surfaces up to 20mm thick. 3. 55 to 75 degree joints from 7.20m to 7.80m, 8.40m to 8.80m, 8.80m to 9.10m and 10.00m to 10.50m, undulating, rough and frequent light grey gravelly clay infill on joint surfaces up to 50mm thick.						7.5																																																																																																																													
9.40 - 9.65			100	19	0	6				8.0																																																																																																																																					
10.00										8.5																																																																																																																																					
			100	7	0	>20			-4.85	10.70										9.0																																																																																																																											
11.50	C2		100	10	0	>20						Medium strong indistinctly thinly laminated dark grey MUDSTONE with occasional randomly oriented 1 to 7mm thick greyish white calcite veins. Partially weathered: slightly reduced strength, closer fracture spacing, occasional heavy light brownish orange discolouration on fracture surfaces ad occasional clay infill on fracture surfaces. Discontinuities: 1. 10 to 25 degree joints closely spaced (50/150/400) planar, rough, clean, unstained. 2. 45 to 65 degree bedding fractures medium spaced (10/250/500)m planar, smooth, occasional heavy light brownish orange staining up to 5mm deep and occasional dark grey gravelly infill on fracture surfaces up to 5mm thick. 3. 65 to 75 degree joints from 10.70m to 11.30m, 11.90m to 12.50m and 12.80m to 13.00m, undulating, rough, unstained and occasional dark grey gravelly clay infill on joint surfaces up to 8mm thick.						9.5																																																																																																																													
13.00			100	45	15	11												10.0																																																																																																																													
13.80 - 14.00																		10.5																																																																																																																													
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<table><tr><td colspan="5">Water Strikes</td><td colspan="13">Remarks</td></tr><tr><td>Struck at (m)</td><td>Casing to (m)</td><td>Time (min)</td><td>Rose to (m)</td><td></td><td colspan="13">Hand dug inspection pit excavated to 1.20m. Location: Landfall  Televiewer completed.</td></tr><tr><td colspan="2">Casing Details</td><td colspan="3">Core Barrel</td><td colspan="13"></td></tr><tr><td>To (m)</td><td>Diam (mm)</td><td colspan="3">SK6L</td><td colspan="13"></td></tr><tr><td>7.00</td><td>200</td><td colspan="3"></td><td colspan="13"></td></tr><tr><td>29.50</td><td>150</td><td colspan="3">Flush Type</td><td colspan="6">Termination Reason</td><td colspan="7">Last Updated</td></tr><tr><td></td><td></td><td colspan="3" rowspan="2">Water</td><td colspan="6" rowspan="2">Terminated at scheduled depth.</td><td colspan="7">02/12/2022</td></tr></table>																		Water Strikes					Remarks													Struck at (m)	Casing to (m)	Time (min)	Rose to (m)		Hand dug inspection pit excavated to 1.20m. Location: Landfall  Televiewer completed.													Casing Details		Core Barrel																To (m)	Diam (mm)	SK6L																7.00	200																	29.50	150	Flush Type			Termination Reason						Last Updated									Water			Terminated at scheduled depth.						02/12/2022						
Water Strikes					Remarks																																																																																																																																										
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)		Hand dug inspection pit excavated to 1.20m. Location: Landfall  Televiewer completed.																																																																																																																																										
Casing Details		Core Barrel																																																																																																																																													
To (m)	Diam (mm)	SK6L																																																																																																																																													
7.00	200																																																																																																																																														
29.50	150	Flush Type			Termination Reason						Last Updated																																																																																																																																				
		Water			Terminated at scheduled depth.						02/12/2022																																																																																																																																				
																																																																																																																																															

















								Project No. 21-1619A		Project Name: North Irish Sea Array Landfall					Borehole ID BH18		
Method Rotary Drilling Rotary Coring		Plant Used Comacchio 405 Comacchio 405		Top (m) 0.00 2.70		Base (m) 2.70 30.00		Coordinates 719790.13 E 765134.97 N		Client: Statkraft Limited		Client's Rep Arup		Sheet 2 of 5 Scale: 1:40			
										Final Depth: 30.00 m						Start Date: 11/04/2022	
										Elevation: 8.09 mOD		End Date: 13/04/2022		Logger: TH		FINAL	
Depth (m)	Samples / Field Records		TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description			Water	Backfill	
8.20			83	50	50							Medium strong (locally weak) massive grey GREYWACKE with frequent greyish white calcite veins of various orientation (up to 30mm thick) and occasional pyrite crystals (1 to 2mm in diameter). Partially weathered: slightly reduced strength, closer fracture spacing, orangish brown discolouration on some fracture surfaces. Discontinuities: 1. 20 to 40 degree joints, medium spaced (120/360/1000) planar, rough, orangish brown staining on some joint surfaces. 2. 65 to 70 degree joint, at 7.10m to 7.30m, planar, smooth, greyish white calcite mineralisation on joint surface (up to 2mm thick). 3. 80 to 90 degree joints, at 7.58m to 7.70m, 8.20m to 9.00m, 8.45m to 8.83m and 8.42m to 8.60m, planar, rough, patchy dark orangish brown staining and gravelly clay infill on most joint surfaces (up to 15mm thick), greyish white calcite mineralisation on some joint surfaces (up to 10mm thick).					7.5
9.00 - 9.15	C		100	62	57							Medium strong massive greyish black MUDSTONE with frequent greyish white calcite veins (up to 20mm thick) occasional pyrite crystals (up to 2mm in diameter). Partially weathered: slightly reduced strength, slightly closer fracture spacing. Discontinuities: 1. 20 to 30 degree joints at 1.20m and 10.47m, planar, smooth. 2. 40 to 60 degree joints, at 9.80m, 10.00m, 10.35m and 10.55m, steeped, rough, grey calcite mineralisation on most joint surfaces. 3. 70 to 90 degree joints, at 9.80m to 10.00m, 10.25m to 10.34m and 10.65m to 10.80m, undulating, rough, patchy dark orangish brown staining on some joint surfaces.					9.0
9.15 - 9.40	C																
9.45 - 9.55	C											Medium strong (locally weak) massive grey calcareous GREYWACKE with occasional greyish white calcite veins of predominantly subvertical orientation. Partially weathered: slightly reduced strength, slightly closer fracture spacing, patchy brown discolouration on some fracture surfaces. Discontinuities: 1. 20 to 30 degree joints, at 11.57m, planar, rough, patchy brown staining on joint surface. 2. 60 to 90 degree joints, at 10.82m to 11.10m, 11.20m to 11.30m and 11.40m to 11.50m, undulating, rough. Weak massive dark grey MUDSTONE with frequent calcite veins of predominantly subvertical orientation (up to 60mm thick). Partially weathered: reduced strength, slightly closer fracture spacing, infill on most fracture surfaces. Discontinuities: 1. 70 to 90 degree joints, at 11.70m to 12.00m, 11.90m to 12.90m, 12.10m to 12.45m, 12.60m to 13.25m and 12.30m to 12.40m, undulating, rough, grey clayey gravelly infill on most joint surfaces (up to 35mm thick).					9.5
9.55	C																
9.70												Medium strong massive grey GREYWACKE with occasional greyish white calcite veins of various orientations (2 to 6mm thick). Partially weathered: slightly reduced strength, slightly closer fracture spacing, patchy calcite mineralisation on some fracture surfaces. Discontinuities: 1. 30 to 50 degree joints, medium, spaced (130/355/650) planar, rough, patchy grey calcite mineralisation on some joint surfaces. 2. 60 to 70 degree joints, at 16.365m to 16.75m and 16.75m to 16.80m, planar, rough, grey calcite mineralisation and blackish grey staining on joint surfaces. 3. 70 to 90 degree joints, at 13.70m to 14.04m, 14.00m to 14.20m, 14.47 to 14.80m and 15.60m to 16.20m, 16.60m to 16.70m, undulating, rough, grey calcite mineralisation on most joint surfaces.					10.0
11.20			97	71	60							Medium strong massive grey GREYWACKE with occasional greyish white calcite veins of various orientations (2 to 6mm thick). Partially weathered: slightly reduced strength, slightly closer fracture spacing, patchy calcite mineralisation on some fracture surfaces. Discontinuities: 1. 30 to 50 degree joints, medium, spaced (130/355/650) planar, rough, patchy grey calcite mineralisation on some joint surfaces. 2. 60 to 70 degree joints, at 16.365m to 16.75m and 16.75m to 16.80m, planar, rough, grey calcite mineralisation and blackish grey staining on joint surfaces. 3. 70 to 90 degree joints, at 13.70m to 14.04m, 14.00m to 14.20m, 14.47 to 14.80m and 15.60m to 16.20m, 16.60m to 16.70m, undulating, rough, grey calcite mineralisation on most joint surfaces.					11.0
12.70			100	72	63							Medium strong massive grey GREYWACKE with occasional greyish white calcite veins of various orientations (2 to 6mm thick). Partially weathered: slightly reduced strength, slightly closer fracture spacing, patchy calcite mineralisation on some fracture surfaces. Discontinuities: 1. 30 to 50 degree joints, medium, spaced (130/355/650) planar, rough, patchy grey calcite mineralisation on some joint surfaces. 2. 60 to 70 degree joints, at 16.365m to 16.75m and 16.75m to 16.80m, planar, rough, grey calcite mineralisation and blackish grey staining on joint surfaces. 3. 70 to 90 degree joints, at 13.70m to 14.04m, 14.00m to 14.20m, 14.47 to 14.80m and 15.60m to 16.20m, 16.60m to 16.70m, undulating, rough, grey calcite mineralisation on most joint surfaces.					11.5
14.20			100	82	82							Medium strong massive grey GREYWACKE with occasional greyish white calcite veins of various orientations (2 to 6mm thick). Partially weathered: slightly reduced strength, slightly closer fracture spacing, patchy calcite mineralisation on some fracture surfaces. Discontinuities: 1. 30 to 50 degree joints, medium, spaced (130/355/650) planar, rough, patchy grey calcite mineralisation on some joint surfaces. 2. 60 to 70 degree joints, at 16.365m to 16.75m and 16.75m to 16.80m, planar, rough, grey calcite mineralisation and blackish grey staining on joint surfaces. 3. 70 to 90 degree joints, at 13.70m to 14.04m, 14.00m to 14.20m, 14.47 to 14.80m and 15.60m to 16.20m, 16.60m to 16.70m, undulating, rough, grey calcite mineralisation on most joint surfaces.					12.0
																	12.5
																	13.0
																	13.5
																	14.0
																	14.5
Water Strikes			Remarks														
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	Hand dug inspection pit excavated to 1.20m Location: Landfall. Televiwer completed. No groundwater encountered- water added during drilling.													
Casing Details			Core Barrel														
To (m)	Diam (mm)	SK6L															
2.70	200																
30.00	150	Flush Type		Termination Reason									Last Updated				
		Water		Terminated at scheduled depth.									02/12/2022				



<div><div>CAUSEWAY GEOTECH</div></div>										Project No. 21-1619A		Project Name: North Irish Sea Array Landfall				Borehole ID BH18																																																																																																																																																																																																					
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Partially weathered: slightly reduced strength, greyish black staining on most fracture surfaces. Discontinuities: 1. 20 to 35 degree joints, medium, spaced (430/975/1200) planar to undulating, rough. 2. 40 to 60 degree joints, medium spaced (110/490/980) planar, rough, patchy grey calcite mineralisation and greyish black staining on most joint surfaces, greenish grey clayey gravelly infill on some joints (up to 45mm thick). 3. 70 to 80 degree joints at 17.10m to 17.40m, 18.70m to 19.00m, 19.25m to 19.40m, 20.55m to 20.75m and 21.30m to 22.00m, undulating, rough, greyish white and greenish grey staining calcite mineralisation on most joint surfaces.</td><td></td><td></td></tr><tr><td>17.20</td><td></td><td>100</td><td>96</td><td>82</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>18.70</td><td></td><td></td><td></td><td></td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td>100</td><td>78</td><td>68</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>20.20</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td>90</td><td>65</td><td>42</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>21.70</td><td></td><td></td><td></td><td></td><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td>TCR</td><td>SCR</td><td>RQD</td><td>FI</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																		Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill	14.85 - 14.95	C										Medium strong massive grey GREYWACKE with occasional greyish white calcite veins of various orientations (2 to 6mm thick). 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Discontinuities: 1. 20 to 35 degree joints, medium, spaced (430/975/1200) planar to undulating, rough. 2. 40 to 60 degree joints, medium spaced (110/490/980) planar, rough, patchy grey calcite mineralisation and greyish black staining on most joint surfaces, greenish grey clayey gravelly infill on some joints (up to 45mm thick). 3. 70 to 80 degree joints at 17.10m to 17.40m, 18.70m to 19.00m, 19.25m to 19.40m, 20.55m to 20.75m and 21.30m to 22.00m, undulating, rough, greyish white and greenish grey staining calcite mineralisation on most joint surfaces.			17.20		100	96	82										18.70					4											100	78	68										20.20																90	65	42										21.70					9																									TCR	SCR	RQD	FI								
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Method Rotary Drilling Rotary Coring		Plant Used Comacchio 405 Comacchio 405		Top (m) 0.00 2.70	Base (m) 2.70 30.00	Coordinates 719790.13 E 765134.97 N		Final Depth: 30.00 m		Start Date: 11/04/2022		Driller: MW		Sheet 4 of 5 Scale: 1:40		
								Elevation: 8.09 mOD		End Date: 13/04/2022		Logger: TH		FINAL		
Depth (m)	Samples / Field Records		TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description			Water	Backfill
22.30 - 22.45	C											Medium strong light grey TUFF with rare greyish white calcite veins. Partially weathered: slightly reduced strength, greyish black staining on most fracture surfaces. Discontinuities: 1. 20 to 35 degree joints, widely spaced (430/975/1200) planar to undulating, rough. 2. 40 to 60 degree joints, medium spaced (110/490/980) planar, rough, patchy grey calcite mineralisation and greyish black staining on most joint surfaces, greenish grey clayey gravelly infill on some joints (up to 45mm thick). 3. 70 to 80 degree joints at 17.10m to 17.40m, 18.70m to 19.00m, 19.25m to 19.40m, 20.55m to 20.75m and 21.30m to 22.00m, undulating, rough, greyish white and greenish grey staining calcite mineralisation on most joint surfaces.				
22.90 - 23.10	C		100	77	61											
23.20						5										
			100	64	53											
24.70									-16.51	24.60						
26.20			100	72	72	4										
			97	64	64											
27.70						NI										
29.20			100	75	65	5										
			TCR	SCR	RQD	FI										
Water Strikes						Remarks										
Struck at (m)		Casing to (m)		Time (min)		Rose to (m)		Hand dug inspection pit excavated to 1.20m Location: Landfall. Televviewer completed. No groundwater encountered- water added during drilling.								
Casing Details				Core Barrel												
To (m)		Diam (mm)		SK6L												
2.70		200														
30.00		150		Flush Type			Termination Reason						Last Updated			
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Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill																																																																																																																																																																																				
30.00		100	75	75				-21.91	30.00		Medium strong grey TUFF with frequent greyish white calcite vein s of various orientations (2 to 25mm thick). Partially weathered: slightly reduced strength, slightly fracture spacing, infill and orangish brown discolouration on some fracture surfaces. Discontinuities: 1. 20 to 30 degree joints, widely spaced (500/770/1500) planar to undulating, rough. 2. 60 to 70 degree joints, at 25.56m to 25.70m, 25.80m to 25.90m, 25.87m to 26.00m, 28.00m to 28.15m, 28.25m to 28.40m, 28.23m to 28.45m and 29.20m to 29.40m, planar, rough, greyish white calcite mineralisation on most joint surfaces, greenish grey gravelly clay infill on some joint surfaces 92 to 5mm thick). 3. 80 to 90 degree joints, at 27.10m to 27.80m, 28.20m to 28.60m, 28.75m to 29.10m, and 29.80m to 30.00m, undulating, rough, greyish white calcite mineralisation and greyish black staining on joint surfaces, clayey gravelly infill on some joint surfaces. End of Borehole at 30.00m																																																																																																																																																																																						
<table><tr><td colspan="4">Water Strikes</td><td colspan="14">Remarks</td></tr><tr><td>Struck at (m)</td><td>Casing to (m)</td><td>Time (min)</td><td>Rose to (m)</td><td colspan="14">Hand dug inspection pit excavated to 1.20m Location: Landfall. Televiever completed. No groundwater encountered- water added during drilling.</td></tr><tr><td colspan="4"></td><td colspan="14"></td></tr><tr><td colspan="4">Casing Details</td><td colspan="4">Core Barrel</td><td colspan="10"></td></tr><tr><td>To (m)</td><td colspan="3">Diam (mm)</td><td colspan="4">SK6L</td><td colspan="10"></td></tr><tr><td>2.70</td><td colspan="3">200</td><td colspan="4"></td><td colspan="10"></td></tr><tr><td>30.00</td><td colspan="3">150</td><td colspan="4">Flush Type</td><td colspan="10">Termination Reason</td></tr><tr><td colspan="4"></td><td colspan="4">Water</td><td colspan="10">Terminated at scheduled depth.</td></tr><tr><td colspan="12"></td><td colspan="2">Last Updated</td><td colspan="2"></td></tr><tr><td colspan="12"></td><td colspan="2">02/12/2022</td><td colspan="2"></td></tr></table>																		Water Strikes				Remarks														Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	Hand dug inspection pit excavated to 1.20m Location: Landfall. Televiever completed. No groundwater encountered- water added during drilling.																																Casing Details				Core Barrel														To (m)	Diam (mm)			SK6L														2.70	200																	30.00	150			Flush Type				Termination Reason														Water				Terminated at scheduled depth.																						Last Updated																02/12/2022			
Water Strikes				Remarks																																																																																																																																																																																													
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**CAUSEWAY**  
— GEOTECH

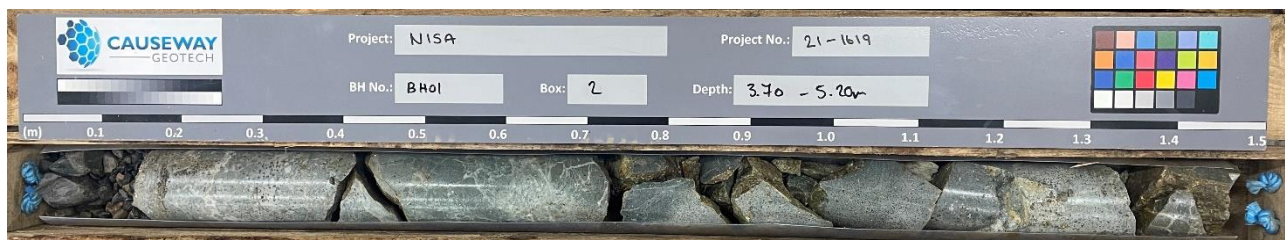
**APPENDIX C**  
**CORE PHOTOGRAPHS**



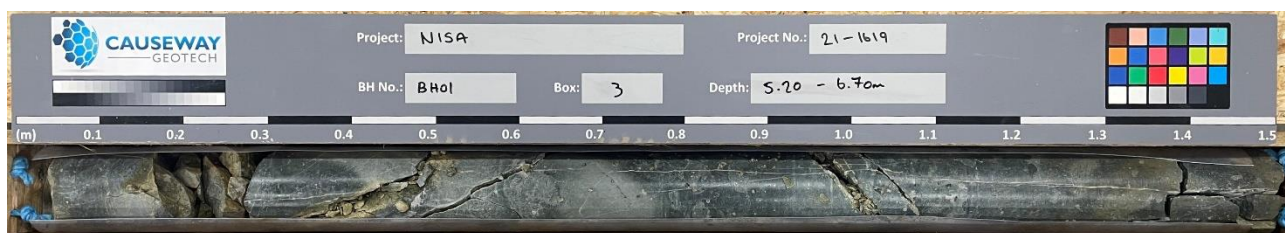




BH01 (Box 1) 2.70-3.70m



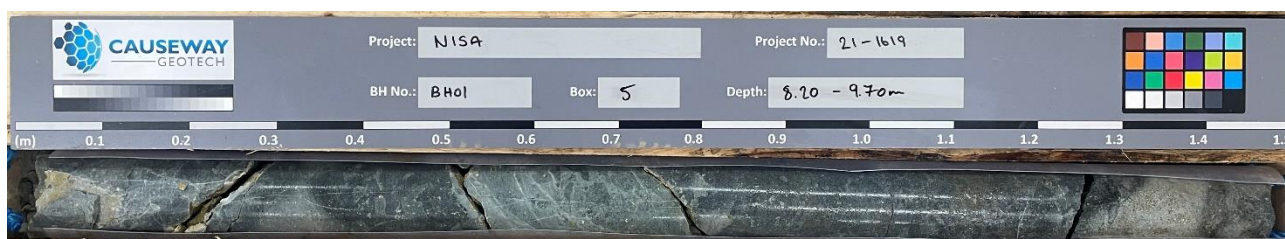
BH01 (Box 2) 3.70-5.20m



BH01 (Box 3) 5.20-6.70m

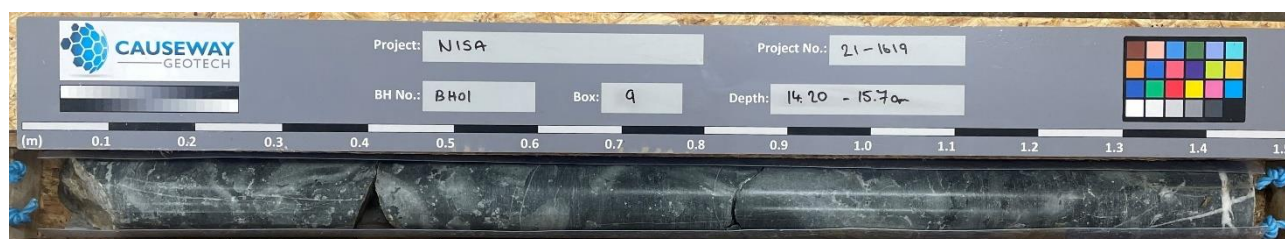
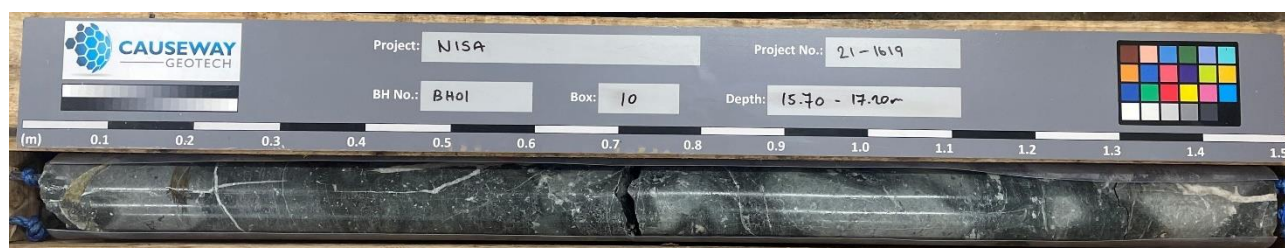


BH01 (Box 4) 6.70-8.20m

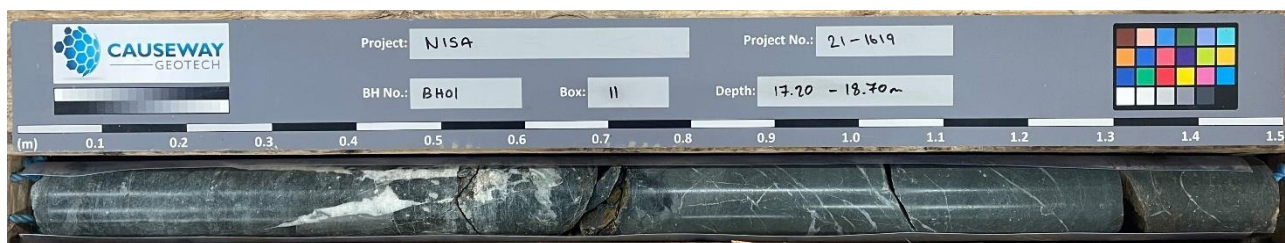


BH01 (Box 5) 8.20-9.70m

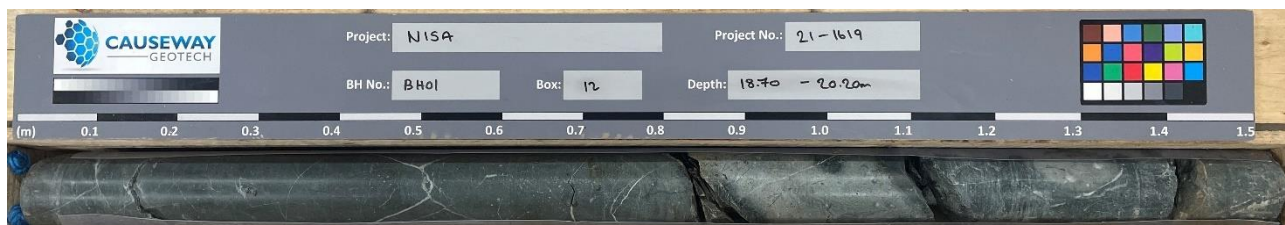


**BH01 (Box 6) 9.70-11.20m****BH01 (Box 7) 11.20-12.70m****BH01 (Box 8) 12.70-14.20m****BH01 (Box 9) 14.20-15.70m****BH01 (Box 10) 15.70-17.20m**

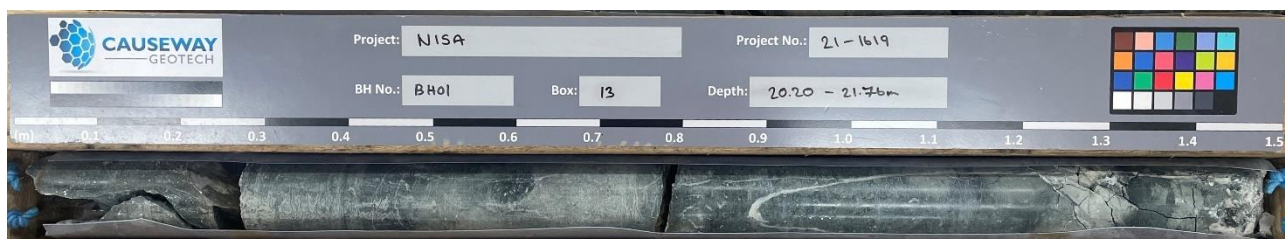




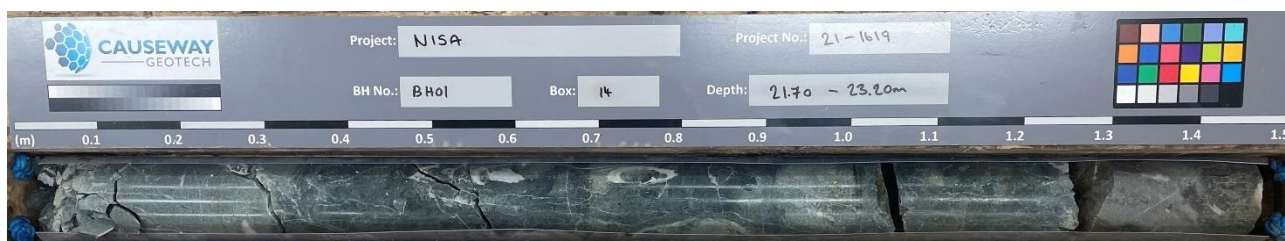
BH01 (Box 11) 17.20-18.70m



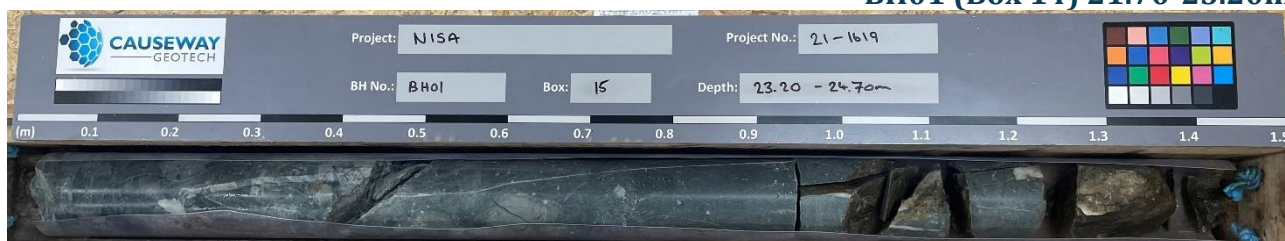
BH01 (Box 12) 18.70-20.20m



BH01 (Box 13) 20.20-21.70m



BH01 (Box 14) 21.70-23.20m



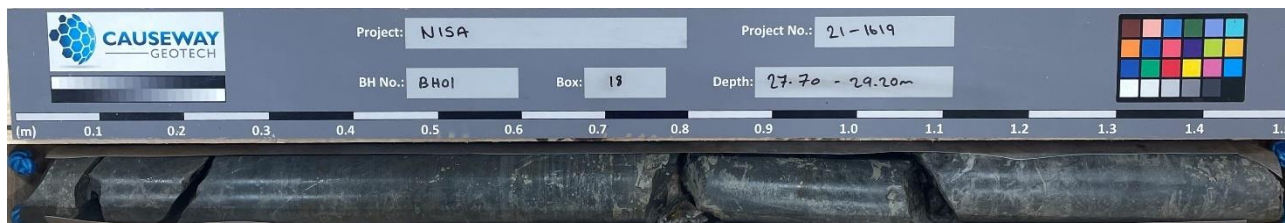
BH01 (Box 15) 23.20-24.70m



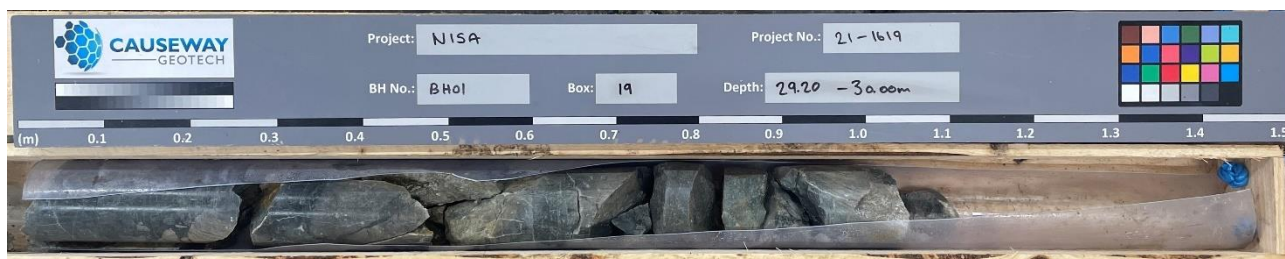
BH01 (Box 16) 24.70-26.20m



BH01 (Box 17) 26.20-27.70m

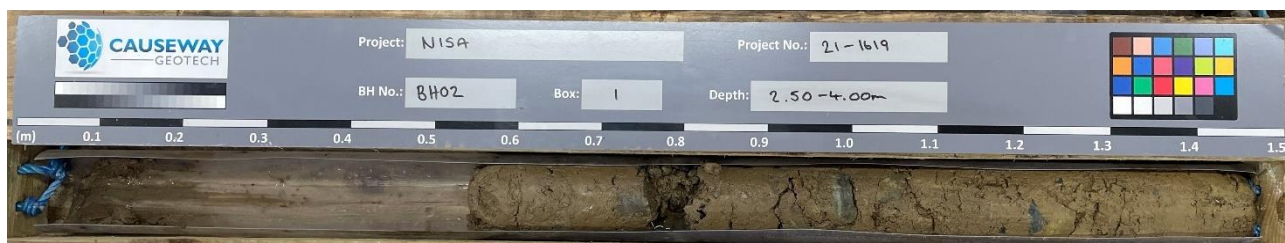


BH01 (Box 18) 27.70-29.20m

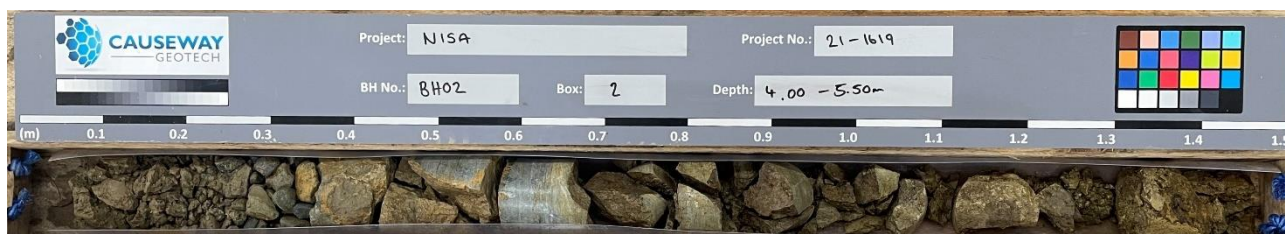


BH01 (Box 19) 29.20-30.00m





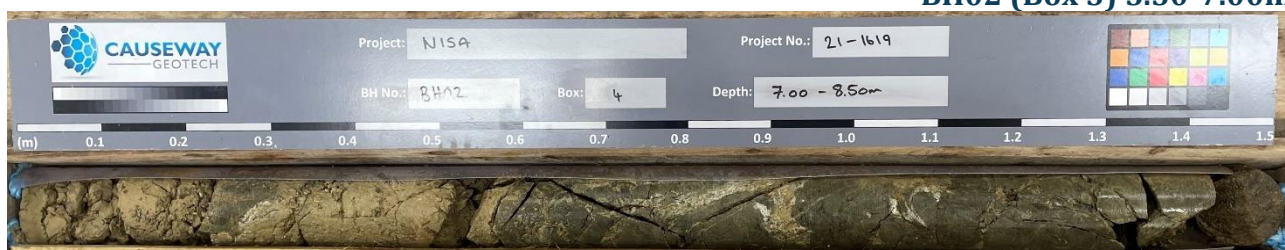
BH02 (Box 1) 2.50-4.00 m



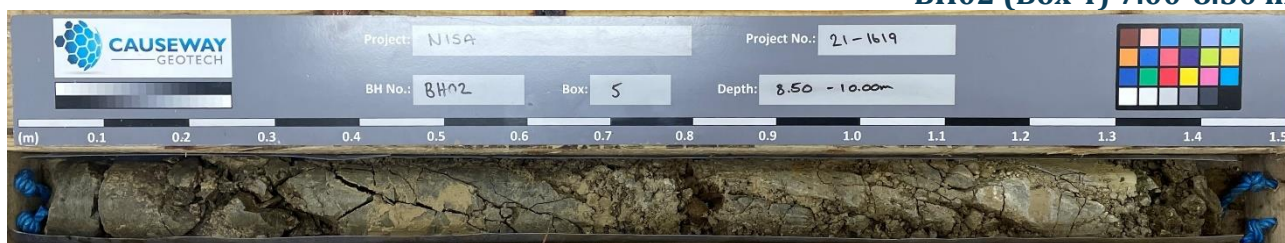
BH02 (Box 2) 4.00-5.50m



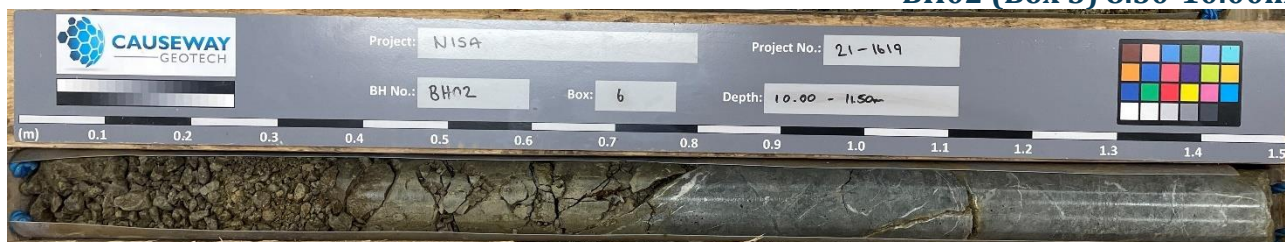
BH02 (Box 3) 5.50-7.00m



BH02 (Box 4) 7.00-8.50 m

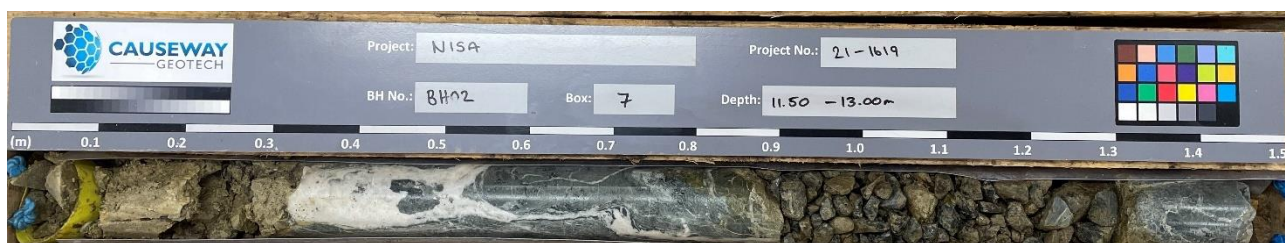


BH02 (Box 5) 8.50-10.00m

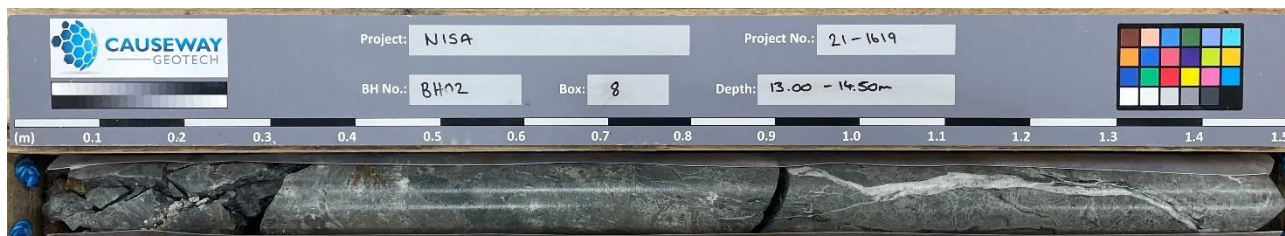


BH02 (Box 6) 10.00-11.50m

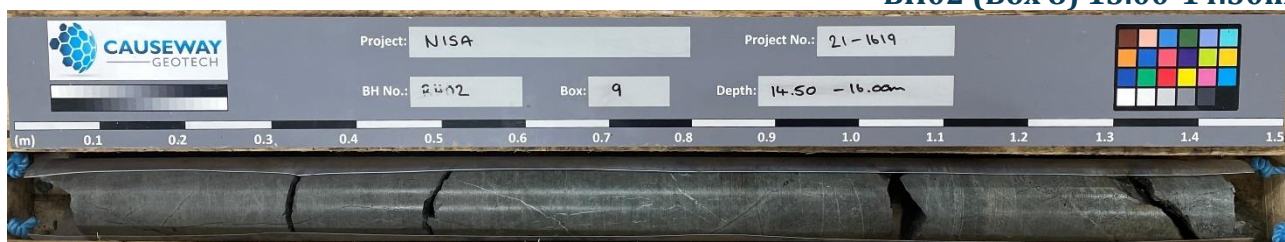




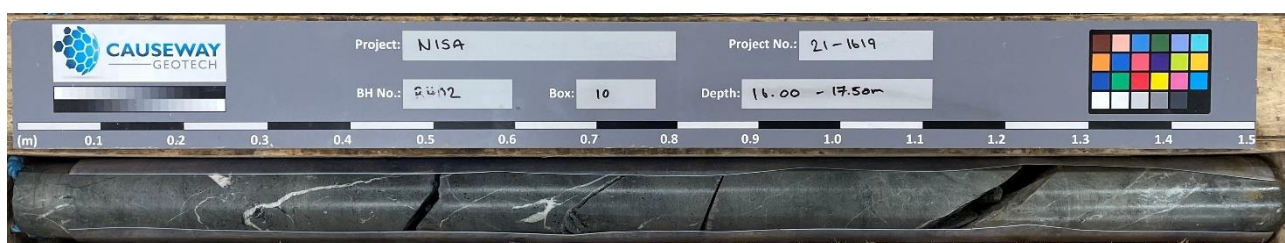
BH02 (Box 7) 11.50-13.00m



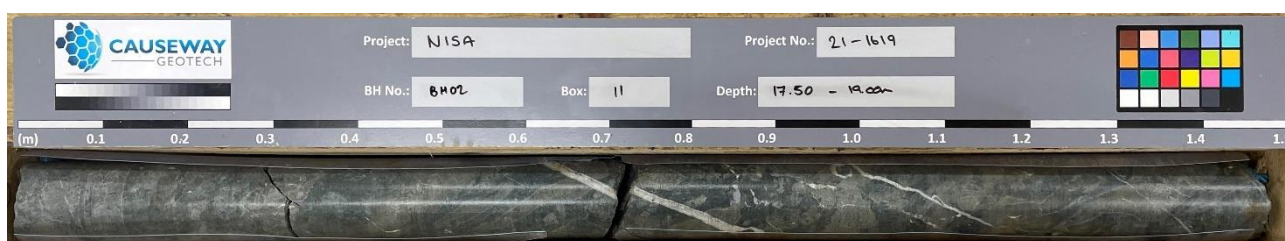
BH02 (Box 8) 13.00-14.50m



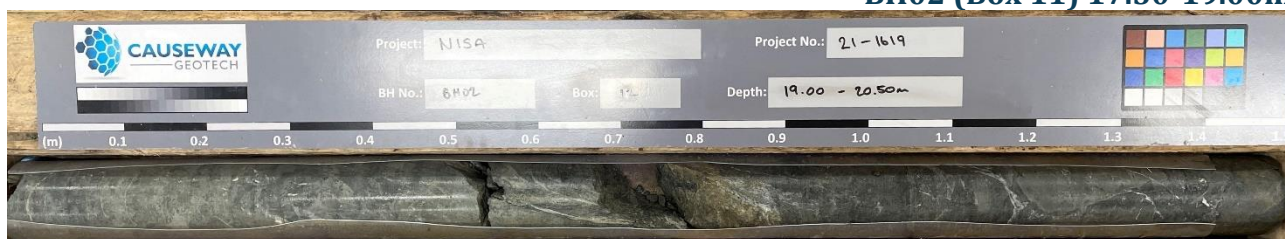
BH02 (Box 9) 14.50-16.00m



BH02 (Box 10) 16.00-17.50m

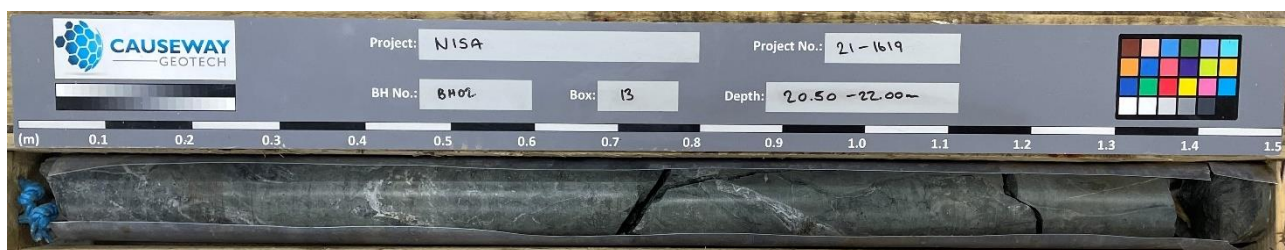


BH02 (Box 11) 17.50-19.00m

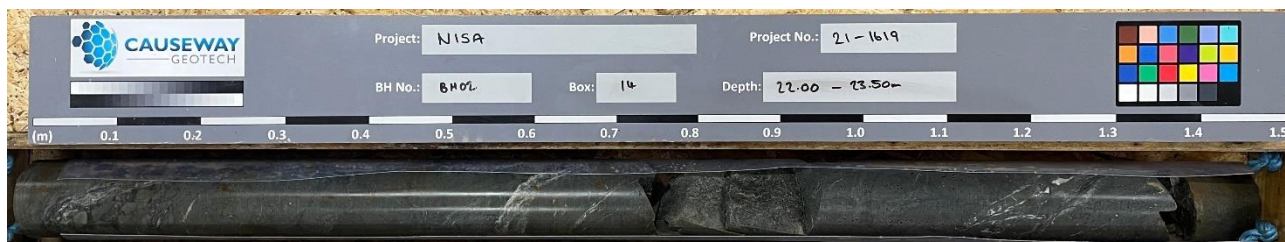


BH02 (Box 12) 19.00-20.50m

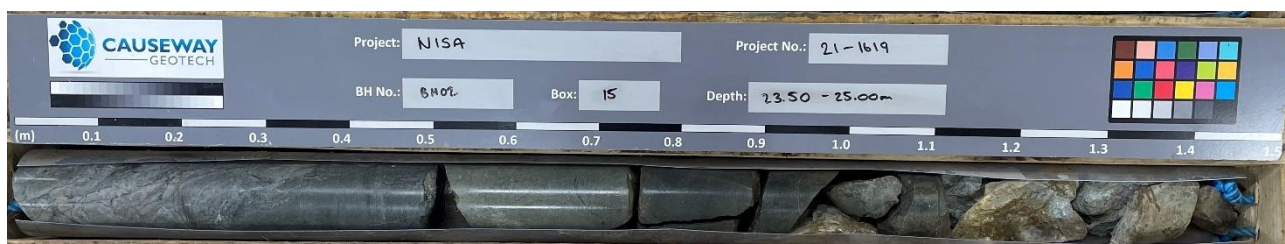




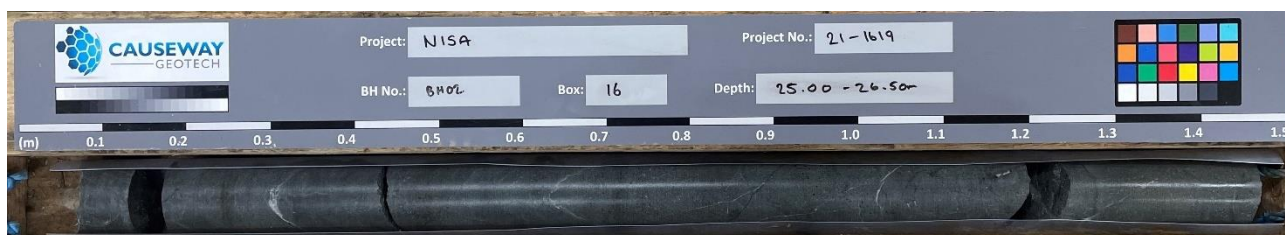
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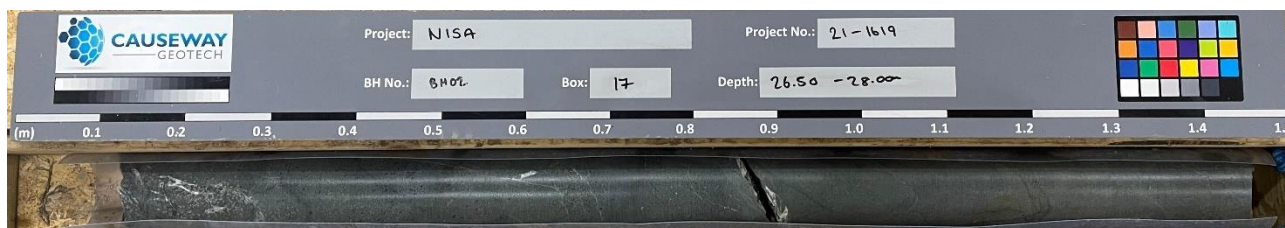
BH02 (Box 14) 22.00-23.50 m



BH02 (Box 15) 23.50-25.00 m



BH02 (Box 16) 25.00-26.50m



BH02 (Box 17) 26.50-28.00m

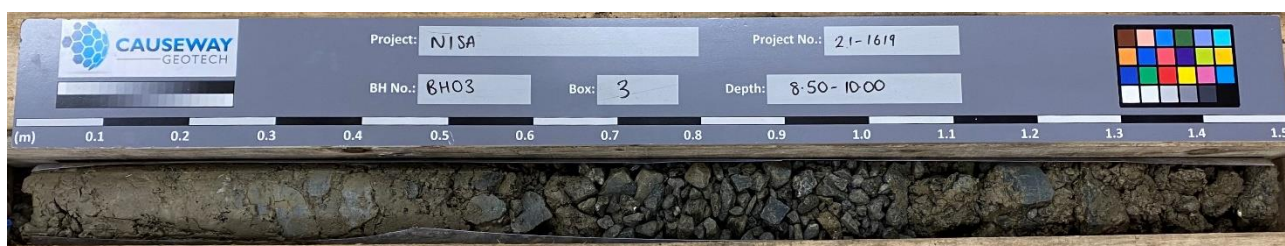




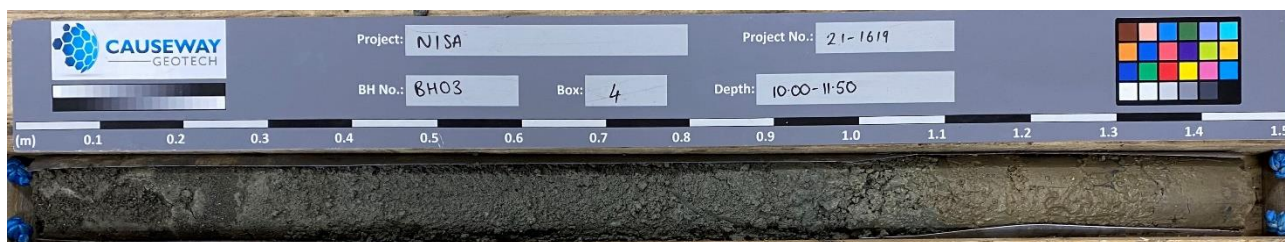
BH03 (Box 1) 5.50-7.00m



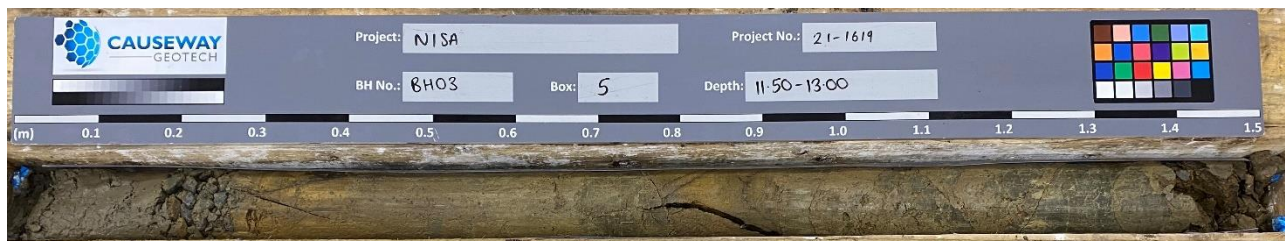
BH03 (Box 2) 7.00-8.50m



BH03 (Box 3) 8.50-10.00m

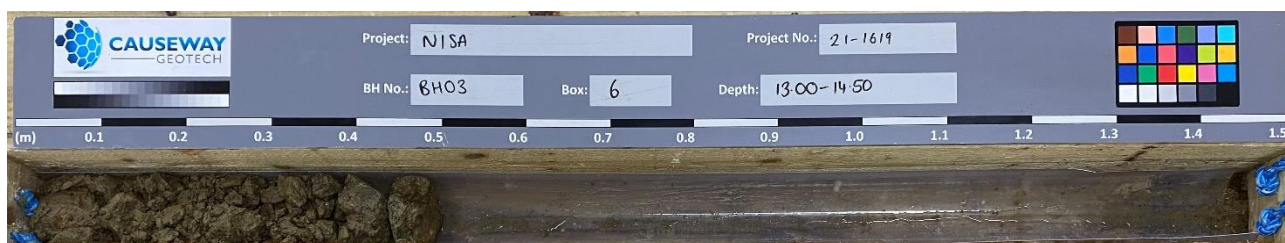


BH03 (Box 4) 10.00-11.50m

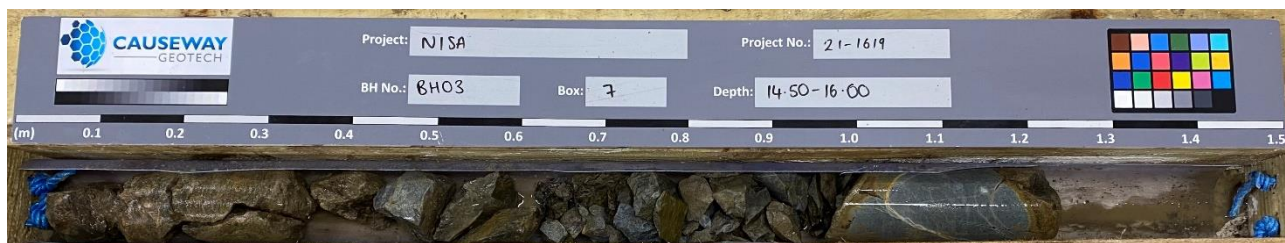


BH03 (Box 5) 11.50-13.00m

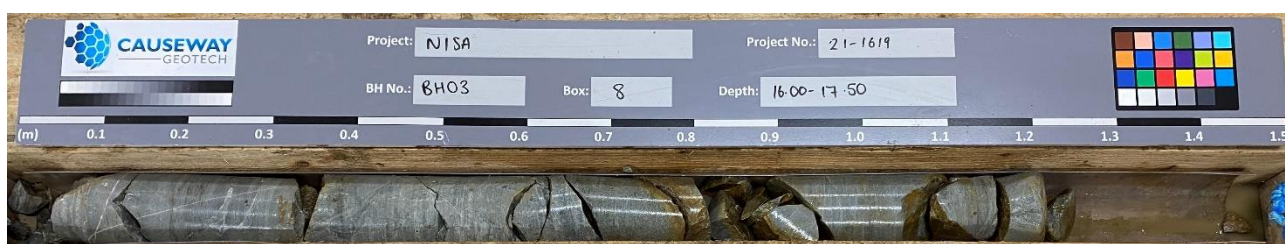




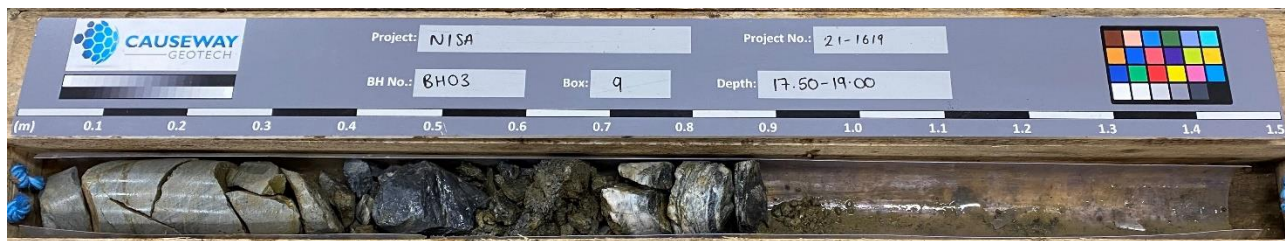
BH03 (Box 6) 13.00-14.50m



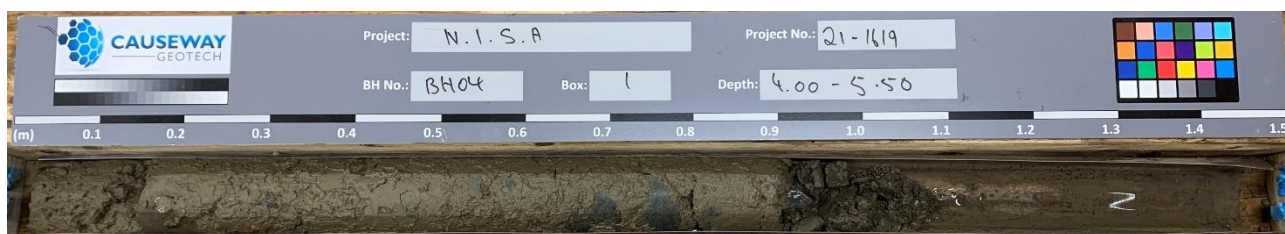
BH03 (Box 7) 14.50-16.00m



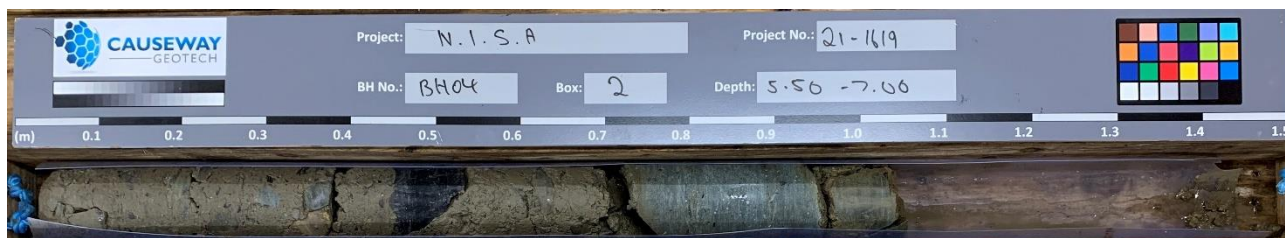
BH03 (Box 8) 16.00-17.50m



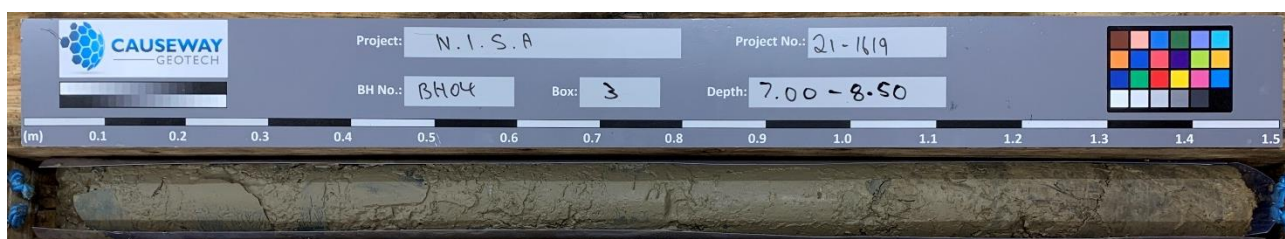
BH03 (Box 9) 17.50-19.00m



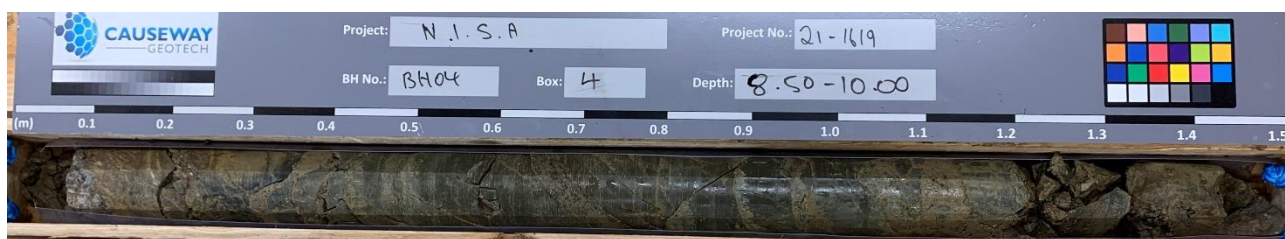
BH04 (Box 1) 4.00-5.50m



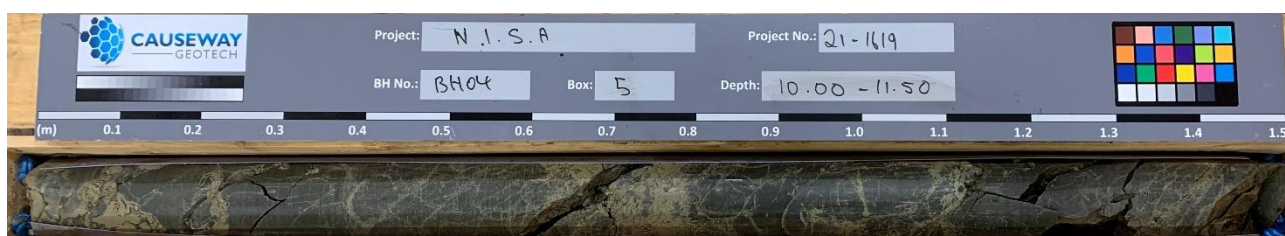
BH04 (Box 2) 5.50-7.00m



BH04 (Box 3) 7.00-8.50m

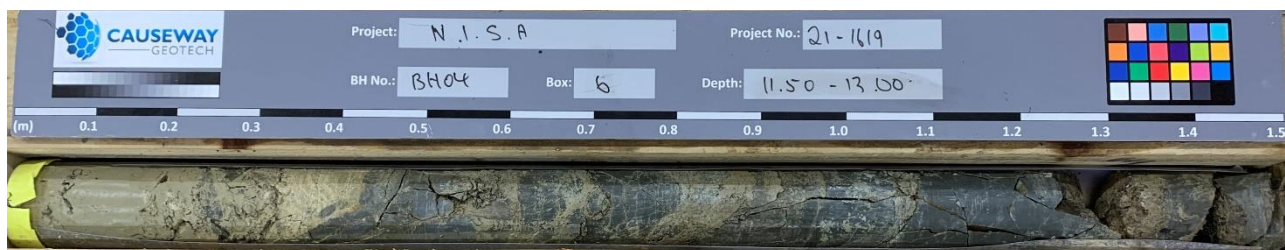


BH04 (Box 4) 8.50-10.00m



BH04 (Box 5) 10.00-11.50m





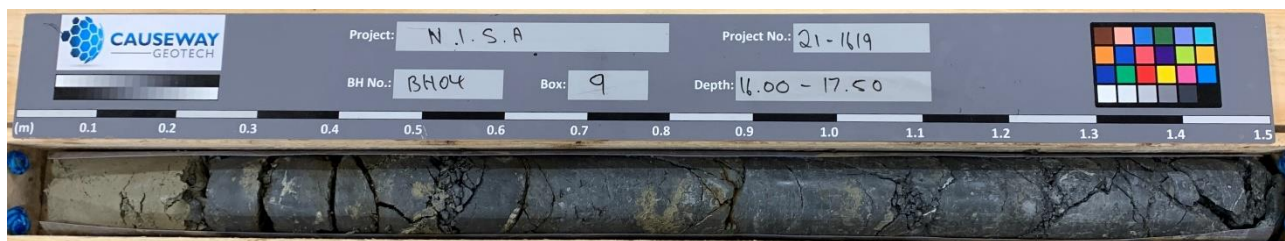
BH04 (Box 6) 11.50-13.00m



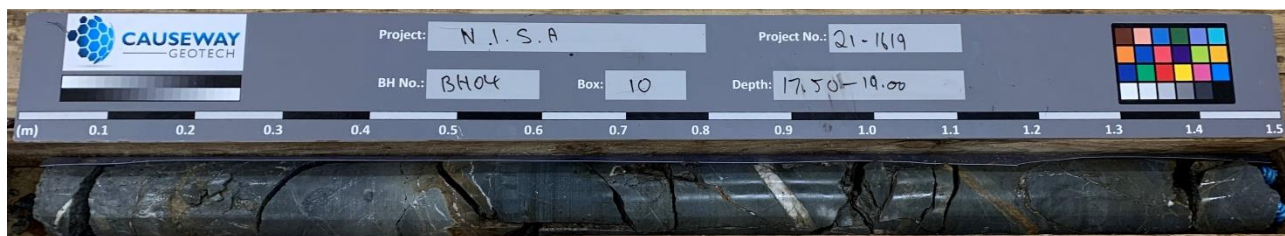
BH04 (Box 7) 13.00-14.50m



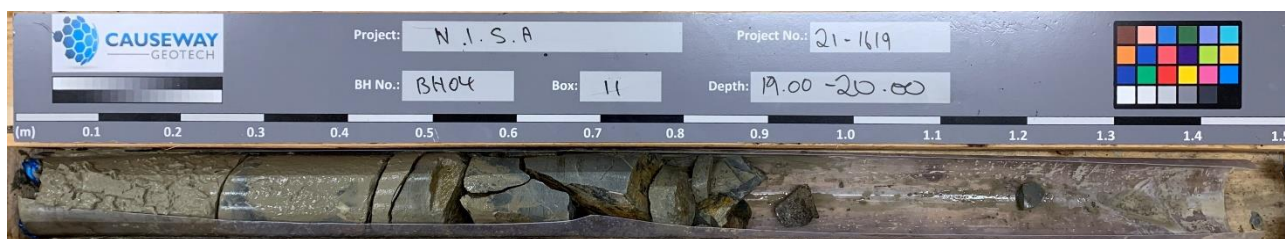
BH04 (Box 8) 14.50-16.00m



BH04 (Box 9) 16.00-17.50m



BH04 (Box 10) 17.50-19.00m

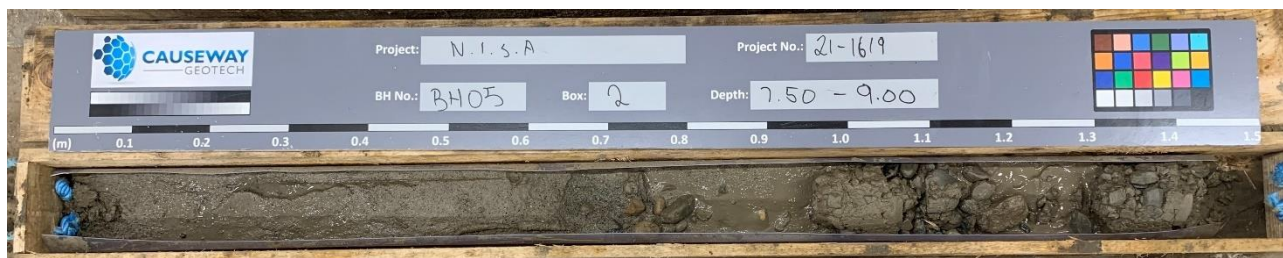


BH04 (Box 11) 19.00-20.00m

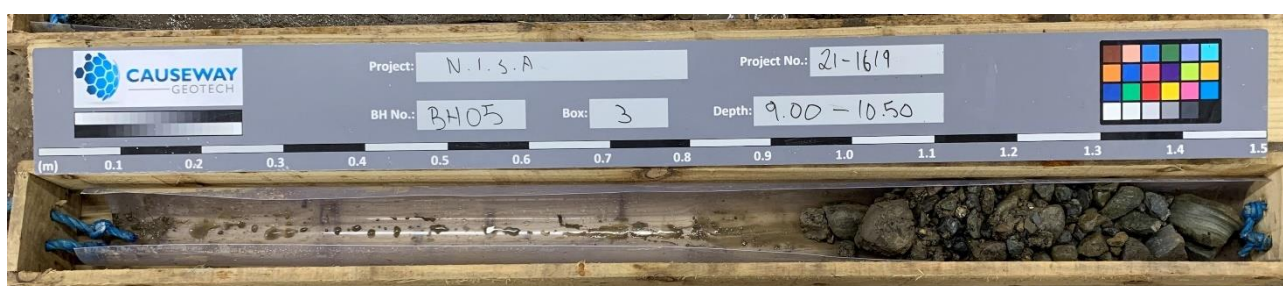




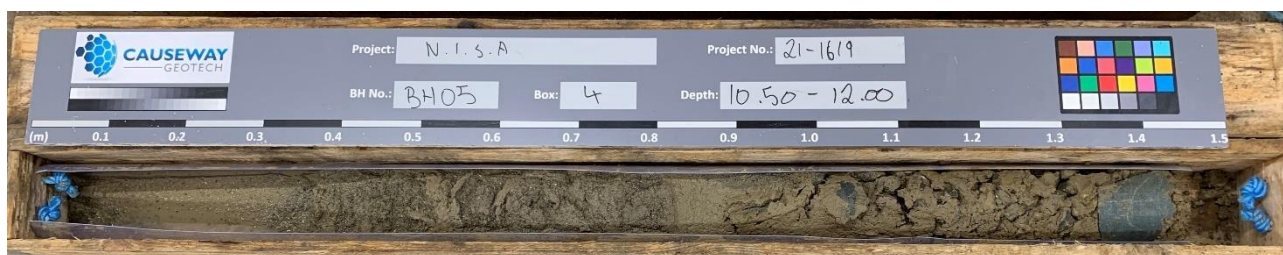
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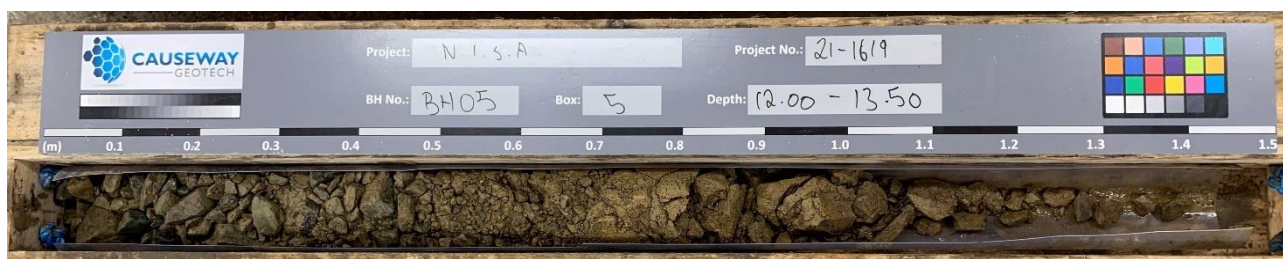
BH05 (Box 2) 7.50-9.00m



BH05 (Box 3) 9.00-10.50m

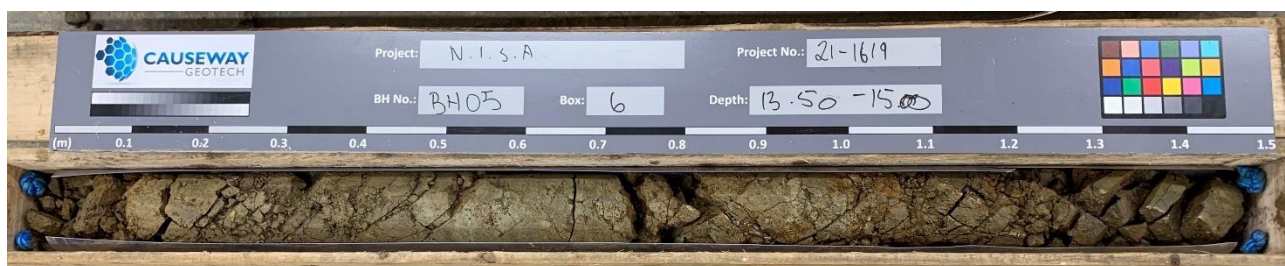


BH05 (Box 4) 10.50-12.00m

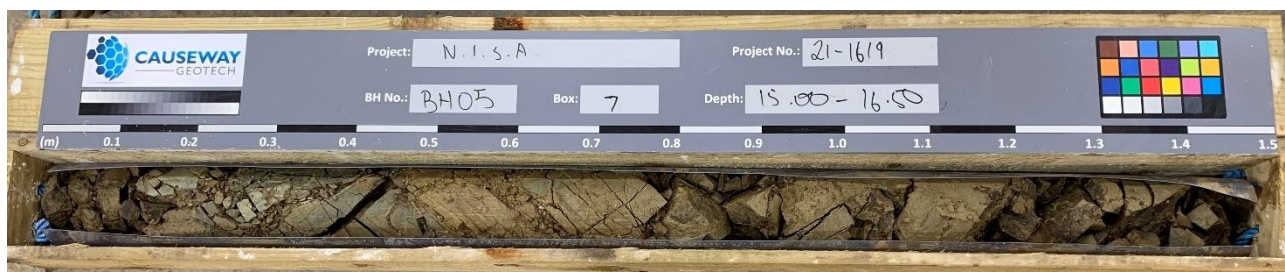


BH05 (Box 5) 12.00-13.50m

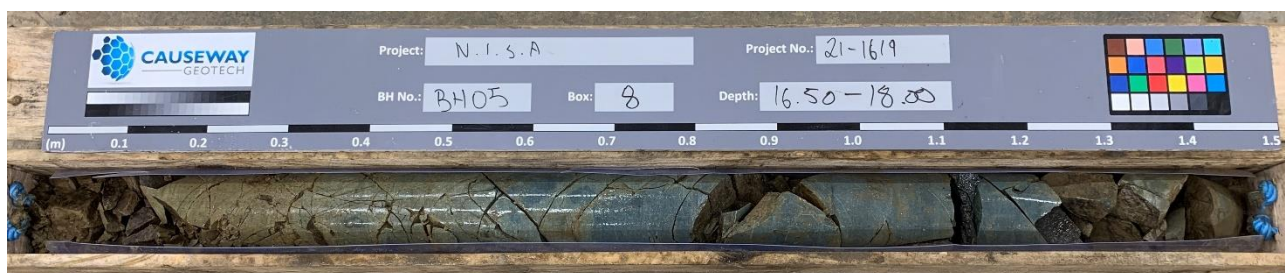




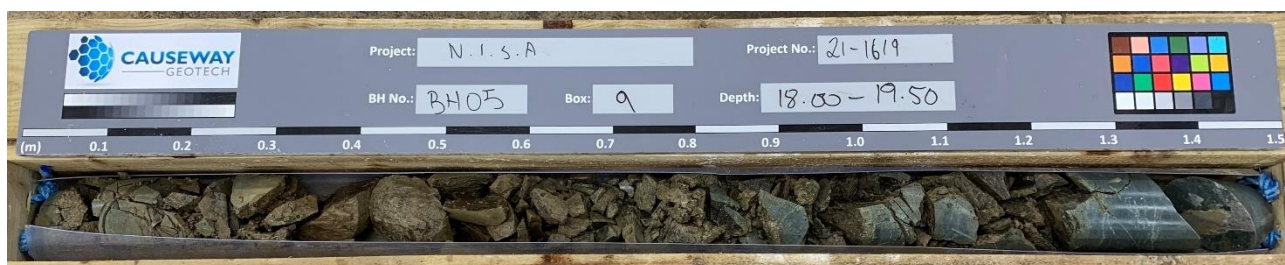
BH05 (Box 6) 13.50-15.00m



BH05 (Box 7) 15.00-16.50 m



BH05 (Box 8) 16.50-18.00m

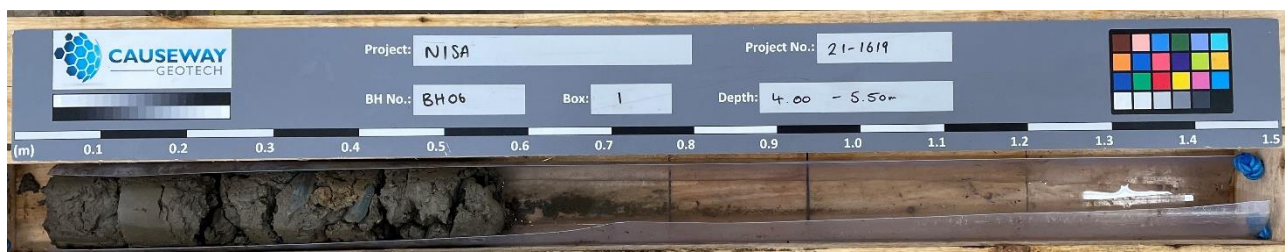


BH05 (Box 9) 18.00-19.50m

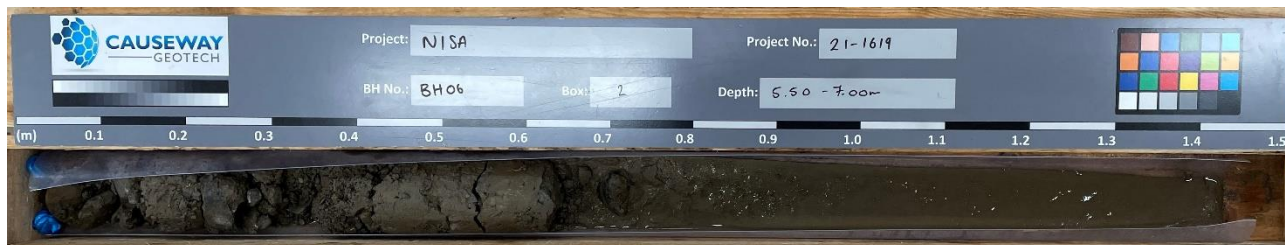


BH05 (Box 10) 19.50-20.00m

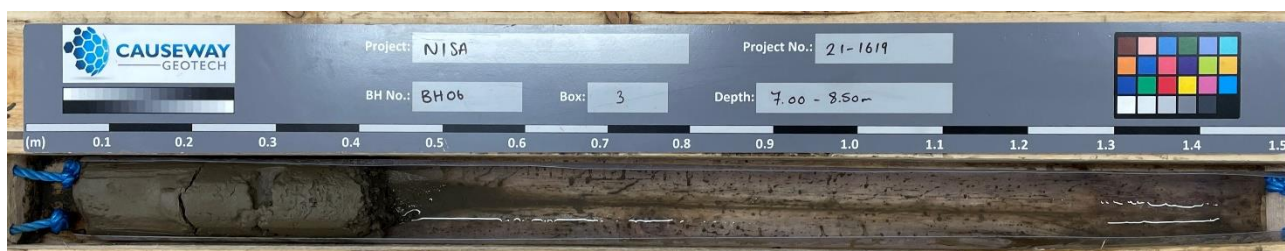




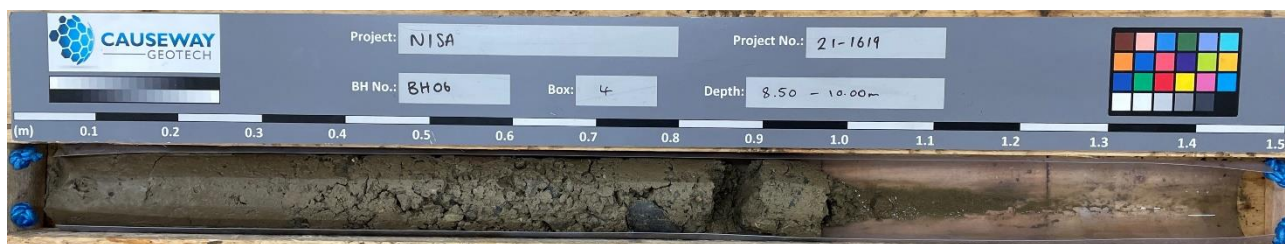
BH06 (Box 1) 4.00-5.50m



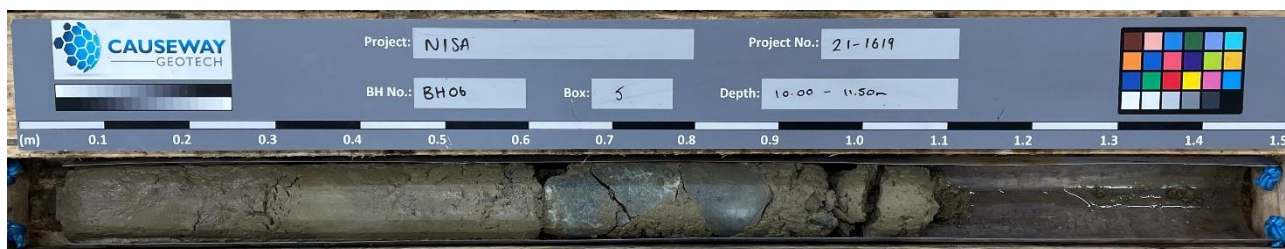
BH06 (Box 2) 5.50-7.00m



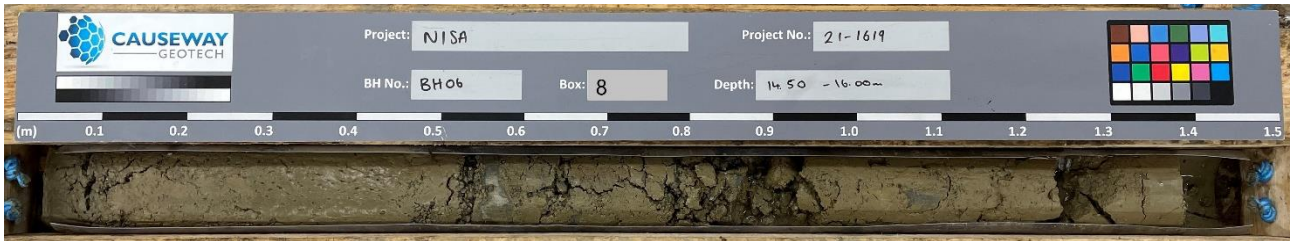
BH06 (Box 3) 7.00-8.50m



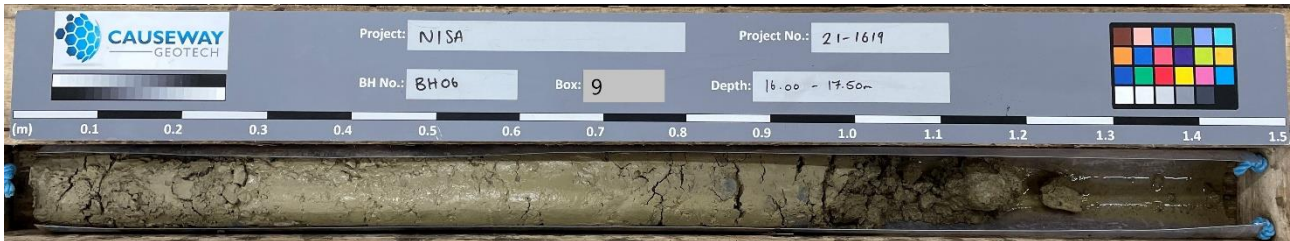
BH06 (Box 4) 8.50-10.00m



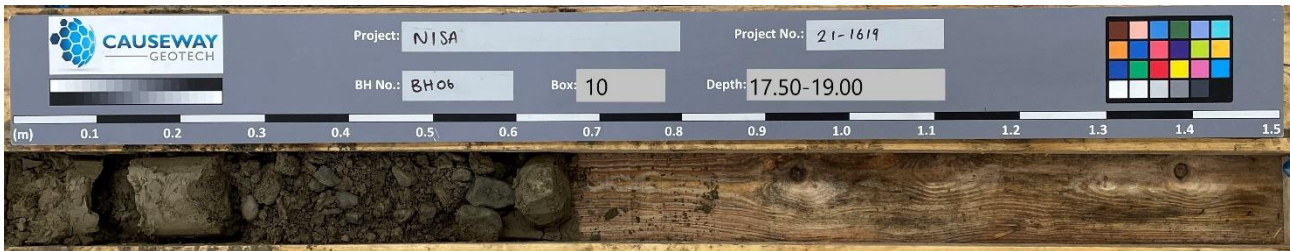
BH06 (Box 5) 10.00-11.50m



BH06 (Box 8) 14.50-16.00m

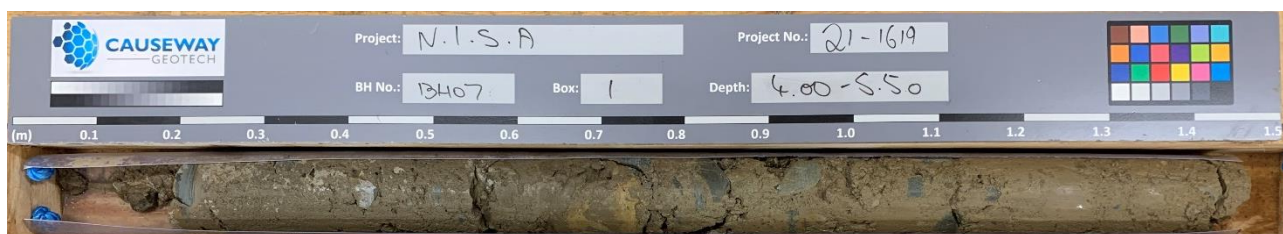


BH06 (Box 9) 16.00-17.50m

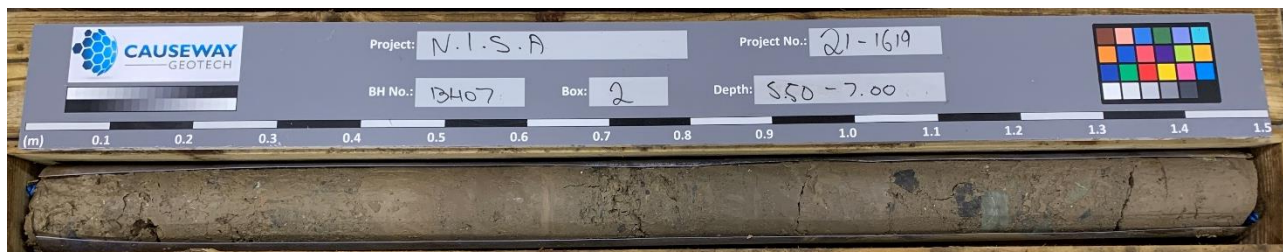


BH06 (Box 10) 17.50-19.00m

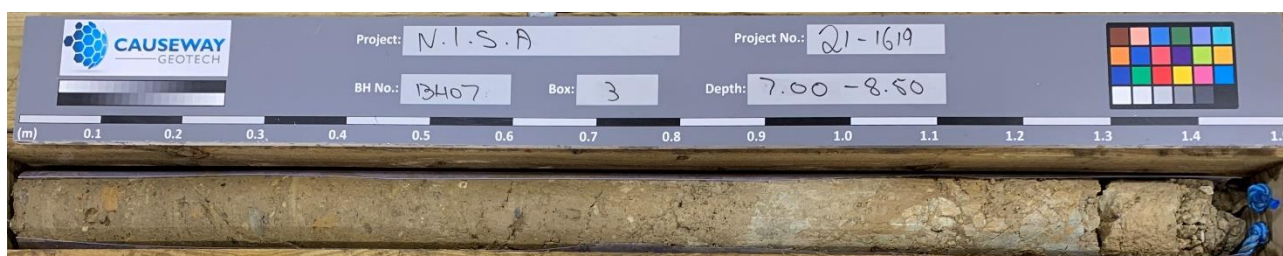




BH07 (Box 1) 4.00-5.50m



BH07 (Box 2) 5.50-7.00m



BH07 (Box 3) 7.00-8.50m



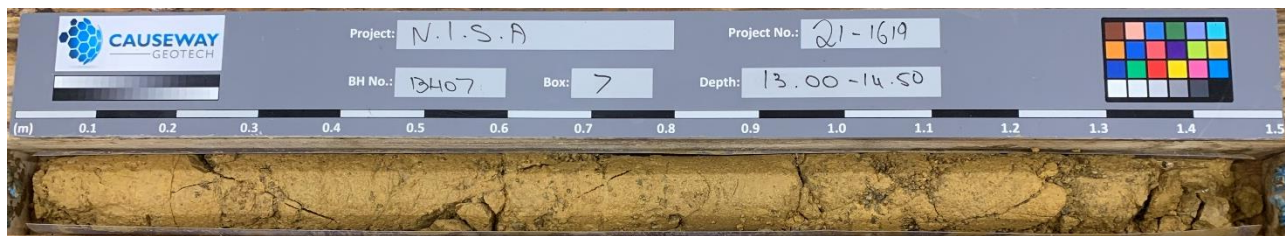
BH07 (Box 4) 8.50-10.00m



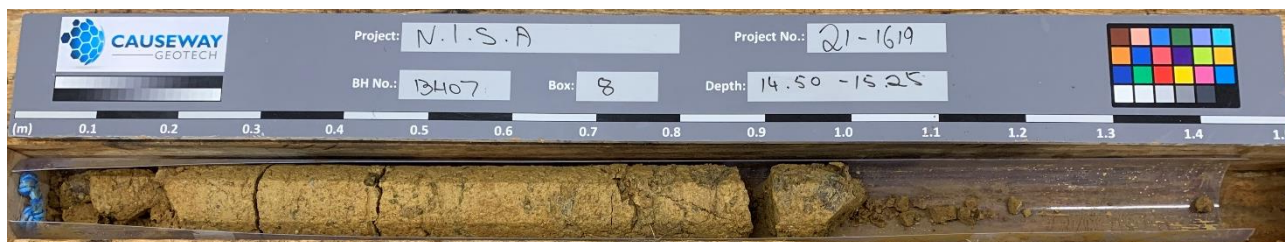
BH07 (Box 5) 10.00-11.50m



BH07 (Box 6) 11.50-13.00m

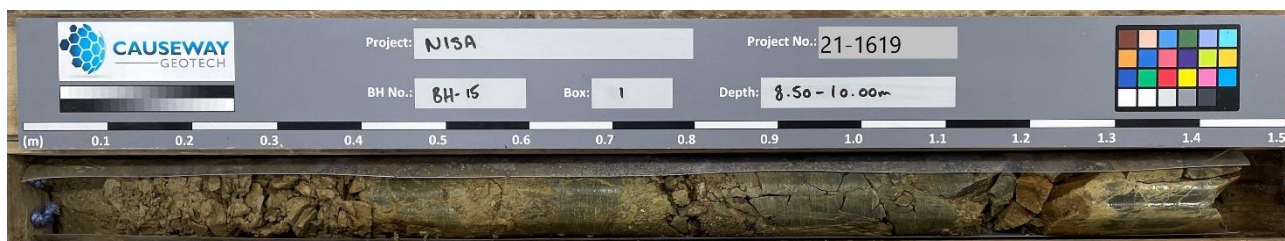


BH07 (Box 7) 13.00-14.50m

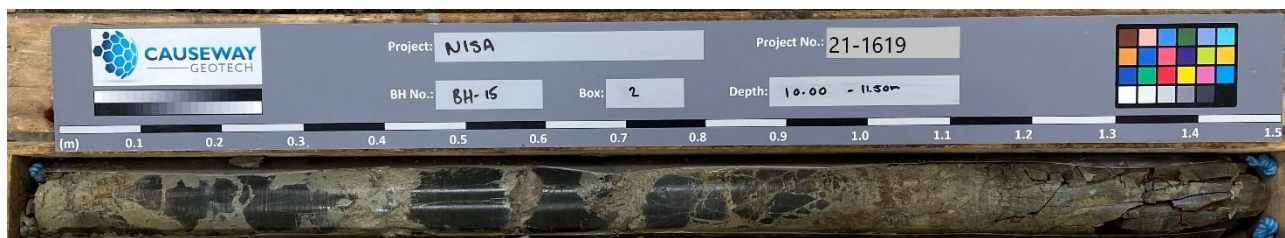


BH07 (Box 8) 14.50-15.25m

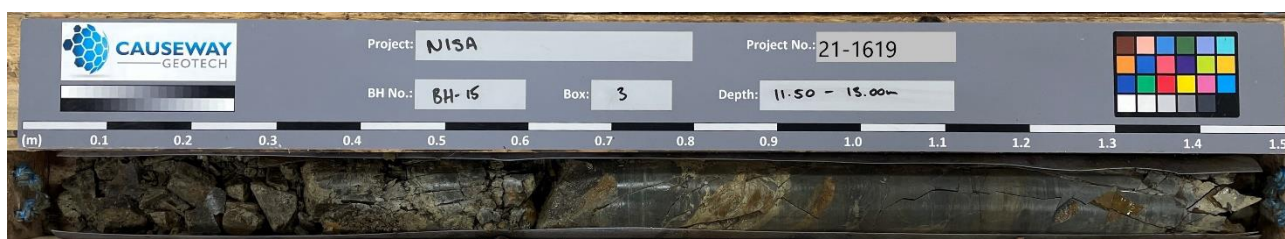




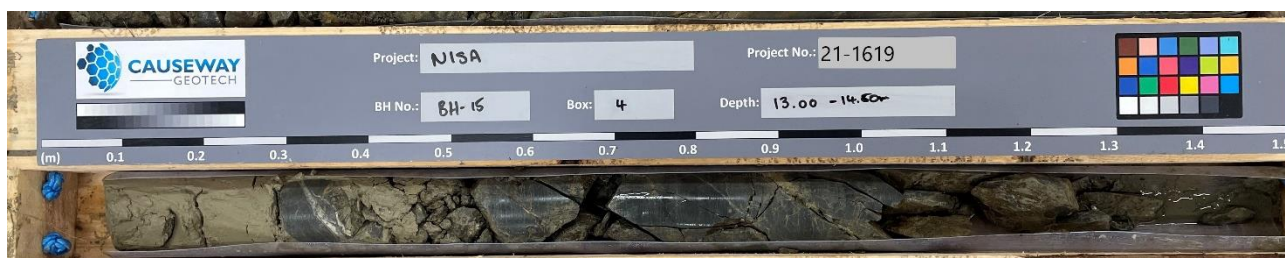
BH15 (Box 1) 8.50-10.00m



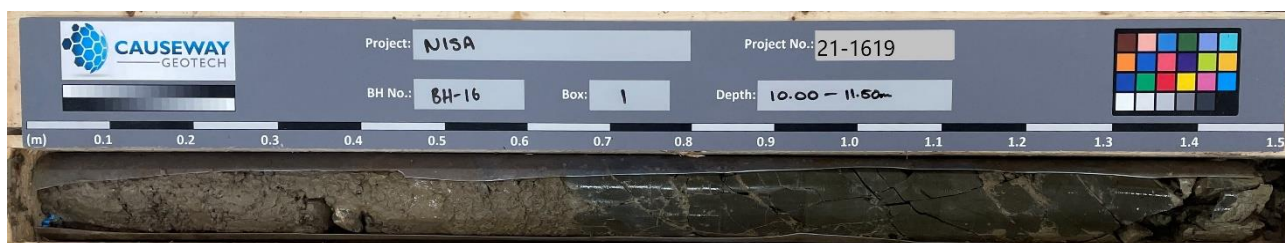
BH15 (Box 2) 10.00-11.50m



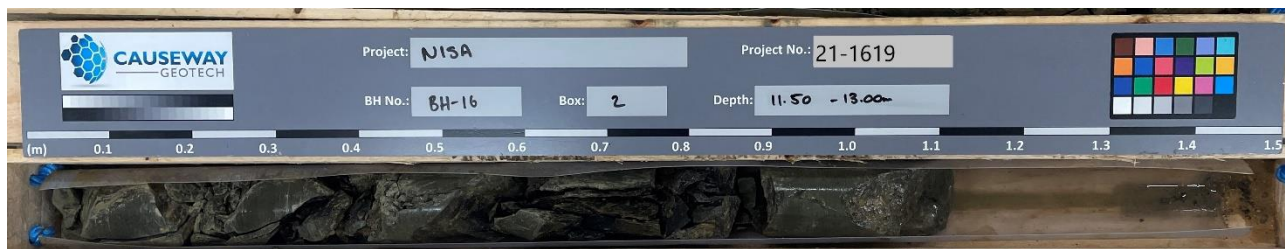
BH15 (Box 3) 11.50-13.00m



BH15 (Box 4) 13.00-14.50m



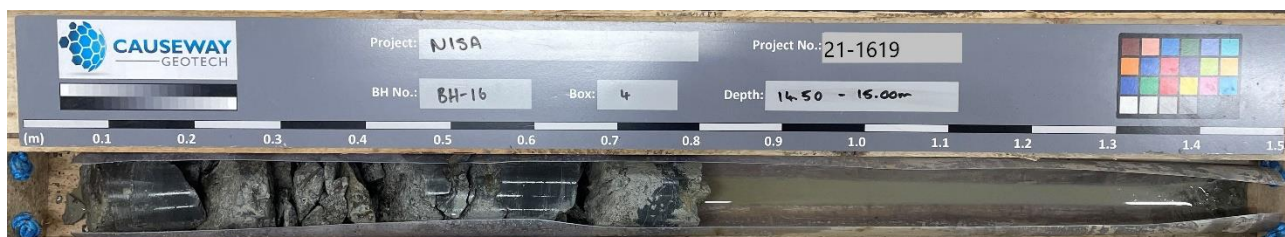
BH16 (Box 1) 10.00-11.50m



BH16 (Box 2) 11.50-13.00m



BH16 (Box 3) 13.00-14.50m

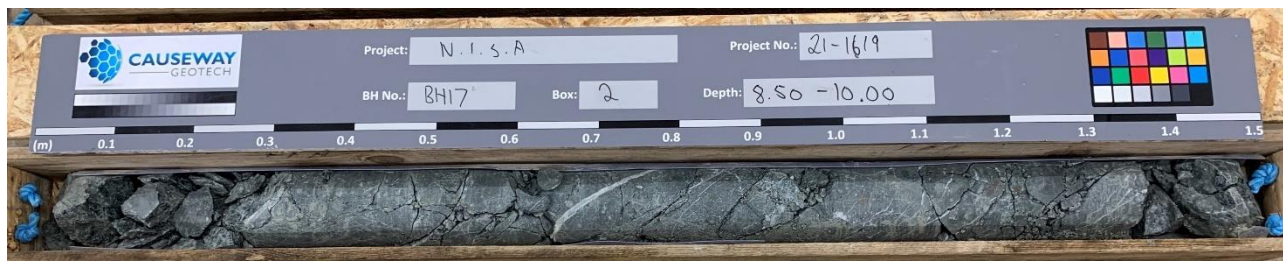


BH16 (Box 4) 14.50-15.00m

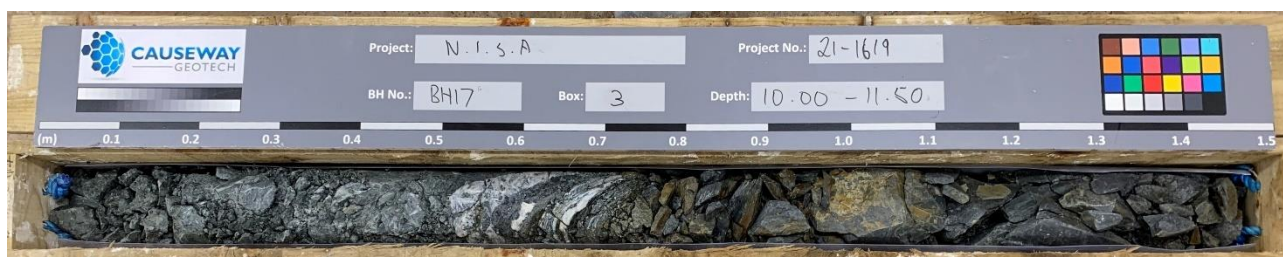




BH17 (Box 1) 7.00-8.50m



BH17 (Box 2) 8.50-10.00m



BH17 (Box 3) 10.00-11.50m

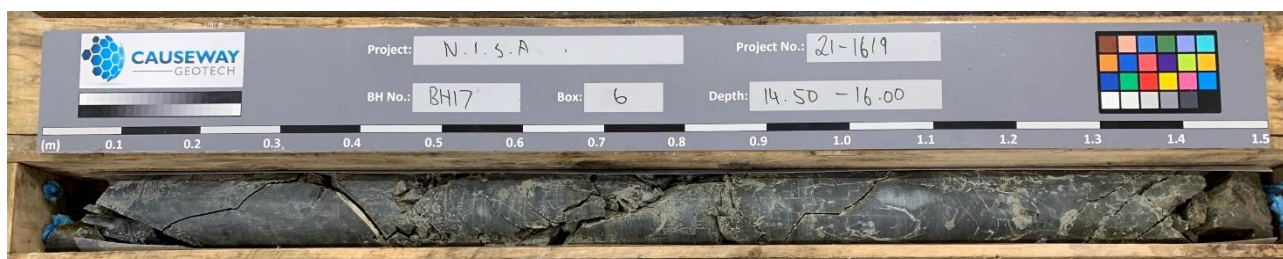


BH17 (Box 4) 11.50-13.00m

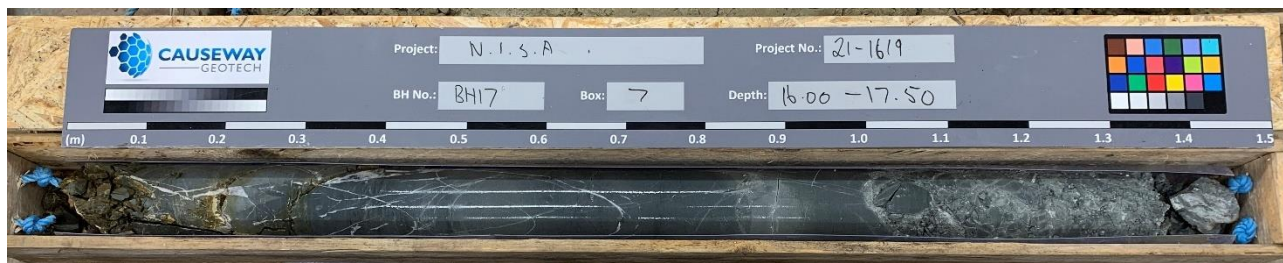


BH17 (Box 5) 13.00-14.50m

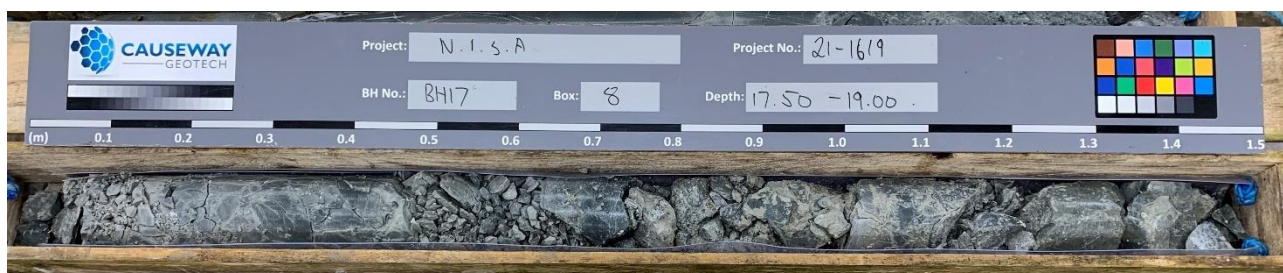




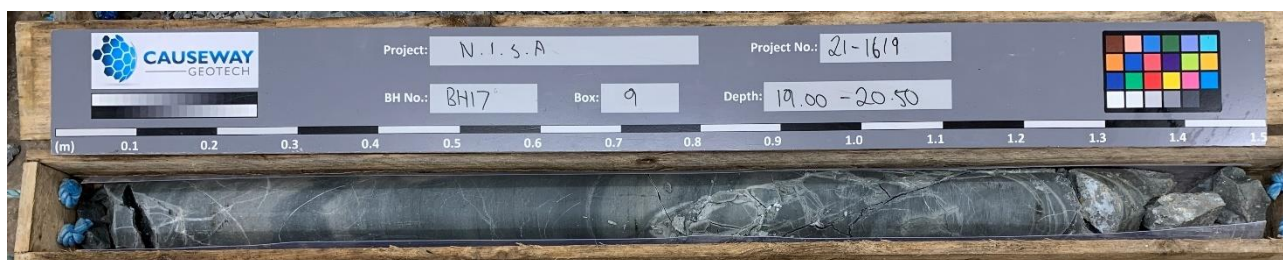
BH17 (Box 6) 14.50-16.00m



BH17 (Box 7) 16.00-17.50m



BH17 (Box 8) 17.50-19.00m



BH17 (Box 9) 19.00-20.50m

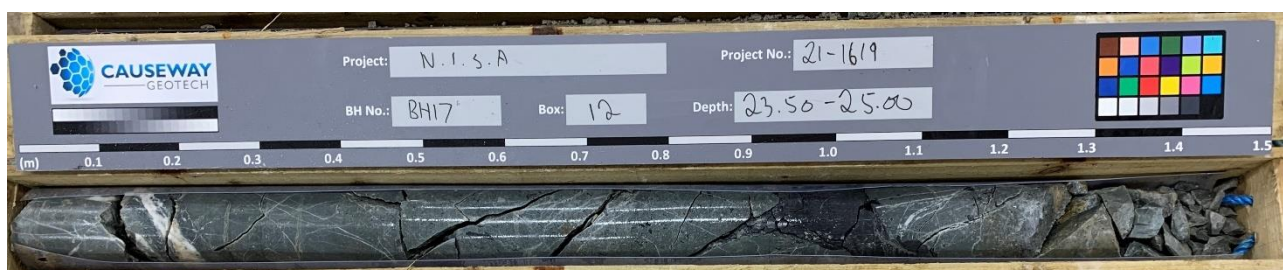


BH17 (Box 10) 20.50-22.00m





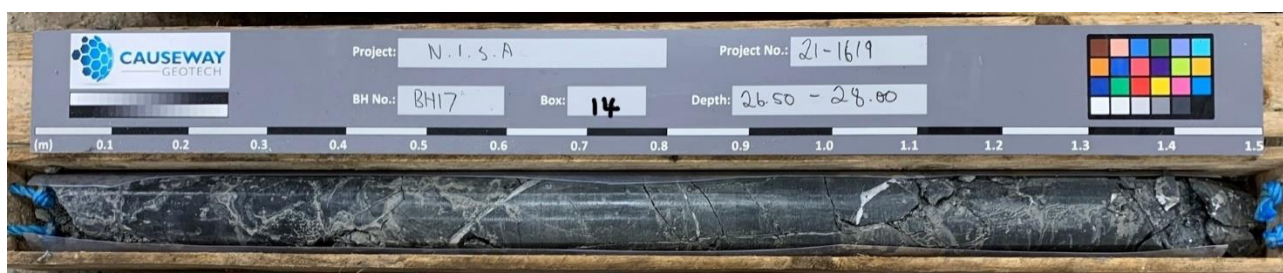
BH17 (Box 11) 22.00-23.50m



BH17 (Box 12) 23.50-25.00m

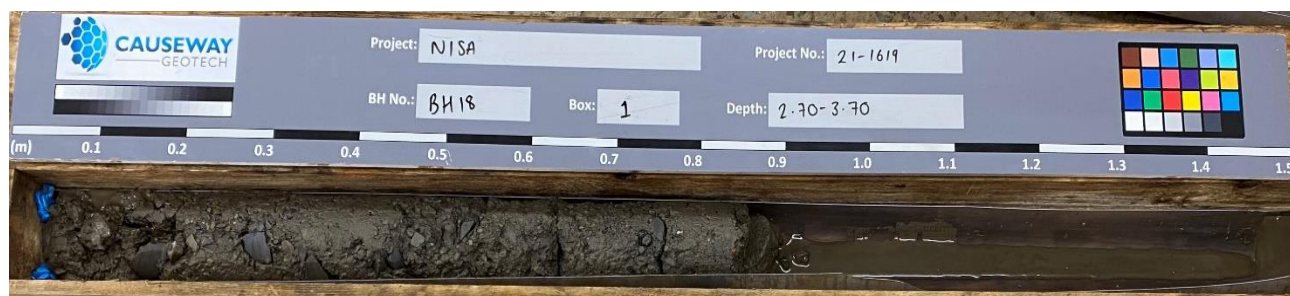


BH17 (Box 13) 25.00-26.50m

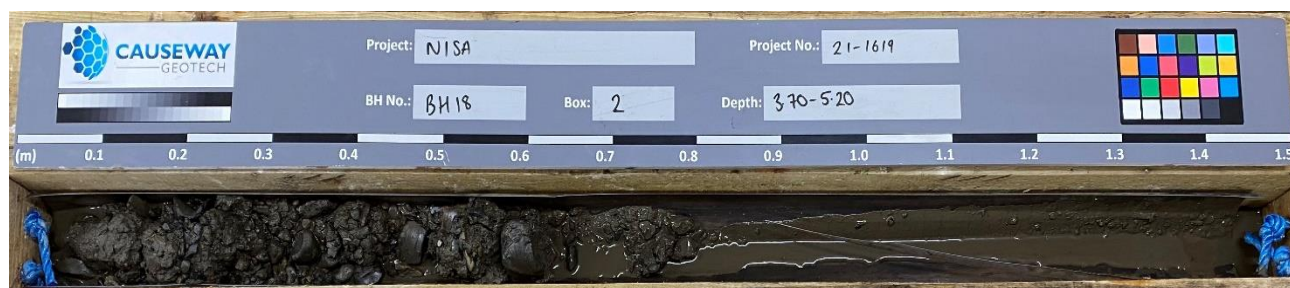


BH17 (Box 14) 26.50-28.00m

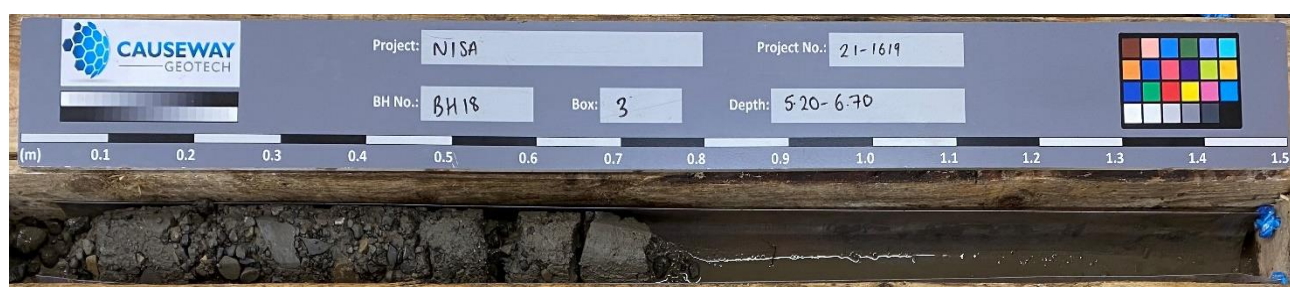




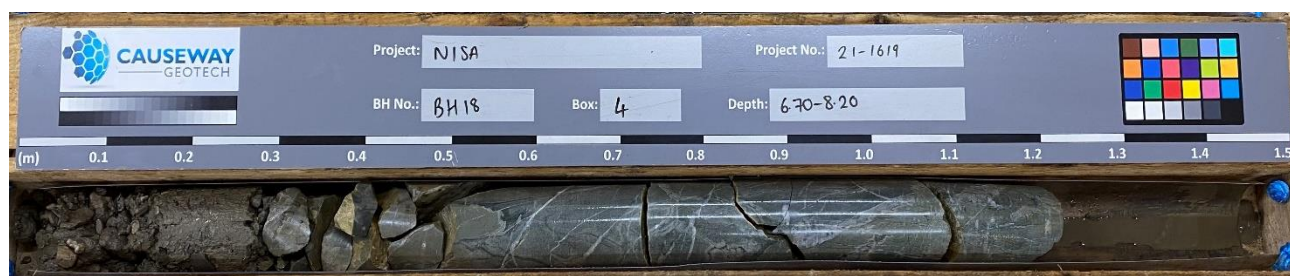
BH18 (Box 1) 2.70-3.70m



BH18 (Box 2) 3.70-5.20m



BH18 (Box 3) 5.20-6.70m

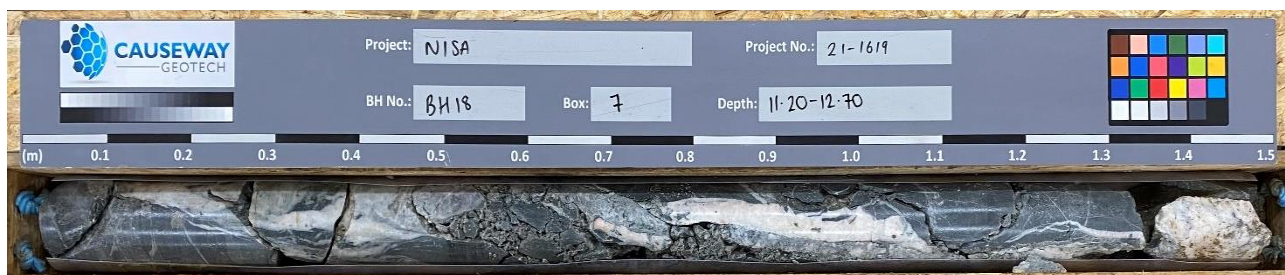
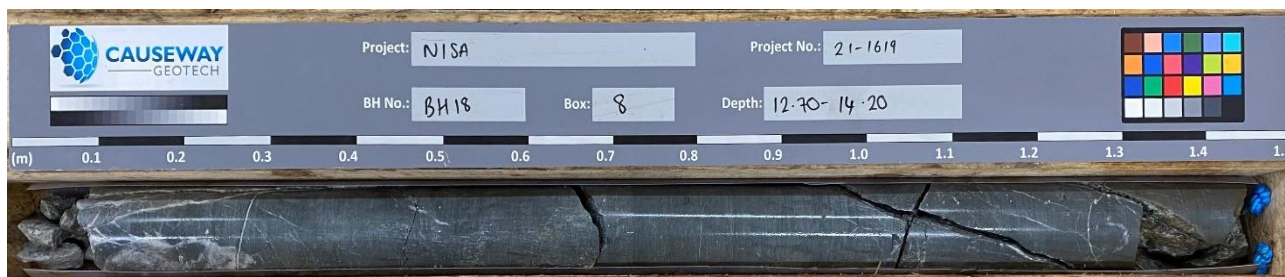
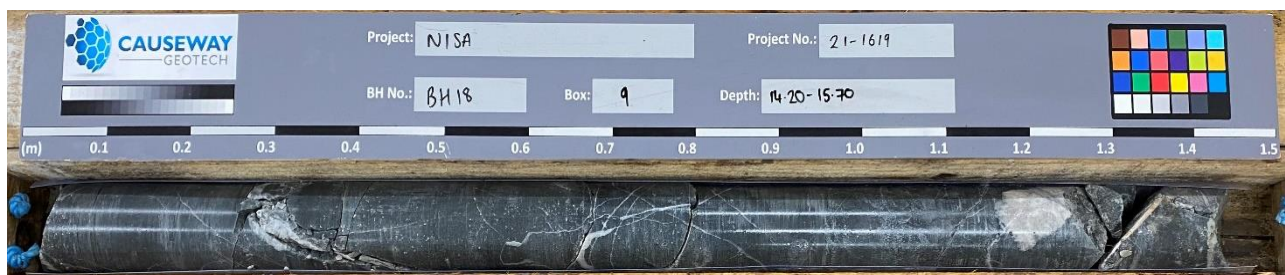
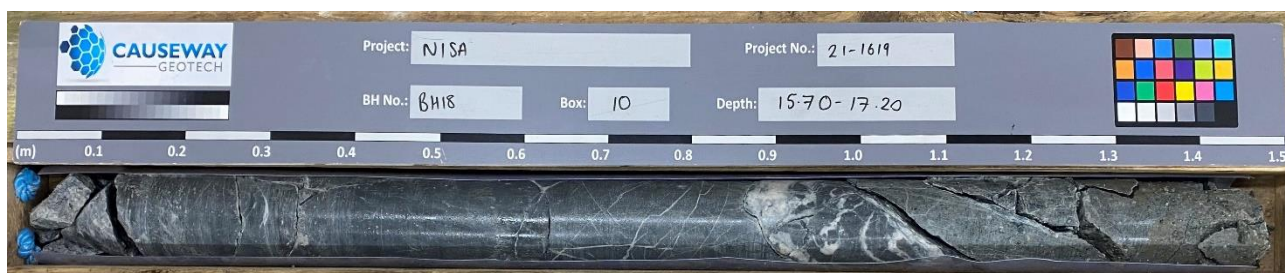


BH18 (Box 4) 6.70-8.20m

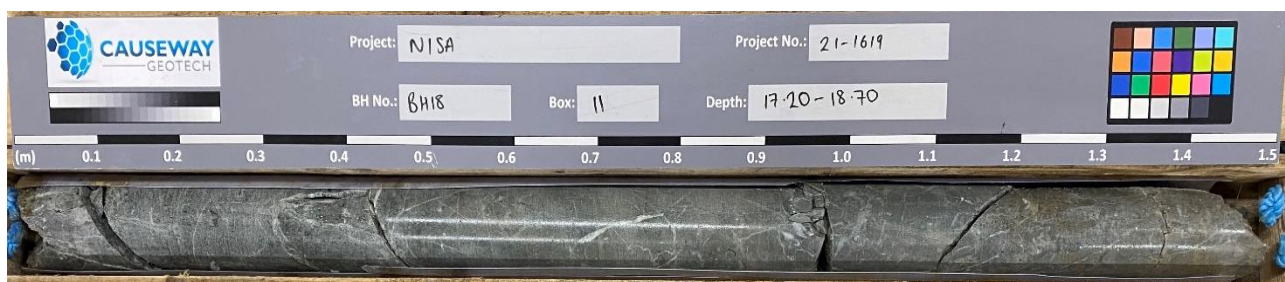
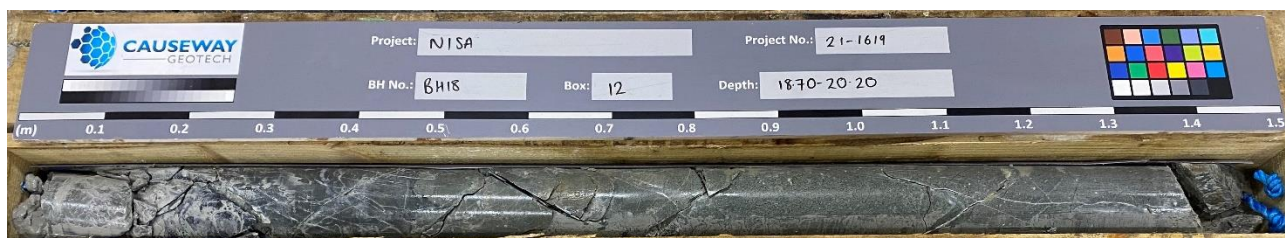
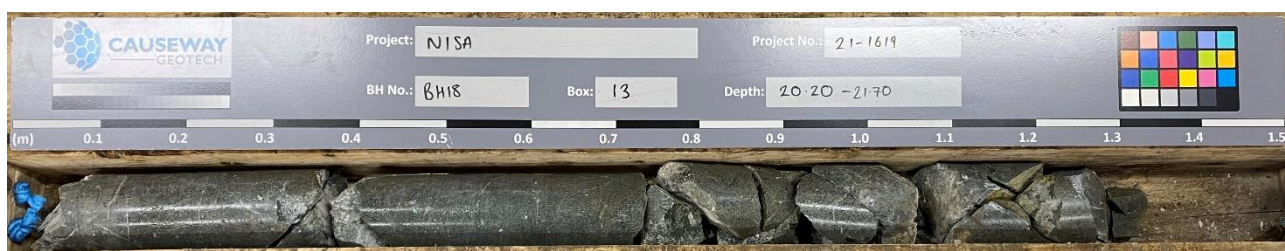
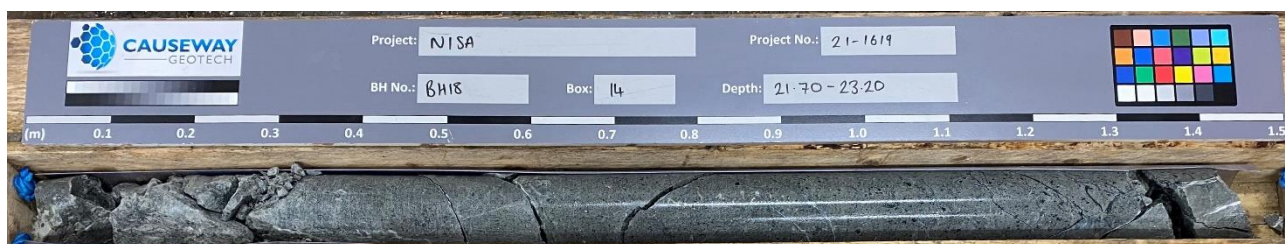


BH18 (Box 5) 8.20-9.70m

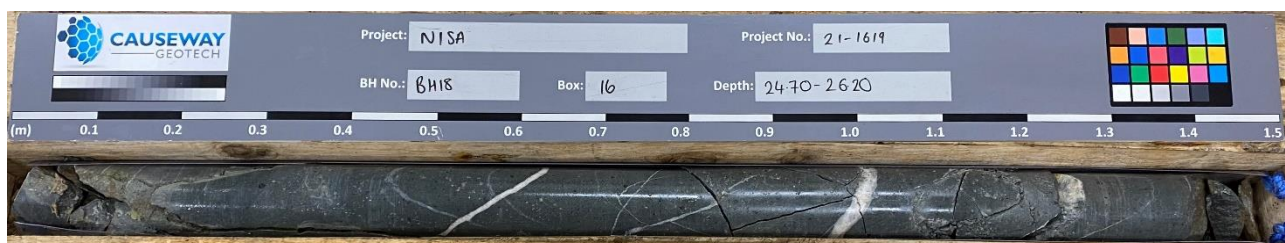


**BH18 (Box 6) 9.70-11.20m****BH18 (Box 7) 11.20-12.70m****BH18 (Box 8) 12.70-14.20m****BH18 (Box 9) 14.20-15.70m****BH18 (Box 10) 15.70-17.20m**

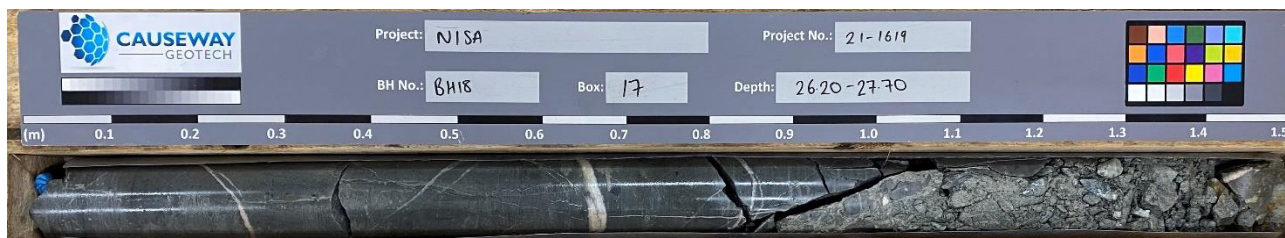


**BH18 (Box 11) 17.20-18.70m****BH18 (Box 12) 18.70-20.20m****BH18 (Box 13) 20.20-21.70m****BH18 (Box 14) 21.70-23.20m****BH18 (Box 15) 23.20-24.70m**

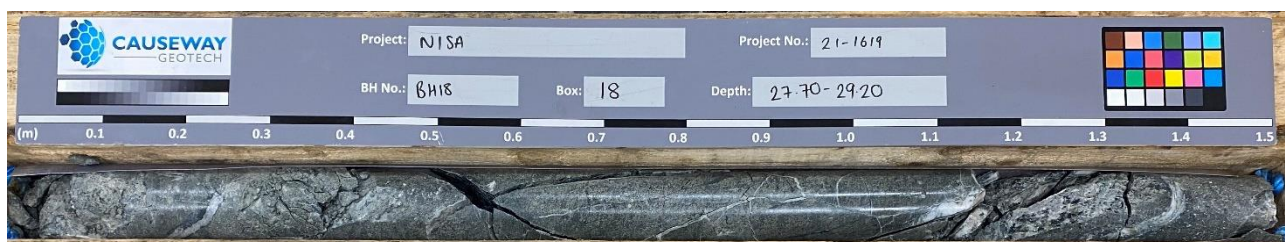




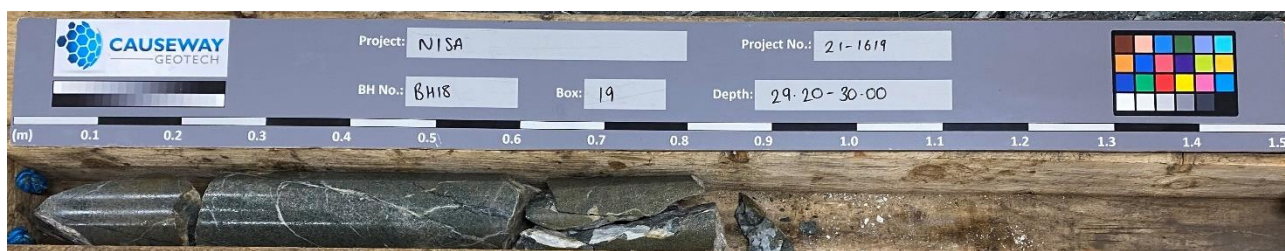
BH18 (Box 16) 24.70-26.20m



BH18 (Box 17) 26.20-27.70m



BH18 (Box 18) 27.70-29.20m



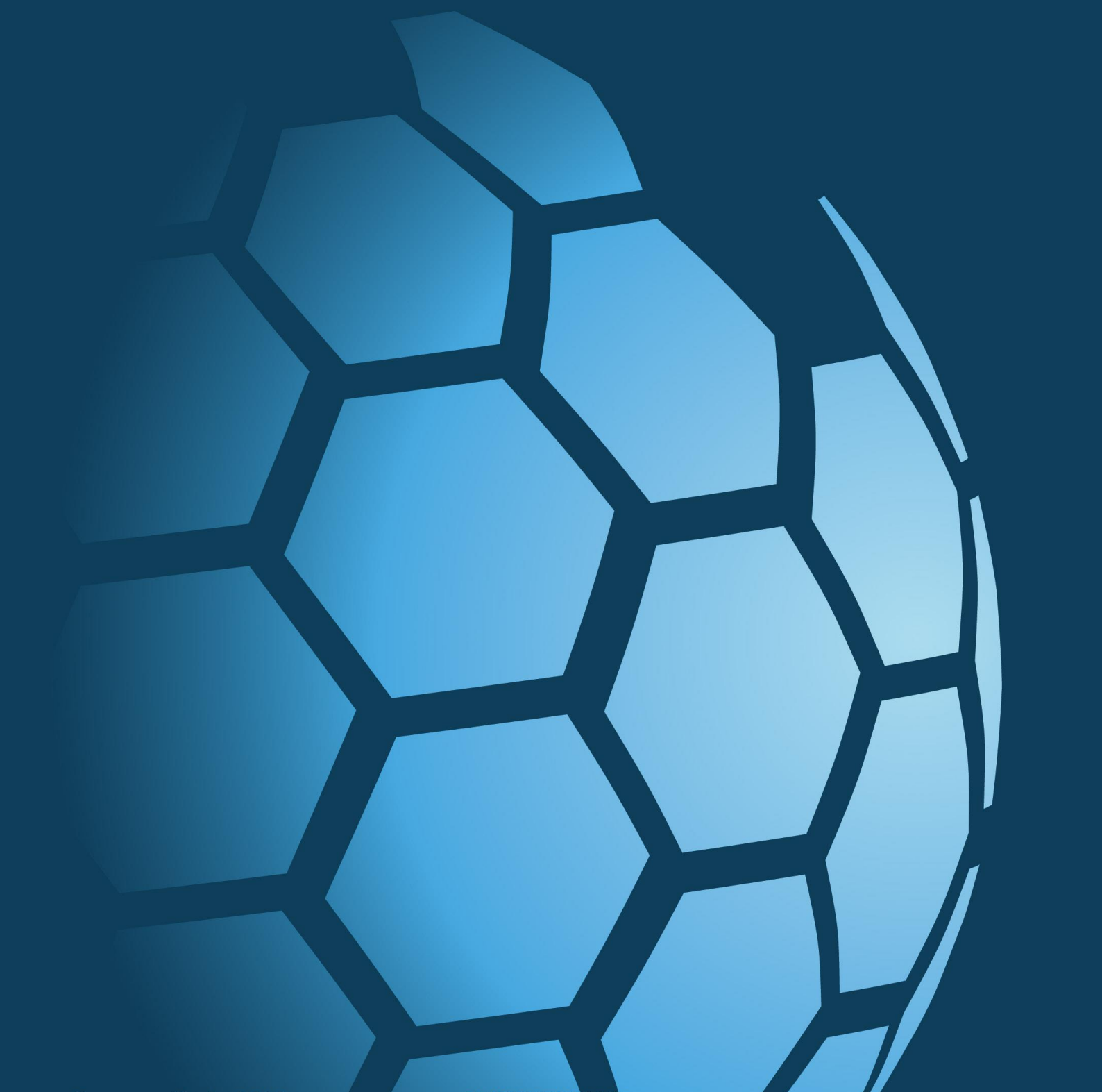
BH18 (Box 19) 29.20-30.00m






**CAUSEWAY**  
— GEOTECH

**APPENDIX D**  
**TRIAL PIT LOGS**





Water Strikes		Depth: 1.20	Remarks: Location: Landfall.		
Struck at (m)	Remarks				
1.20	Slow seepage at 1.2	Width: 1.00			
		Length: 3.00			
		Stability:	Termination Reason	Last Updated	
		Stable	Slow progress due to machine size.	02/12/2022	





**Coordinates**  
719680.68 E  
765119.19 N

<b>Client:</b>	Statkraft Limited
<b>Client's Representative:</b>	Arup

Sheet 1 of 1  
Scale: 1:25

**Plant:**  
6T Tracked Excavator

**Elevation**  
9.08 mOD

<b>Date:</b>	15/03/2022
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Logger:	RS
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FINAL

Water Strikes		Remarks:		
Struck at (m)	Remarks	Depth:	No groundwater encountered.	
		Width:	Shear vane completed.	
		Length:	Location: Landfall	
		Stability:	Termination Reason	Last Updated
		Stable	Slow progress due to machine size.	02/12/2022

Remarks

Depth: 1.90  
Width: 1.00  
Length: 2.50

**Remarks:**  
No groundwater encountered.  
Shear vane completed.  
Location: Landfall

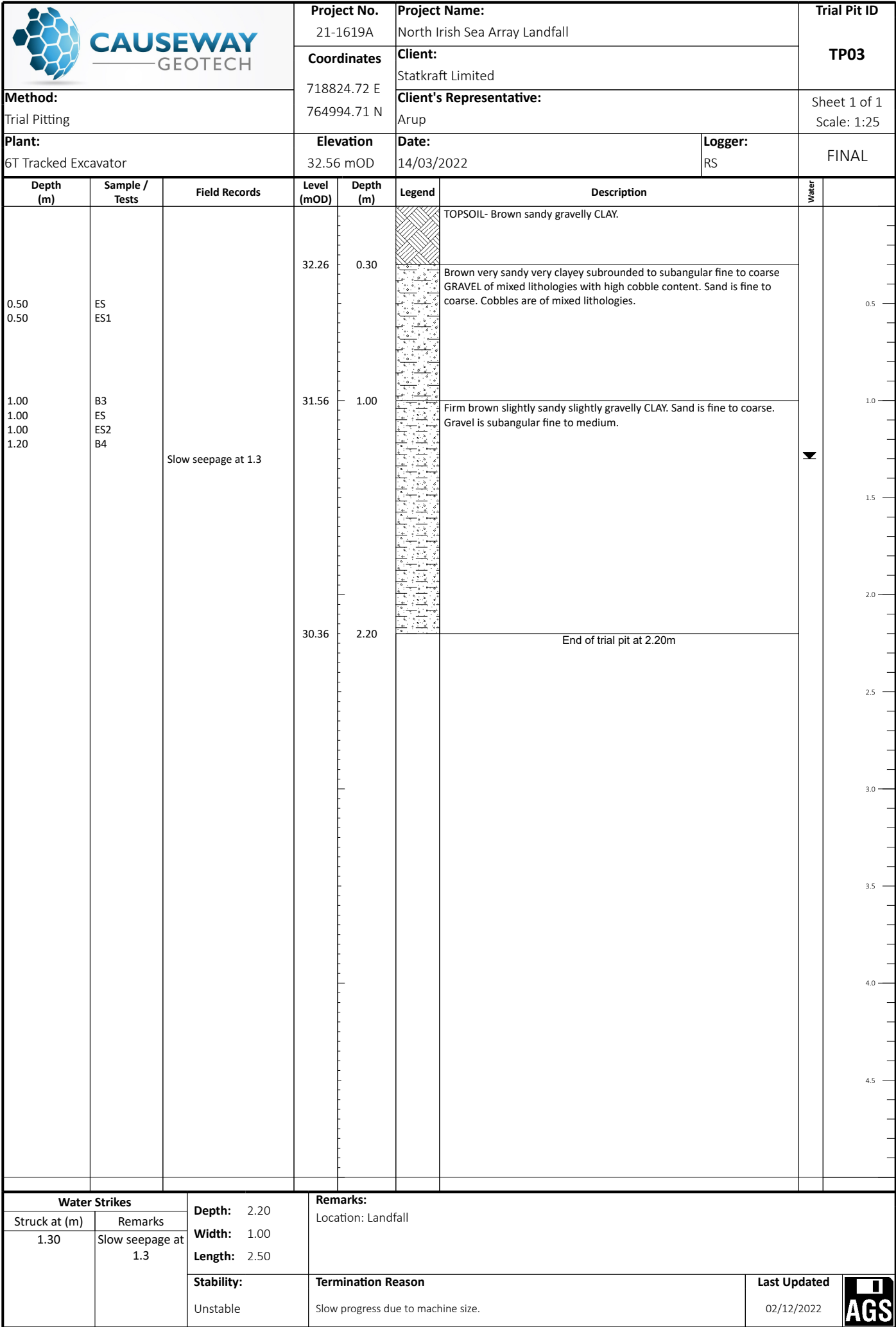
**Stability:**  
Stable





Termination Reason
Slow progress due to machine size.

Last Updated



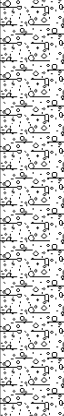


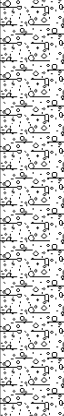


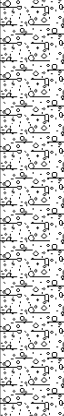




02/12/2022





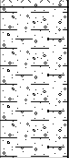



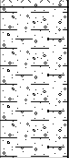



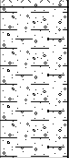







<div><div>CAUSEWAY GEOTECH</div></div>			Project No. 21-1619A		Project Name: North Irish Sea Array Landfall			Trial Pit ID  TP04				
			Coordinates 718952.35 E 764938.10 N		Client: Statkraft Limited  Client's Representative: Arup							
Method: Trial Pitting			Elevation 30.67 mOD		Date: 14/03/2022			Logger: RS		Sheet 1 of 1 Scale: 1:25		
Plant: 6T Tracked Excavator								FINAL				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description				Water		
0.50 0.50 0.50	ES ES1	HVP=138, HVR=20	30.37	0.30		TOPSOIL- Brown sandy gravelly CLAY.					0.5	
1.00 1.00 1.00 1.20	B3 ES ES2 B4					Stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of limestone. Cobbles are of limestone.					1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	
			28.87	1.80		End of trial pit at 1.80m						
Water Strikes			Depth: 1.80		Remarks: No groundwater encountered. Shear vane completed. Location: Landfall							
Struck at (m)		Remarks	Width: 1.00									
			Length: 3.00									
			Stability: Stable		Termination Reason Slow progress due to machine size.				Last Updated 02/12/2022			



<div><div>CAUSEWAY GEOTECH</div></div>			Project No. 21-1619A		Project Name: North Irish Sea Array Landfall			Trial Pit ID  TP05																																												
			Coordinates 719280.25 E 765140.50 N		Client: Statkraft Limited  Client's Representative: Arup																																															
Method: Trial Pitting			Elevation 19.75 mOD		Date: 14/03/2022			Logger: RS		Sheet 1 of 1 Scale: 1:25																																										
Plant: 6T Tracked Excavator								FINAL																																												
<table><tr><th>Depth (m)</th><th>Sample / Tests</th><th>Field Records</th><th>Level (mOD)</th><th>Depth (m)</th><th>Legend</th><th>Description</th><th>Water</th><th></th></tr><tr><td>0.50 0.50 0.50</td><td>B3 ES ES1</td><td rowspan="4">Slow seepage at 1.7</td><td>19.44</td><td>0.30</td><td></td><td>TOPSOIL- Brown sandy gravelly CLAY.</td><td></td><td></td></tr><tr><td>1.00 1.00 1.00 1.20</td><td>B4 ES ES2 B5</td><td>18.05</td><td>1.70</td><td></td><td>Stiff yellowish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies. Cobbles are of mudstone.</td><td></td><td>0.5 1.0 1.5</td></tr><tr><td>2.00</td><td>B6</td><td>17.34</td><td>2.40</td><td></td><td>Brown very gravelly very silty fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.</td><td>▼</td><td>2.0 2.5 3.0 3.5 4.0 4.5</td></tr><tr><td colspan="6">End of trial pit at 2.40m</td><td></td><td></td></tr></table>											Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water		0.50 0.50 0.50	B3 ES ES1	Slow seepage at 1.7	19.44	0.30		TOPSOIL- Brown sandy gravelly CLAY.			1.00 1.00 1.00 1.20	B4 ES ES2 B5	18.05	1.70		Stiff yellowish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies. Cobbles are of mudstone.		0.5 1.0 1.5	2.00	B6	17.34	2.40		Brown very gravelly very silty fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.	▼	2.0 2.5 3.0 3.5 4.0 4.5	End of trial pit at 2.40m							
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water																																													
0.50 0.50 0.50	B3 ES ES1	Slow seepage at 1.7	19.44	0.30		TOPSOIL- Brown sandy gravelly CLAY.																																														
1.00 1.00 1.00 1.20	B4 ES ES2 B5		18.05	1.70		Stiff yellowish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies. Cobbles are of mudstone.		0.5 1.0 1.5																																												
2.00	B6		17.34	2.40		Brown very gravelly very silty fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.	▼	2.0 2.5 3.0 3.5 4.0 4.5																																												
End of trial pit at 2.40m																																																				
<table><tr><th colspan="2">Water Strikes</th><th rowspan="2">Depth: 2.40 Width: 1.00 Length: 3.00  Stability: Unstable</th><th rowspan="2">Remarks: Location: Landfall.</th><th rowspan="2">Termination Reason Slow progress due to machine size.</th><th rowspan="2">Last Updated 02/12/2022</th><th rowspan="2"></th></tr><tr><th>Struck at (m)</th><th>Remarks</th></tr><tr><td>1.70</td><td>Slow seepage at 1.7</td></tr></table>			Water Strikes		Depth: 2.40 Width: 1.00 Length: 3.00  Stability: Unstable	Remarks: Location: Landfall.	Termination Reason Slow progress due to machine size.	Last Updated 02/12/2022		Struck at (m)	Remarks	1.70	Slow seepage at 1.7																																							
Water Strikes		Depth: 2.40 Width: 1.00 Length: 3.00  Stability: Unstable	Remarks: Location: Landfall.	Termination Reason Slow progress due to machine size.						Last Updated 02/12/2022																																										
Struck at (m)	Remarks																																																			
1.70	Slow seepage at 1.7																																																			

<div><div>CAUSEWAY GEOTECH</div></div>			Project No. 21-1619A		Project Name: North Irish Sea Array Landfall			Trial Pit ID  TP07																																									
			Coordinates 719490.98 E 765233.68 N		Client: Statkraft Limited  Client's Representative: Arup																																												
Method: Trial Pitting			Elevation 9.22 mOD		Date: 15/03/2022			Logger: RS		Sheet 1 of 1 Scale: 1:25																																							
Plant: 6T Tracked Excavator								FINAL																																									
<table><tr><th>Depth (m)</th><th>Sample / Tests</th><th>Field Records</th><th>Level (mOD)</th><th>Depth (m)</th><th>Legend</th><th>Description</th><th>Water</th><th></th></tr><tr><td>0.50 0.50 0.50</td><td>B3 ES ES1</td><td rowspan="4">Slow seepage at 2.00</td><td>8.97</td><td>0.25</td><td></td><td>TOPSOIL- Brown sandy gravelly CLAY.</td><td rowspan="4"></td><td></td></tr><tr><td>1.00 1.00 1.00 1.20</td><td>B4 ES ES2 B5</td><td>7.72</td><td>1.50</td><td></td><td>Stiff brownish yellow slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies predominantly limestone. Cobbles are of limestone.</td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of limestone.</td><td></td></tr><tr><td>2.00</td><td>B6</td><td>7.22</td><td>2.00</td><td></td><td>End of trial pit at 2.00m</td><td></td></tr></table>											Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water		0.50 0.50 0.50	B3 ES ES1	Slow seepage at 2.00	8.97	0.25		TOPSOIL- Brown sandy gravelly CLAY.			1.00 1.00 1.00 1.20	B4 ES ES2 B5	7.72	1.50		Stiff brownish yellow slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies predominantly limestone. Cobbles are of limestone.							Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of limestone.		2.00	B6	7.22	2.00		End of trial pit at 2.00m	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water																																										
0.50 0.50 0.50	B3 ES ES1	Slow seepage at 2.00	8.97	0.25		TOPSOIL- Brown sandy gravelly CLAY.																																											
1.00 1.00 1.00 1.20	B4 ES ES2 B5		7.72	1.50		Stiff brownish yellow slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies predominantly limestone. Cobbles are of limestone.																																											
						Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of limestone.																																											
2.00	B6		7.22	2.00		End of trial pit at 2.00m																																											
<table><tr><th colspan="2">Water Strikes</th><th rowspan="2">Depth: 2.00 Width: 1.00 Length: 2.50  Stability: Stable</th><th rowspan="2">Remarks: Location: Landfall  Termination Reason Slow progress due to machine size.</th><th rowspan="2">Last Updated 02/12/2022</th><th rowspan="2"></th></tr><tr><th>Struck at (m)</th><th>Remarks</th></tr><tr><td>2.00</td><td>Slow seepage at 2.00</td></tr></table>			Water Strikes		Depth: 2.00 Width: 1.00 Length: 2.50  Stability: Stable	Remarks: Location: Landfall  Termination Reason Slow progress due to machine size.	Last Updated 02/12/2022		Struck at (m)	Remarks	2.00	Slow seepage at 2.00																																					
Water Strikes		Depth: 2.00 Width: 1.00 Length: 2.50  Stability: Stable	Remarks: Location: Landfall  Termination Reason Slow progress due to machine size.	Last Updated 02/12/2022																																													
Struck at (m)	Remarks																																																
2.00	Slow seepage at 2.00																																																






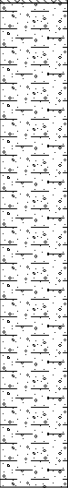

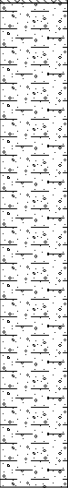

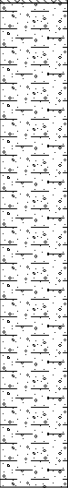

**Trial Pit ID**

**TP08**

Sheet 1 of 1  
Scale: 1:25

FINAL

Water Strikes		Depth: 1.70 Width: 1.00 Length: 3.00	Remarks: Location: Landfall		
Struck at (m)	Remarks				
1.40	Slow seepage at 1.4				
		Stability:	Termination Reason		Last Updated
		Stable	Slow progress due to machine size.		02/12/2022
					

<div><div>CAUSEWAY GEOTECH</div></div>			Project No. 21-1619A		Project Name: North Irish Sea Array Landfall			Trial Pit ID  TP09																																						
			Coordinates 719637.39 E 765368.70 N		Client: Statkraft Limited  Client's Representative: Arup																																									
Method: Trial Pitting			Elevation 4.05 mOD		Date: 15/03/2022			Logger: RS		Sheet 1 of 1 Scale: 1:25																																				
Plant: 6T Tracked Excavator								FINAL																																						
<table><tr><th>Depth (m)</th><th>Sample / Tests</th><th>Field Records</th><th>Level (mOD)</th><th>Depth (m)</th><th>Legend</th><th>Description</th><th>Water</th><th></th></tr><tr><td>0.50 0.50</td><td>ES ES1</td><td></td><td>3.75</td><td>0.30</td><td></td><td>TOPSOIL- Brown sandy gravelly CLAY.</td><td></td><td>0.5</td></tr><tr><td>1.00 1.00 1.00 1.20</td><td>B3 ES ES2 B4</td><td></td><td></td><td></td><td></td><td>Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.</td><td></td><td>1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5</td></tr><tr><td></td><td></td><td></td><td>2.15</td><td>1.90</td><td></td><td>End of trial pit at 1.90m</td><td></td><td></td></tr></table>											Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water		0.50 0.50	ES ES1		3.75	0.30		TOPSOIL- Brown sandy gravelly CLAY.		0.5	1.00 1.00 1.00 1.20	B3 ES ES2 B4					Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.		1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5				2.15	1.90		End of trial pit at 1.90m		
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water																																							
0.50 0.50	ES ES1		3.75	0.30		TOPSOIL- Brown sandy gravelly CLAY.		0.5																																						
1.00 1.00 1.00 1.20	B3 ES ES2 B4					Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.		1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5																																						
			2.15	1.90		End of trial pit at 1.90m																																								
Water Strikes		Depth: 1.90		Remarks: No groundwater encountered . Location: Landfall.																																										
Struck at (m)	Remarks	Width: 1.00 Length: 2.50																																												
		Stability: Stable		Termination Reason Slow progress due to machine size.			Last Updated 02/12/2022																																							





**Coordinates**  
719245.88 E  
764996.74 N

<b>Client:</b>	Statkraft Limited
<b>Client's Representative:</b>	Arup

Sheet 1 of 1  
Scale: 1:25


**Plant:**  
6T Tracked Excavator





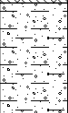
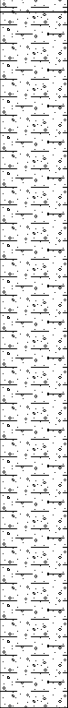



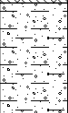
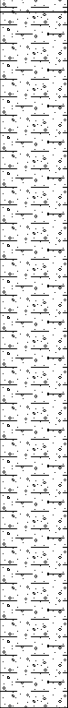



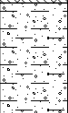
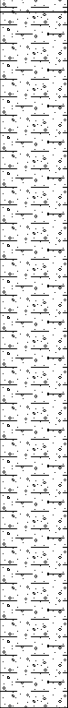

<b>Date:</b>	14/03/2022
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Logger:	RS
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FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
						TOPSOIL- Brown sandy gravelly CLAY.	
0.50	ES		22.86	0.30		Stiff brown slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse of mixed lithologies. Cobbles are of mixed lithologies.	
0.50	ES1						
1.00	B3						
1.00	ES						
1.00	ES2						
1.20	B4	Slow seepage at 1.0					
2.00	B5		21.16	2.00		End of trial pit at 2.00m	

Water Strikes		Depth: 2.00	Remarks:			
Struck at (m)	Remarks		Location: Landfall.			
1.00	Slow seepage at 1.0	Width: 1.00				
		Length: 3.00				
		Stability:	Termination Reason		Last Updated	
Unstable	Slow progress due to machine size.		02/12/2022			

<div><div>CAUSEWAY GEOTECH</div></div>			Project No. 21-1619A		Project Name: North Irish Sea Array Landfall			Trial Pit ID  TP12																																								
			Coordinates 719639.96 E 765470.89 N		Client: Statkraft Limited  Client's Representative: Arup																																											
Method: Trial Pitting			Elevation 6.19 mOD		Date: 14/03/2022			Logger: RS		Sheet 1 of 1 Scale: 1:25																																						
Plant: 6T Tracked Excavator								FINAL																																								
<table><tr><th>Depth (m)</th><th>Sample / Tests</th><th>Field Records</th><th>Level (mOD)</th><th>Depth (m)</th><th>Legend</th><th>Description</th><th>Water</th><th></th></tr><tr><td>0.50 0.50</td><td>ES ES1</td><td rowspan="4">Seepage at 1.</td><td>5.89</td><td>0.30</td><td></td><td>TOPSOIL- Brown sandy gravelly CLAY.</td><td rowspan="4"></td><td rowspan="4"></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>Firm yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies.</td></tr><tr><td>1.00 1.00 1.00 1.20</td><td>B3 ES ES2 B4</td><td></td><td>5.49</td><td>0.70</td><td></td><td>Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.</td></tr><tr><td></td><td></td><td></td><td>3.19</td><td>3.00</td><td></td><td>End of trial pit at 3.00m</td></tr></table>											Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water		0.50 0.50	ES ES1	Seepage at 1.	5.89	0.30		TOPSOIL- Brown sandy gravelly CLAY.								Firm yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies.	1.00 1.00 1.00 1.20	B3 ES ES2 B4		5.49	0.70		Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.				3.19	3.00		End of trial pit at 3.00m
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water																																									
0.50 0.50	ES ES1	Seepage at 1.	5.89	0.30		TOPSOIL- Brown sandy gravelly CLAY.																																										
						Firm yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies.																																										
1.00 1.00 1.00 1.20	B3 ES ES2 B4			5.49	0.70				Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.																																							
				3.19	3.00				End of trial pit at 3.00m																																							
Water Strikes		Depth: 3.00		Remarks: Location: Landfall																																												
Struck at (m)	Remarks	Width: 1.00 Length: 3.00																																														
1.00	Seepage at 1.	Stability: Stable		Termination Reason Terminated at scheduled depth				Last Updated 02/12/2022																																								



**CAUSEWAY**  
— GEOTECH

**APPENDIX E**  
**TRIAL PIT PHOTOGRAPHS**





TP01





TP01







TP01







TP01





TP02







TP02







TP02





TP02







TP03







TP03







TP03







**TP03**





TP03



**TP04**





TP04







TP04







TP04





TP04



TP04





TP04





TP05







TP05







TP05





TP05





TP05





TP05







TP07







TP07







TP07





TP07





TP08







TP08







TP08





TP08







TP09







TP09







TP09







TP09



TP09





TP11







TP11







TP11







TP11





TP12





TP12







TP12







TP12







TP12



**CAUSEWAY**  
— GEOTECH

**APPENDIX F**  
**GEOTECHNICAL LABORATORY TEST RESULTS**







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Registered in Northern Ireland.  
Company Number: NI610766

**REGIONAL OFFICE**  
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**ROI:** +353 (0)1 526 7465

Registered in Ireland.  
Company Number: 633786

[www.causewaygeotech.com](http://www.causewaygeotech.com)

## SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

27 April 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 18/03/2022 and 11/04/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 4 - FINAL

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	13
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	9
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	7
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	7
SOIL	Moisture Condition Value at natural moisture content	BS 1377-4: 1990: Cl 5.4	5



## SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – subcontracted to Pro Soils Limited ( <i>UKAS 4043</i> )	Thermal Resistivity		6
SOIL – Subcontracted to Eurofins Chemtest Ltd ( <i>UKAS 2183</i> )	BRE Test - Suite B		3

## Summary of Classification Test Results

Project No. 21-1619		Project Name North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
TP03	3	1.00		B	Brown slightly gravelly silty fine to coarse SAND.			14.0	51	23	17	6		ML/CL
TP04	3	1.00		B	Brown sandy slightly gravelly silty CLAY.			14.0	65	34	19	15		CL
TP04	4	1.20		B	Brown sandy slightly gravelly silty CLAY.			13.0						
TP05	3	0.50		B	Brown sandy slightly gravelly silty CLAY.			21.0	72	37	18	19		CI
TP05	4	1.00		B	Brown sandy slightly gravelly silty CLAY.			23.0	74	34	17	17		CL
TP05	6	2.00		B	Brown slightly gravelly clayey fine to coarse SAND.			18.0	62	35	20	15		CL/CI
TP08	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.			14.0	62	41	20	21		CI
TP08	4	1.20		B	Greyish brown sandy slightly gravelly silty CLAY.			15.0						
TP11	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.			20.0	74	36	18	18		CI
TP11	4	1.20		B	Greyish brown sandy slightly gravelly silty CLAY.			21.0						
TP11	5	2.00		B	Greyish brown sandy slightly gravelly silty CLAY.			14.0	60	28	15	13		CL
TP12	3	1.00		B	Greyish brown silty CLAY.			25.0	96	31	11	20		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 5

### Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

04/11/2022 00:00

Approved By

Stephen.Watson



10122





Project Name
--------------

## North Irish Sea Array

All tests performed in accordance with BS1377:1990 unless specified otherwise



10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP03

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Brown slightly gravelly silty fine to coarse SAND.

Depth, m

1.00

Specimen Reference

6

Specimen  
Depth

1

m

Sample Type

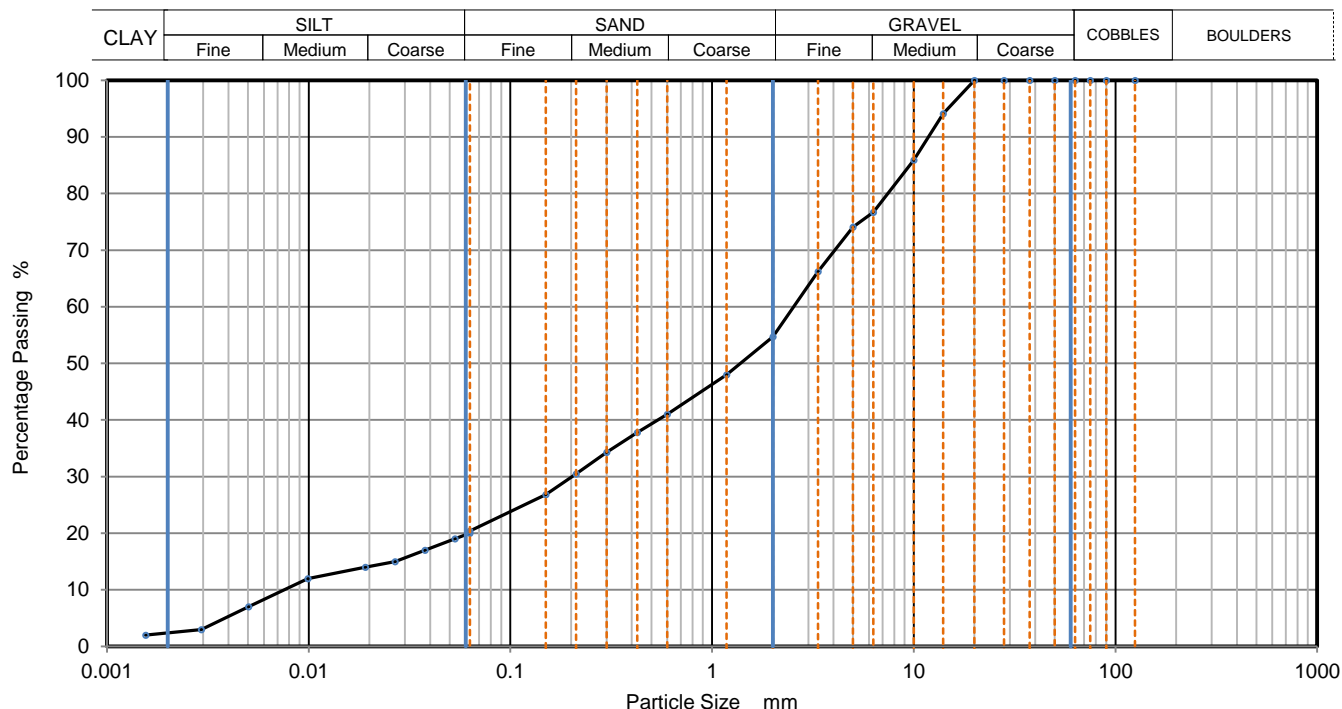
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032141



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	20
90	100	0.05308	19
75	100	0.03774	17
63	100	0.02683	15
50	100	0.01908	14
37.5	100	0.00990	12
28	100	0.00503	7
20	100	0.00293	3
14	94	0.00155	2
10	86		
6.3	77		
5	74		
3.35	66		
2	55		
1.18	48		
0.6	41	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	38		
0.3	34		
0.212	31		
0.15	27		
0.063	20		

Dry Mass of sample, g

504

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	45.3
Sand	34.3
Silt	18.0
Clay	2.4

Grading Analysis		
D100	mm	
D60	mm	2.53
D30	mm	0.202
D10	mm	0.0077
Uniformity Coefficient		330
Curvature Coefficient		2.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP04

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

6

Specimen  
Depth

1

m

Sample Type

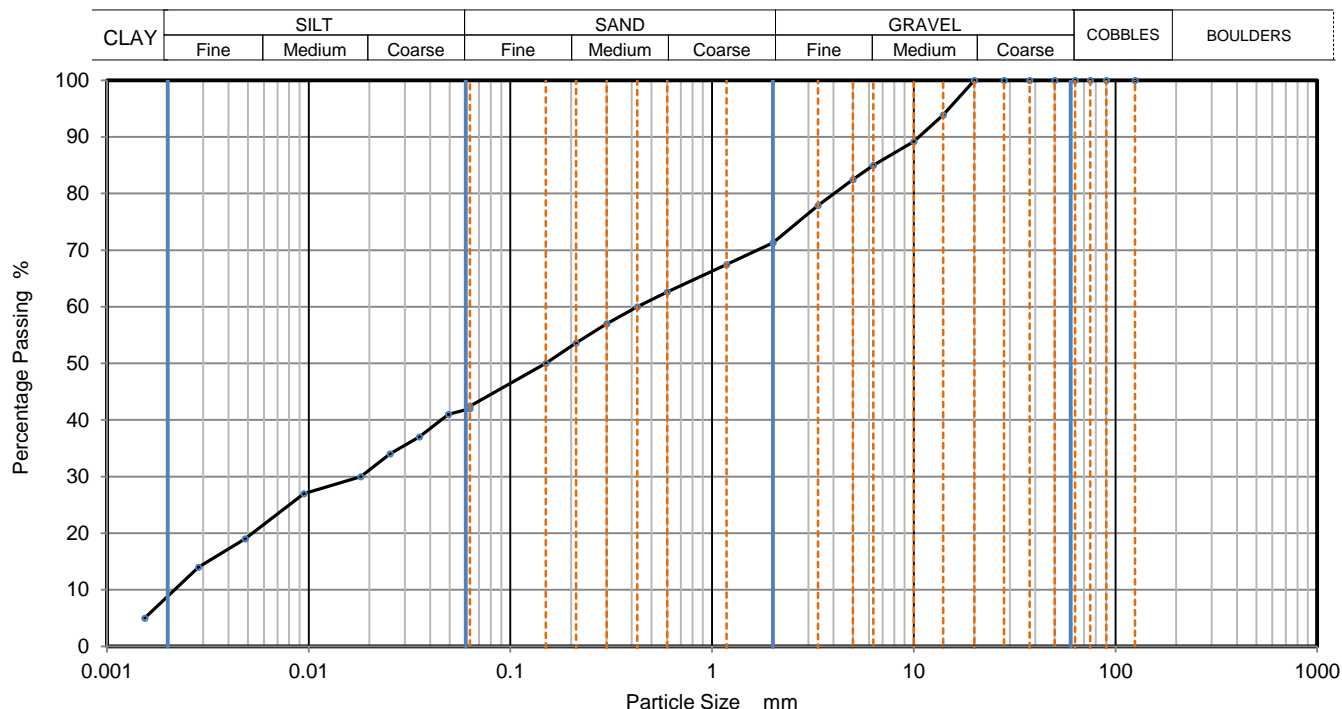
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032142



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.04939	41
75	100	0.03537	37
63	100	0.02532	34
50	100	0.01813	30
37.5	100	0.00947	27
28	100	0.00485	19
20	100	0.00284	14
14	94	0.00154	5
10	89		
6.3	85		
5	83		
3.35	78		
2	71		
1.18	68		
0.6	63	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	60		
0.3	57		
0.212	54		
0.15	50		
0.063	42		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	28.7
Sand	28.9
Silt	33.3
Clay	9.1

Grading Analysis		
D100	mm	
D60	mm	0.423
D30	mm	0.018
D10	mm	0.00213
Uniformity Coefficient		200
Curvature Coefficient		0.36

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP05

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

0.50

Specimen Reference

6

Specimen  
Depth

0.5

m

Sample Type

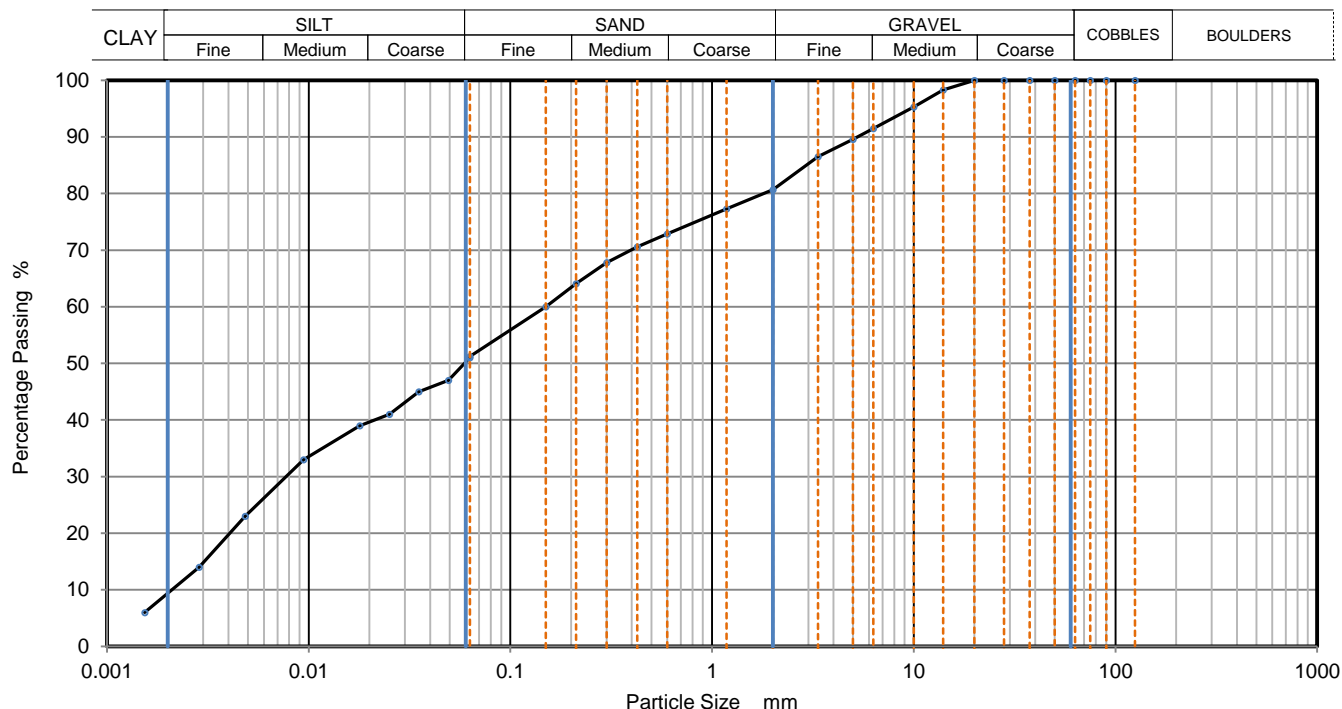
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032144



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.04939	47
75	100	0.03515	45
63	100	0.02517	41
50	100	0.01791	39
37.5	100	0.00942	33
28	100	0.00485	23
20	100	0.00286	14
14	98	0.00154	6
10	95		
6.3	92		
5	90		
3.35	87		
2	81		
1.18	77		
0.6	73	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	71		
0.3	68		
0.212	64		
0.15	60		
0.063	51		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.3
Sand	29.5
Silt	41.6
Clay	9.6

Grading Analysis		
D100	mm	
D60	mm	0.15
D30	mm	0.00787
D10	mm	0.00206
Uniformity Coefficient		73
Curvature Coefficient		0.2

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP05

Site Name

North Irish Sea Array

Sample No.

6

Soil Description

Brown slightly gravelly clayey fine to coarse SAND.

Depth, m

2.00

Specimen Reference

6

Specimen  
Depth

2

m

Sample Type

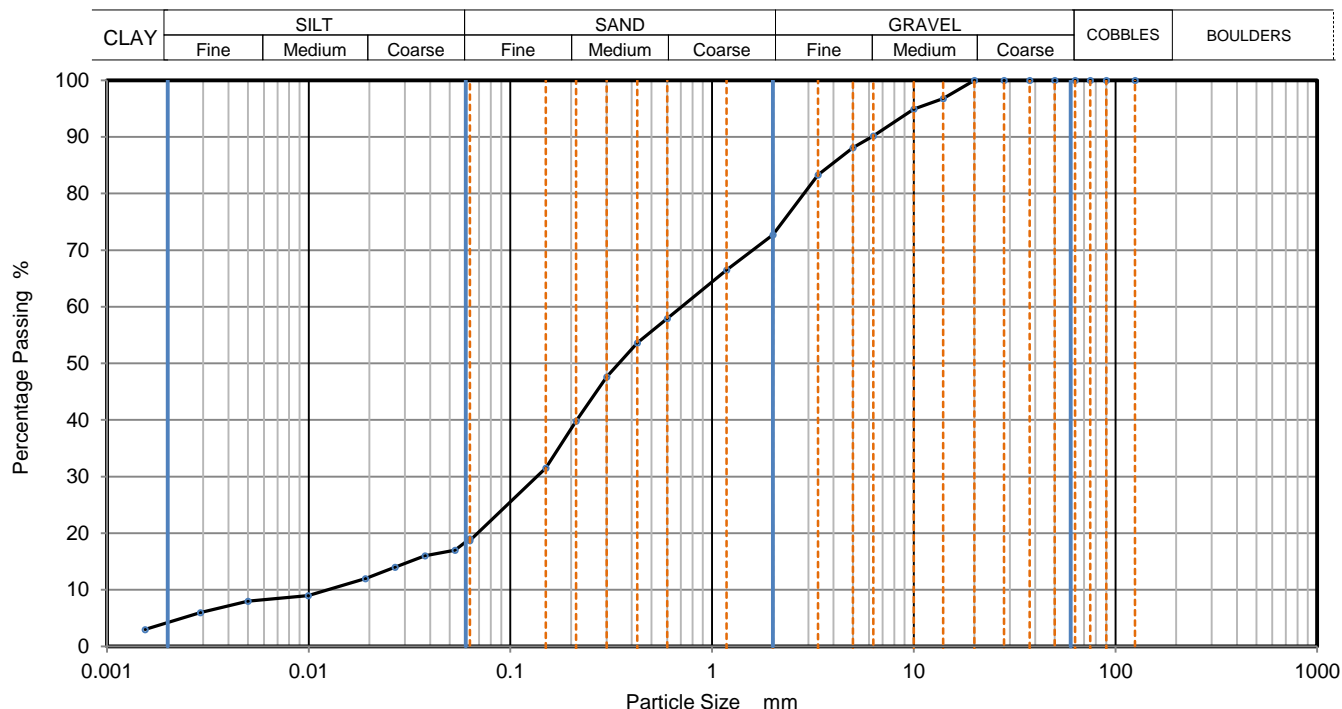
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032146



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	19
90	100	0.05308	17
75	100	0.03774	16
63	100	0.02683	14
50	100	0.01908	12
37.5	100	0.00996	9
28	100	0.00501	8
20	100	0.00290	6
14	97	0.00154	3
10	95		
6.3	90		
5	88		
3.35	83		
2	73		
1.18	67		
0.6	58	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	54		
0.3	48		
0.212	40		
0.15	32		
0.063	19		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	27.3
Sand	54.0
Silt	14.3
Clay	4.4

Grading Analysis		
D100	mm	
D60	mm	0.709
D30	mm	0.135
D10	mm	0.0114
Uniformity Coefficient		62
Curvature Coefficient		2.3

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP08

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

6

Specimen  
Depth

1

m

Sample Type

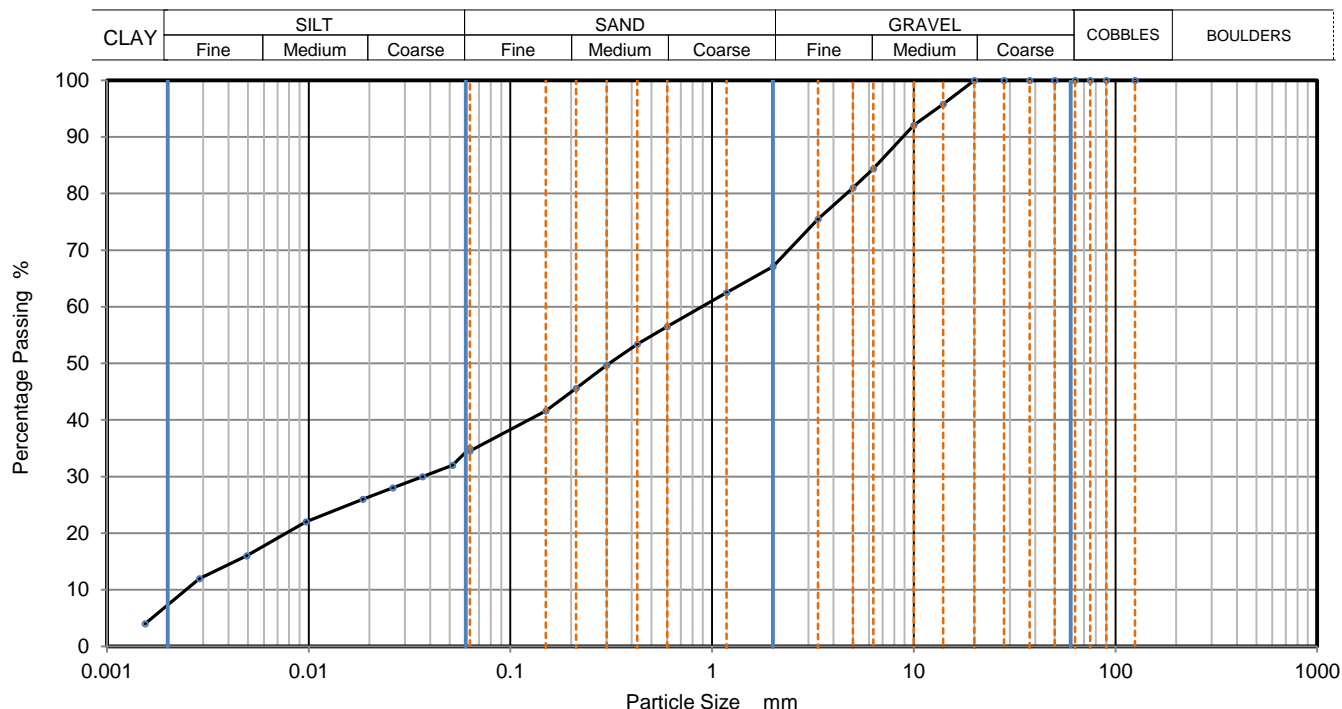
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032147



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	35
90	100	0.05157	32
75	100	0.03668	30
63	100	0.02609	28
50	100	0.01855	26
37.5	100	0.00969	22
28	100	0.00493	16
20	100	0.00287	12
14	96	0.00154	4
10	92		
6.3	84		
5	81		
3.35	76		
2	67		
1.18	63		
0.6	57	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	53		
0.3	50		
0.212	46		
0.15	42		
0.063	35		

Dry Mass of sample, g

507

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	32.9
Sand	32.6
Silt	27.1
Clay	7.4

Grading Analysis		
D100	mm	
D60	mm	0.89
D30	mm	0.0341
D10	mm	0.00243
Uniformity Coefficient		370
Curvature Coefficient		0.54

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP11

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

6

Specimen  
Depth

1

m

Sample Type

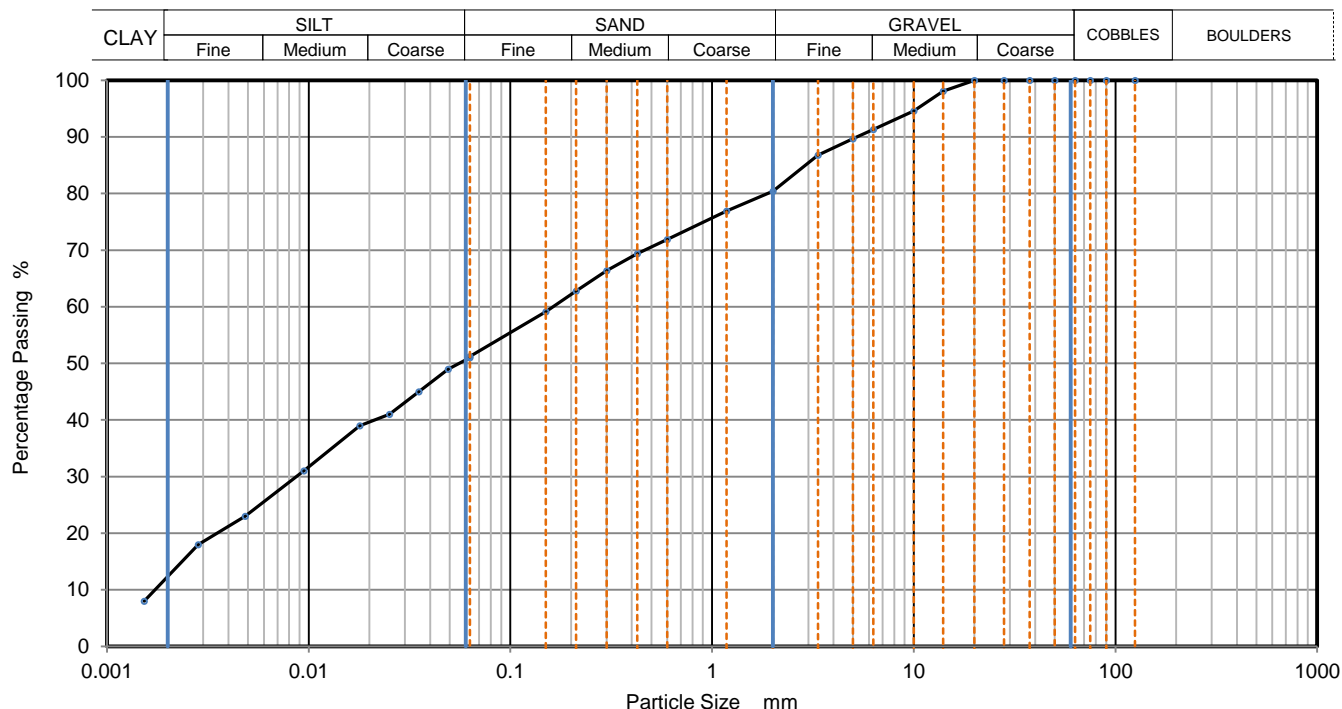
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032149



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.04907	49
75	100	0.03515	45
63	100	0.02517	41
50	100	0.01791	39
37.5	100	0.00947	31
28	100	0.00485	23
20	100	0.00283	18
14	98	0.00153	8
10	95		
6.3	91		
5	90		
3.35	87		
2	80		
1.18	77		
0.6	72	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	69		
0.3	66		
0.212	63		
0.15	59		
0.063	51		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.6
Sand	29.2
Silt	38.5
Clay	12.7

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	96
Curvature Coefficient	0.29

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP12

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown silty CLAY.

Depth, m

1.00

Specimen Reference

7

Specimen  
Depth

1

m

Sample Type

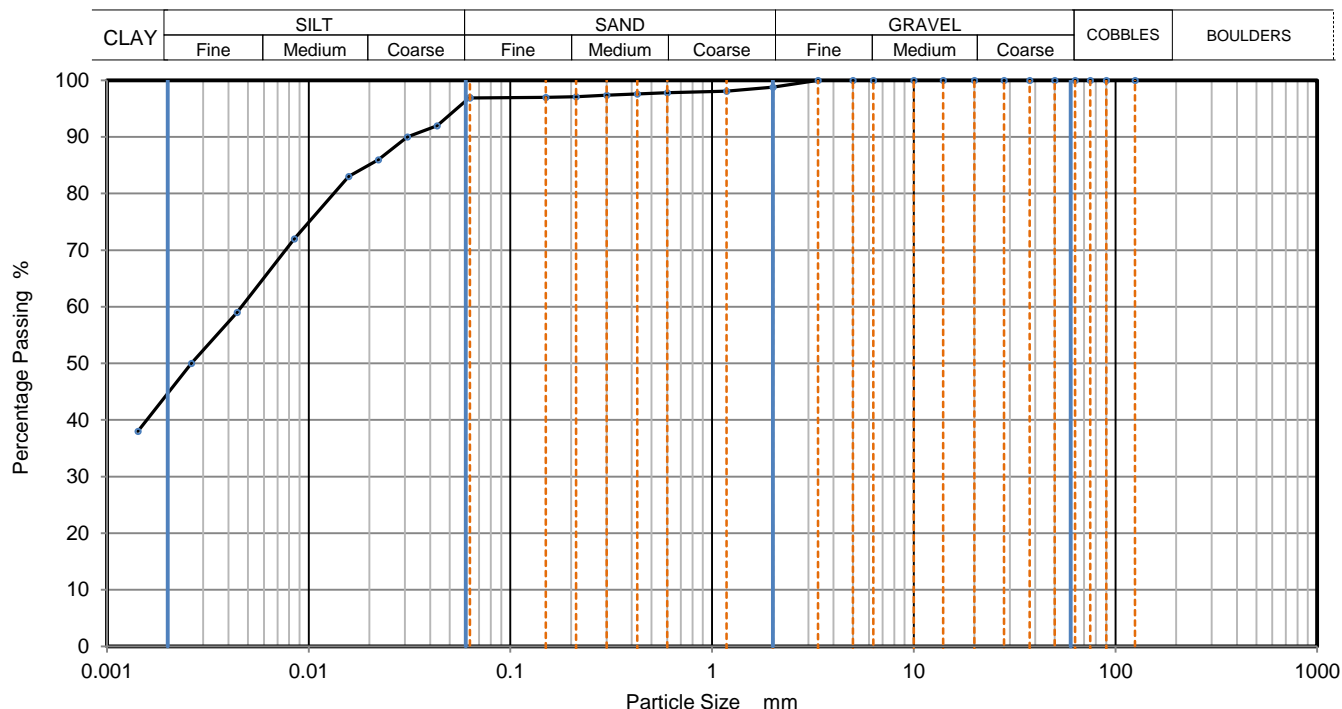
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032152



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	97
90	100	0.04328	92
75	100	0.03086	90
63	100	0.02218	86
50	100	0.01581	83
37.5	100	0.00848	72
28	100	0.00442	59
20	100	0.00262	50
14	100	0.00142	38
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	98		
0.6	98	Particle density (assumed) 2.65 Mg/m3	
0.425	98		
0.3	97		
0.212	97		
0.15	97		
0.063	97		

Dry Mass of sample, g

373

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	1.2
Sand	1.9
Silt	52.3
Clay	44.6

Grading Analysis		
D100	mm	
D60	mm	0.00473
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122



## Moisture Condition Value at Natural Moisture Content Summary of Results

Project No.

21-1619

Project Name

North Irish Sea Array

Hole No.	Sample				Soil Description	Retained on 20mm sieve  %	Moisture Content <20mm  %	Moisture Condition Value	Method of Interpretation	Remarks
	Ref	Top	Base	Type						
TP04	4	1.20		B	Brown sandy slightly gravelly silty CLAY.	4	14	10.4	Best fit line	
TP05	4	1.00		B	Brown sandy slightly gravelly silty CLAY.	10	22	6.5	Best fit line	
TP08	4	1.20		B	Greyish brown sandy slightly gravelly silty CLAY.	15	13	8.2	Best fit line	
TP11	4	1.20		B	Greyish brown sandy slightly gravelly silty CLAY.	18	22	6.7	Best fit line	
TP12	3	1.00		B	Greyish brown silty CLAY.	0	23	13.1	Best fit line	

LAB 10R - Version 6

Key

Test performed in accordance with BS1377:Part4:1990, clause 5.4 unless annotated otherwise

Date Printed

04/12/2022 00:00

Approved By

Stephen.Watson



10122



2183

# Final Report

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**Report No.:** 22-11176-1  
**Initial Date of Issue:** 30-Mar-2022  
**Client** Causeway Geotech Ltd

**Client Address:** 8 Drumahiskey Road  
Balnamore  
Ballymoney  
County Antrim  
BT53 7QL

**Contact(s):** Carin Cornwall  
Colm Hurley  
Darren O'Mahony  
Gabriella Horan  
Joe Gervin  
John Cameron  
Lucy Newland  
Martin Gardiner  
Matthew Gilbert  
Neil Haggan  
Paul Dunlop  
Sean Ross  
Stephen Franey  
Stephen Watson  
Stuart Abraham  
Thomas McAllister

**Project** 21-1619 North Irish Sea Array

**Quotation No.:** **Date Received:** 24-Mar-2022

**Order No.:** **Date Instructed:** 24-Mar-2022

**No. of Samples:** 3

**Turnaround (Wkdays):** 7 **Results Due:** 01-Apr-2022

**Date Approved:** 30-Mar-2022

**Approved By:**



**Details:** Stuart Henderson, Technical  
Manager

---





## Results - Soil

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>				22-11176	22-11176	22-11176
Quotation No.:	<b>Chemtest Sample ID.:</b>				1398031	1398032	1398033
Order No.:	Client Sample Ref.:				4	3	4
	Sample Location:				TP04	TP08	TP12
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				1.2	1.0	1.2
	Date Sampled:				23-Mar-2022	23-Mar-2022	23-Mar-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>			
Moisture	N	2030	%	0.020	14	15	21
pH	U	2010		4.0	8.5	8.5	8.5
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.048	0.046	0.059
Sulphate (Total)	U	2430	%	0.010	0.011	0.010	0.014
Sulphate (Acid Soluble)	U	2430	%	0.010	0.021	< 0.010	0.019



## Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## **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](mailto:customerservices@chemtest.com)



# LABORATORY REPORT



4043

**Contract Number: PSL22/2277**

Report Date: 27 April 2022  
Client's Reference: 21-1619  
Client Name: Causeway Geotech  
8 Drumahiskey Road  
Ballymoney  
Co. Antrim  
BT53 7QL

**For the attention of: Stephen Watson**

Contract Title: North Irish Sea Array  
Date Received: 28/3/2022  
Date Commenced: 28/3/2022  
Date Completed: 27/4/2022

**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)

T Watkins  
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,  
Doncaster DN4 0AR  
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awatkins@prosoils.co.uk

Page 1 of



## SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

**PSL**  
Professional Soils Laboratory

## North Irish Sea Array

**Contract No:**

PSL22/2277

**Client Ref:**

**21-1619**

## SUMMARY OF THERMAL PROPERTY TESTS

**In accordance with ASTM-D5334**

[illegible]

## North Irish Sea Array

**Contract No:**

PSL22/2277

**Client Ref:**

**21-1619**



**HEAD OFFICE**  
Causeway Geotech Ltd  
8 Drumahiskey Road  
Ballymoney  
Co. Antrim, N. Ireland, BT53 7QL  
**NI:** +44 (0)28 276 66640

Registered in Northern Ireland.  
Company Number: NI610766

**REGIONAL OFFICE**  
Causeway Geotech (IRL) Ltd  
Unit 1 Fingal House  
Stephenstown Industrial Estate  
Balbriggan, Co Dublin, Ireland, K32 VR66  
**ROI:** +353 (0)1 526 7465

Registered in Ireland.  
Company Number: 633786

[www.causewaygeotech.com](http://www.causewaygeotech.com)

## SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

28 April 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 18/03/2022 and 28/04/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd





**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 4 - FINAL

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	15
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	11
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	11
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	11
SOIL	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377-4: 1990: Cl 3.3 & 3.4	1
SOIL	Moisture Condition Value at natural moisture content	BS 1377-4: 1990: Cl 5.4	5
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 8	2

## SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – subcontracted to Pro Soils Limited ( <i>UKAS 4043</i> )	Thermal Resistivity		6

## Summary of Classification Test Results

Project No. 21-1619		Project Name North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
BH03	2	0.80	1.00	B	Brown sandy slightly gravelly silty CLAY.			23.0	83	42	21	21		CI
BH03	3	1.80	2.00	B	Brown sandy slightly gravelly silty CLAY.			14.0						
BH03	4	2.80	3.00	B	Brown sandy slightly gravelly silty CLAY.			13.0						
BH03	5	3.80	4.00	B	Brown sandy slightly gravelly silty CLAY.			13.0	65	30	16	14		CL
BH03	14	5.00	5.45	U	Brown sandy slightly gravelly silty CLAY.			13.0						
BH03	10	5.50		D	Brown sandy slightly gravelly silty CLAY.			11.0	60	25	14	11		CL
BH03	12	7.50		D	Brown sandy slightly gravelly silty CLAY.			22.0						
TP01	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.			17.0	92	45	22	23		CI
TP02	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.			14.0	67	30	19	11		CL
TP07	4	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.			16.0	65	30	19	11		CL
TP07	6	2.00		B	Greyish brown sandy slightly gravelly silty CLAY.			14.0	67	40	16	24		CI
TP09	4	1.20		B	Greyish brown silty CLAY.			23.0	98	41	22	19		CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 5

### Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

04/11/2022 00:00

Approved By

Stephen.Watson



10122





Project Name
--------------

## North Irish Sea Array

All tests performed in accordance with BS1377:1990 unless specified otherwise



Stephen.Watson

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

2

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

0.80

Specimen Reference

6

Specimen  
Depth

0.8

m

Sample Type

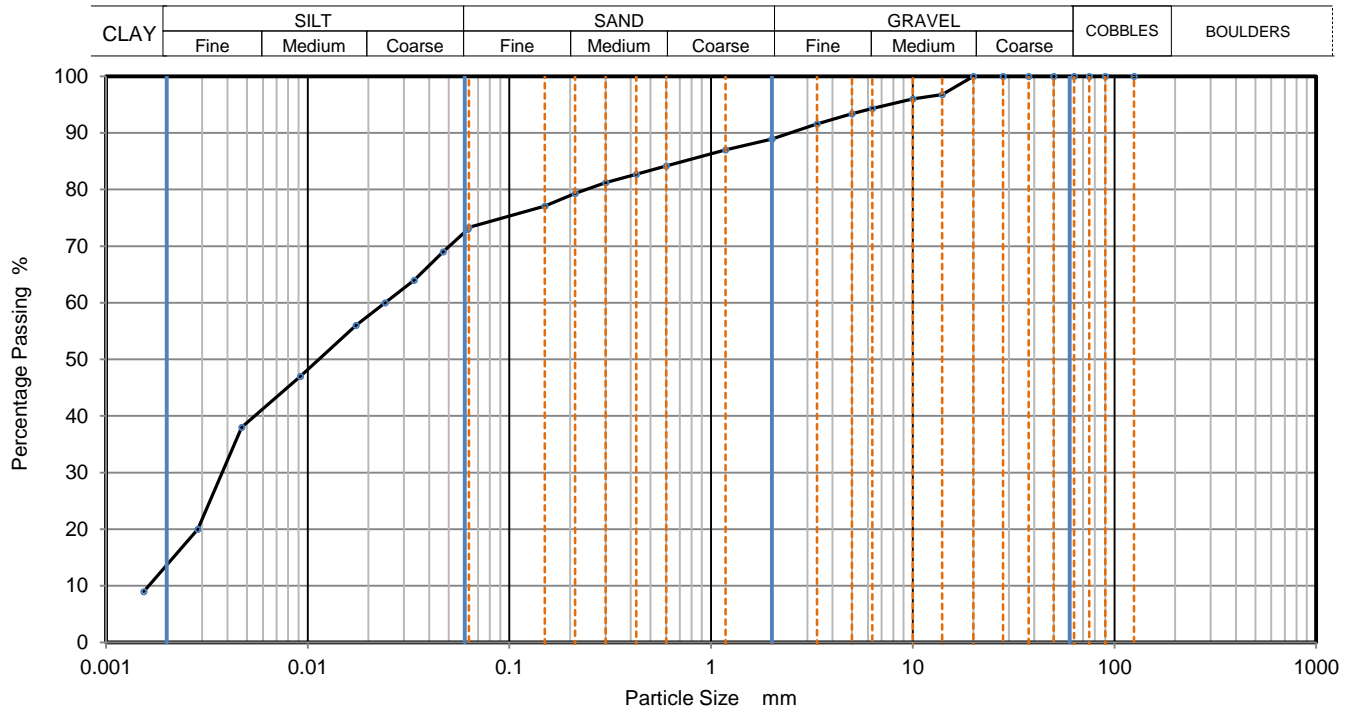
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032121



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06230	73
90	100	0.04701	69
75	100	0.03373	64
63	100	0.02418	60
50	100	0.01734	56
37.5	100	0.00919	47
28	100	0.00471	38
20	100	0.00285	20
14	97	0.00154	9
10	96		
6.3	94		
5	93		
3.35	92		
2	89		
1.18	87		
0.6	84	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	83		
0.3	81		
0.212	79		
0.15	77		
0.063	73		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	11.1
Sand	15.6
Silt	59.7
Clay	13.6

Grading Analysis		
D100	mm	
D60	mm	0.0242
D30	mm	0.00378
D10	mm	0.00164
Uniformity Coefficient		15
Curvature Coefficient		0.36

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

5

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

3.80

Specimen Reference

6

Specimen  
Depth

3.8

m

Sample Type

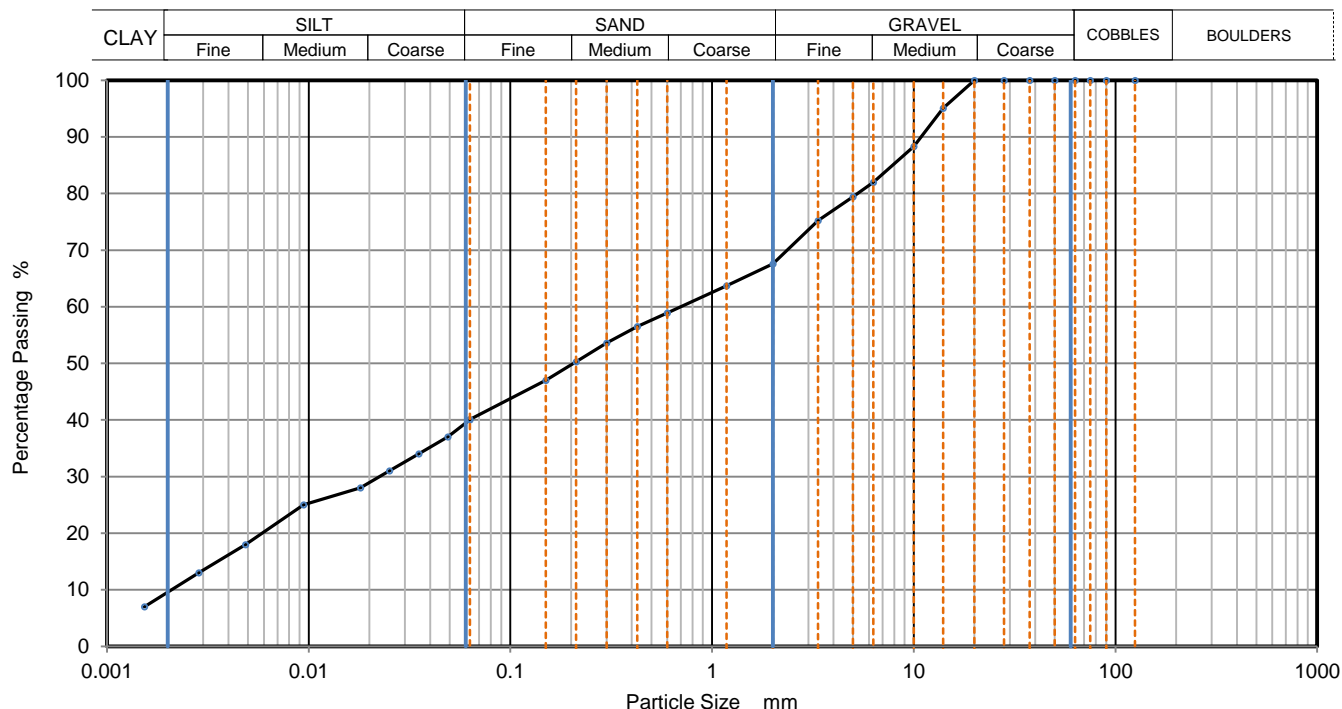
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032125



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	40
90	100	0.04903	37
75	100	0.03513	34
63	100	0.02517	31
50	100	0.01802	28
37.5	100	0.00942	25
28	100	0.00485	18
20	100	0.00285	13
14	95	0.00153	7
10	88		
6.3	82		
5	79		
3.35	75		
2	68		
1.18	64		
0.6	59	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	57		
0.3	54		
0.212	50		
0.15	47		
0.063	40		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	32.4
Sand	27.5
Silt	30.1
Clay	10.0

Grading Analysis		
D100	mm	
D60	mm	0.702
D30	mm	0.022
D10	mm	0.002
Uniformity Coefficient		350
Curvature Coefficient		0.34

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

10

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

5.50

Specimen Reference

6

Specimen  
Depth

5.5

m

Sample Type

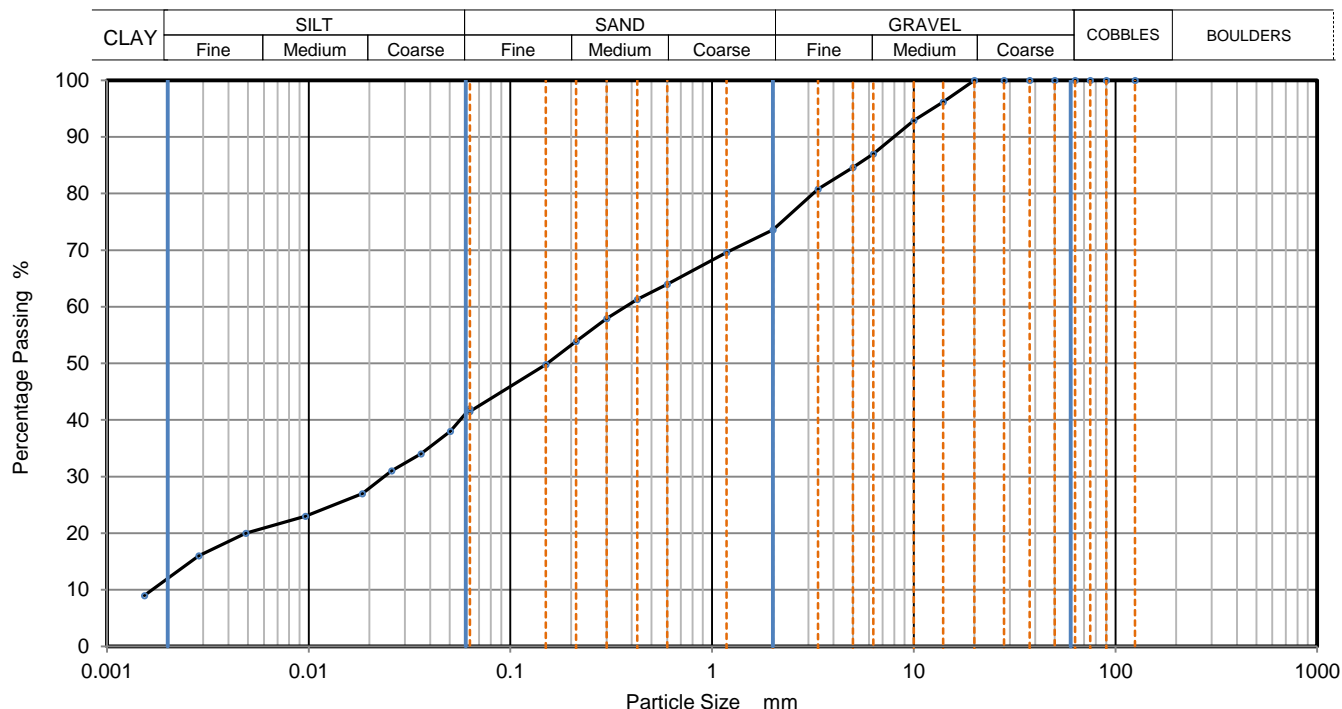
D

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032127



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05033	38
75	100	0.03604	34
63	100	0.02580	31
50	100	0.01846	27
37.5	100	0.00965	23
28	100	0.00488	20
20	100	0.00285	16
14	96	0.00153	9
10	93		
6.3	87		
5	85		
3.35	81		
2	74		
1.18	70		
0.6	64	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	61		
0.3	58		
0.212	54		
0.15	50		
0.063	42		

Dry Mass of sample, g

501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.4
Sand	32.2
Silt	29.3
Clay	12.1

Grading Analysis		
D100	mm	
D60	mm	0.372
D30	mm	0.0242
D10	mm	0.00167
Uniformity Coefficient		220
Curvature Coefficient		0.95

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP01

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

7

Specimen  
Depth

1

m

Sample Type

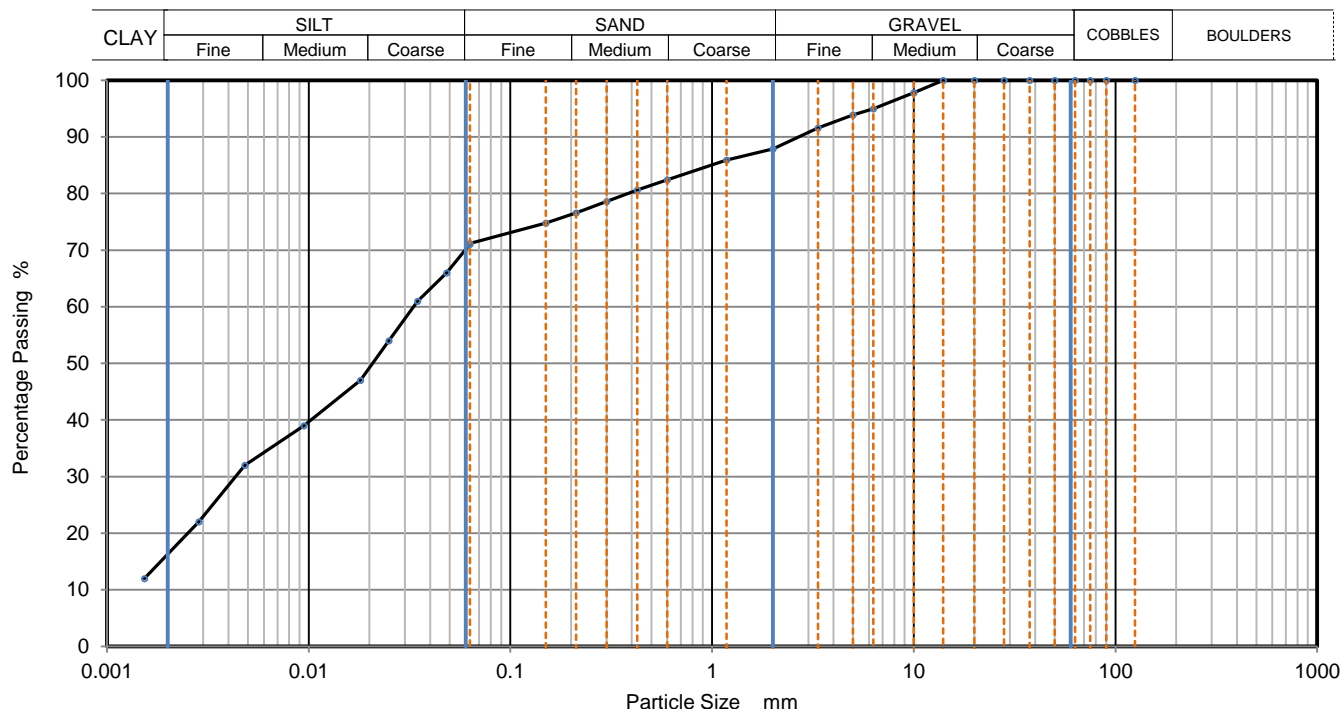
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032129



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	71
90	100	0.04837	66
75	100	0.03467	61
63	100	0.02501	54
50	100	0.01802	47
37.5	100	0.00948	39
28	100	0.00482	32
20	100	0.00285	22
14	100	0.00153	12
10	98		
6.3	95		
5	94		
3.35	92		
2	88		
1.18	86		
0.6	82	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	81		
0.3	79		
0.212	77		
0.15	75		
0.063	71		

Dry Mass of sample, g

501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	12.1
Sand	16.6
Silt	54.8
Clay	16.5

Grading Analysis		
D100	mm	
D60	mm	0.0326
D30	mm	0.00435
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP02

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

7

Specimen  
Depth

1

m

Sample Type

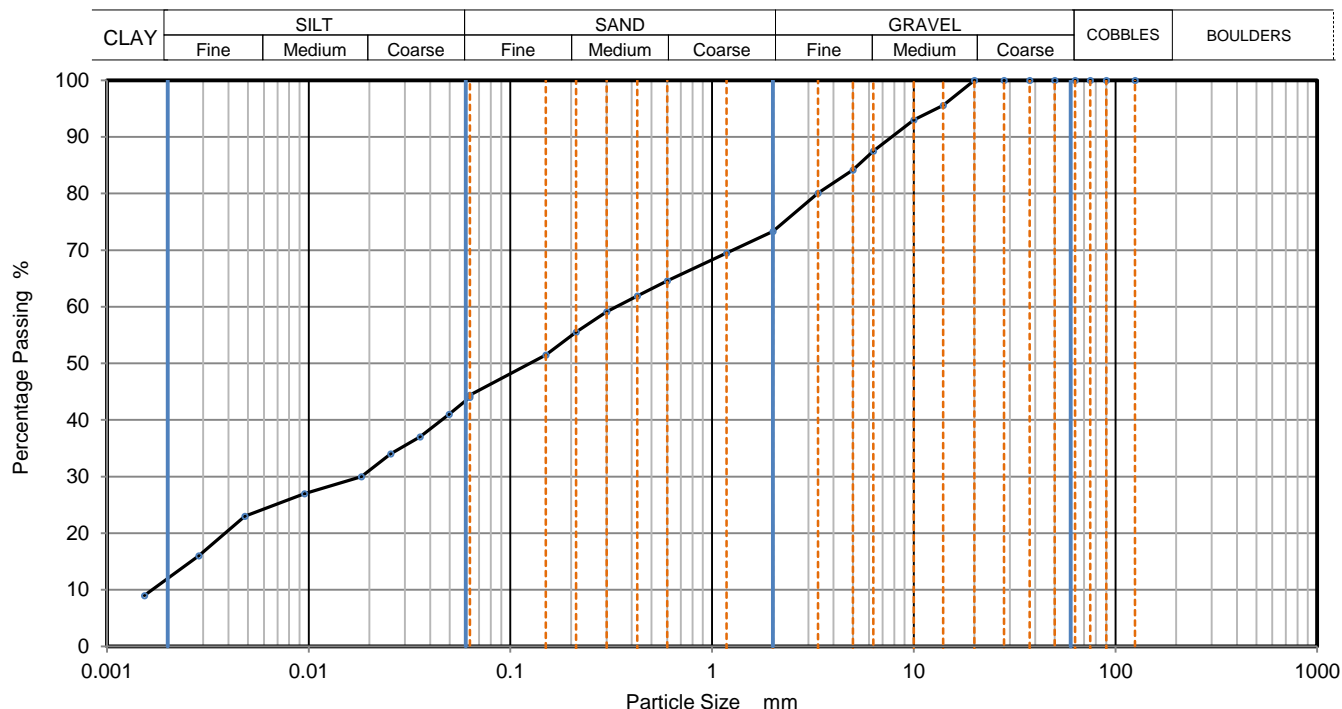
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032131



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.04969	41
75	100	0.03559	37
63	100	0.02549	34
50	100	0.01824	30
37.5	100	0.00953	27
28	100	0.00482	23
20	100	0.00285	16
14	96	0.00153	9
10	93		
6.3	88		
5	84		
3.35	80		
2	73		
1.18	70		
0.6	65	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	62		
0.3	59		
0.212	56		
0.15	52		
0.063	44		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.7
Sand	28.9
Silt	32.5
Clay	11.9

Grading Analysis		
D100	mm	
D60	mm	0.335
D30	mm	0.0176
D10	mm	0.00169
Uniformity Coefficient		200
Curvature Coefficient		0.55

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP07

Site Name

North Irish Sea Array

Sample No.

4

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

7

Specimen  
Depth

1

m

Sample Type

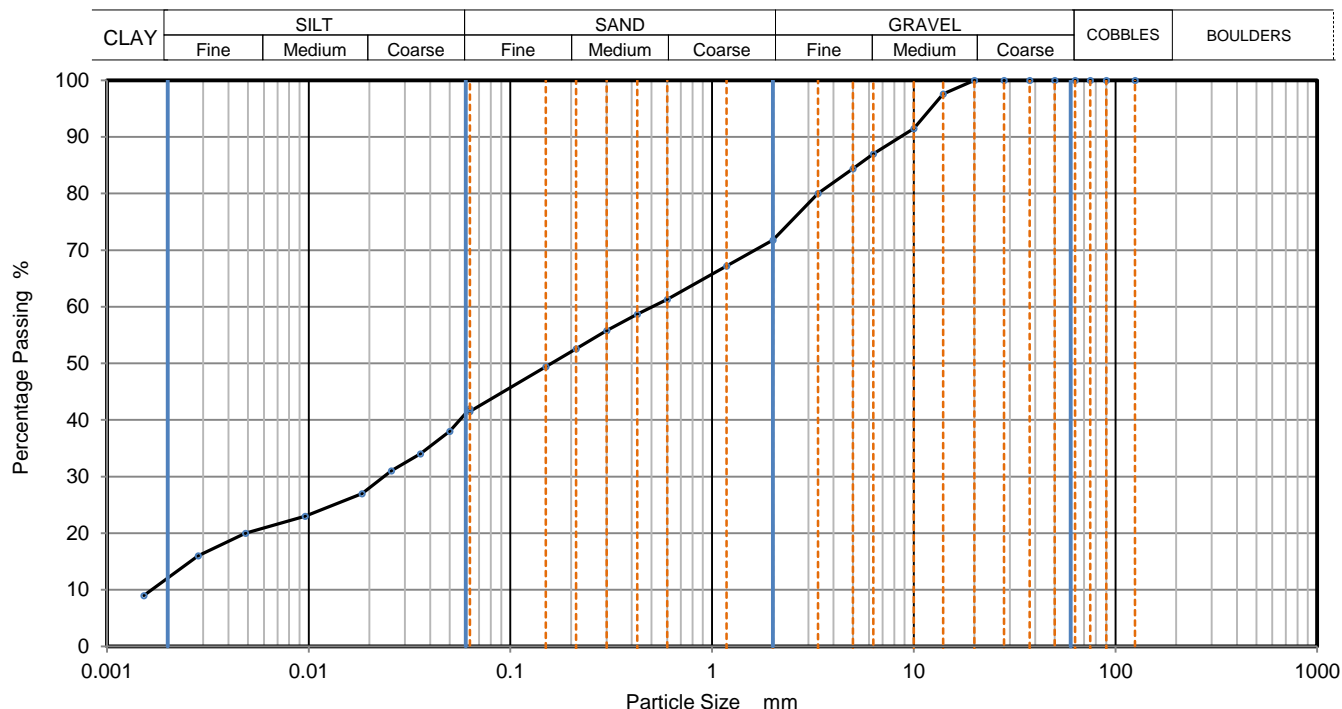
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032133



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05000	38
75	100	0.03581	34
63	100	0.02564	31
50	100	0.01835	27
37.5	100	0.00959	23
28	100	0.00485	20
20	100	0.00283	16
14	98	0.00152	9
10	92		
6.3	87		
5	84		
3.35	80		
2	72		
1.18	67		
0.6	61	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	59		
0.3	56		
0.212	53		
0.15	49		
0.063	42		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	28.2
Sand	30.4
Silt	29.2
Clay	12.2

Grading Analysis		
D100	mm	
D60	mm	0.504
D30	mm	0.0241
D10	mm	0.00166
Uniformity Coefficient		300
Curvature Coefficient		0.7

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP07

Site Name

North Irish Sea Array

Sample No.

6

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

2.00

Specimen Reference

6

Specimen  
Depth

2

m

Sample Type

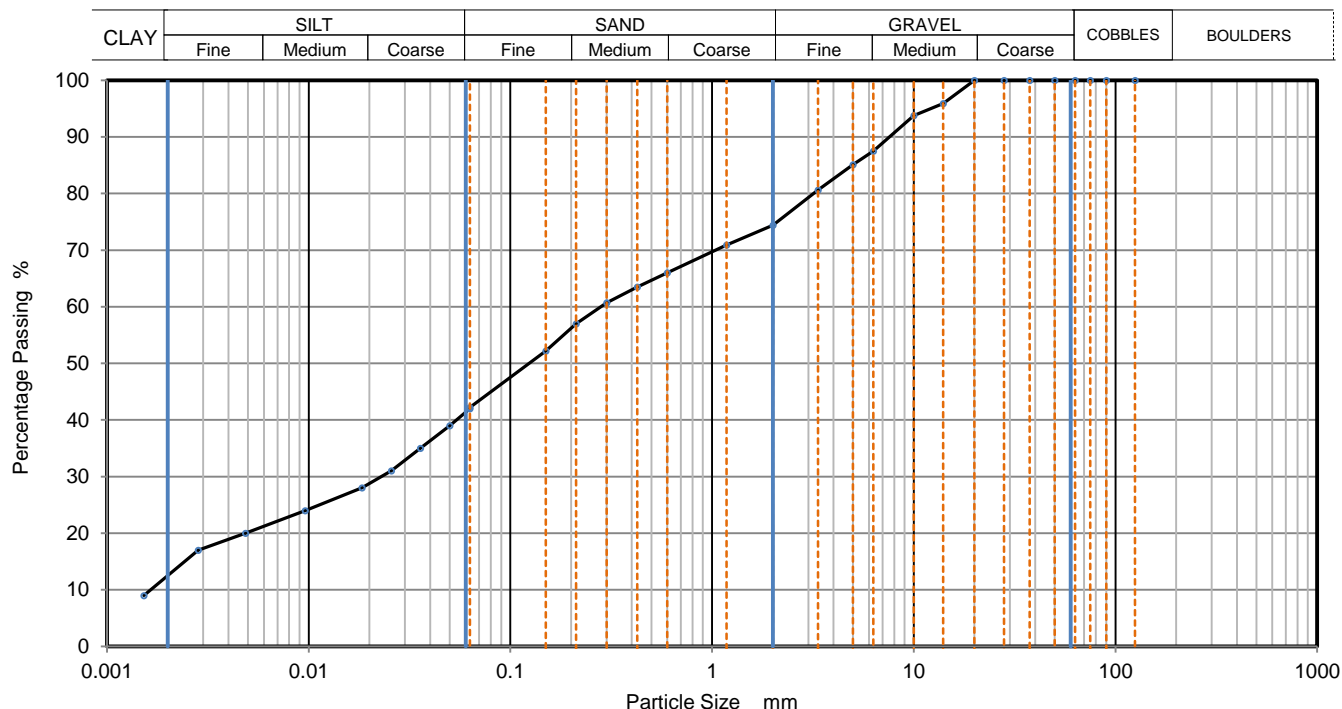
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032135



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05000	39
75	100	0.03581	35
63	100	0.02564	31
50	100	0.01835	28
37.5	100	0.00959	24
28	100	0.00485	20
20	100	0.00283	17
14	96	0.00152	9
10	94		
6.3	88		
5	85		
3.35	81		
2	74		
1.18	71		
0.6	66	Particle density (assumed) 2.65 Mg/m3	
0.425	64		
0.3	61		
0.212	57		
0.15	52		
0.063	42		

Dry Mass of sample, g

507

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	25.6
Sand	32.2
Silt	29.8
Clay	12.4

Grading Analysis		
D100	mm	
D60	mm	0.281
D30	mm	0.023
D10	mm	0.00163
Uniformity Coefficient		170
Curvature Coefficient		1.2

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP09

Site Name

North Irish Sea Array

Sample No.

4

Soil Description

Greyish brown silty CLAY.

Depth, m

1.20

Specimen Reference

7

Specimen  
Depth

1.2

m

Sample Type

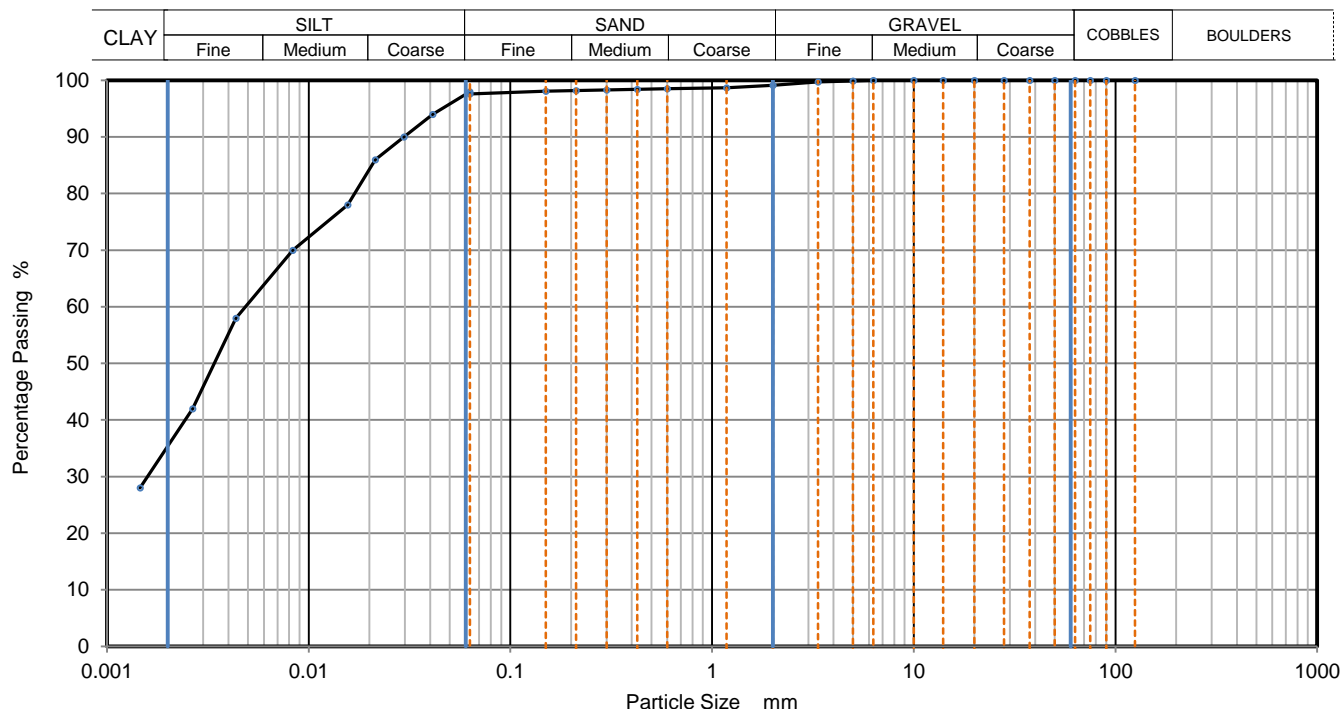
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032137



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	98
90	100	0.04115	94
75	100	0.02965	90
63	100	0.02135	86
50	100	0.01562	78
37.5	100	0.00833	70
28	100	0.00435	58
20	100	0.00265	42
14	100	0.00146	28
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	98		
0.3	98		
0.212	98		
0.15	98		
0.063	98		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.9
Sand	1.5
Silt	62.3
Clay	35.3

Grading Analysis		
D100	mm	
D60	mm	0.00492
D30	mm	0.0016
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP20

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.00

Specimen Reference

6

Specimen  
Depth

1

m

Sample Type

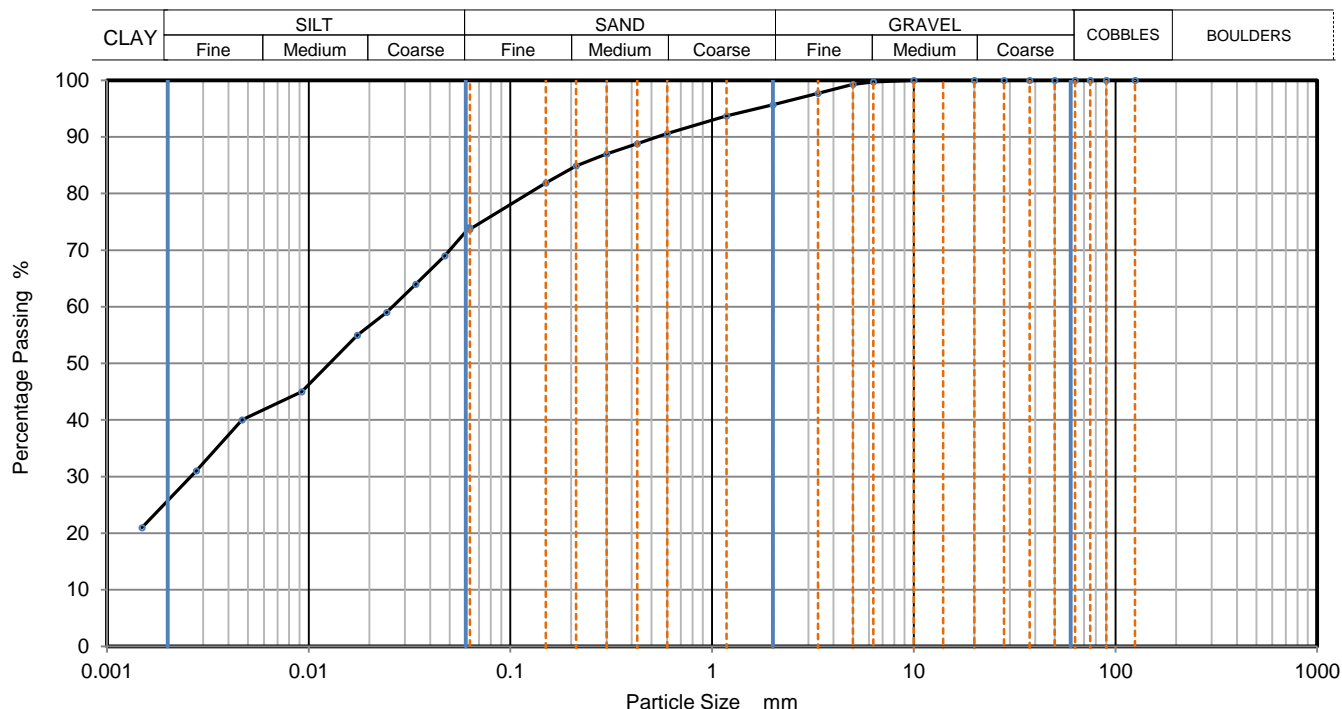
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032138



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06275	74
90	100	0.04735	69
75	100	0.03396	64
63	100	0.02435	59
50	100	0.01745	55
37.5	100	0.00925	45
28	100	0.00468	40
20	100	0.00277	31
		0.00149	21
10	100		
6.3	100		
5	99		
3.35	98		
2	96		
1.18	94		
0.6	91	Particle density (assumed) 2.65 Mg/m3	
0.425	89		
0.3	87		
0.212	85		
0.15	82		
0.063	74		

Dry Mass of sample, g

503

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	4.3
Sand	22.1
Silt	47.7
Clay	25.9

Grading Analysis		
D100	mm	
D60	mm	0.0253
D30	mm	0.00261
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP20

Site Name

North Irish Sea Array

Sample No.

4

Soil Description

Greyish brown clayey fine to coarse SAND.

Depth, m

1.20

Specimen Reference

6

Specimen  
Depth

1.2

m

Sample Type

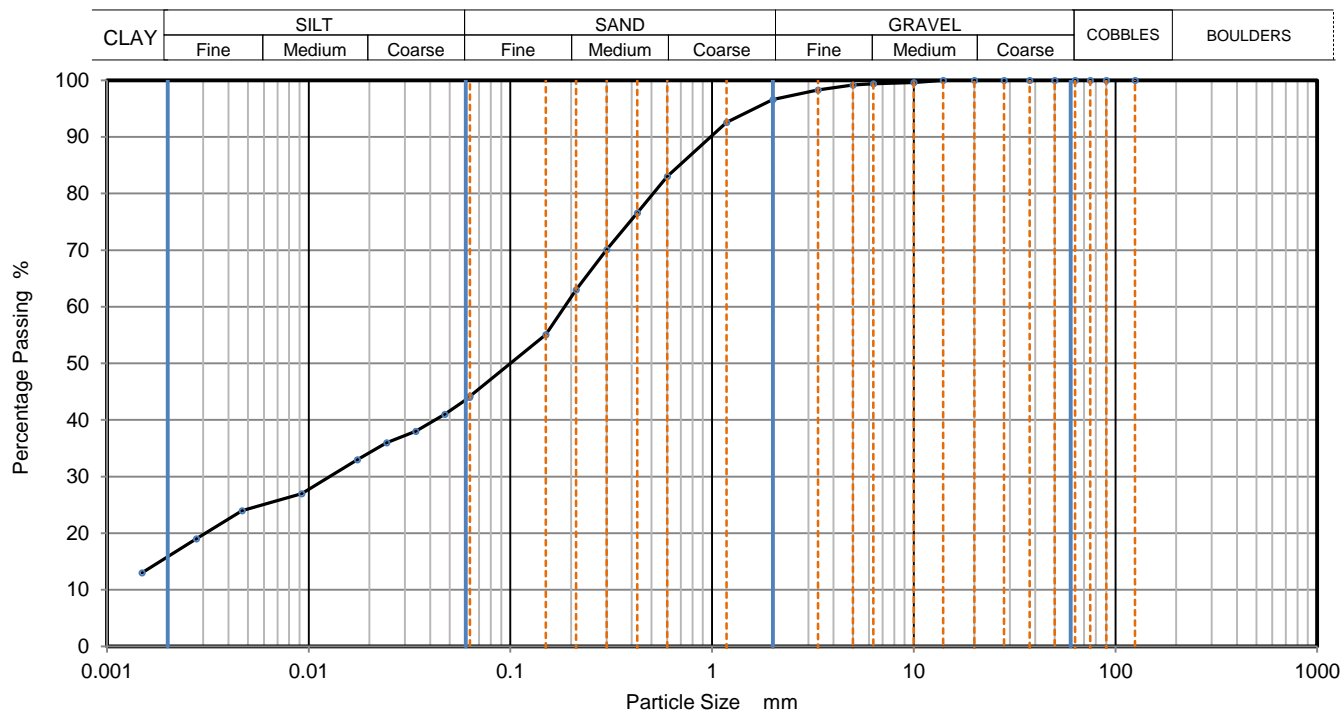
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032139



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06275	44
90	100	0.04735	41
75	100	0.03396	38
63	100	0.02435	36
50	100	0.01745	33
37.5	100	0.00925	27
28	100	0.00468	24
20	100	0.00277	19
14	100	0.00149	13
10	100		
6.3	99		
5	99		
3.35	98		
2	97		
1.18	93		
0.6	83	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	77		
0.3	70		
0.212	63		
0.15	55		
0.063	44		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	3.4
Sand	52.4
Silt	28.7
Clay	15.5

Grading Analysis		
D100	mm	
D60	mm	0.186
D30	mm	0.0128
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

TP21

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly clayey SILT with occasional shell fragments.

Depth, m

1.00

Specimen Reference

7

Specimen  
Depth

1

m

Sample Type

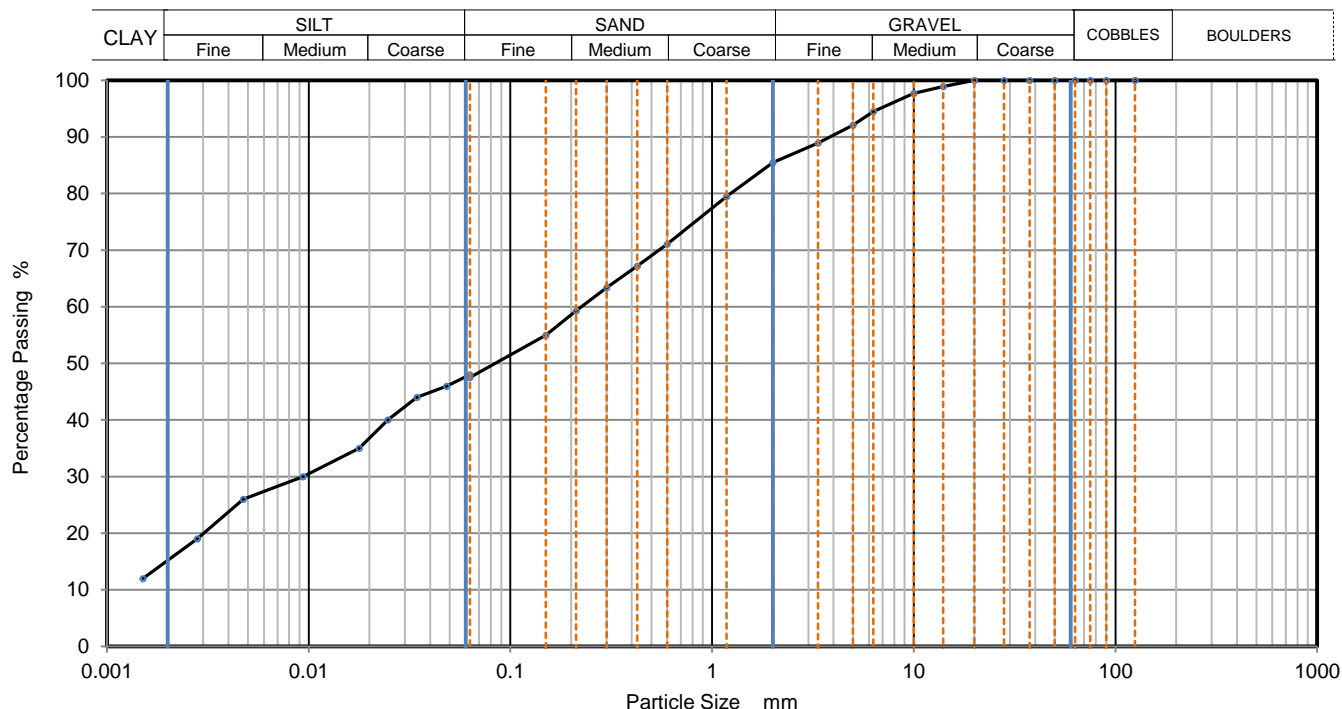
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032140



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.04836	46
75	100	0.03443	44
63	100	0.02468	40
50	100	0.01779	35
37.5	100	0.00936	30
28	100	0.00474	26
20	100	0.00280	19
14	99	0.00151	12
10	98		
6.3	95		
5	92		
3.35	89		
2	86		
1.18	80		
0.6	71	Particle density (assumed) 2.65 Mg/m3	
0.425	67		
0.3	63		
0.212	59		
0.15	55		
0.063	48		

Dry Mass of sample, g

502

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.5
Sand	38.0
Silt	32.0
Clay	15.5

Grading Analysis		
D100	mm	
D60	mm	0.224
D30	mm	0.00947
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



## Moisture Condition Value at Natural Moisture Content Summary of Results

Project No.

21-1619

Project Name

North Irish Sea Array

Hole No.	Sample				Soil Description	Retained on 20mm sieve  %	Moisture Content <20mm  %	Moisture Condition Value	Method of Interpretation	Remarks
	Ref	Top	Base	Type						
TP01	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.	0	20	13.0	Best fit line	
TP02	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.	12	96	8.8	Best fit line	
TP07	4	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.	14	16	8.7	Best fit line	
TP09	4	1.20		B	Greyish brown sandy slightly gravelly silty CLAY.	0	23	13.9	Best fit line	
TP21	3	1.00		B	Greyish brown slightly sandy silty CLAY with occasional shell fragments.	4	69	7.8	Best fit line	

LAB 10R - Version 6

Key

Test performed in accordance with BS1377:Part4:1990, clause 5.4 unless annotated otherwise

Date Printed

04/11/2022 00:00

Approved By

Stephen.Watson



10122



# Dry Density / Moisture Content Relationship Light Compaction

Job Ref

21-1619

Borehole / Pit No

TP09

Site Name

North Irish Sea Array

Sample No

3

Soil Description

Greyish brown silty CLAY.

Depth

1.00 m

Specimen Ref.

2

Specimen Depth

m

Sample Type

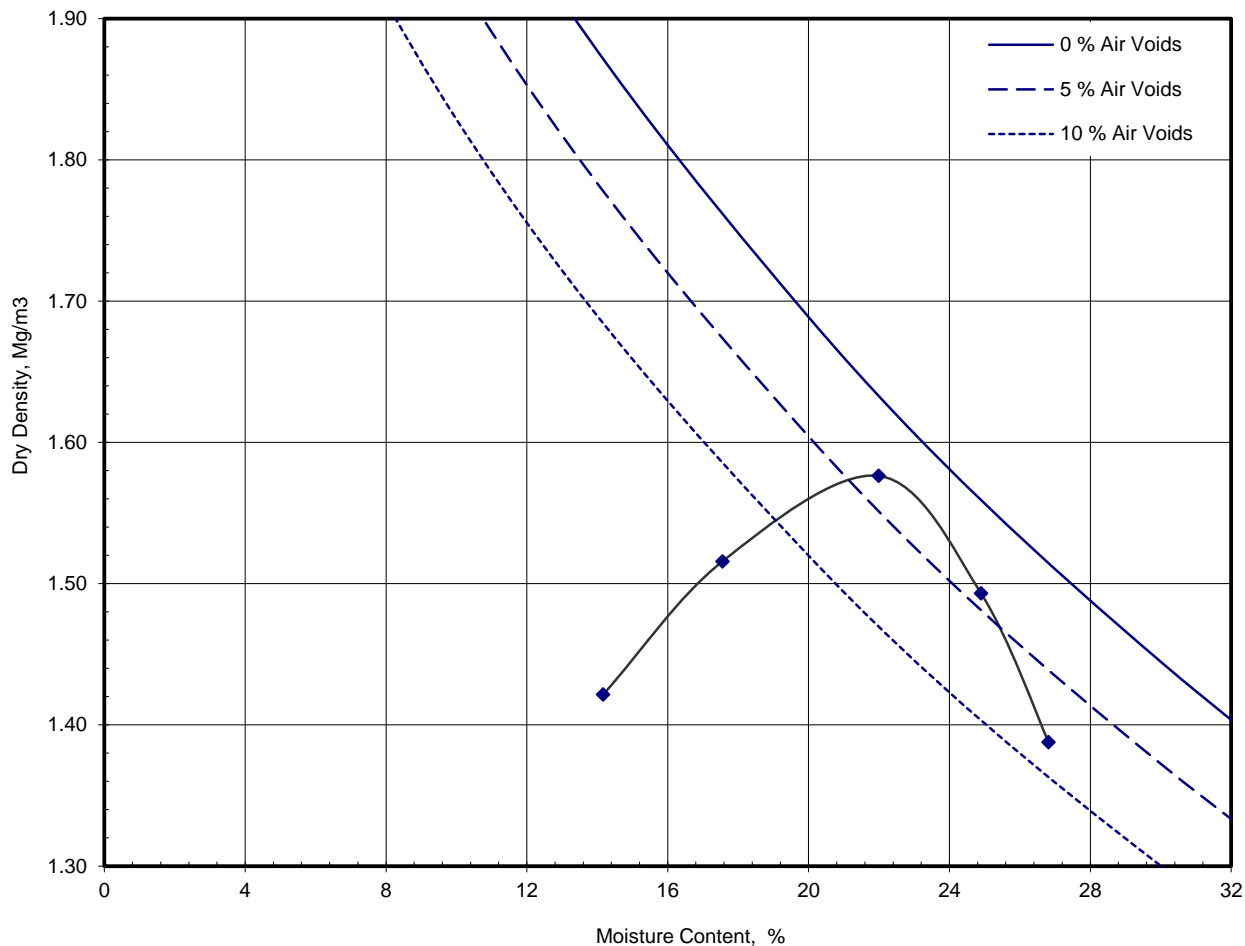
B

Test Method

BS1377:Part 4:1990, clause 3.3, 2.5kg rammer

Keylab ID

Caus2022032136



Preparation	Material used was natural	
Mould Type	One Litre	
Samples Used	Single sample tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m <sup>3</sup>	2.55

Maximum Dry Density	Mg/m <sup>3</sup>	1.58
Optimum Moisture Content	%	22

Approved

Stephen.Watson

Remarks



LAB 08R - Version 5

10122



# **Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**

Job Ref	21-1619		
	Borehole/Pit No.		
BH03			
Site Name	North Irish Sea Array		
Sample No.			13
Soil Description	Brown sandy slightly gravelly silty CLAY.		
Depth			2.00
Specimen Reference	2	Specimen Depth	2.05 m
Sample Type	U		
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.		
KeyLAB ID	Caus2022032123		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		
Date of test	30/03/2022		

Test Number

Length

Diameter

Bulk Density

Moisture Content

Dry Density

Rate of Strain

Cell Pressure

At failure

Axial Strain

Deviator Stress,  $(\sigma_1 - \sigma_3)_f$

Undrained Shear Strength,  $c_u$

Mode of Failure

1

210.1 mm

104.3 mm

2.21 Mg/m<sup>3</sup>

12 %

1.97 Mg/m<sup>3</sup>

4.0 %/min

50 kPa

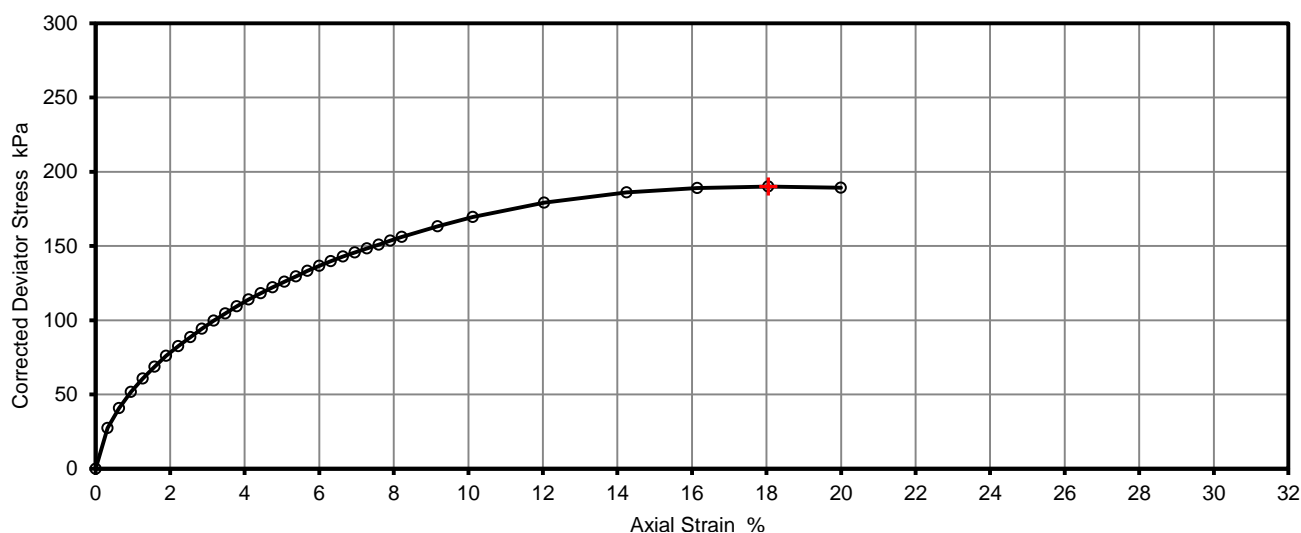
18.0 %

190 kPa

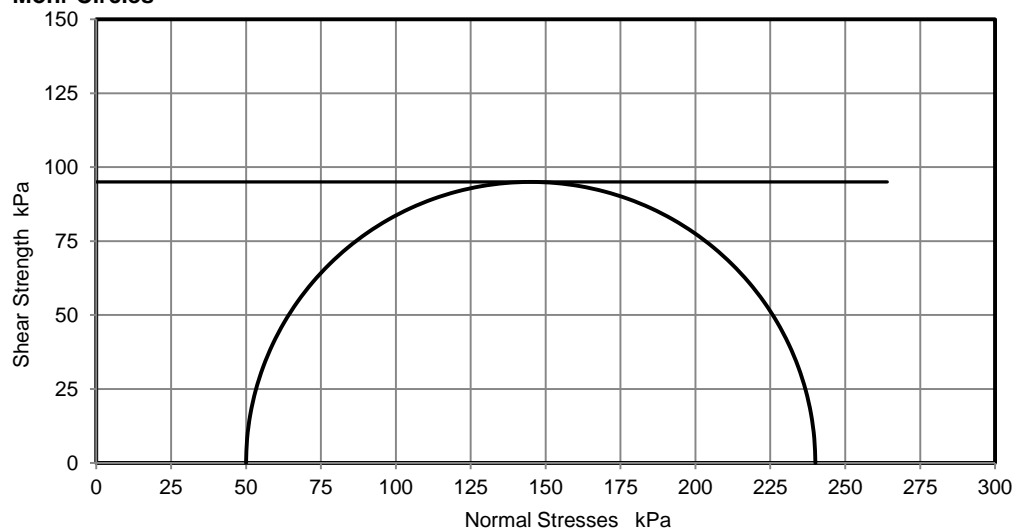
95 kPa  $\frac{1}{2}(\sigma_1 - \sigma_3)_f$

Compound

## **Deviator Stress v Axial Strain**



## **Mohr Circles**



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks

Approved

Stephen.Watson

Printed

11/04/2022 16:04







# Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

Job Ref	21-1619
Borehole/Pit No.	BH03
Sample No.	14
Depth	5.00
Sample Type	U
KeyLAB ID	Caus2022032126
Date of test	30/03/2022

Site Name	North Irish Sea Array		
Soil Description	Brown sandy slightly gravelly silty CLAY.		
Specimen Reference	4	Specimen Depth	5.05 m
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number  
Length  
Diameter  
Bulk Density  
Moisture Content  
Dry Density

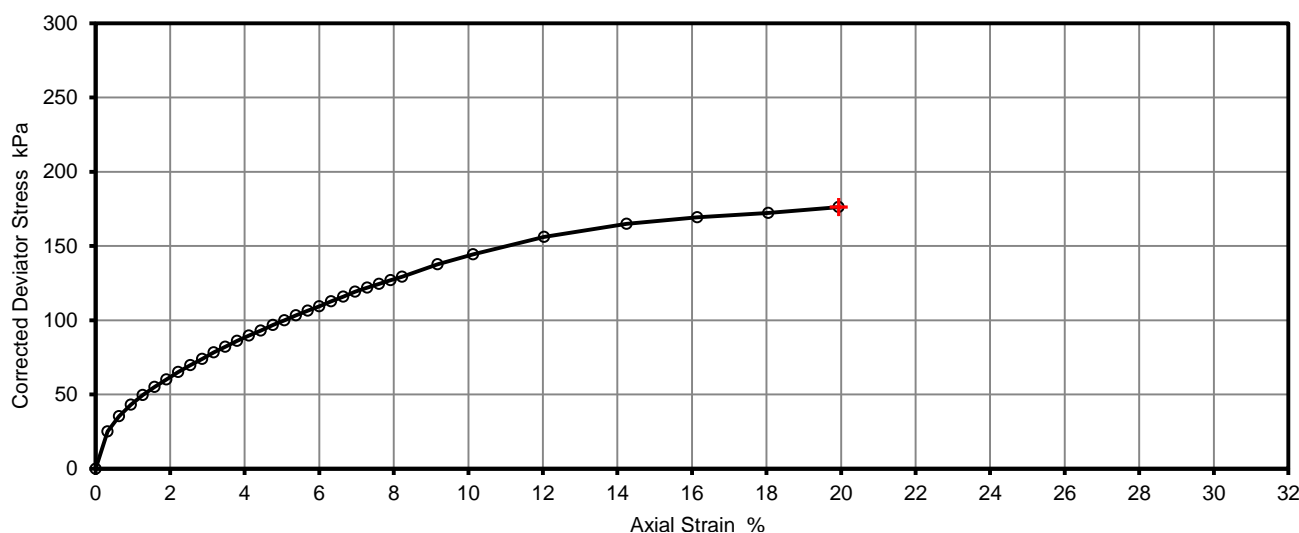
1	
210.1	mm
105.0	mm
2.23	Mg/m3
11	%
2.02	Mg/m3

Rate of Strain  
Cell Pressure  
At failure

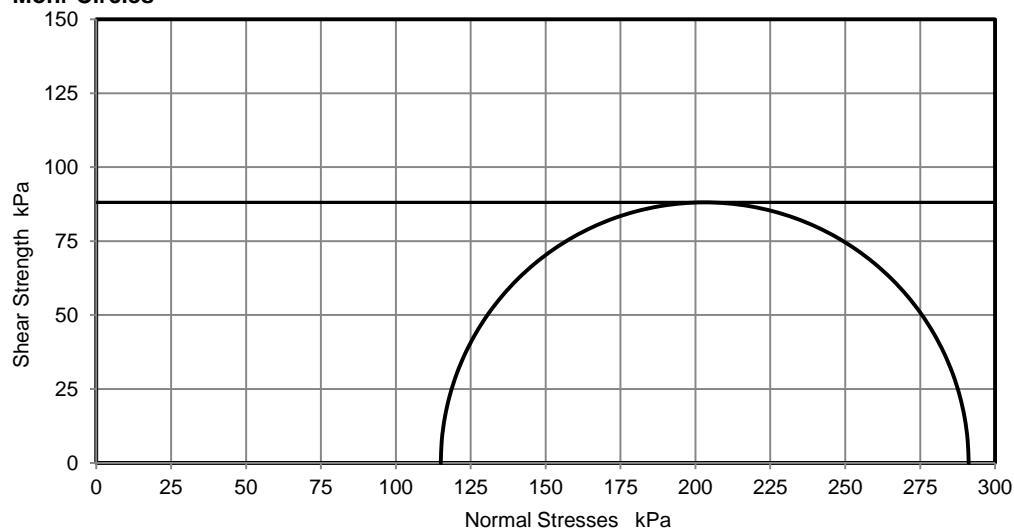
4.0	%/min
115	kPa
19.9	%
176	kPa
88	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$

Axial Strain  
Deviator Stress,  $(\sigma_1 - \sigma_3)_f$   
Undrained Shear Strength,  $c_u$   
Mode of Failure

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected  
for area change and  
membrane effects

Mohr circles and their  
interpretation is not covered  
by BS1377.  
This is provided for  
information only.

## Remarks

No failure defined. Testing terminated at 20% axial strain.

## Approved

Stephen.Watson

## Printed

11/04/2022 16:04





# LABORATORY REPORT



4043

**Contract Number: PSL22/2280**

Report Date: 27 April 2022  
Client's Reference: 21-1619  
Client Name: Causeway Geotech  
8 Drumahiskey Road  
Ballymoney  
Co. Antrim  
BT53 7QL

**For the attention of: Stephen Watson**

Contract Title: North Irish Sea Array  
Date Received: 28/3/2022  
Date Commenced: 28/3/2022  
Date Completed: 27/4/2022

**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)

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Page 1 of

## SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

**PSL**  
Professional Soils Laboratory

## North Irish Sea Array

**Contract No:**

PSL22/2280

**Client Ref:**

**21-1619**



## SUMMARY OF THERMAL PROPERTY TESTS

**In accordance with ASTM-D5334**

[illegible]

## North Irish Sea Array

**Contract No:**

PSL22/2280

**Client Ref:**

**21-1619**

**SOIL AND ROCK SAMPLE ANALYSIS  
 LABORATORY TEST REPORT**


15 April 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 24/03/2022 and 15/04/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.



Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 6

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	13
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	6
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	6
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	6

#### **SUB-CONTRACTED TESTS**

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	BRE Test - Suite B		3



## Summary of Classification Test Results

Project No.		Project Name												
21-1619		North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w	Passing	LL	PL	PI	Particle	Casagrande
	Ref	Top	Base	Type		bulk	dry	%	425µm	%	%	%	density	
						Mg/m3			%	%	%	%	Mg/m3	
BH04	1	0.30	0.50	B	Greyish brown sandy slightly gravelly silty CLAY.			23.0						
BH04	2	0.80	1.00	B	Greyish brown sandy slightly gravelly silty CLAY.			15.0	69	32	17	15		CL
BH04	4	1.20		D	Greyish brown sandy slightly gravelly silty CLAY.			25.0						
BH04	3	1.80	2.00	B	Greyish brown very sandy slightly gravelly silty CLAY.			19.0						
BH06	3	0.30	0.50	B	Greyish brown sandy slightly gravelly silty CLAY.			44.0	90	54	28	26		CH
BH06	8	1.20		D	Greyish brown sandy slightly gravelly silty CLAY.			14.0	70	30	16	14		CL
BH06	6	2.80	3.00	B	Greyish brown sandy slightly gravelly silty CLAY.			14.0	64	26	15	11		CL
BH06	7	3.80	4.00	B	Greyish brown sandy slightly gravelly silty CLAY.			14.0						
BH07	3	0.30	0.50	B	Greyish brown sandy slightly gravelly silty CLAY.			31.0						
BH07	11	1.20	1.65	U	Greyish brown sandy slightly gravelly silty CLAY.			40.0						
BH07	5	1.80	2.00	B	Greyish brown sandy slightly gravelly silty CLAY.			17.0	75	34	18	16		CL
BH07	8	2.00		D	Greyish brown sandy slightly gravelly silty CLAY.			19.0						

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 5

### Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

15/04/2022

Approved By

Stephen.Watson



10122



Project Name	
--------------	--

## North Irish Sea Array

All tests performed in accordance with BS1377:1990 unless specified otherwise



Stephen.Watson

10122

1pt - single point test

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH04

Site Name

North Irish Sea Array

Sample No.

2

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

0.80

Specimen Reference

9

Specimen  
Depth

0.8

m

Sample Type

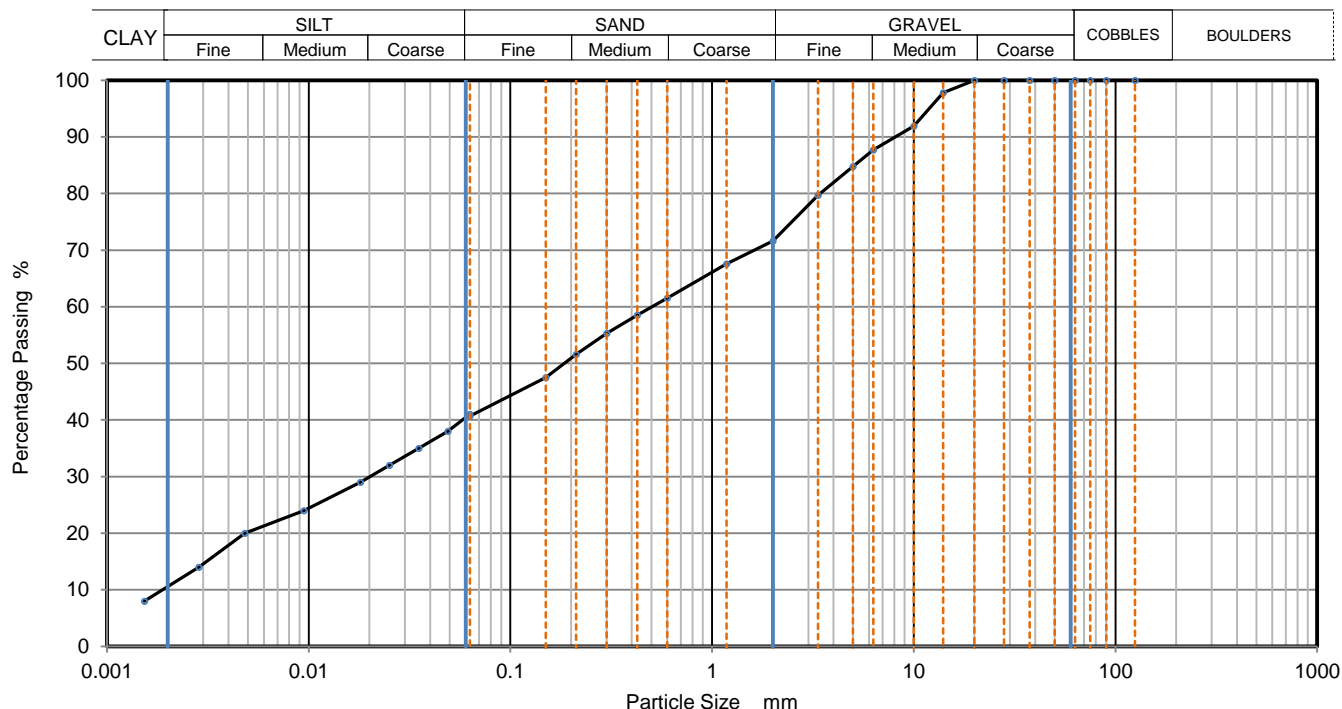
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus202203241



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.04903	38
75	100	0.03513	35
63	100	0.02517	32
50	100	0.01802	29
37.5	100	0.00948	24
28	100	0.00482	20
20	100	0.00285	14
14	98	0.00153	8
10	92		
6.3	88		
5	85		
3.35	80		
2	72		
1.18	68		
0.6	62	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	59		
0.3	55		
0.212	52		
0.15	48		
0.063	41		

Dry Mass of sample, g

501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	28.4
Sand	30.9
Silt	30.6
Clay	10.1

Grading Analysis		
D100	mm	
D60	mm	0.505
D30	mm	0.0209
D10	mm	0.00197
Uniformity Coefficient		260
Curvature Coefficient		0.44

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH04

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

1.80

Specimen Reference

6

Specimen  
Depth

1.8

m

Sample Type

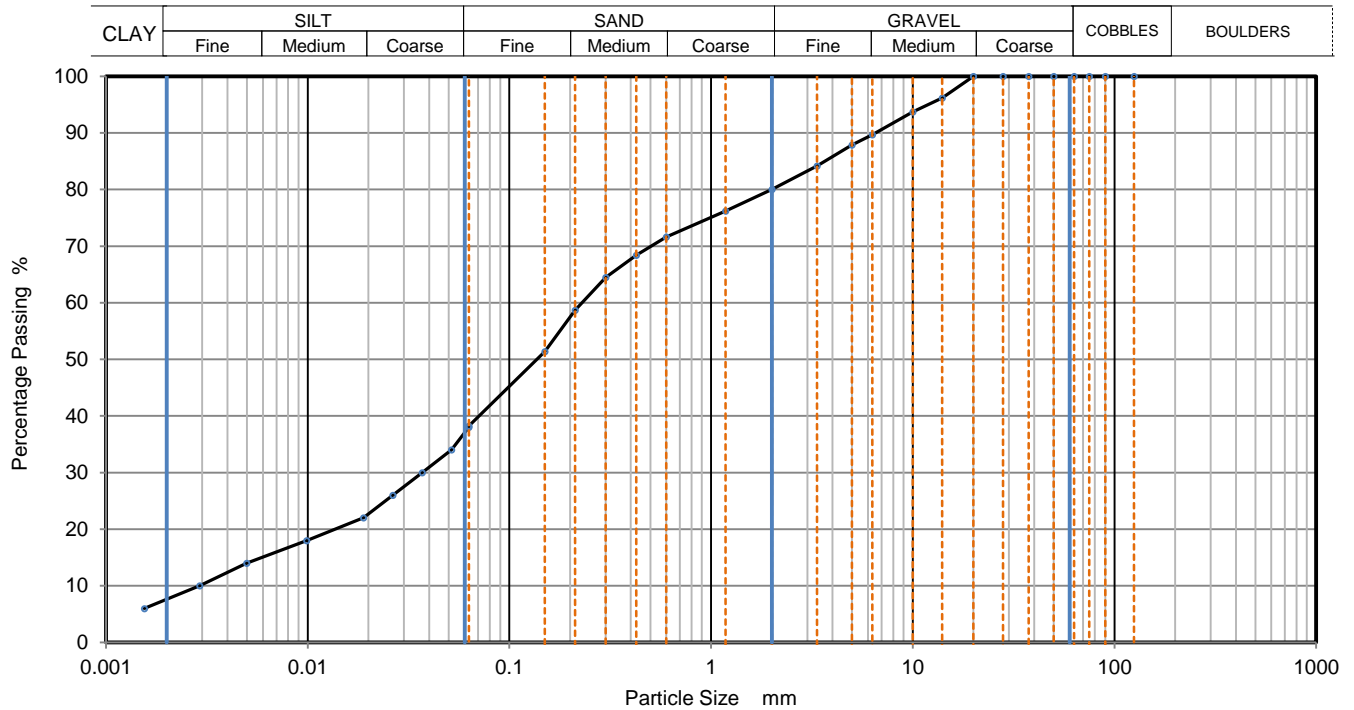
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus202203243



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	38
90	100	0.05160	34
75	100	0.03693	30
63	100	0.02642	26
50	100	0.01890	22
37.5	100	0.00987	18
28	100	0.00499	14
20	100	0.00291	10
14	96	0.00155	6
10	94		
6.3	90		
5	88		
3.35	84		
2	80		
1.18	76		
0.6	72	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	68		
0.3	65		
0.212	59		
0.15	51		
0.063	38		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.0
Sand	41.8
Silt	30.5
Clay	7.7

Grading Analysis		
D100	mm	
D60	mm	0.23
D30	mm	0.0364
D10	mm	0.00289
Uniformity Coefficient		80
Curvature Coefficient		2

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH06

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

0.30

Specimen Reference

9

Specimen  
Depth

0.3

m

Sample Type

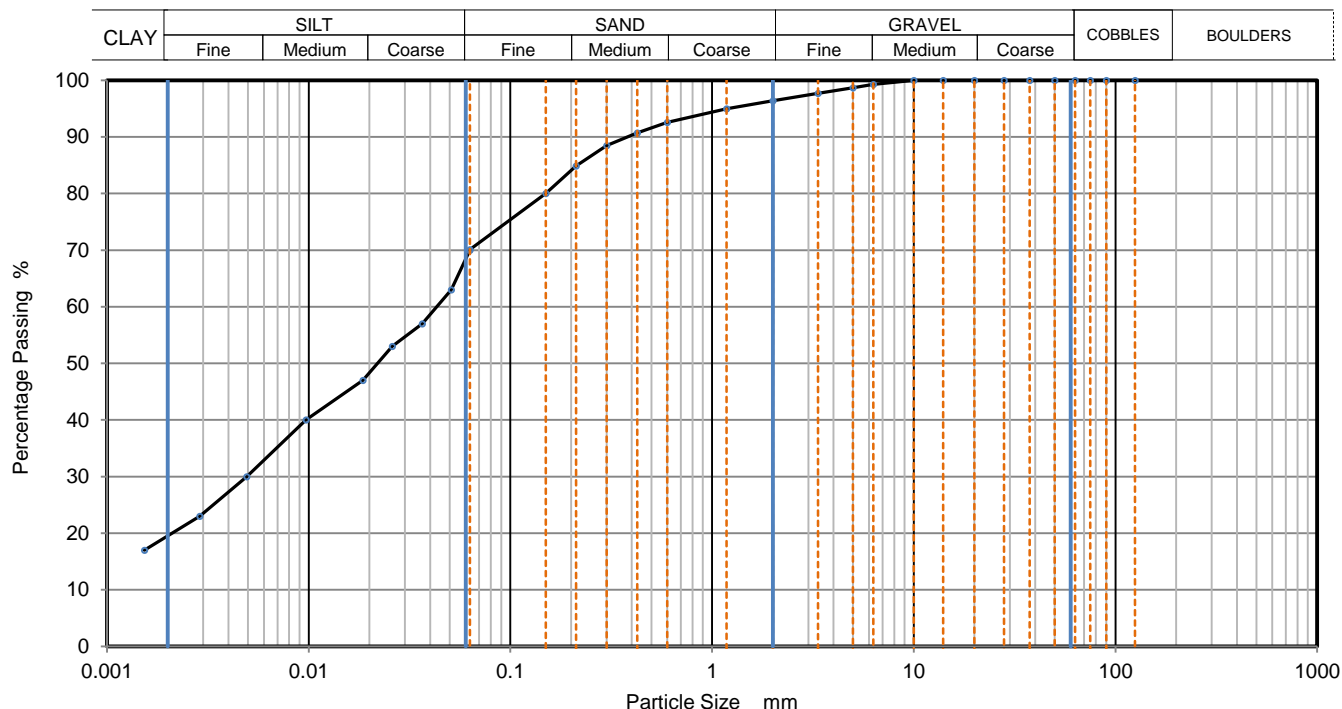
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus202203244



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	70
90	100	0.05097	63
75	100	0.03649	57
63	100	0.02596	53
50	100	0.01857	47
37.5	100	0.00970	40
28	100	0.00493	30
20	100	0.00288	23
14	100	0.00153	17
10	100		
6.3	99		
5	99		
3.35	98		
2	96		
1.18	95		
0.6	93	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	91		
0.3	89		
0.212	85		
0.15	80		
0.063	70		

Dry Mass of sample, g

501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	3.6
Sand	26.3
Silt	50.6
Clay	19.5

Grading Analysis		
D100	mm	
D60	mm	0.0429
D30	mm	0.00492
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH06

Site Name

North Irish Sea Array

Sample No.

6

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

2.80

Specimen Reference

9

Specimen  
Depth

2.8

m

Sample Type

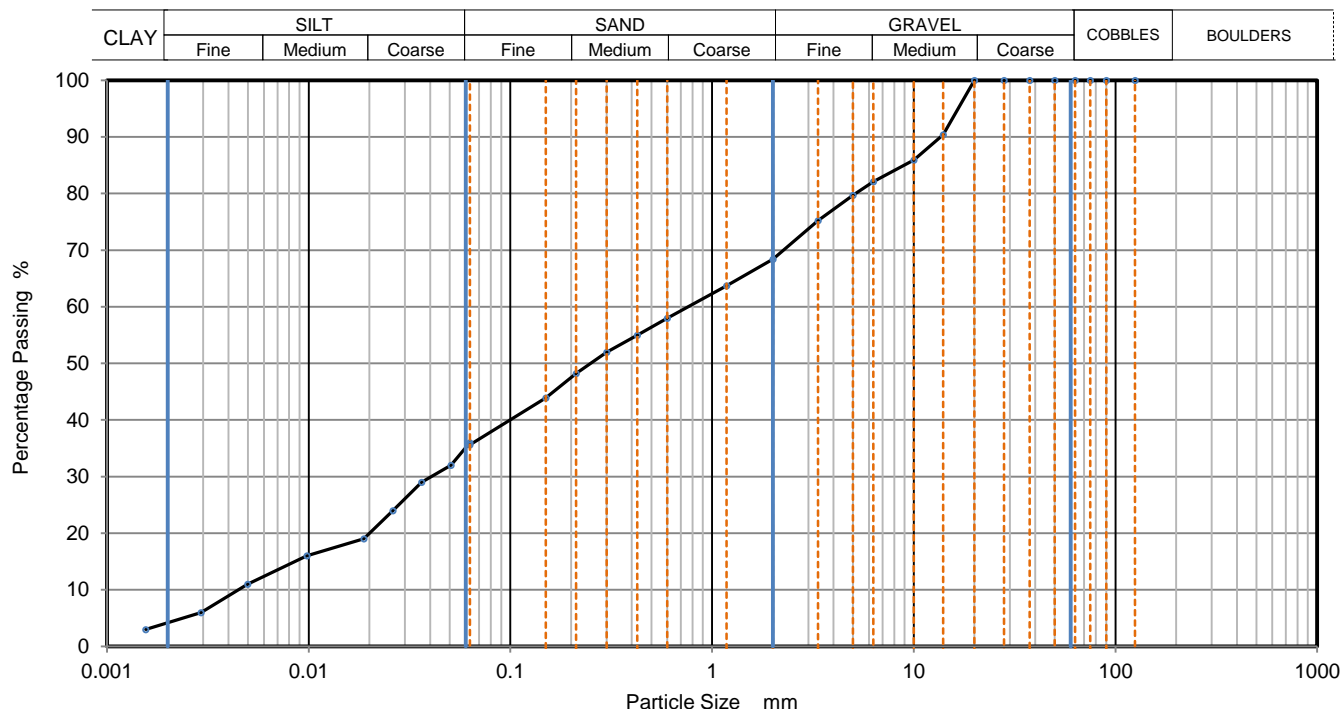
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus202203247



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	36
90	100	0.05065	32
75	100	0.03627	29
63	100	0.02611	24
50	100	0.01879	19
37.5	100	0.00981	16
28	100	0.00499	11
20	100	0.00293	6
14	90	0.00156	3
10	86		
6.3	82		
5	80		
3.35	75		
2	68		
1.18	64		
0.6	58	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	55		
0.3	52		
0.212	48		
0.15	44		
0.063	36		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	31.6
Sand	32.8
Silt	31.1
Clay	4.5

Grading Analysis		
D100	mm	
D60	mm	0.765
D30	mm	0.0397
D10	mm	0.00431
Uniformity Coefficient		180
Curvature Coefficient		0.48

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH07

Site Name

North Irish Sea Array

Sample No.

5

Soil Description

Greyish brown sandy gravelly silty CLAY.

Depth, m

1.80

Specimen Reference

7

Specimen  
Depth

1.8

m

Sample Type

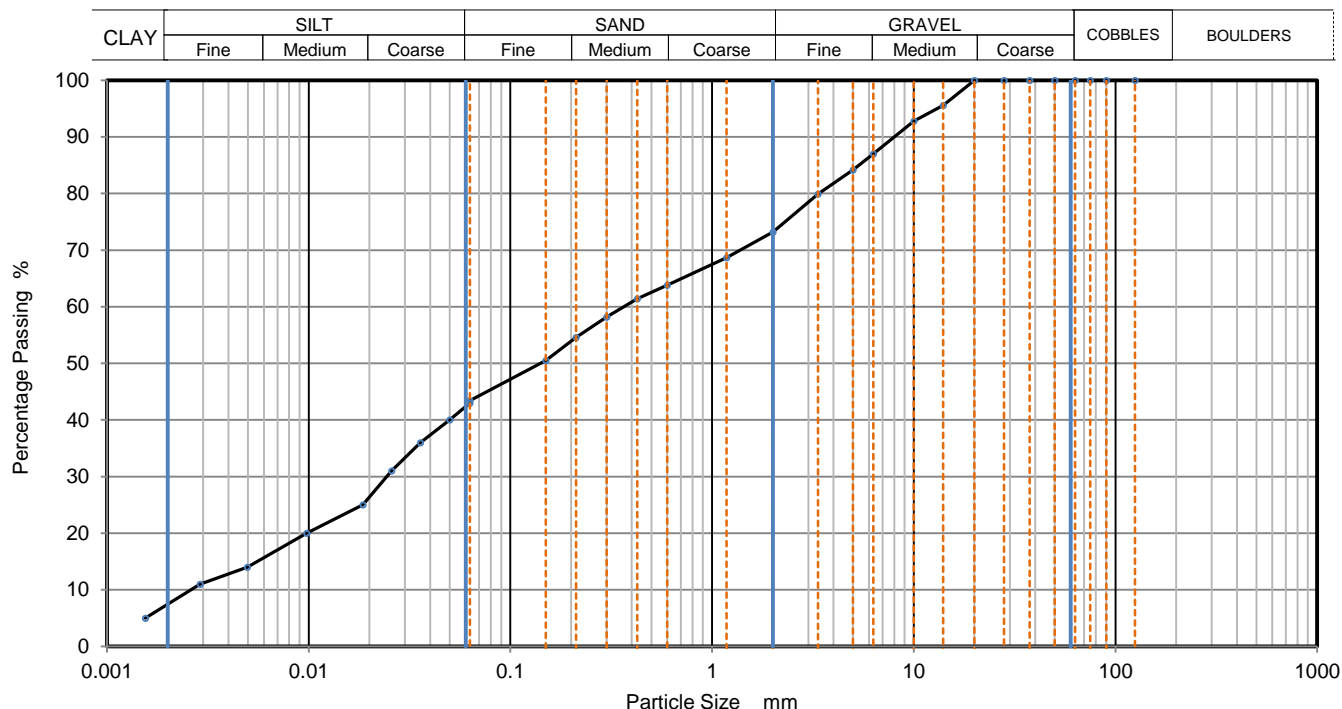
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032411



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	43
90	100	0.05001	40
75	100	0.03582	36
63	100	0.02580	31
50	100	0.01857	25
37.5	100	0.00976	20
28	100	0.00496	14
20	100	0.00290	11
14	96	0.00155	5
10	93		
6.3	87		
5	84		
3.35	80		
2	73		
1.18	69		
0.6	64	Particle density (assumed) 2.65 Mg/m3	
0.425	61		
0.3	58		
0.212	55		
0.15	51		
0.063	43		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.8
Sand	29.7
Silt	35.9
Clay	7.6

Grading Analysis		
D100	mm	
D60	mm	0.365
D30	mm	0.0247
D10	mm	0.00262
Uniformity Coefficient		140
Curvature Coefficient		0.63

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH07

Site Name

North Irish Sea Array

Sample No.

7

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

3.80

Specimen Reference

9

Specimen  
Depth

3.8

m

Sample Type

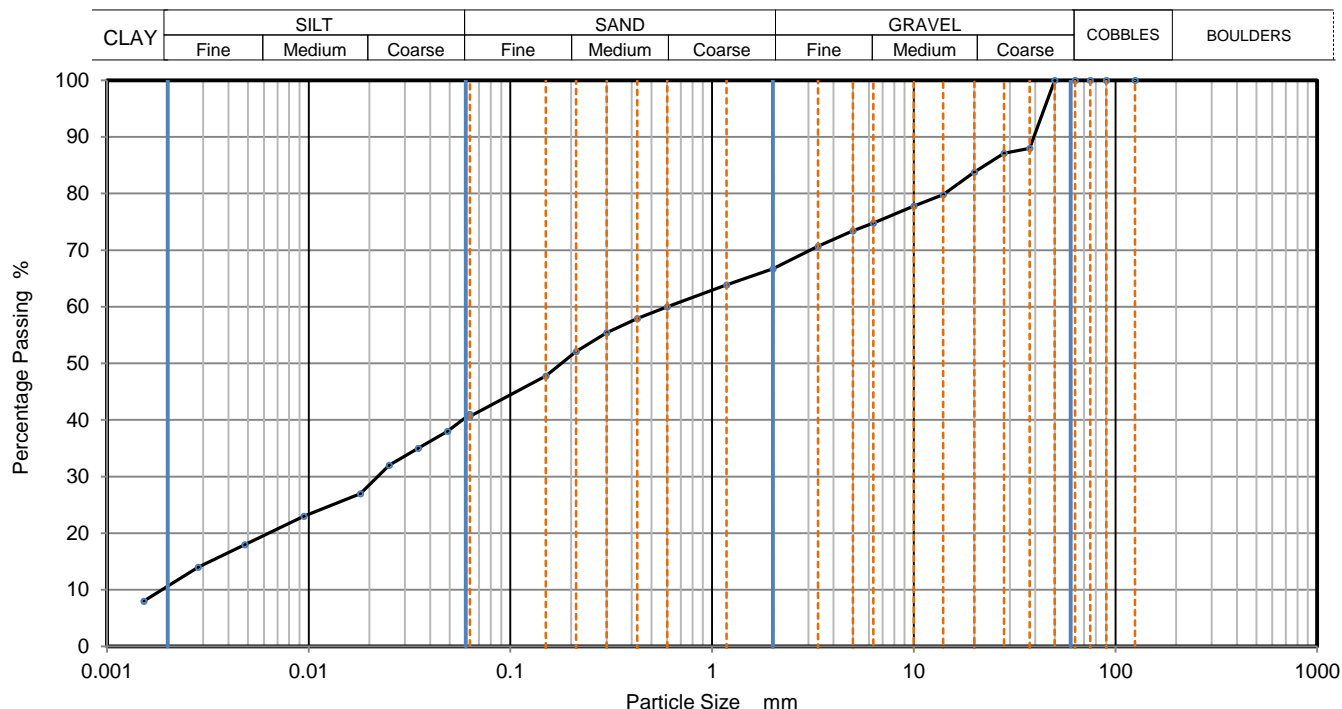
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032414



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.04875	38
75	100	0.03492	35
63	100	0.02501	32
50	100	0.01802	27
37.5	88	0.00947	23
28	87	0.00482	18
20	84	0.00283	14
14	80	0.00152	8
10	78		
6.3	75		
5	73		
3.35	71		
2	67		
1.18	64		
0.6	60	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	58		
0.3	55		
0.212	52		
0.15	48		
0.063	41		

Dry Mass of sample, g

2866

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	33.3
Sand	26.1
Silt	30.4
Clay	10.2

Grading Analysis		
D100	mm	
D60	mm	0.601
D30	mm	0.0223
D10	mm	0.00196
Uniformity Coefficient		310
Curvature Coefficient		0.42

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122



2183

# Final Report

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**Report No.:** 22-12440-1  
**Initial Date of Issue:** 11-Apr-2022  
**Client** Causeway Geotech Ltd

**Client Address:** 8 Drumahiskey Road  
Balnamore  
Ballymoney  
County Antrim  
BT53 7QL

**Contact(s):** Carin Cornwall  
Colm Hurley  
Darren O'Mahony  
Gabriella Horan  
Joe Gervin  
John Cameron  
Lucy Newland  
Martin Gardiner  
Matthew Gilbert  
Neil Haggan  
Paul Dunlop  
Sean Ross  
Stephen Franey  
Stephen Watson  
Stuart Abraham  
Thomas McAllister

**Project** 21-1619 North Irish Sea Array

**Quotation No.:** **Date Received:** 01-Apr-2022

**Order No.:** **Date Instructed:** 01-Apr-2022

**No. of Samples:** 3

**Turnaround (Wkdays):** 7 **Results Due:** 11-Apr-2022

**Date Approved:** 11-Apr-2022

**Approved By:**



**Details:** Stuart Henderson, Technical  
Manager

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## Results - Soil

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>				22-12440	22-12440	22-12440
Quotation No.:	<b>Chemtest Sample ID.:</b>				1403841	1403842	1403843
Order No.:	Client Sample Ref.:				2	4	7
	Sample Location:				BH04	BH06	BH07
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.8	0.8	3.8
	Date Sampled:				31-Mar-2022	31-Mar-2022	31-Mar-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>			
Moisture	N	2030	%	0.020	12	22	11
pH	U	2010		4.0	8.7	8.4	8.7
Sulphate (2:1 Water Soluble) as SO <sub>4</sub>	U	2120	g/l	0.010	0.026	0.022	< 0.010
Sulphate (Total)	U	2430	%	0.010	0.037	0.054	0.035
Sulphate (Acid Soluble)	U	2430	%	0.010	0.016	< 0.010	0.016

## Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.



## **Report Information**

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### **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

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### **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)

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### **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](mailto:customerservices@chemtest.com)

**SOIL AND ROCK SAMPLE ANALYSIS  
LABORATORY TEST REPORT**

15 April 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 24/03/2022 and 15/04/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.



Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 7

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	11
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	10
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	10
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	10
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 8	2

#### **SUB-CONTRACTED TESTS**

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.


<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	BRE Test - Suite B		4



## Summary of Classification Test Results

Project No.		Project Name												
21-1619		North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w	Passing	LL	PL	PI	Particle	Casagrande
	Ref	Top	Base	Type		bulk	dry	%	425µm	%	%	%	density	
						Mg/m3			%				Mg/m3	
BH05	3	0.30	0.50	B	Brown sandy slightly gravelly silty CLAY.			23.0	72	43	22	21		CI
BH05	5	1.80	2.00	B	Brown sandy slightly gravelly silty CLAY.			15.0	71	31	15	16		CL
BH05	6	2.80	3.00	B	Brown sandy slightly gravelly silty CLAY.			12.0	58	31	16	15		CL
BH05	14	3.00	3.45	U	Brown slightly sandy gravelly silty CLAY.			13.0	60	27	15	12		CL
BH05	8	4.80	5.00	B	Brown sandy slightly gravelly silty CLAY.			14.0						
BH05	15	6.00	6.45	U	Brown sandy slightly gravelly silty CLAY.			13.0	67	29	15	14		CL
BH16	3	0.30	0.50	B	Brown sandy slightly gravelly silty CLAY.			25.0	82	40	22	18		CI
BH16	5	1.80	2.00	B	Brown sandy slightly gravelly silty CLAY.			15.0	74	31	18	13		CL
BH16	7	3.80	4.00	B	Greyish brown sandy slightly gravelly silty CLAY.			13.0	69	28	15	13		CL
BH16	14	6.00	6.45	U	Greyish brown sandy slightly gravelly silty CLAY.			9.8	65	25	14	11		CL
BH16	15	9.00	9.45	U	Greyish brown sandy slightly gravelly silty CLAY.			10.0	63	25	14	11		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise LAB 01R Version 5

Key			Date Printed	Approved By	 <b>UKAS</b> TESTING 10122
Density test	Liquid Limit	Particle density	15/04/2022	Stephen.Watson	
Linear measurement unless :	4pt cone unless :	sp - small pyknometer			
wd - water displacement	cas - Casagrande method	gj - gas jar			
wi - immersion in water	1pt - single point test				



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

0.30

Specimen Reference

6

Specimen  
Depth

0.3

m

Sample Type

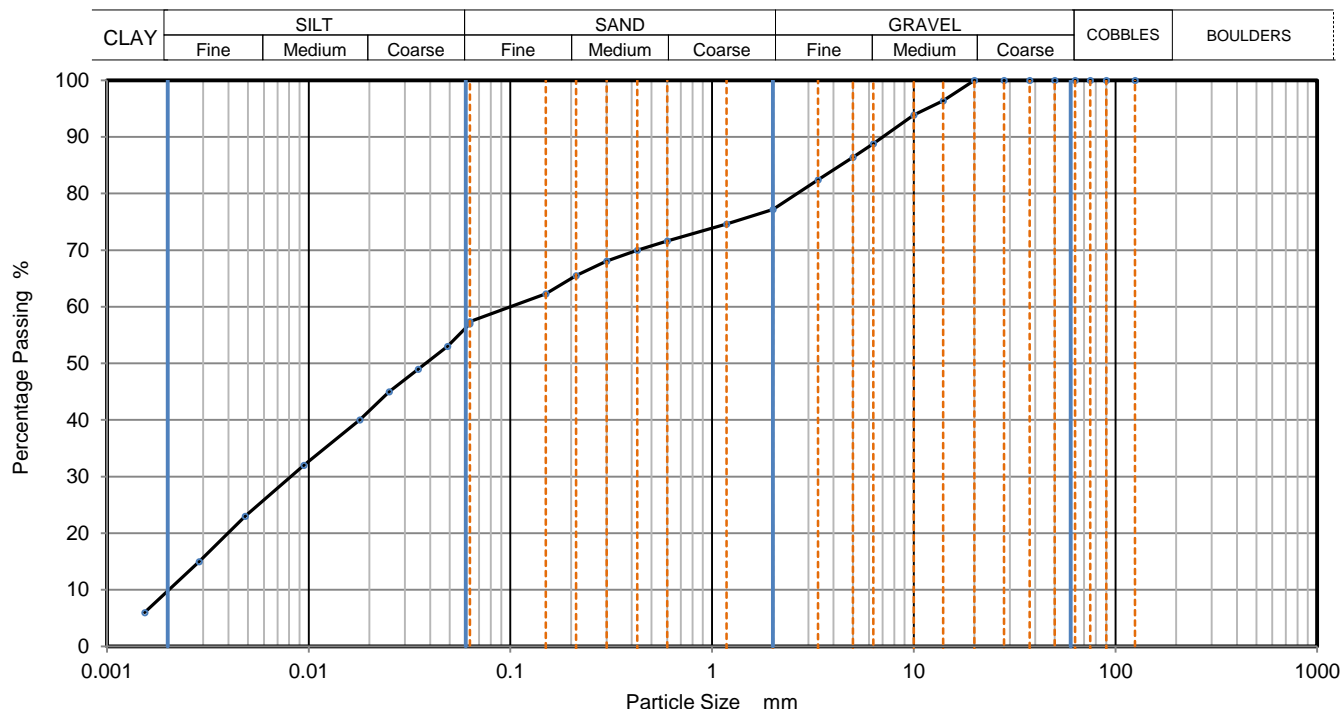
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus202203298



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	57
90	100	0.04875	53
75	100	0.03492	49
63	100	0.02501	45
50	100	0.01791	40
37.5	100	0.00947	32
28	100	0.00485	23
20	100	0.00286	15
14	96	0.00154	6
10	94		
6.3	89		
5	86		
3.35	82		
2	77		
1.18	75		
0.6	72	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	70		
0.3	68		
0.212	66		
0.15	62		
0.063	57		

Dry Mass of sample, g

503

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.8
Sand	19.8
Silt	47.4
Clay	10.0

Grading Analysis		
D100	mm	
D60	mm	0.0996
D30	mm	0.00816
D10	mm	0.002
Uniformity Coefficient		50
Curvature Coefficient		0.33

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

5

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

1.80

Specimen Reference

6

Specimen  
Depth

1.8

m

Sample Type

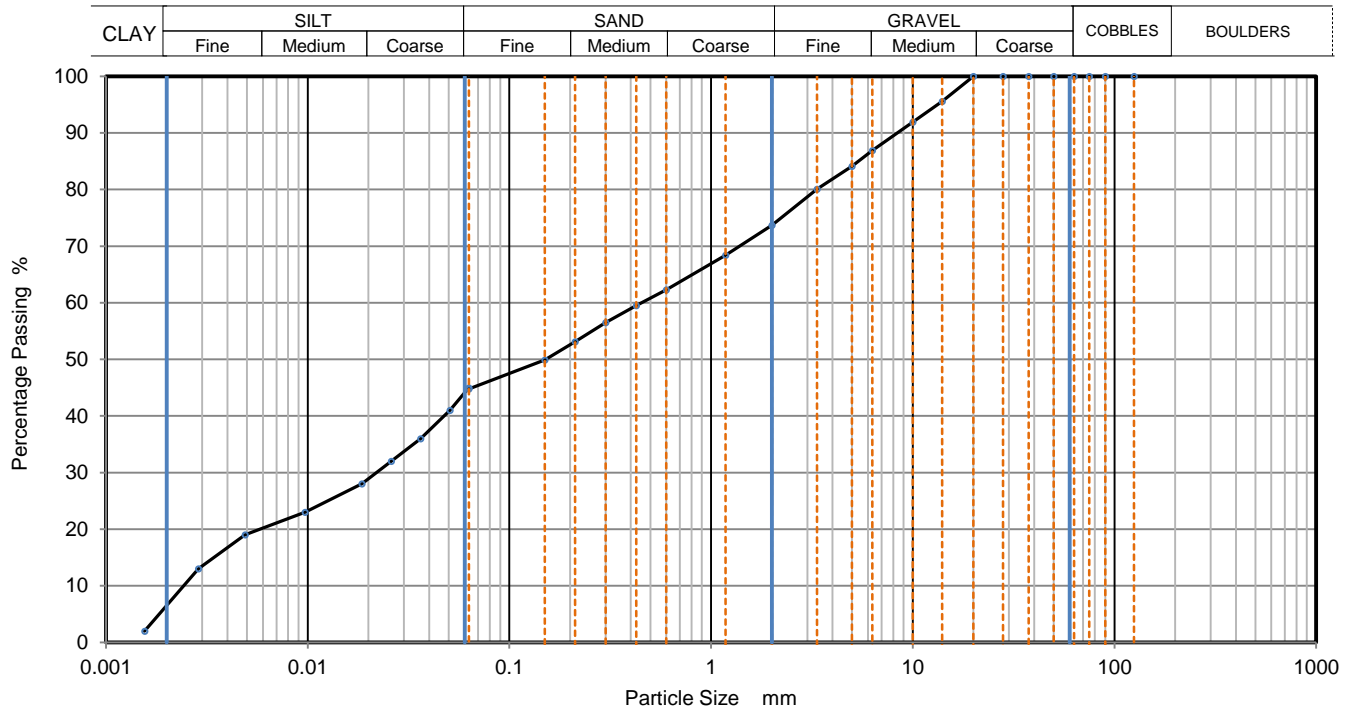
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus202203299



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	45
90	100	0.05065	41
75	100	0.03625	36
63	100	0.02594	32
50	100	0.01855	28
37.5	100	0.00969	23
28	100	0.00490	19
20	100	0.00287	13
14	96	0.00155	2
10	92		
6.3	87		
5	84		
3.35	80		
2	74		
1.18	68		
0.6	62	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	60		
0.3	57		
0.212	53		
0.15	50		
0.063	45		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.3
Sand	28.9
Silt	38.3
Clay	6.5

Grading Analysis		
D100	mm	
D60	mm	0.451
D30	mm	0.0222
D10	mm	0.00245
Uniformity Coefficient		180
Curvature Coefficient		0.45

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

6

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

2.80

Specimen Reference

6

Specimen  
Depth

2.8

m

Sample Type

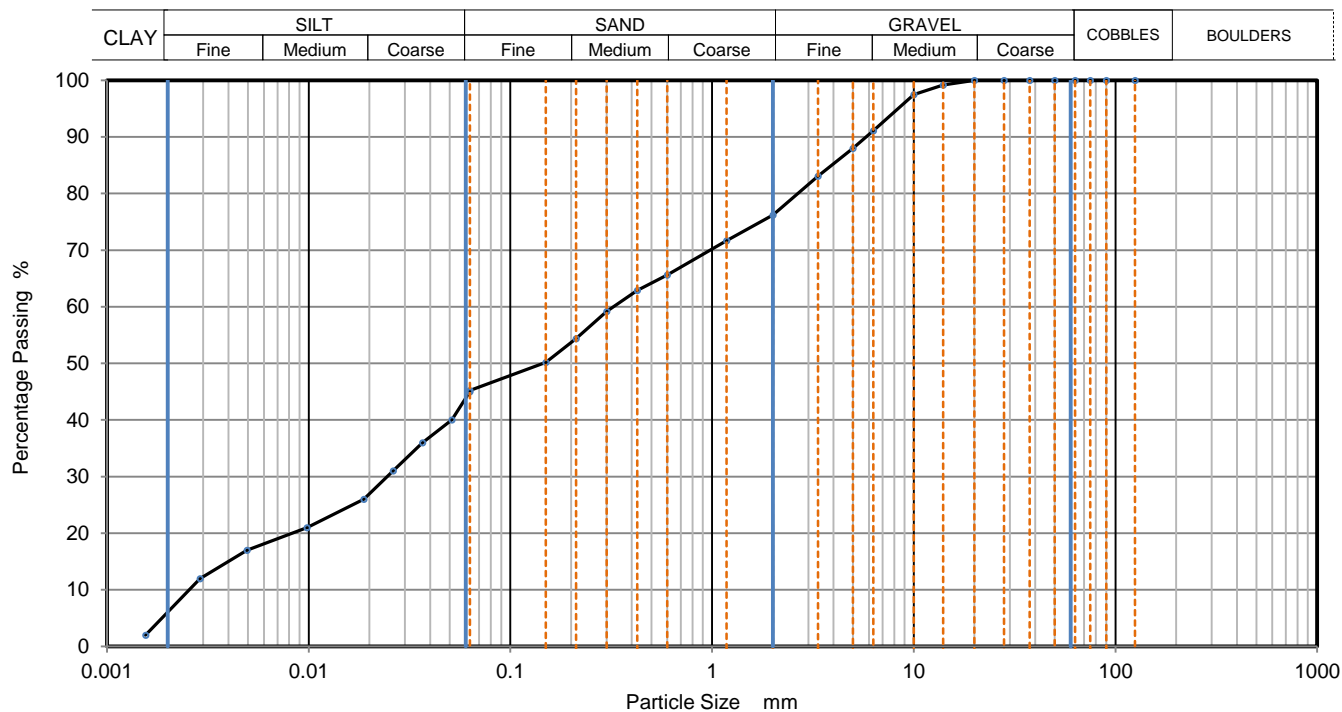
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032910



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	45
90	100	0.05127	40
75	100	0.03668	36
63	100	0.02624	31
50	100	0.01877	26
37.5	100	0.00980	21
28	100	0.00495	17
20	100	0.00289	12
14	99	0.00155	2
10	98		
6.3	91		
5	88		
3.35	83		
2	76		
1.18	72		
0.6	66	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	63		
0.3	59		
0.212	54		
0.15	50		
0.063	45		

Dry Mass of sample, g

501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.8
Sand	31.1
Silt	38.8
Clay	6.3

Grading Analysis		
D100	mm	
D60	mm	0.324
D30	mm	0.0246
D10	mm	0.00255
Uniformity Coefficient		130
Curvature Coefficient		0.73

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

14

Soil Description

Brown slightly sandy gravelly silty CLAY.

Depth, m

3.00

Specimen Reference

7

Specimen  
Depth

3

m

Sample Type

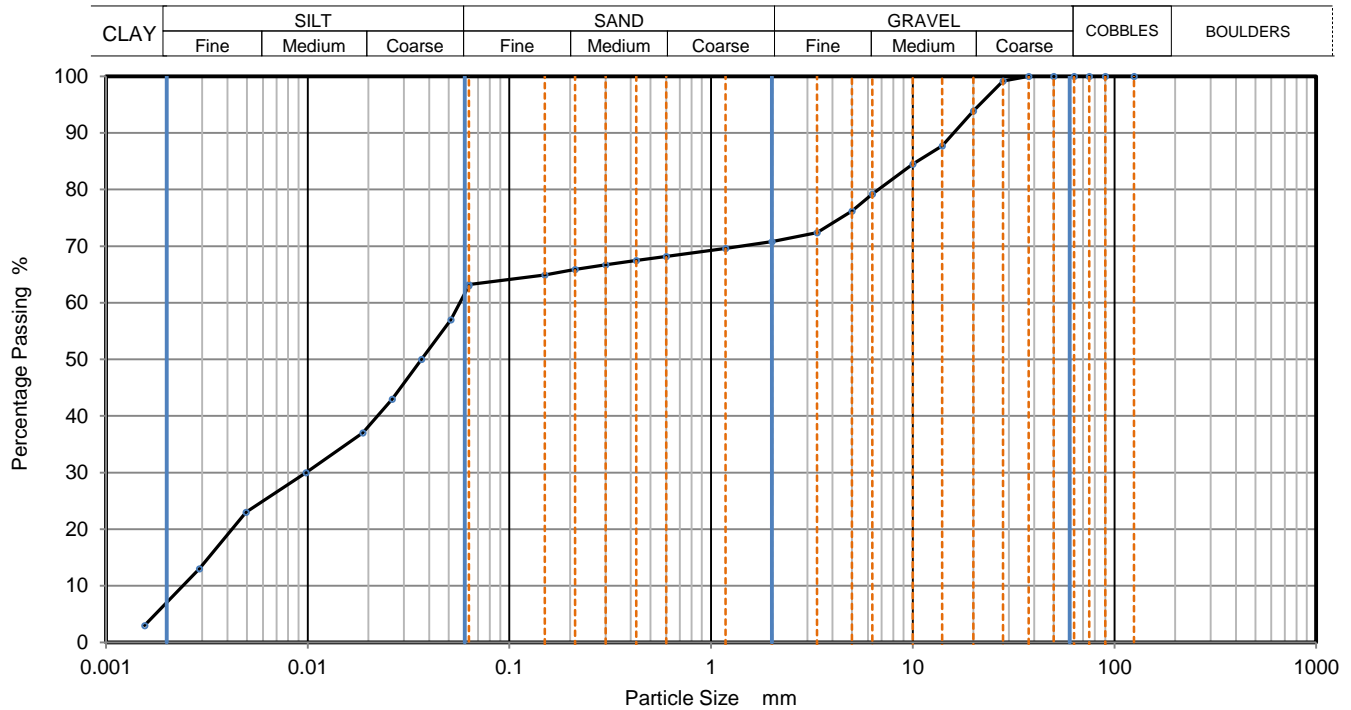
U

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032911



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	63
90	100	0.05127	57
75	100	0.03668	50
63	100	0.02624	43
50	100	0.01877	37
37.5	100	0.00980	30
28	99	0.00495	23
20	94	0.00290	13
14	88	0.00155	3
10	85		
6.3	79		
5	76		
3.35	72		
2	71		
1.18	70		
0.6	68	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	68		
0.3	67		
0.212	66		
0.15	65		
0.063	63		

Dry Mass of sample, g

2785

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	29.2
Sand	7.6
Silt	55.8
Clay	7.4

Grading Analysis		
D100	mm	
D60	mm	0.057
D30	mm	0.00986
D10	mm	0.00236
Uniformity Coefficient		24
Curvature Coefficient		0.72

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

15

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

6.00

Specimen Reference

6

Specimen  
Depth

6

m

Sample Type

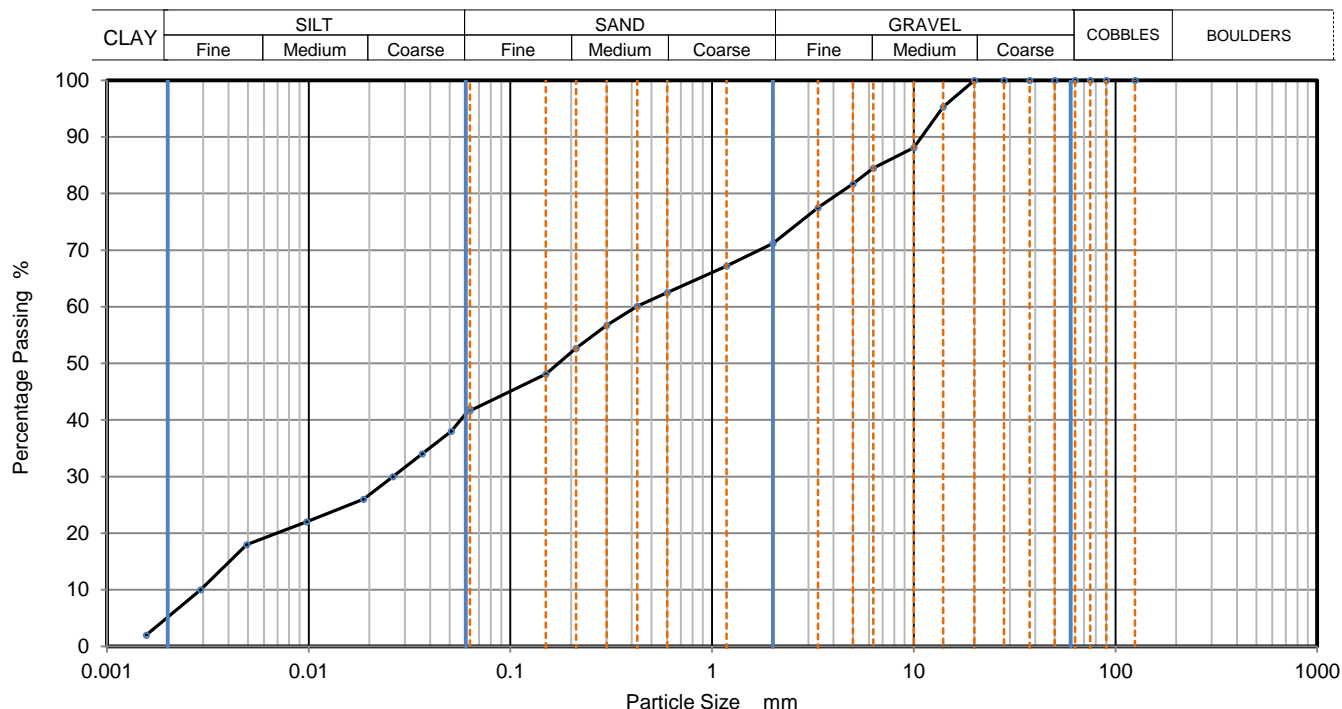
U

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032913



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05097	38
75	100	0.03649	34
63	100	0.02611	30
50	100	0.01868	26
37.5	100	0.00976	22
28	100	0.00493	18
20	100	0.00291	10
14	95	0.00156	2
10	88		
6.3	85		
5	82		
3.35	78		
2	71		
1.18	67		
0.6	63	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	60		
0.3	57		
0.212	53		
0.15	48		
0.063	42		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	28.8
Sand	29.6
Silt	36.5
Clay	5.1

Grading Analysis		
D100	mm	
D60	mm	0.422
D30	mm	0.0267
D10	mm	0.00293
Uniformity Coefficient		140
Curvature Coefficient		0.58

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH16

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

0.30

Specimen Reference

6

Specimen  
Depth

0.3

m

Sample Type

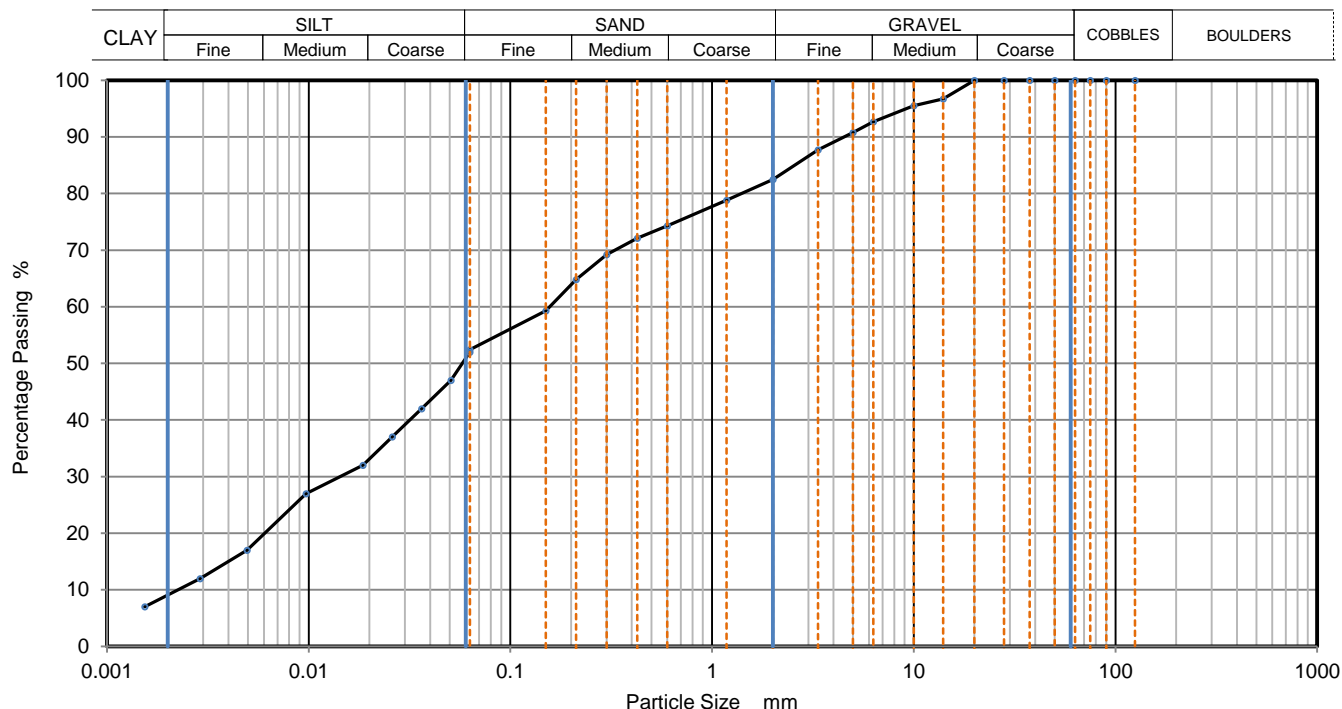
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032914



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	52
90	100	0.05065	47
75	100	0.03625	42
63	100	0.02594	37
50	100	0.01855	32
37.5	100	0.00969	27
28	100	0.00495	17
20	100	0.00289	12
14	97	0.00154	7
10	96		
6.3	93		
5	91		
3.35	88		
2	83		
1.18	79		
0.6	74	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	72		
0.3	69		
0.212	65		
0.15	59		
0.063	52		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.5
Sand	30.0
Silt	42.9
Clay	9.6

Grading Analysis		
D100	mm	
D60	mm	0.157
D30	mm	0.0135
D10	mm	0.00211
Uniformity Coefficient		74
Curvature Coefficient		0.55

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH16

Site Name

North Irish Sea Array

Sample No.

5

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

1.80

Specimen Reference

6

Specimen  
Depth

1.8

m

Sample Type

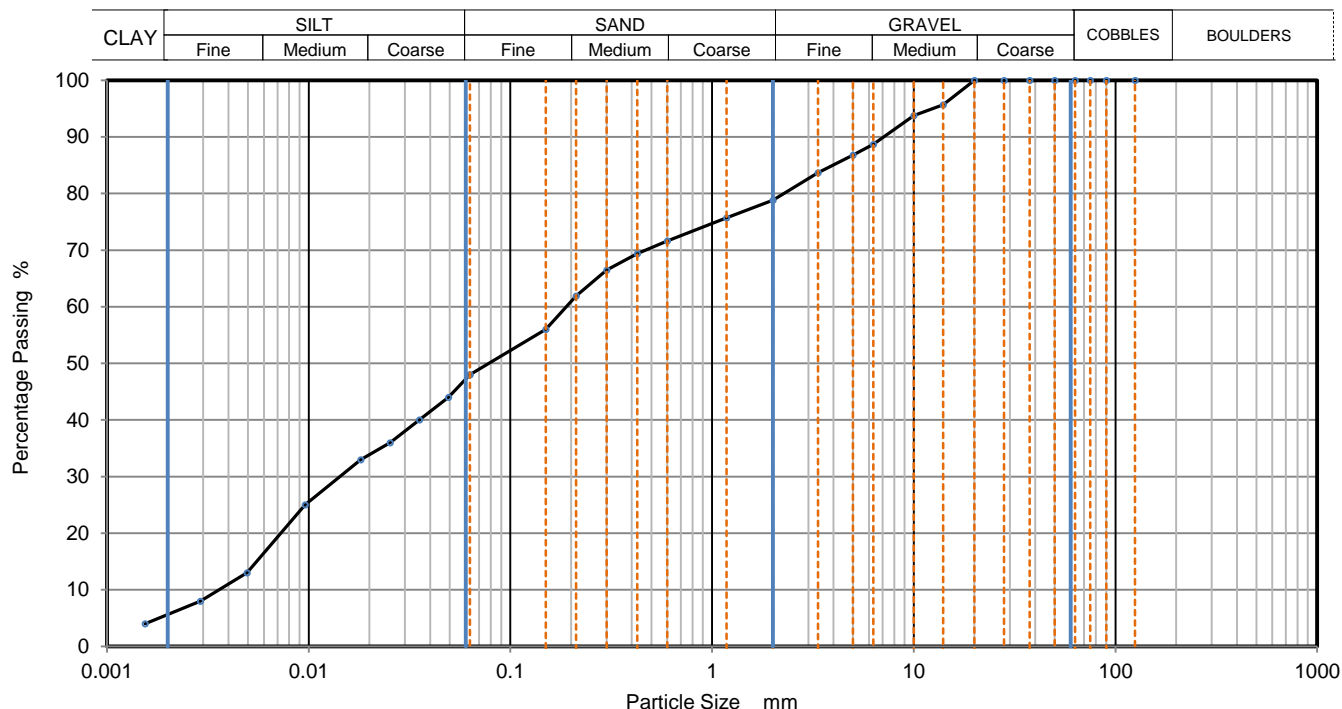
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032915



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.04939	44
75	100	0.03537	40
63	100	0.02532	36
50	100	0.01813	33
37.5	100	0.00958	25
28	100	0.00495	13
20	100	0.00290	8
14	96	0.00154	4
10	94		
6.3	89		
5	87		
3.35	84		
2	79		
1.18	76		
0.6	72	Particle density (assumed) 2.65 Mg/m3	
0.425	69		
0.3	67		
0.212	62		
0.15	56		
0.063	48		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.2
Sand	30.8
Silt	42.6
Clay	5.4

Grading Analysis		
D100	mm	
D60	mm	0.19
D30	mm	0.0146
D10	mm	0.0036
Uniformity Coefficient		53
Curvature Coefficient		0.31

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH16

Site Name

North Irish Sea Array

Sample No.

7

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

3.80

Specimen Reference

6

Specimen  
Depth

3.8

m

Sample Type

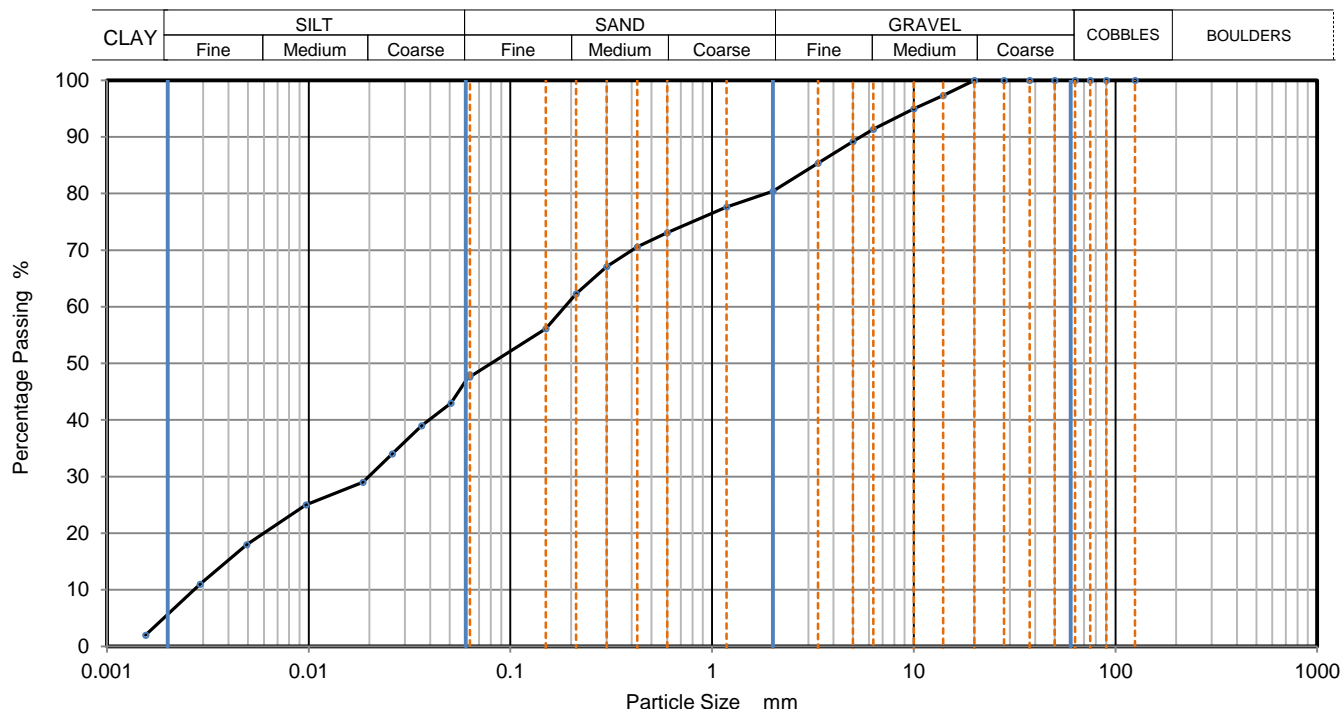
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032916



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.05065	43
75	100	0.03625	39
63	100	0.02594	34
50	100	0.01855	29
37.5	100	0.00969	25
28	100	0.00493	18
20	100	0.00289	11
14	97	0.00155	2
10	95		
6.3	91		
5	89		
3.35	85		
2	80		
1.18	78		
0.6	73	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	71		
0.3	67		
0.212	62		
0.15	56		
0.063	48		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.6
Sand	32.8
Silt	41.6
Clay	6.0

Grading Analysis		
D100	mm	
D60	mm	0.186
D30	mm	0.0193
D10	mm	0.00264
Uniformity Coefficient		71
Curvature Coefficient		0.76

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH16

Site Name

North Irish Sea Array

Sample No.

14

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

6.00

Specimen Reference

7

Specimen  
Depth

6

m

Sample Type

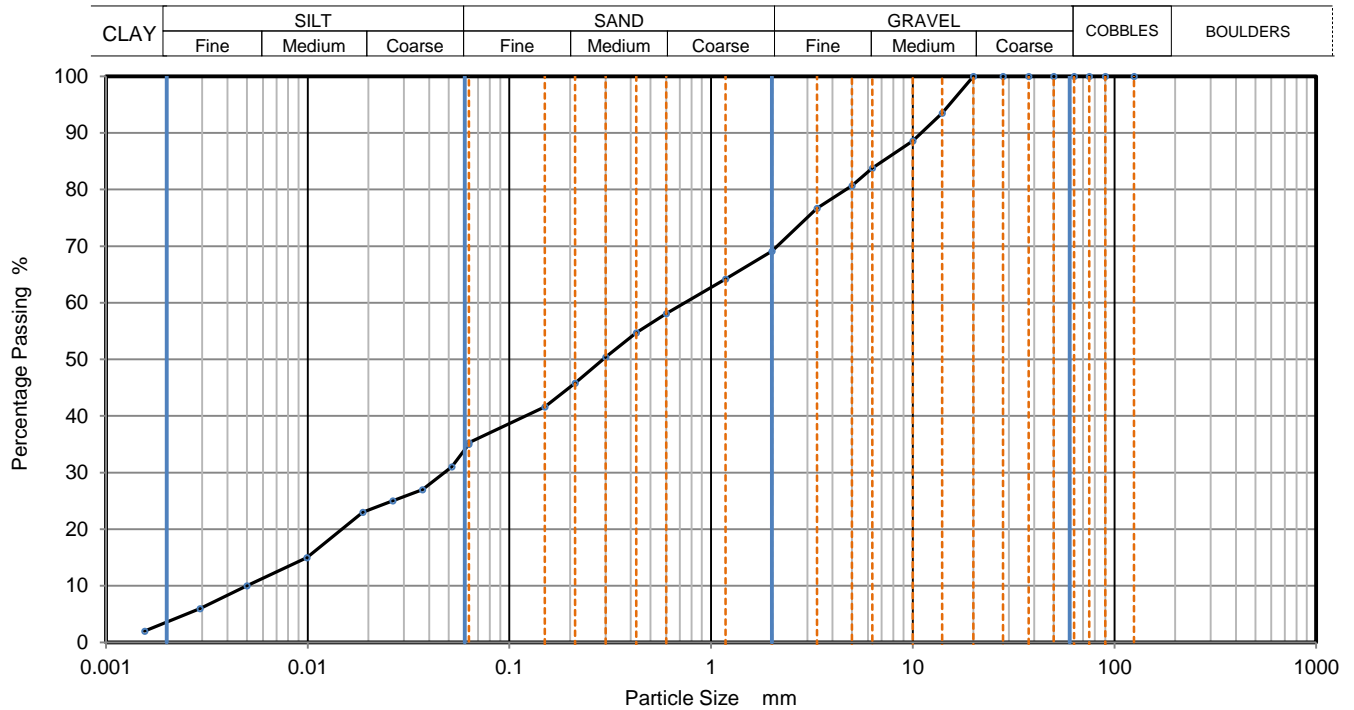
U

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032918



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	35
90	100	0.05188	31
75	100	0.03711	27
63	100	0.02639	25
50	100	0.01877	23
37.5	100	0.00990	15
28	100	0.00501	10
20	100	0.00292	6
14	94	0.00155	2
10	89		
6.3	84		
5	81		
3.35	77		
2	69		
1.18	64		
0.6	58	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	55		
0.3	50		
0.212	46		
0.15	42		
0.063	35		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	30.9
Sand	33.8
Silt	31.6
Clay	3.7

Grading Analysis		
D100	mm	
D60	mm	0.739
D30	mm	0.0473
D10	mm	0.00476
Uniformity Coefficient		160
Curvature Coefficient		0.64

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH16

Site Name

North Irish Sea Array

Sample No.

15

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

9.00

Specimen Reference

6

Specimen  
Depth

9

m

Sample Type

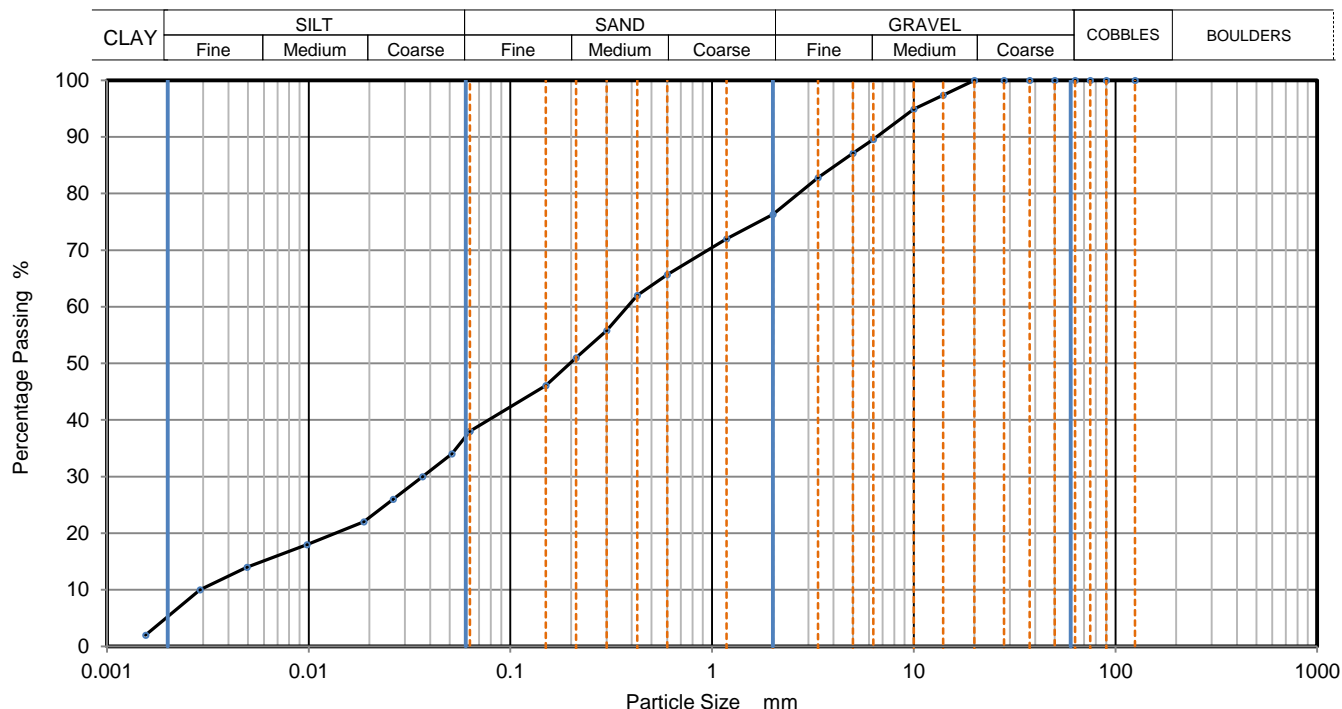
U

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032919



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	38
90	100	0.05127	34
75	100	0.03668	30
63	100	0.02624	26
50	100	0.01877	22
37.5	100	0.00980	18
28	100	0.00495	14
20	100	0.00289	10
14	97	0.00155	2
10	95		
6.3	90		
5	87		
3.35	83		
2	76		
1.18	72		
0.6	66	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	62		
0.3	56		
0.212	51		
0.15	46		
0.063	38		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.7
Sand	38.2
Silt	32.8
Clay	5.3

Grading Analysis		
D100	mm	
D60	mm	0.38
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# **Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**

		Job Ref	21-1619
		Borehole/Pit No.	BH05
Site Name	North Irish Sea Array		Sample No. 14
Soil Description	Brown slightly sandy gravelly silty CLAY.		Depth 3.00
Specimen Reference	8	Specimen Depth 3.05 m	Sample Type U
Specimen Description	Stiff brown slightly sandy gravelly silty CLAY.		KeyLAB ID Caus2022032911
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		Date of test 04/04/2022

Test Number

Length

Diameter

Bulk Density

Moisture Content

Dry Density

Rate of Strain

Cell Pressure

At failure

Axial Strain

Deviator Stress, ( $\sigma_1 - \sigma_3$ )<sub>f</sub>

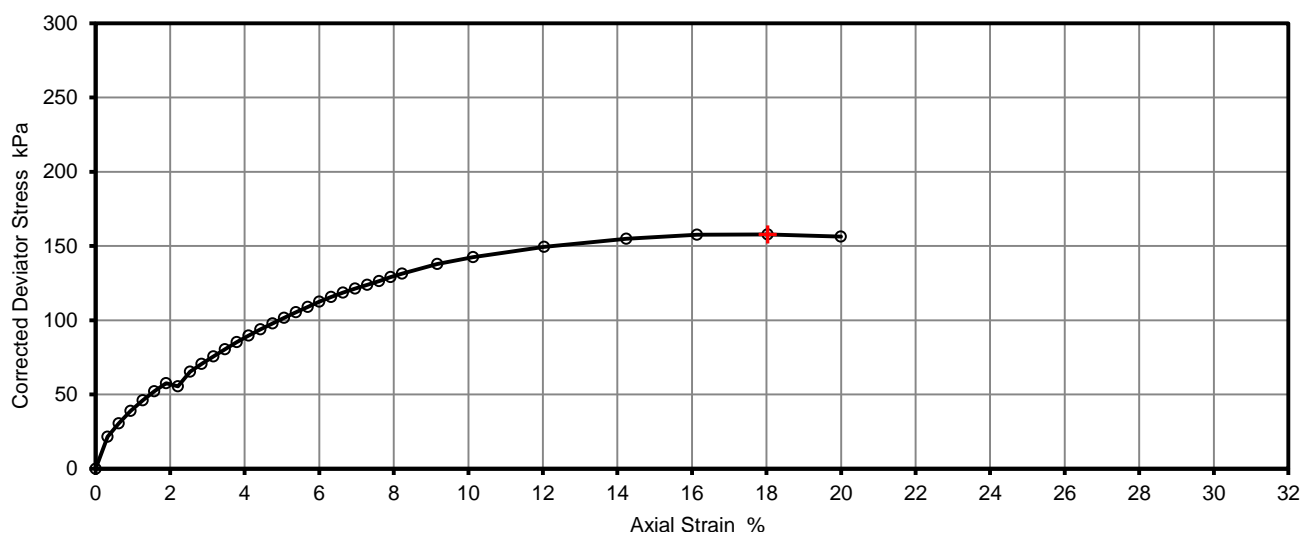
Undrained Shear Strength,  $c_u$

Mode of Failure

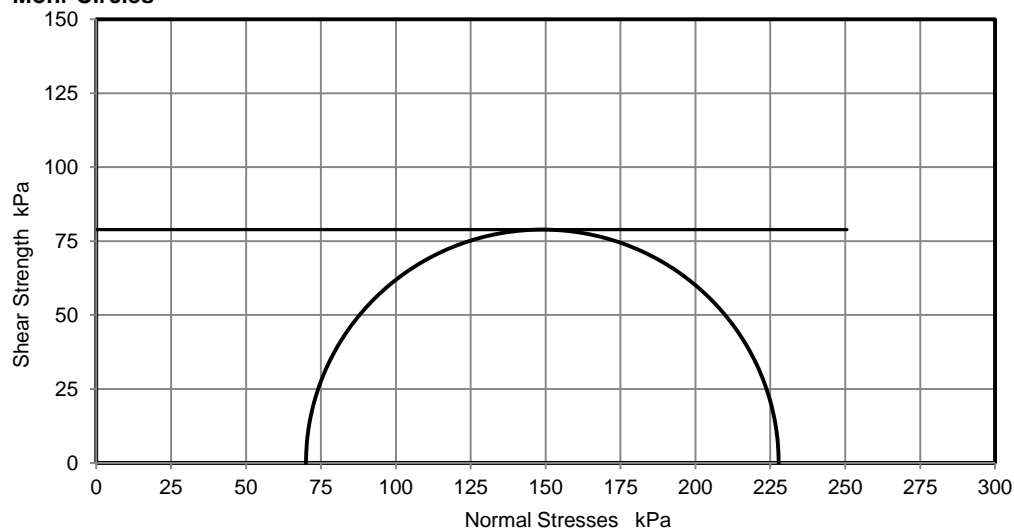
1	
210.1	mm
104.3	mm
2.19	Mg/m <sup>3</sup>
11	%
1.97	Mg/m <sup>3</sup>

4.0	%/min
70	kPa
18.0	%
158	kPa
79	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Compound	

## **Deviator Stress v Axial Strain**



## **Mohr Circles**



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks

Approved

Stephen.Watson

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15/04/2022 10:11







# **Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**

Job Ref	21-1619
Borehole/Pit No.	BH16
Sample No.	14
Depth	6.00
Sample Type	U
KeyLAB ID	Caus2022032918
Date of test	04/04/2022

Site Name	North Irish Sea Array		
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.		
Specimen Reference	8	Specimen Depth	6.05 m
Specimen Description	Firm greyish brown sandy slightly gravelly silty CLAY.		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number  
Length  
Diameter  
Bulk Density  
Moisture Content  
Dry Density

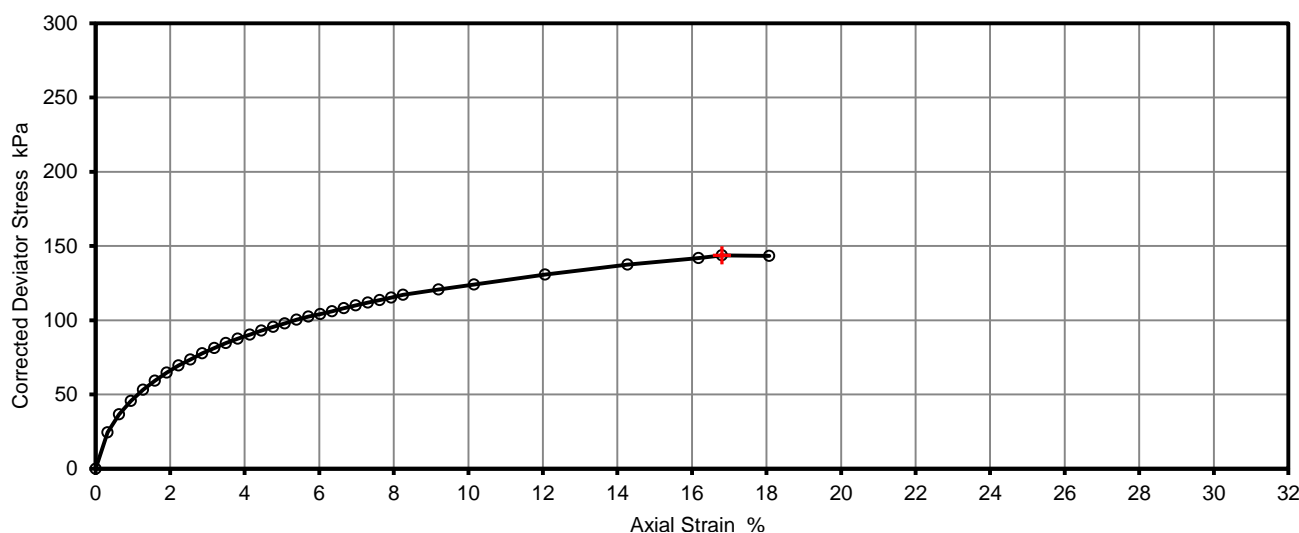
1	
210.0	mm
105.4	mm
2.28	Mg/m3
14	%
2.00	Mg/m3

Rate of Strain  
Cell Pressure  
At failure

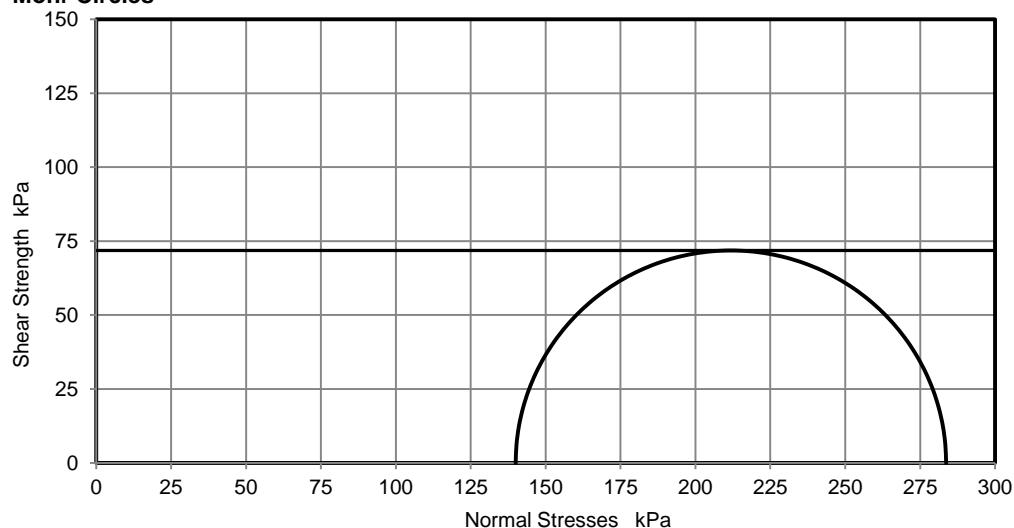
4.0	%/min
140	kPa
16.8	%
144	kPa
72	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Plastic	

Axial Strain  
Deviator Stress,  $(\sigma_1 - \sigma_3)_f$   
Undrained Shear Strength,  $c_u$   
Mode of Failure

**Deviator Stress v Axial Strain**



**Mohr Circles**



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks

Approved

Stephen.Watson

Printed

15/04/2022 10:11





2183

# Final Report

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**Report No.:** 22-12442-1  
**Initial Date of Issue:** 08-Apr-2022  
**Client** Causeway Geotech Ltd

**Client Address:** 8 Drumahiskey Road  
Balnamore  
Ballymoney  
County Antrim  
BT53 7QL

**Contact(s):** Carin Cornwall  
Colm Hurley  
Darren O'Mahony  
Gabriella Horan  
Joe Gervin  
John Cameron  
Lucy Newland  
Martin Gardiner  
Matthew Gilbert  
Neil Haggan  
Paul Dunlop  
Sean Ross  
Stephen Franey  
Stephen Watson  
Stuart Abraham  
Thomas McAllister

**Project** 21-1619 North Irish Sea Array

**Quotation No.:** **Date Received:** 01-Apr-2022

**Order No.:** **Date Instructed:** 01-Apr-2022

**No. of Samples:** 4

**Turnaround (Wkdays):** 7 **Results Due:** 11-Apr-2022

**Date Approved:** 08-Apr-2022

**Approved By:**



**Details:** Stuart Henderson, Technical  
Manager

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## Results - Soil

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>				22-12442	22-12442	22-12442	22-12442
Quotation No.:	<b>Chemtest Sample ID.:</b>				1403851	1403852	1403853	1403854
Order No.:	Client Sample Ref.:				3	5	5	8
	Sample Location:				BH05	BH05	BH16	BH16
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.3	1.8	1.8	4.8
	Date Sampled:				31-Mar-2022	31-Mar-2022	31-Mar-2022	31-Mar-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>				
Moisture	N	2030	%	0.020	22	15	16	14
pH	U	2010		4.0	8.4	8.6	8.8	8.8
Sulphate (2:1 Water Soluble) as SO <sub>4</sub>	U	2120	g/l	0.010	0.048	0.029	0.019	0.052
Sulphate (Total)	U	2430	%	0.010	0.66	1.9	0.28	0.040
Sulphate (Acid Soluble)	U	2430	%	0.010	< 0.010	0.24	0.19	0.19

## Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## **Report Information**

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### **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)

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### **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](mailto:customerservices@chemtest.com)





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Company Number: NI610766

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Registered in Ireland.  
Company Number: 633786

[www.causewaygeotech.com](http://www.causewaygeotech.com)

## SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

20 April 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 28/03/2022 and 20/04/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 8

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	14
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	8
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	6
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	5
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 8	2

#### **SUB-CONTRACTED TESTS**

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	BRE Test - Suite B		2

## Summary of Classification Test Results

Project No.		Project Name												
21-1619		North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w	Passing	LL	PL	PI	Particle	Casagrande
	Ref	Top	Base	Type		bulk	dry	%	425µm	%	%	%	density	
						Mg/m3			%	%	%	%	Mg/m3	
BH09	3	0.30	0.50	B	Brown sandy slightly gravelly silty CLAY.			22.0	81	30	18	12		CL
BH09	5	1.80	2.00	B	Brown sandy slightly gravelly silty CLAY.			14.0	77	25	15	10		CL
BH09	10	3.00		D	Brown sandy slightly gravelly silty CLAY.			8.0						
BH09	6	3.80	4.00	B	Brown sandy gravelly silty CLAY.			11.0	58	25	14	11		CL
BH09	7	4.80	5.00	B	Brown sandy slightly gravelly silty CLAY.			12.0						
BH09	8	5.80	6.00	B	Brown sandy clayey subangular fine to coarse GRAVEL.			6.2	53	24	13	11		CL
BH15	4	0.80	1.00	B	Brown sandy slightly gravelly silty CLAY.			16.0	69	33	18	15		CL
BH15	5	1.80	2.00	B	Greyish brown sandy slightly gravelly silty CLAY.			14.0						
BH15	6	2.80	3.00	B	Greyish brown sandy slightly gravelly silty CLAY.			14.0	70	28	16	12		CL
BH15	7	3.80	4.00	B	Greyish brown sandy slightly gravelly silty CLAY.			16.0						
BH15	8	4.80	5.00	B	Greyish brown sandy slightly gravelly silty CLAY.			15.0	70	27	14	13		CL
BH15	9	5.80	6.00	B	Greyish brown sandy slightly gravelly silty CLAY.			15.0						

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 5

### Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

20/04/2022

Approved By

Stephen.Watson




10122




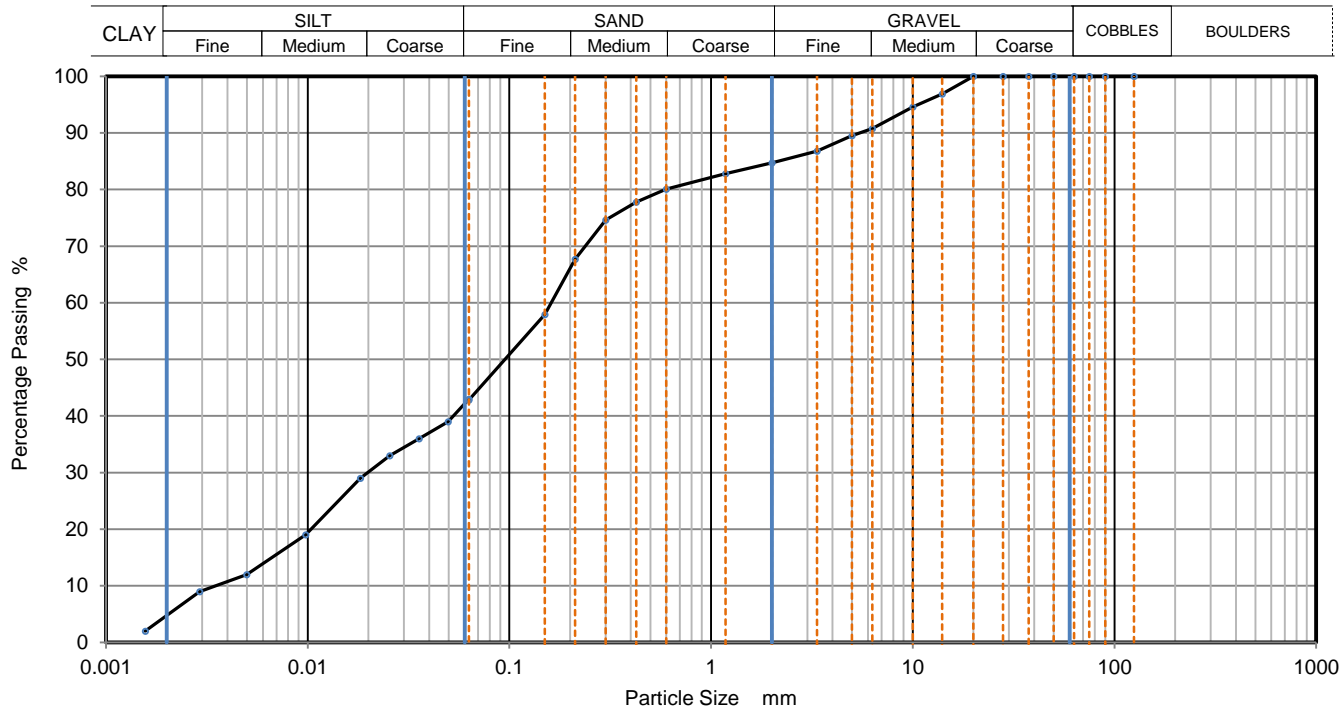
## Summary of Classification Test Results

Project No.		Project Name												
21-1619		North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w	Passing	LL	PL	PI	Particle	Casagrande
	Ref	Top	Base	Type		bulk	dry	%	425µm	%	%	%	density	
BH15	18	6.00	6.45	U	Greyish brown sandy slightly gravelly silty CLAY.			14.0	65	28	14	14		CL
BH15	16	8.00		D	Greyish brown sandy slightly gravelly silty CLAY.			15.0						

All tests performed in accordance with BS1377:1990 unless specified otherwise LAB 01R Version 5

<b>Key</b>  Density test                      Liquid Limit                      Particle density  Linear measurement unless :    4pt cone unless :                      sp - small pyknometer  wd - water displacement        cas - Casagrande method              gj - gas jar  wi - immersion in water        1pt - single point test			Date Printed  20/04/2022		Approved By  Stephen.Watson		 10122
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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	<b>21-1619</b>
				Borehole/Pit No.	BH09
Site Name	North Irish Sea Array			Sample No.	3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	0.30
Specimen Reference	6	Specimen Depth	0.3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022032920



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	43
90	100	0.04969	39
75	100	0.03559	36
63	100	0.02549	33
50	100	0.01824	29
37.5	100	0.00976	19
28	100	0.00499	12
20	100	0.00291	9
14	97	0.00156	2
10	95		
6.3	91		
5	90		
3.35	87		
2	85		
1.18	83		
0.6	80	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	78		
0.3	75		
0.212	68		
0.15	58		
0.063	43		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.3
Sand	41.9
Silt	38.4
Clay	4.4

Grading Analysis		
D100	mm	
D60	mm	0.161
D30	mm	0.0199
D10	mm	0.00365
Uniformity Coefficient		44
Curvature Coefficient		0.67

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH09

Site Name

North Irish Sea Array

Sample No.

5

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

1.80

Specimen Reference

6

Specimen  
Depth

1.8

m

Sample Type

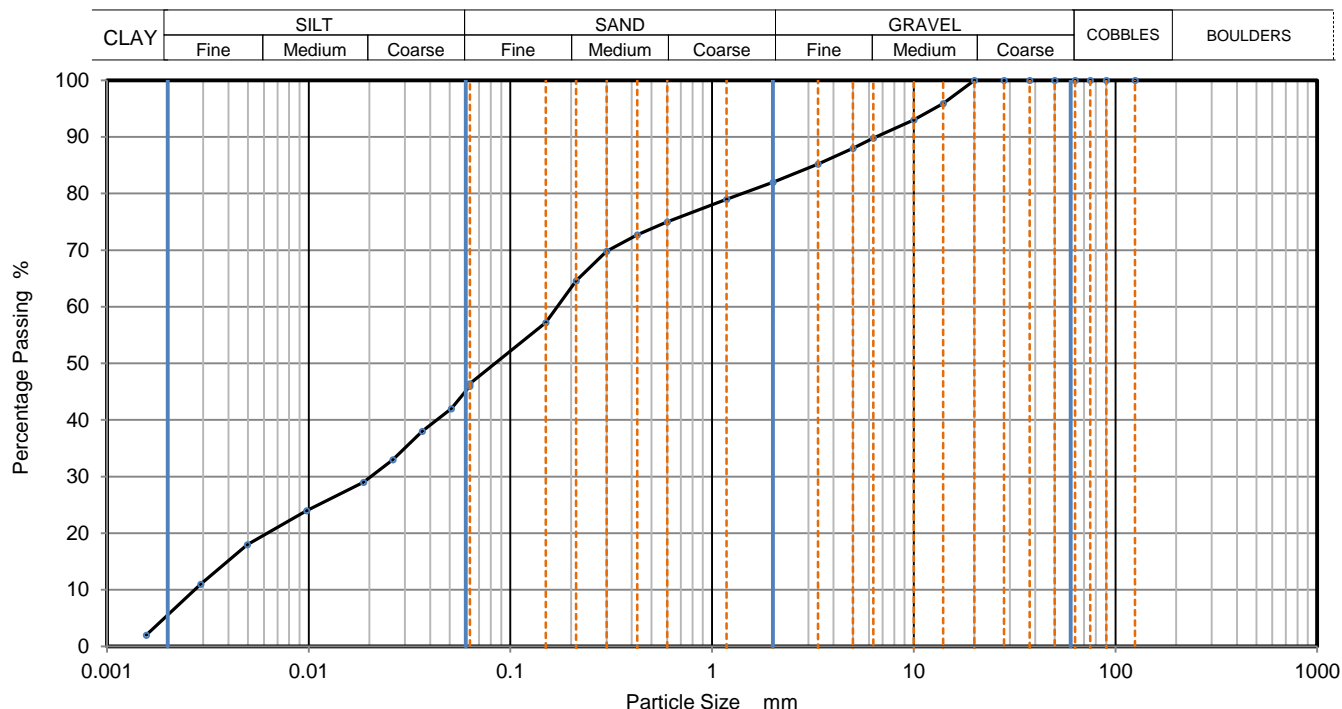
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032922



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	46
90	100	0.05097	42
75	100	0.03649	38
63	100	0.02611	33
50	100	0.01868	29
37.5	100	0.00976	24
28	100	0.00496	18
20	100	0.00291	11
14	96	0.00156	2
10	93		
6.3	90		
5	88		
3.35	85		
2	82		
1.18	79		
0.6	75	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	73		
0.3	70		
0.212	65		
0.15	57		
0.063	46		

Dry Mass of sample, g

505

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	18.0
Sand	35.6
Silt	40.7
Clay	5.7

Grading Analysis		
D100	mm	
D60	mm	0.171
D30	mm	0.0206
D10	mm	0.0027
Uniformity Coefficient		63
Curvature Coefficient		0.92

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH09

Site Name

North Irish Sea Array

Sample No.

6

Soil Description

Brown sandy gravelly silty CLAY.

Depth, m

3.80

Specimen Reference

6

Specimen  
Depth

3.8

m

Sample Type

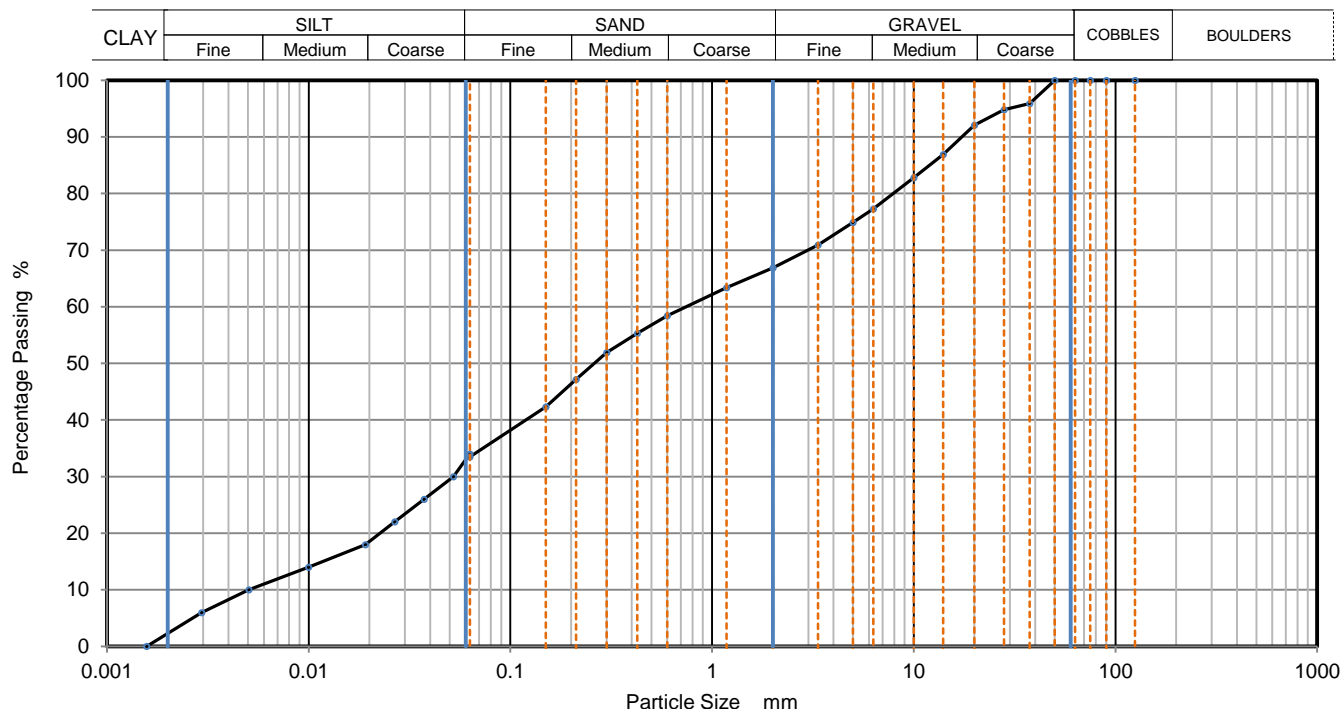
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032925



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	34
90	100	0.05222	30
75	100	0.03736	26
63	100	0.02672	22
50	100	0.01911	18
37.5	96	0.00998	14
28	95	0.00504	10
20	92	0.00294	6
14	87	0.00157	0
10	83		
6.3	77		
5	75		
3.35	71		
2	67		
1.18	63		
0.6	58	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	55		
0.3	52		
0.212	47		
0.15	42		
0.063	34		

Dry Mass of sample, g

3180

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	33.1
Sand	33.4
Silt	31.2
Clay	2.3

Grading Analysis		
D100	mm	
D60	mm	0.747
D30	mm	0.0533
D10	mm	0.00517
Uniformity Coefficient		140
Curvature Coefficient		0.74

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH09

Site Name

North Irish Sea Array

Sample No.

8

Soil Description

Brown sandy clayey subangular fine to coarse GRAVEL.

Depth, m

5.80

Specimen Reference

6

Specimen  
Depth

5.8

m

Sample Type

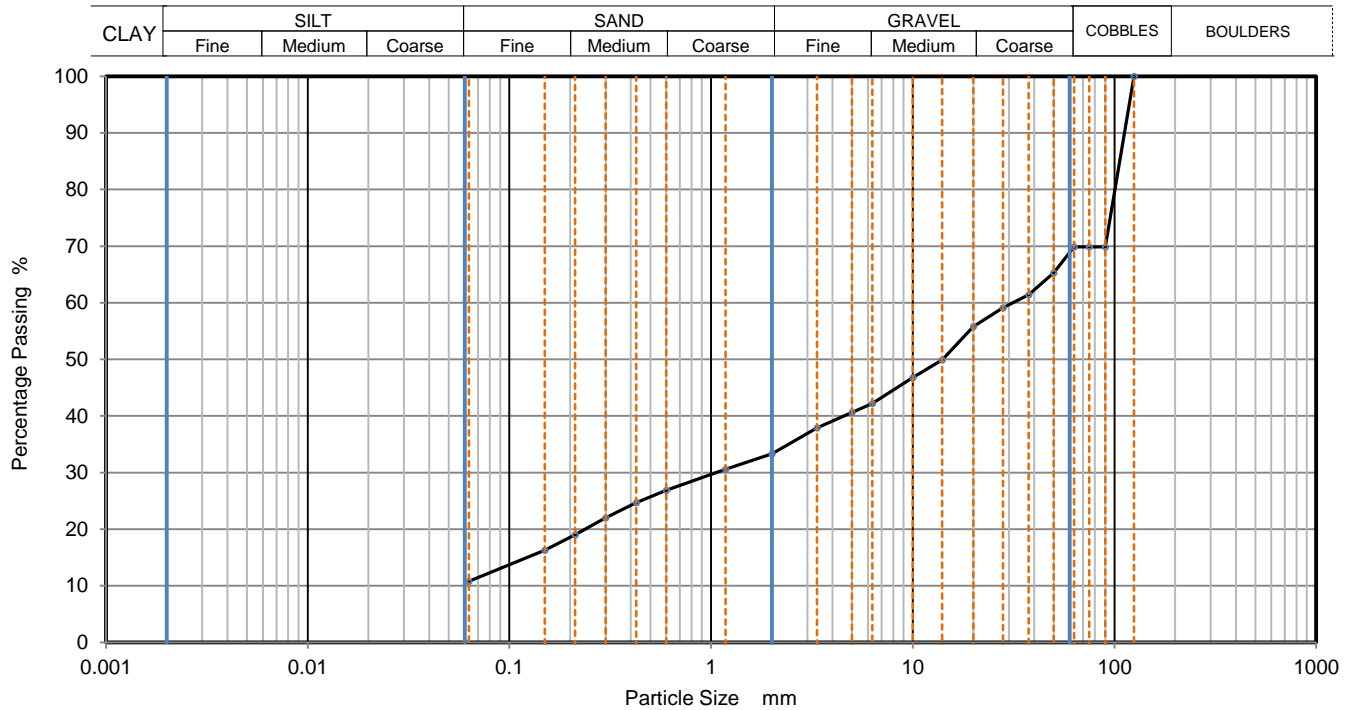
B

Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

Caus2022032927



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	70		
75	70		
63	70		
50	65		
37.5	61		
28	59		
20	56		
14	50		
10	47		
6.3	42		
5	41		
3.35	38		
2	33		
1.18	31		
0.6	27		
0.425	25		
0.3	22		
0.212	19		
0.15	16		
0.063	11		

Dry Mass of sample, g

11639

Sample Proportions	% dry mass
Cobbles	30.1
Gravel	36.6
Sand	22.5
Fines <0.063mm	11.0

Grading Analysis		
D100	mm	125
D60	mm	31.3
D30	mm	1.05
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH15

Site Name

North Irish Sea Array

Sample No.

4

Soil Description

Brown sandy slightly gravelly silty CLAY.

Depth, m

0.80

Specimen Reference

6

Specimen  
Depth

0.8

m

Sample Type

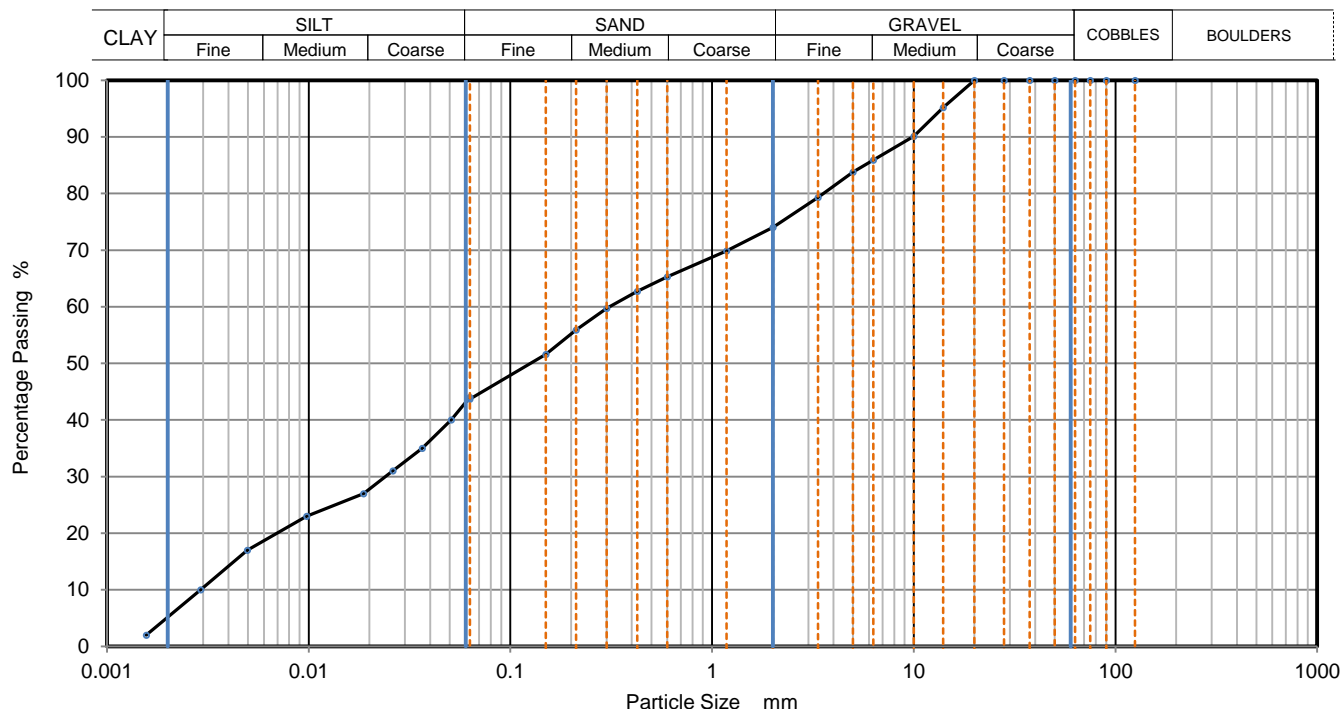
B

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032928



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.05097	40
75	100	0.03649	35
63	100	0.02611	31
50	100	0.01868	27
37.5	100	0.00976	23
28	100	0.00496	17
20	100	0.00291	10
14	95	0.00156	2
10	90		
6.3	86		
5	84		
3.35	79		
2	74		
1.18	70		
0.6	65	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	63		
0.3	60		
0.212	56		
0.15	52		
0.063	44		

Dry Mass of sample, g

504

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.0
Sand	30.3
Silt	38.3
Clay	5.4

Grading Analysis		
D100	mm	
D60	mm	0.312
D30	mm	0.0237
D10	mm	0.00282
Uniformity Coefficient		110
Curvature Coefficient		0.64

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH15

Site Name

North Irish Sea Array

Sample No.

18

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

6.00

Specimen Reference

7

Specimen  
Depth

6

m

Sample Type

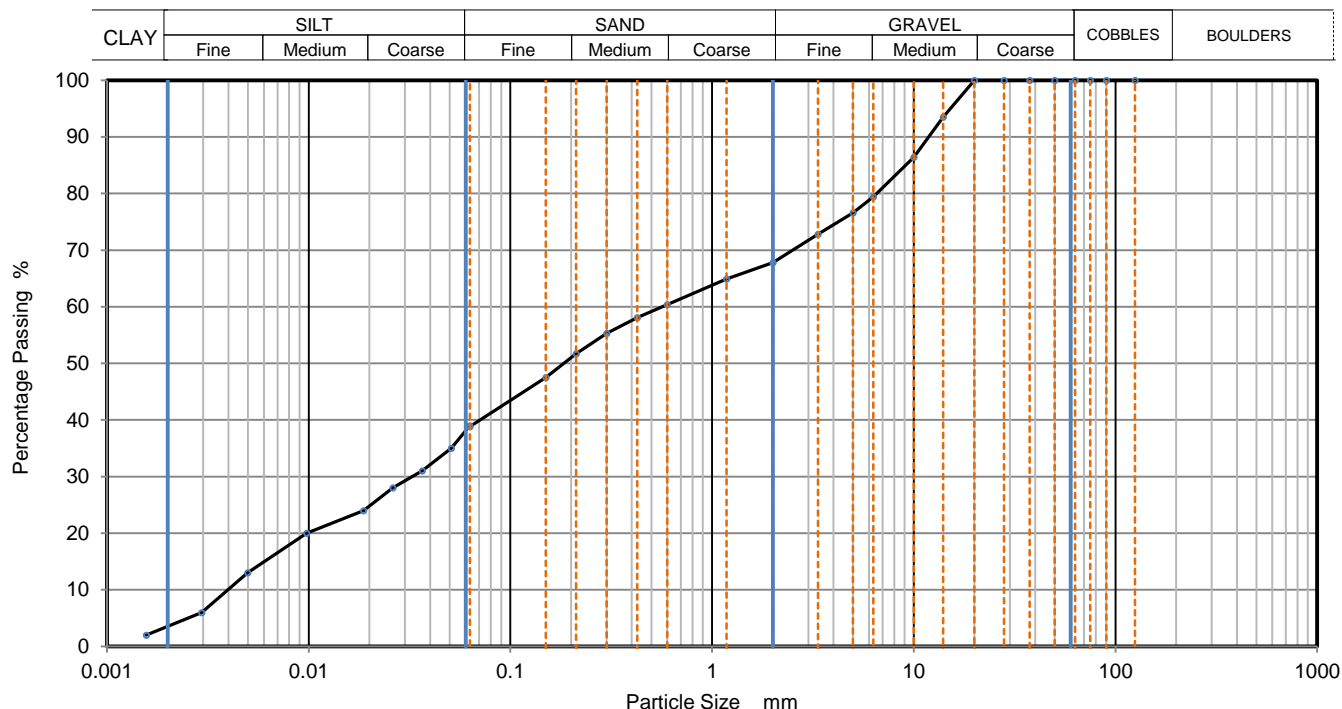
U

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus2022032935



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	39
90	100	0.05097	35
75	100	0.03649	31
63	100	0.02611	28
50	100	0.01868	24
37.5	100	0.00976	20
28	100	0.00499	13
20	100	0.00294	6
14	94	0.00156	2
10	86		
6.3	79		
5	77		
3.35	73		
2	68		
1.18	65		
0.6	60	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	58		
0.3	55		
0.212	52		
0.15	48		
0.063	39		

Dry Mass of sample, g

503

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	32.2
Sand	29.0
Silt	35.5
Clay	3.3

Grading Analysis		
D100	mm	
D60	mm	0.566
D30	mm	0.0321
D10	mm	0.00404
Uniformity Coefficient		140
Curvature Coefficient		0.45

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# **Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**

Job Ref	21-1619
Borehole/Pit No.	BH09
Sample No.	14
Depth	2.00
Sample Type	U
KeyLAB ID	Caus2022032923
Date of test	13/04/2022

Site Name	North Irish Sea Array		
Soil Description	Brown sandy slightly gravelly silty CLAY.		
Specimen Reference	2	Specimen Depth	2.05 m
Specimen Description	Firm to stiff brown sandy slightly gravelly silty CLAY.		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number  
Length  
Diameter  
Bulk Density  
Moisture Content  
Dry Density

1
209.7
103.8
2.21
13
1.96

mm  
mm  
Mg/m3  
%  
Mg/m3

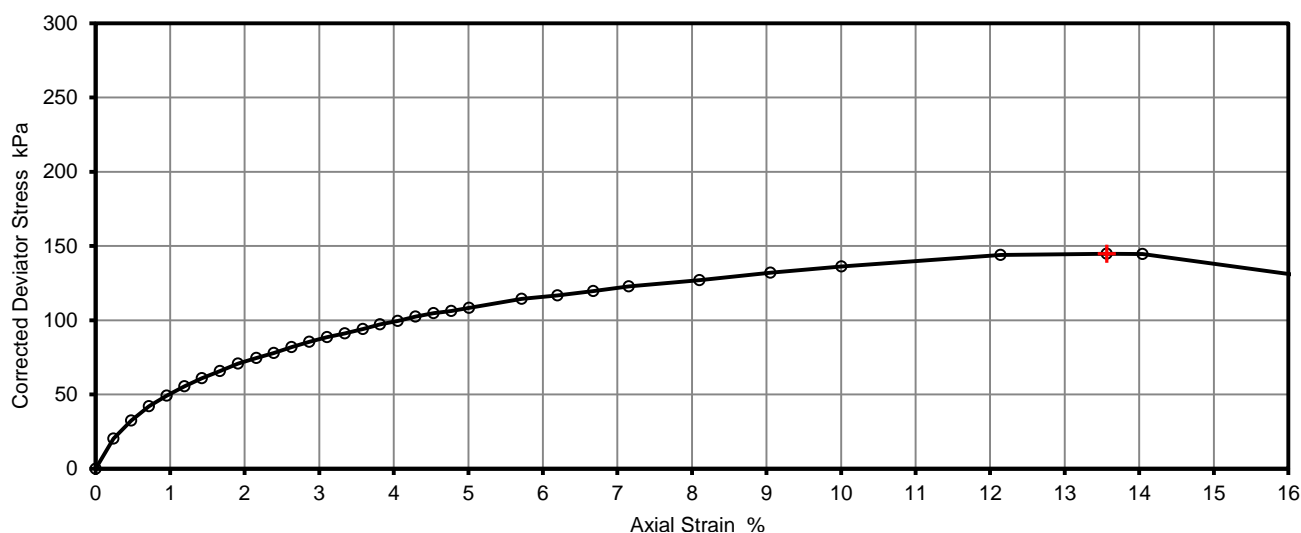
Rate of Strain  
Cell Pressure  
At failure

3.0
50
13.6
145
72
Brittle

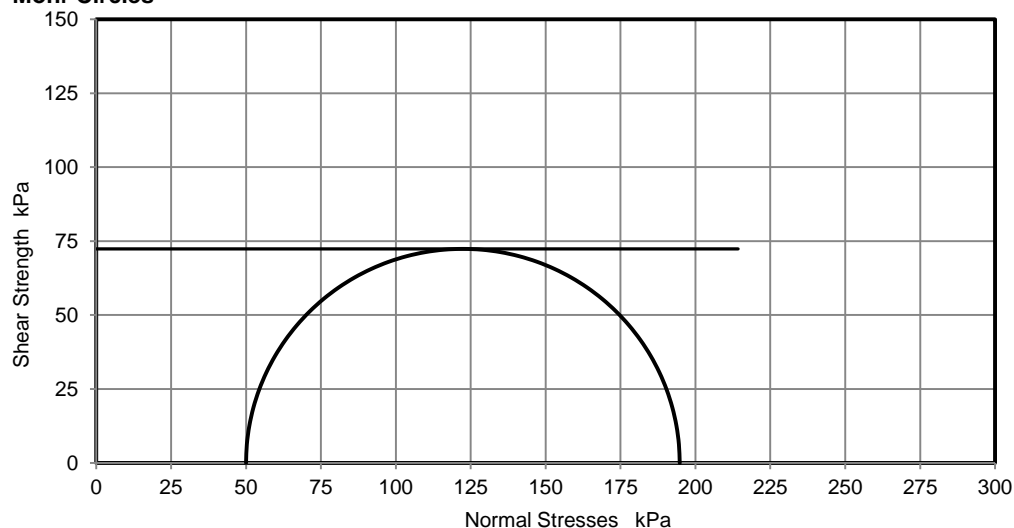
%/min  
kPa  
%  
kPa  
kPa  $\frac{1}{2}(\sigma_1 - \sigma_3)_f$

Axial Strain  
Deviator Stress,  $(\sigma_1 - \sigma_3)_f$   
Undrained Shear Strength, cu  
Mode of Failure

## **Deviator Stress v Axial Strain**



## **Mohr Circles**



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks

Approved

Stephen.Watson

Printed

20/04/2022 08:35





# Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

Job Ref	21-1619
Borehole/Pit No.	BH15
Sample No.	18
Depth	6.00
Sample Type	U
KeyLAB ID	Caus2022032935
Date of test	13/04/2022

Site Name	North Irish Sea Array		
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.		
Specimen Reference	8	Specimen Depth	6.05 m
Specimen Description	Stiff greyish brown sandy slightly gravelly silty CLAY.		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Test Number  
Length  
Diameter  
Bulk Density  
Moisture Content  
Dry Density

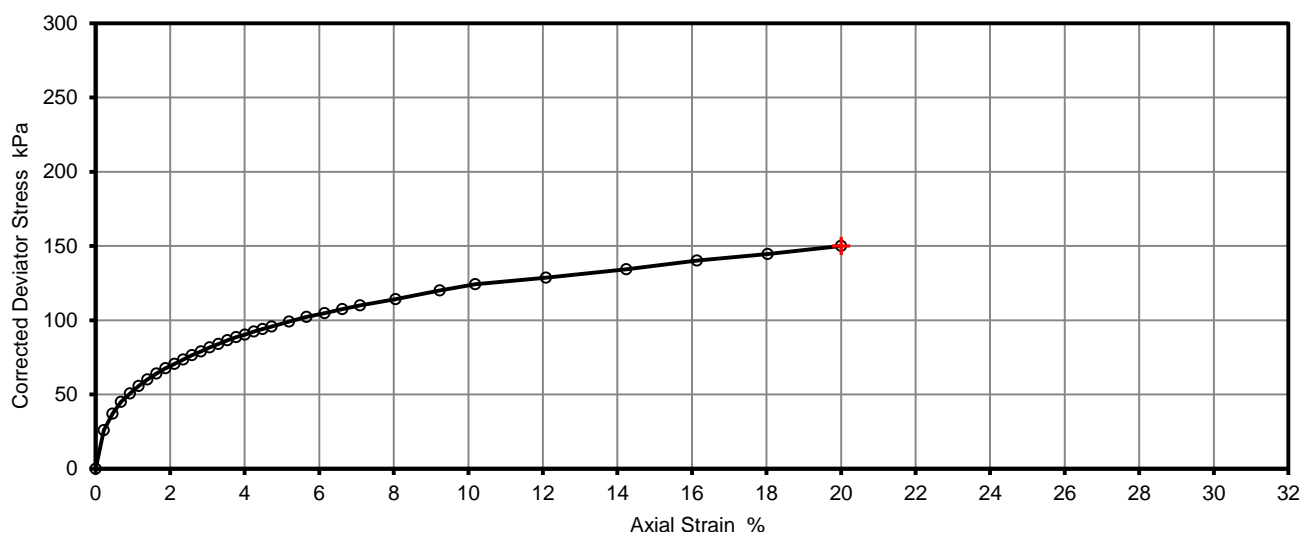
1	
209.4	mm
103.9	mm
2.37	Mg/m3
10	%
2.14	Mg/m3

Rate of Strain  
Cell Pressure  
At failure

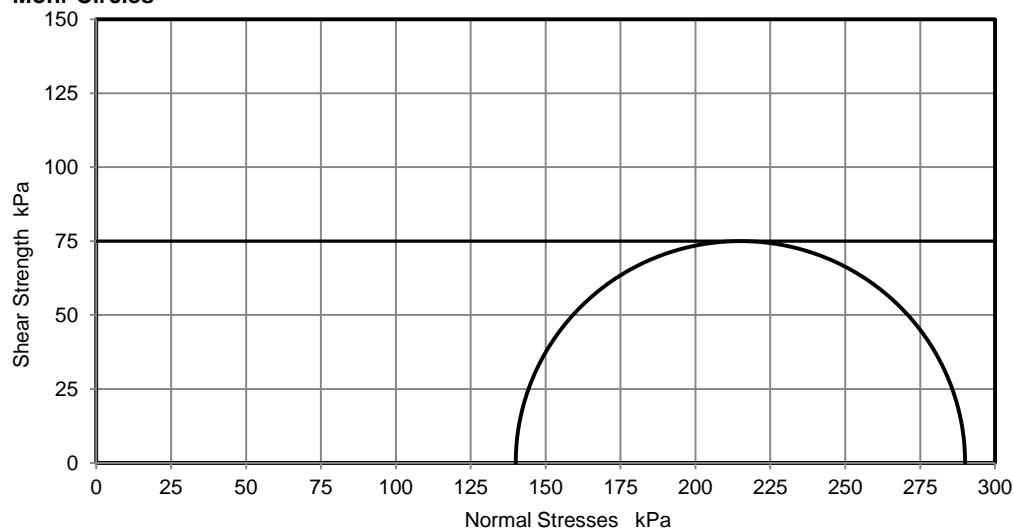
3.0	%/min
140	kPa
20.0	%
150	kPa
75	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$

Axial Strain  
Deviator Stress,  $(\sigma_1 - \sigma_3)_f$   
Undrained Shear Strength,  $c_u$   
Mode of Failure

## Deviator Stress v Axial Strain



## Mohr Circles



Deviator stress corrected  
for area change and  
membrane effects

Mohr circles and their  
interpretation is not covered  
by BS1377.  
This is provided for  
information only.

## Remarks

No failure defined. Testing terminated at 20% axial strain.

## Approved

Stephen.Watson

## Printed

20/04/2022 08:35







2183

# Final Report

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**Report No.:** 22-12437-1  
**Initial Date of Issue:** 07-Apr-2022  
**Client** Causeway Geotech Ltd

**Client Address:** 8 Drumahiskey Road  
Balnamore  
Ballymoney  
County Antrim  
BT53 7QL

**Contact(s):** Carin Cornwall  
Colm Hurley  
Darren O'Mahony  
Gabriella Horan  
Joe Gervin  
John Cameron  
Lucy Newland  
Martin Gardiner  
Matthew Gilbert  
Neil Haggan  
Paul Dunlop  
Sean Ross  
Stephen Franey  
Stephen Watson  
Stuart Abraham  
Thomas McAllister

**Project** 21-1619 North Irish Sea Array

**Quotation No.:** **Date Received:** 01-Apr-2022

**Order No.:** **Date Instructed:** 01-Apr-2022

**No. of Samples:** 2

**Turnaround (Wkdays):** 7 **Results Due:** 11-Apr-2022

**Date Approved:** 07-Apr-2022

**Approved By:**



**Details:** Stuart Henderson, Technical  
Manager

---



## Results - Soil

**Project: 21-1619 North Irish Sea Array**

Client: Causeway Geotech Ltd	Chemtest Job No.:				22-12437	22-12437
Quotation No.:	Chemtest Sample ID.:				1403832	1403833
Order No.:	Client Sample Ref.:				6	17
	Sample Location:				BH09	BH15
	Sample Type:				SOIL	SOIL
	Top Depth (m):				3.8	1.2
	Date Sampled:				31-Mar-2022	31-Mar-2022
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	13	15
pH	U	2010		4.0	8.8	8.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.089	0.023
Sulphate (Total)	U	2430	%	0.010	0.15	0.28
Sulphate (Acid Soluble)	U	2430	%	0.010	0.11	0.013



## Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## **Report Information**

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### **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

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### **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](mailto:customerservices@chemtest.com)

**SOIL AND ROCK SAMPLE ANALYSIS  
LABORATORY TEST REPORT**

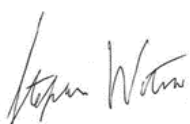
24 May 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 06/05/2022 and 24/05/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.



Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 9 - FINAL

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	14
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	14
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	14
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	12

## SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – subcontracted to Pro Soils Limited ( <i>UKAS 4043</i> )	Effective shear strength consolidated-undrained triaxial compression test with measurement of pore pressure (up to 4 days)	BS 1377-8:1990	1
	Extra over days (more than initial 4 days)		3




## Summary of Classification Test Results


Project No. 21-1619		Project Name North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type		bulk Mg/m3	dry Mg/m3							
BH04		4.00	5.00	C	Brown sandy gravelly silty CLAY.			10.0	62	29	14	15		CL
BH04		7.00	8.25	C	Brown sandy gravelly clayey SILT.			10.0	60	21	17	4		ML
BH06		5.50	6.13	C	Brown sandy gravelly silty CLAY.			12.0	54	29	14	15		CL
BH06		5.75	5.90	C	Brown gravelly slightly silty fine to coarse SAND.			9.7	40	25	16	9		CL
BH06		6.13	7.00	C	Brown sandy slightly gravelly silty CLAY.			49.0	84	32	18	14		CL
BH06		8.50	9.50	C	Brown sandy gravelly silty CLAY.			9.7	46	25	16	9		CL
BH06		10.00	10.15	C	Brown sandy slightly gravelly silty CLAY.			32.0	84	30	13	17		CL
BH06		14.50	14.90	C	Brown sandy slightly gravelly silty CLAY.			34.0	72	27	19	8		CL
BH06		14.90	15.45	C	Brown slightly sandy slightly clayey subangular fine to coarse GRAVEL with cobbles.			9.7	58	27	21	6		ML/CL
BH06		15.45	15.90	C	Brown sandy gravelly silty CLAY.			12.0	58	26	11	15		CL
BH07		5.70		C	Brown sandy slightly gravelly silty CLAY.			11.0	74	25	12	13		CL
BH07		7.30	8.00	C	Brown sandy slightly gravelly silty CLAY.			10.0	58	25	16	9		CL

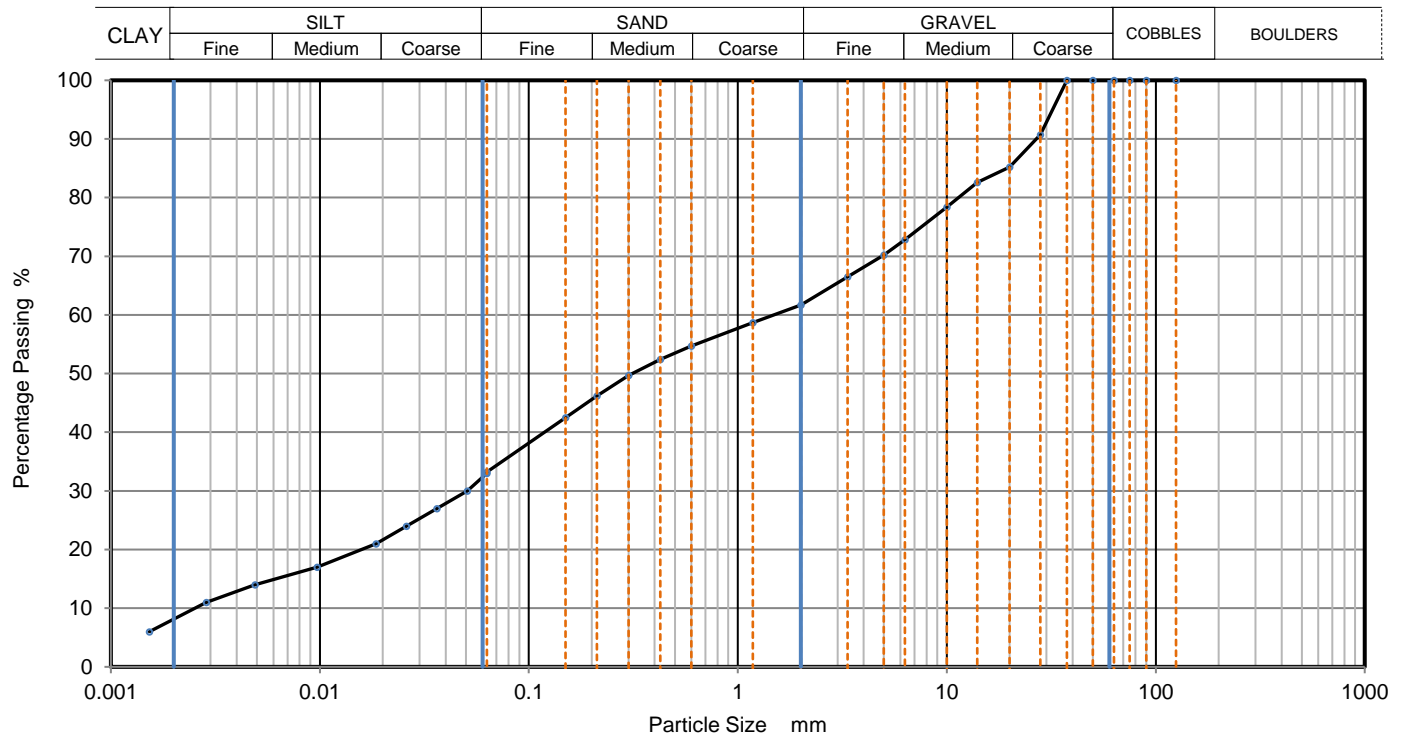
All tests performed in accordance with BS1377:1990 unless specified otherwise

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Key			Date Printed	Approved By	 10122
Density test	Liquid Limit	Particle density	17/05/2022	Stephen.Watson	
Linear measurement unless :	4pt cone unless :	sp - small pyknometer			
wd - water displacement	cas - Casagrande method	gj - gas jar			
wi - immersion in water	1pt - single point test				



	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH04
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	4.00
Specimen Reference	9	Specimen Depth	4 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204288



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	33
90	100	0.05065	30
75	100	0.03625	27
63	100	0.02594	24
50	100	0.01855	21
37.5	100	0.00969	17
28	91	0.00490	14
20	85	0.00286	11
14	83	0.00153	6
10	78		
6.3	73		
5	70		
3.35	67		
2	62		
1.18	59		
0.6	55	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	52		
0.3	50		
0.212	46		
0.15	43		
0.063	33		

Dry Mass of sample, g

2414

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	38.3
Sand	28.5
Silt	24.8
Clay	8.4

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	590
Curvature Coefficient	0.69


Remarks

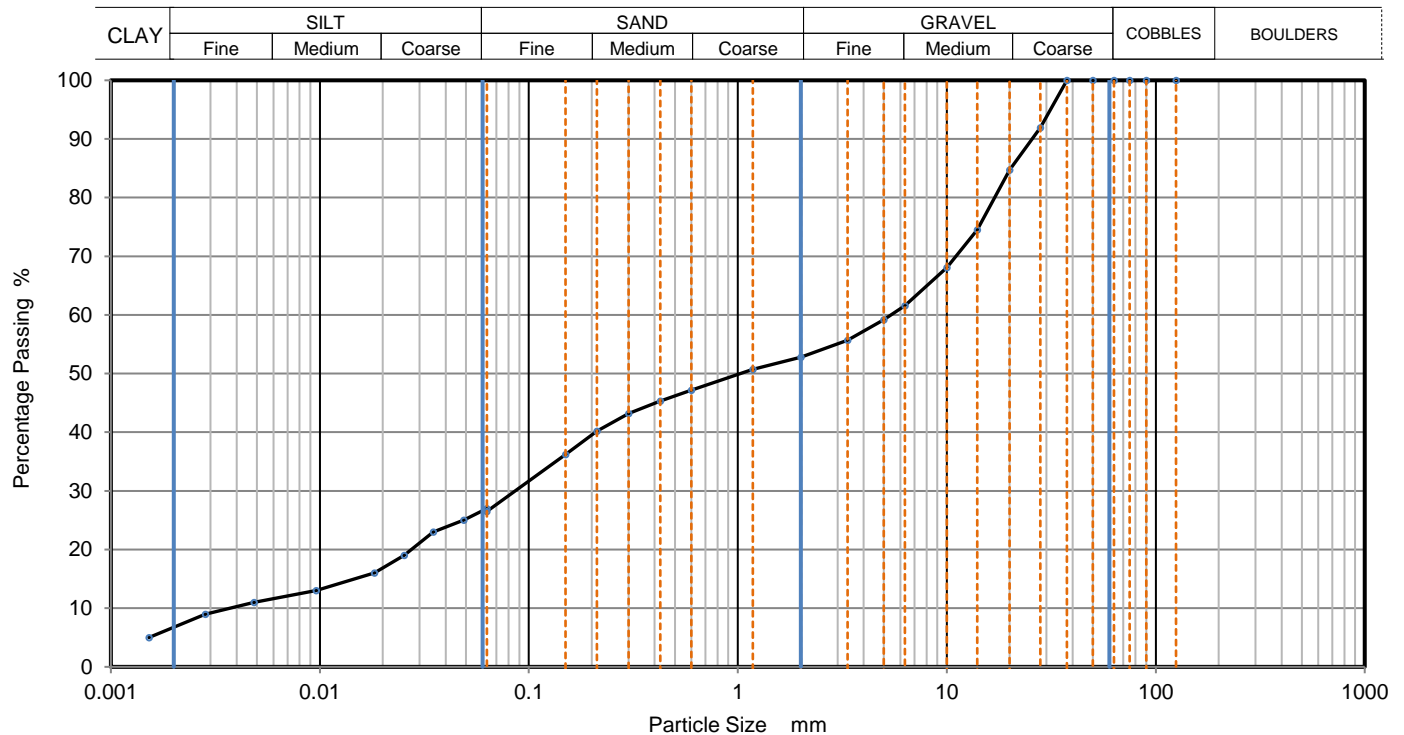
Preparation and testing in accordance with BS1377-2 :1990 unless noted below



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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH04
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly clayey SILT.			Depth, m	7.00
Specimen Reference	9	Specimen Depth	7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204289



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	27
90	100	0.04875	25
75	100	0.03492	23
63	100	0.02532	19
50	100	0.01823	16
37.5	100	0.00958	13
28	92	0.00485	11
20	85	0.00283	9
14	75	0.00152	5
10	68		
6.3	62		
5	59		
3.35	56		
2	53		
1.18	51		
0.6	47	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	45		
0.3	43		
0.212	40		
0.15	36		
0.063	27		

Dry Mass of sample, g

2834

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	47.2
Sand	26.3
Silt	19.9
Clay	6.6

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1400
Curvature Coefficient	0.35

Remarks


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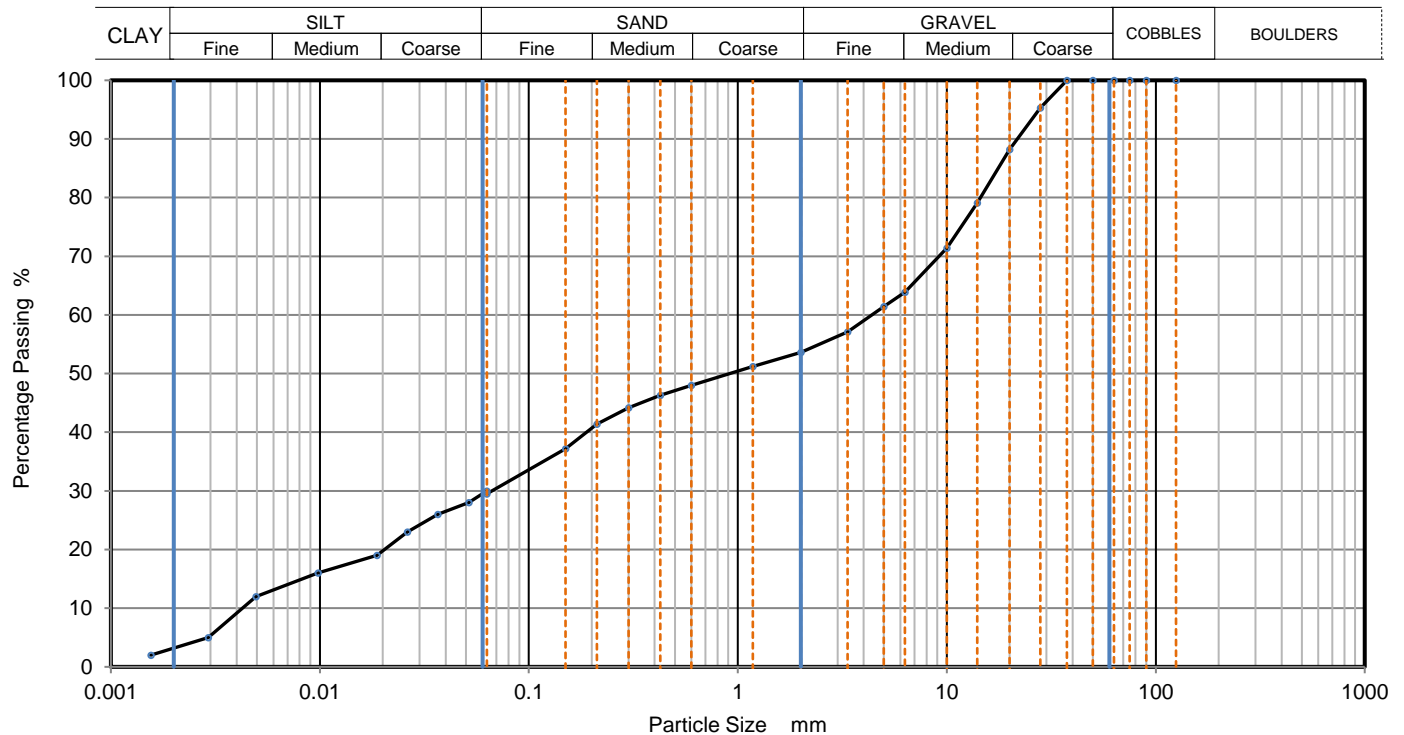


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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	5.50
Specimen Reference	9	Specimen Depth	5.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204280



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	30
90	100	0.05157	28
75	100	0.03668	26
63	100	0.02624	23
50	100	0.01877	19
37.5	100	0.00980	16
28	95	0.00495	12
20	88	0.00292	5
14	79	0.00155	2
10	71		
6.3	64		
5	61		
3.35	57		
2	54		
1.18	51		
0.6	48	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	46		
0.3	44		
0.212	41		
0.15	37		
0.063	30		

Dry Mass of sample, g

2397

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	46.4
Sand	24.1
Silt	26.4
Clay	3.1

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	1000
Curvature Coefficient	0.24

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below




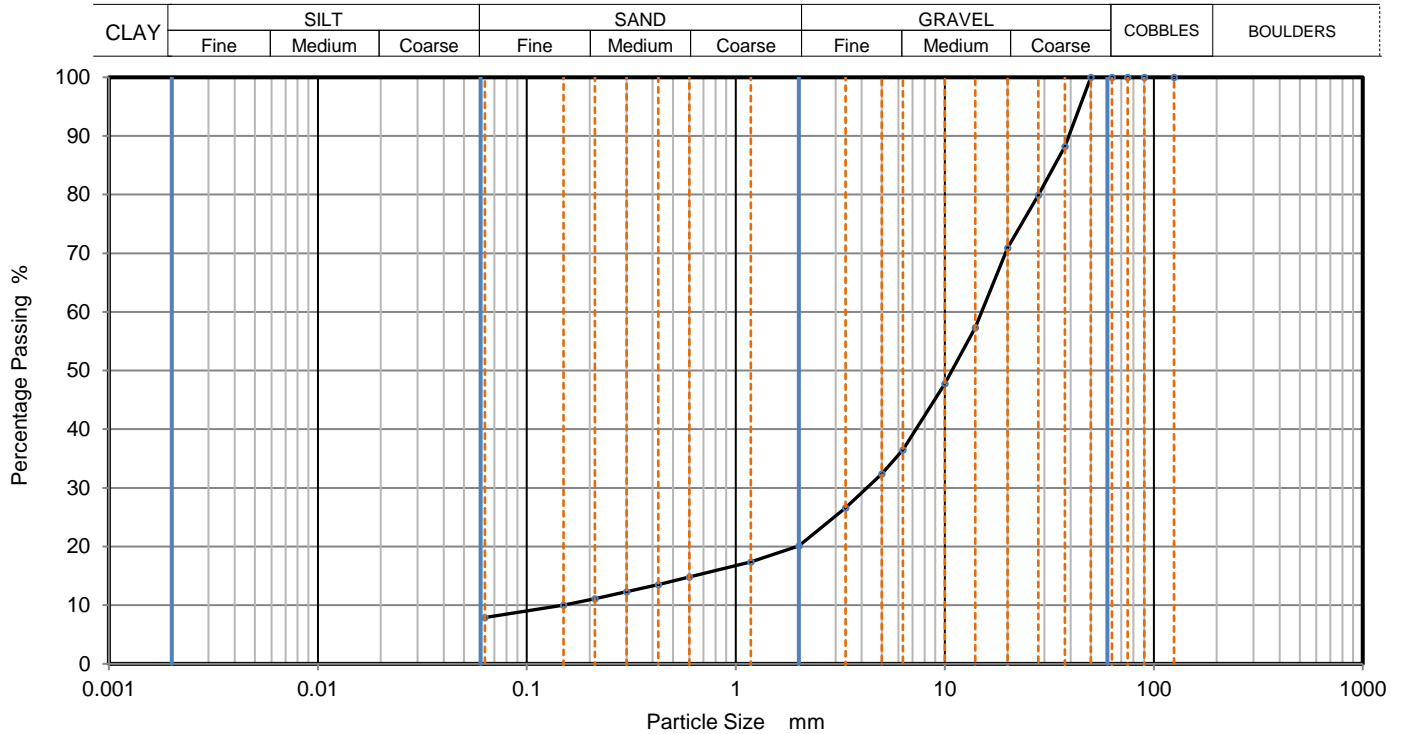
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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown gravelly slightly silty fine to coarse SAND.			Depth, m	5.75
Specimen Reference	9	Specimen Depth	5.75 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus202204281



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	88		
28	80		
20	71		
14	57		
10	48		
6.3	37		
5	32		
3.35	27		
2	20		
1.18	17		
0.6	15		
0.425	14		
0.3	12		
0.212	11		
0.15	10		
0.063	8		

Dry Mass of sample, g

2275

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	79.9
Sand	12.2
Fines <0.063mm	8.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	100
Curvature Coefficient	7.9


Remarks

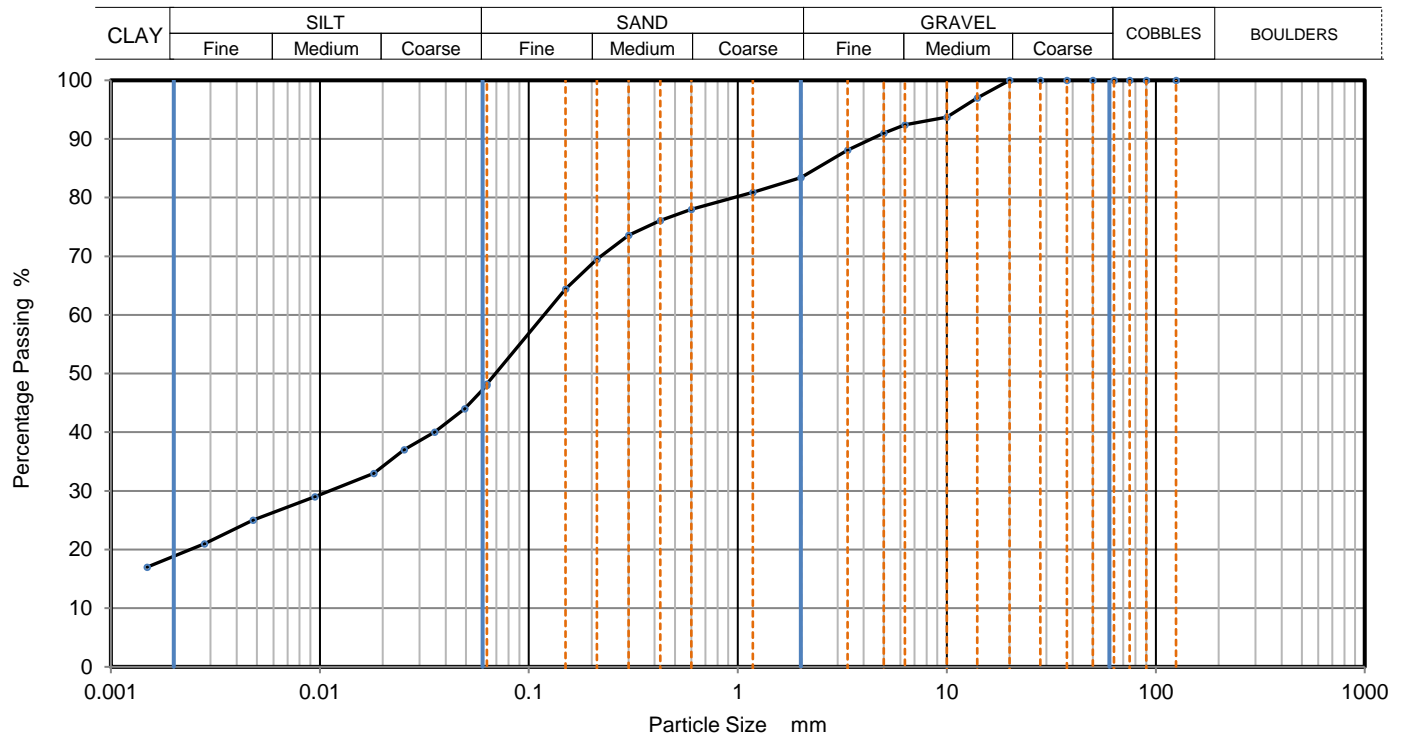
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	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	6.13
Specimen Reference	9	Specimen Depth	6.13 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204282



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.04939	44
75	100	0.03537	40
63	100	0.02532	37
50	100	0.01813	33
37.5	100	0.00947	29
28	100	0.00479	25
20	100	0.00280	21
14	97	0.00149	17
10	94		
6.3	92		
5	91		
3.35	88		
2	83		
1.18	81		
0.6	78	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	76		
0.3	74		
0.212	70		
0.15	64		
0.063	48		

Dry Mass of sample, g

508

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.6
Sand	35.2
Silt	29.0
Clay	19.2

Grading Analysis		
D100	mm	
D60	mm	0.119
D30	mm	0.0114
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below




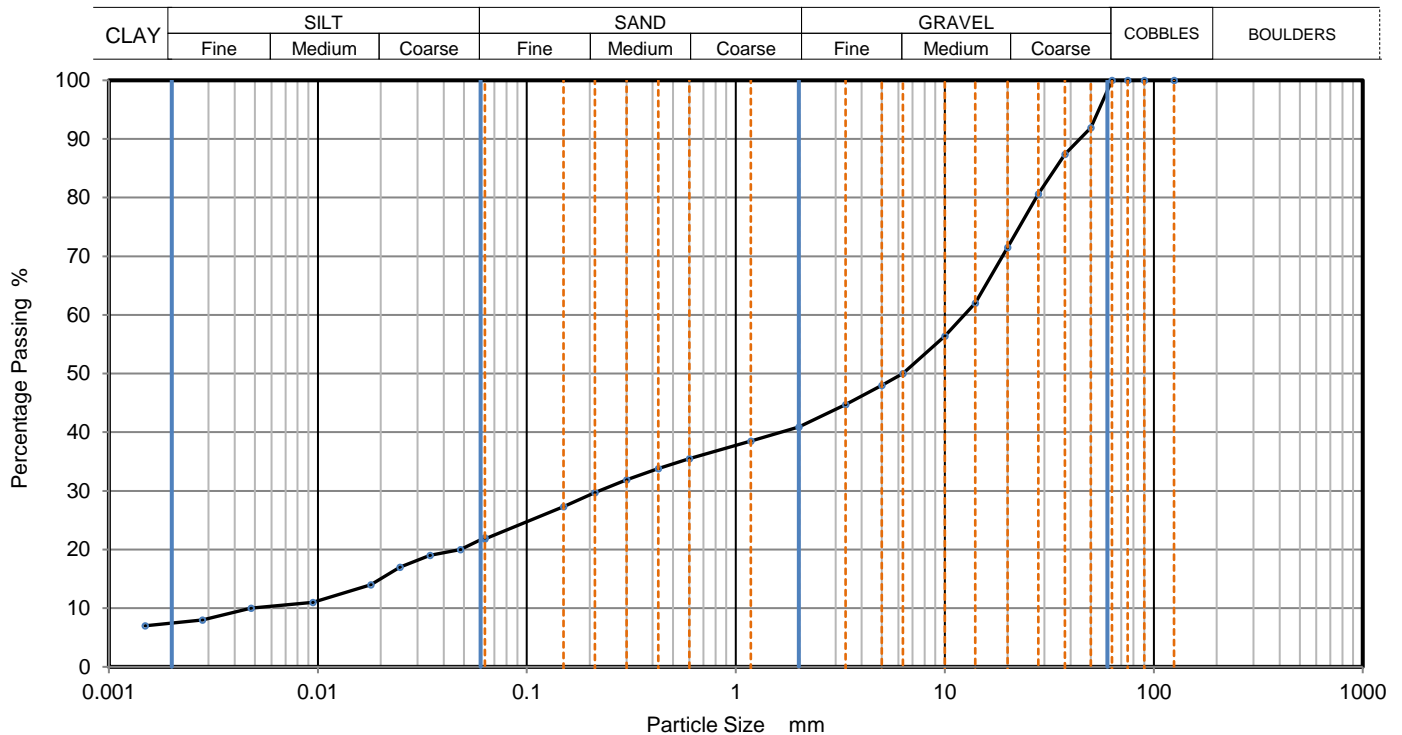
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	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	8.50
Specimen Reference	9	Specimen Depth	8.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204283



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	22
90	100	0.04810	20
75	100	0.03447	19
63	100	0.02470	17
50	92	0.01791	14
37.5	87	0.00947	11
28	81	0.00479	10
20	72	0.00280	8
14	62	0.00149	7
10	56		
6.3	50		
5	48		
3.35	45		
2	41		
1.18	39		
0.6	36	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	34		
0.3	32		
0.212	30		
0.15	27		
0.063	22		

Dry Mass of sample, g

14785

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	59.1
Sand	19.2
Silt	14.2
Clay	7.5

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2300
Curvature Coefficient	0.75

Remarks

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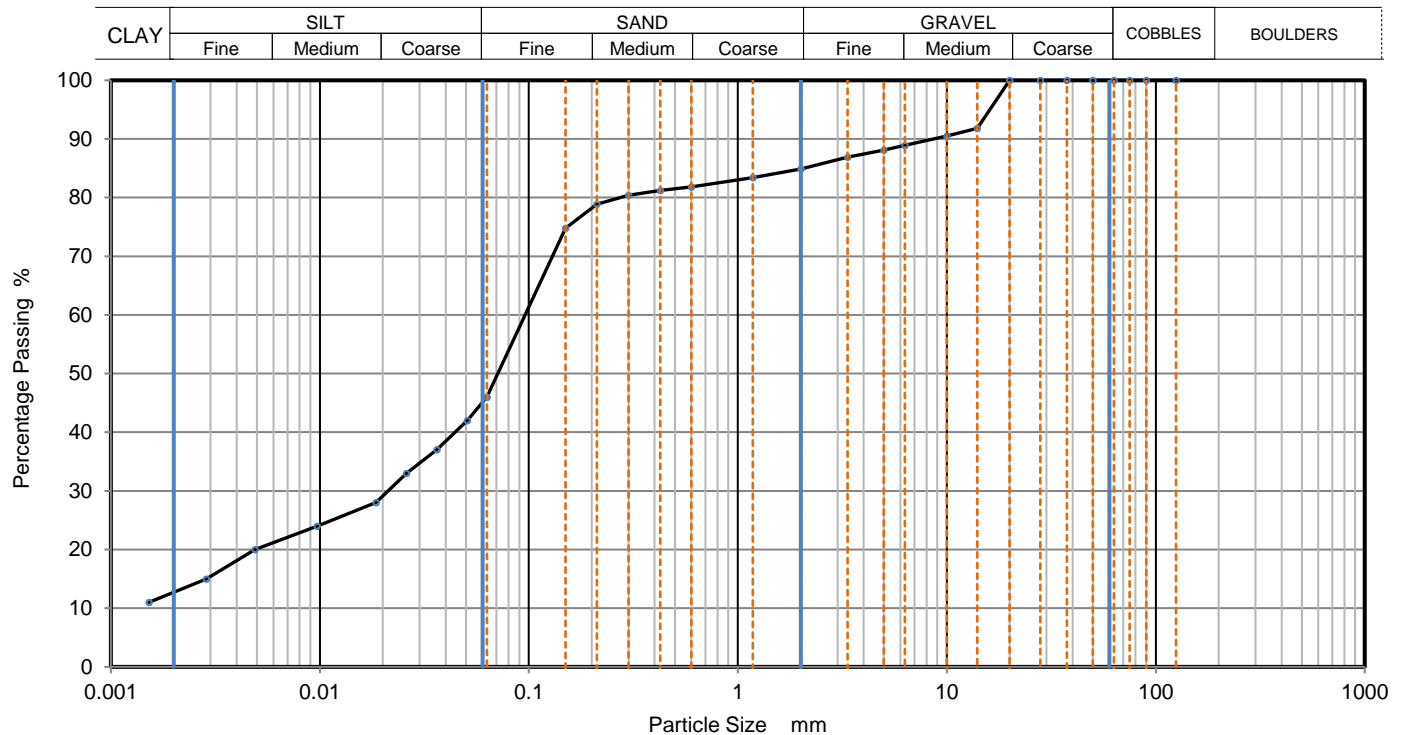
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	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	10.00
Specimen Reference	9	Specimen Depth	10 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204284



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	46
90	100	0.05065	42
75	100	0.03625	37
63	100	0.02594	33
50	100	0.01855	28
37.5	100	0.00969	24
28	100	0.00490	20
20	100	0.00286	15
14	92	0.00152	11
10	91		
6.3	89		
5	88		
3.35	87		
2	85		
1.18	83		
0.6	82	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	81		
0.3	80		
0.212	79		
0.15	75		
0.063	46		

Dry Mass of sample, g

509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.1
Sand	38.9
Silt	33.1
Clay	12.9

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below




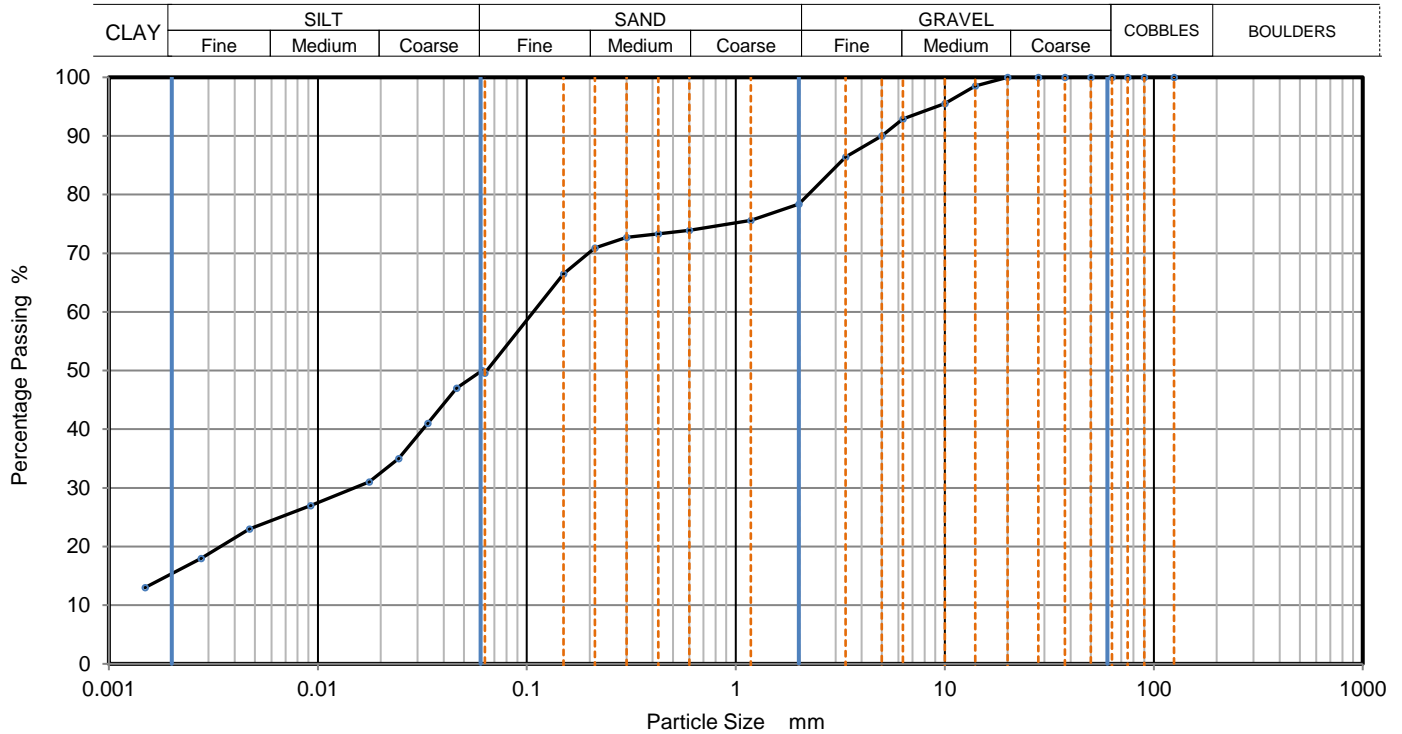
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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	14.50
Specimen Reference	9	Specimen Depth	14.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204285



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06107	50
90	100	0.04609	47
75	100	0.03355	41
63	100	0.02437	35
50	100	0.01757	31
37.5	100	0.00925	27
28	100	0.00471	23
20	100	0.00277	18
14	99	0.00149	13
10	96		
6.3	93		
5	90		
3.35	86		
2	78		
1.18	76		
0.6	74	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	73		
0.3	73		
0.212	71		
0.15	67		
0.063	50		

Dry Mass of sample, g

524

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.6
Sand	28.8
Silt	34.1
Clay	15.5

Grading Analysis		
D100	mm	
D60	mm	0.107
D30	mm	0.0147
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below




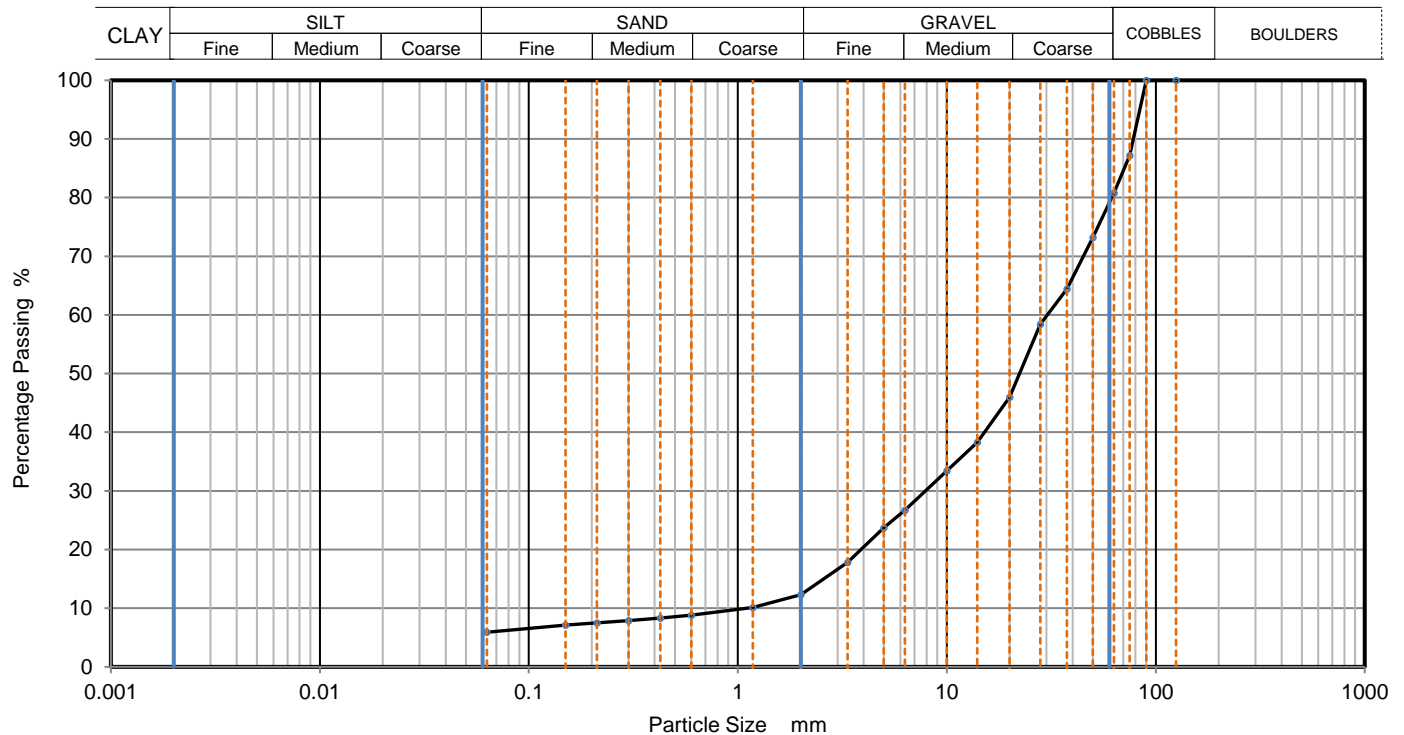
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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown slightly sandy slightly clayey subangular fine to coarse GRAVEL with cobbles.			Depth, m	14.90
Specimen Reference	9	Specimen Depth	14.9 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus202204286



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	87		
63	81		
50	73		
37.5	64		
28	58		
20	46		
14	38		
10	33		
6.3	27		
5	24		
3.35	18		
2	12		
1.18	10		
0.6	9		
0.425	8		
0.3	8		
0.212	8		
0.15	7		
0.063	6		

Dry Mass of sample, g

6646

Sample Proportions	% dry mass
Cobbles	19.2
Gravel	68.5
Sand	6.4
Fines <0.063mm	6.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	27
Curvature Coefficient	1.8


#### Remarks

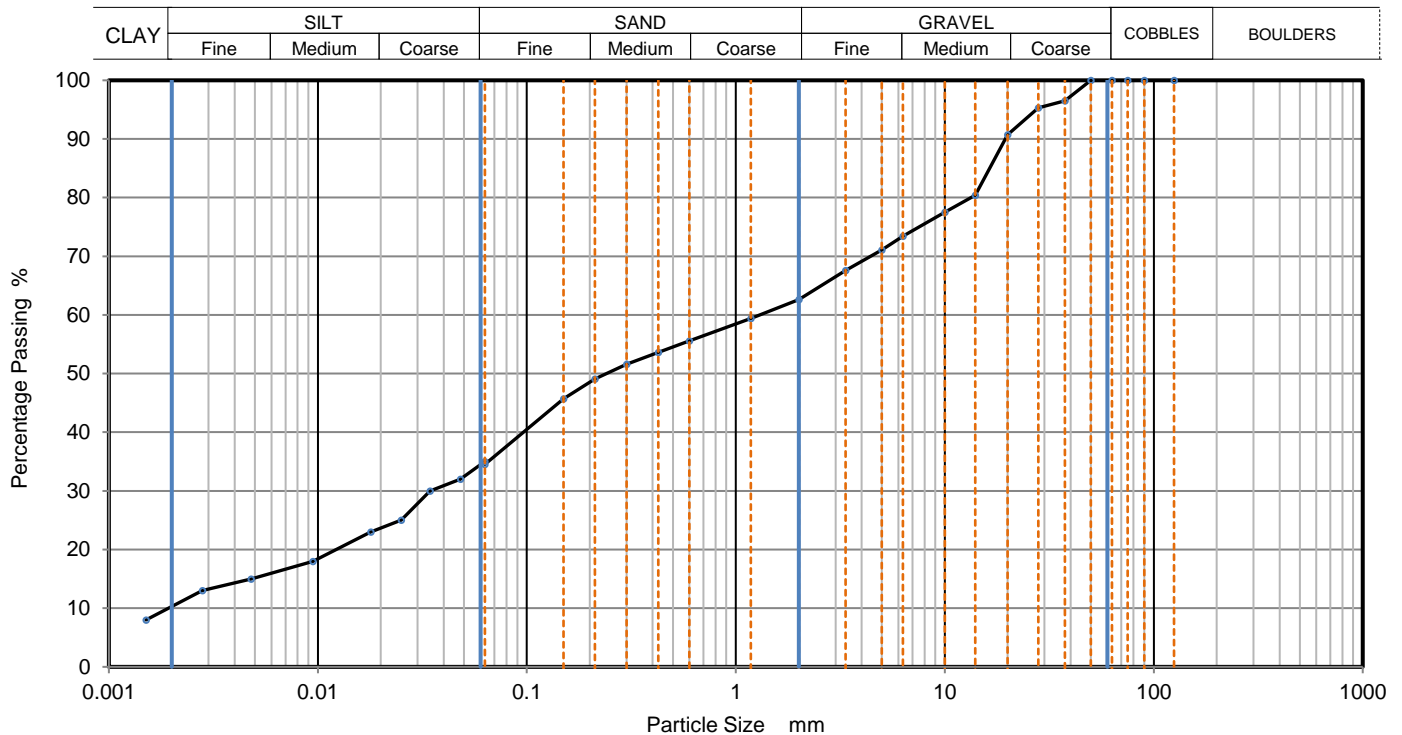
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	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH06
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	15.45
Specimen Reference	9	Specimen Depth	15.45 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202204287



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	35
90	100	0.04810	32
75	100	0.03447	30
63	100	0.02501	25
50	100	0.01791	23
37.5	97	0.00947	18
28	95	0.00479	15
20	91	0.00280	13
14	80	0.00150	8
10	78		
6.3	73		
5	71		
3.35	68		
2	63		
1.18	59		
0.6	56	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	54		
0.3	52		
0.212	49		
0.15	46		
0.063	35		

Dry Mass of sample, g

3113

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	37.4
Sand	28.1
Silt	24.0
Clay	10.5

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	700
Curvature Coefficient	0.52

Remarks


Preparation and testing in accordance with BS1377-2:1990 unless noted below

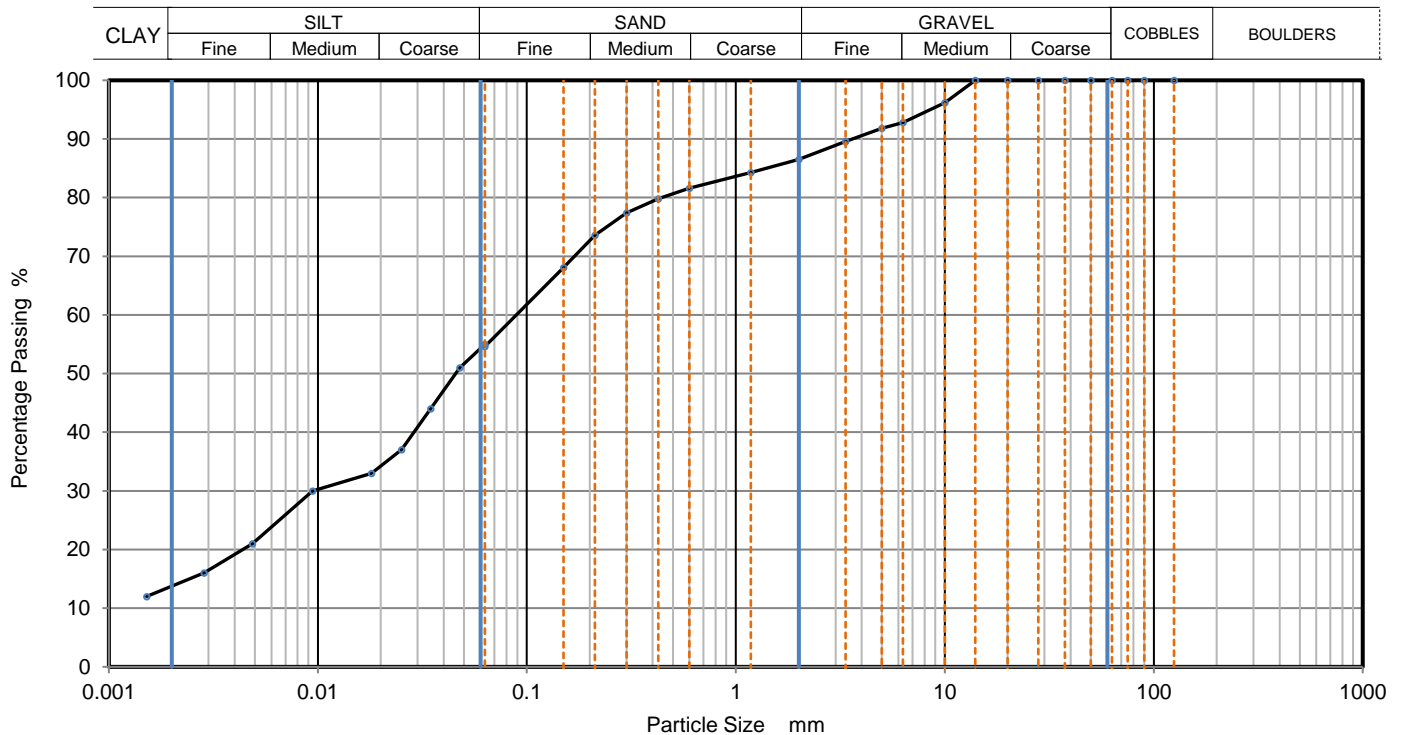


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	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
				Borehole/Pit No.	BH07
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	5.70
Specimen Reference	3	Specimen Depth	5.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202205051



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	55
90	100	0.04770	51
75	100	0.03467	44
63	100	0.02517	37
50	100	0.01802	33
37.5	100	0.00942	30
28	100	0.00485	21
20	100	0.00285	16
14	100	0.00152	12
10	96		
6.3	93		
5	92		
3.35	90		
2	87		
1.18	84		
0.6	82	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	80		
0.3	77		
0.212	74		
0.15	68		
0.063	55		

Dry Mass of sample, g

221

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	13.5
Sand	32.0
Silt	40.6
Clay	13.9


Grading Analysis		
D100	mm	
D60	mm	0.0892
D30	mm	0.00952
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

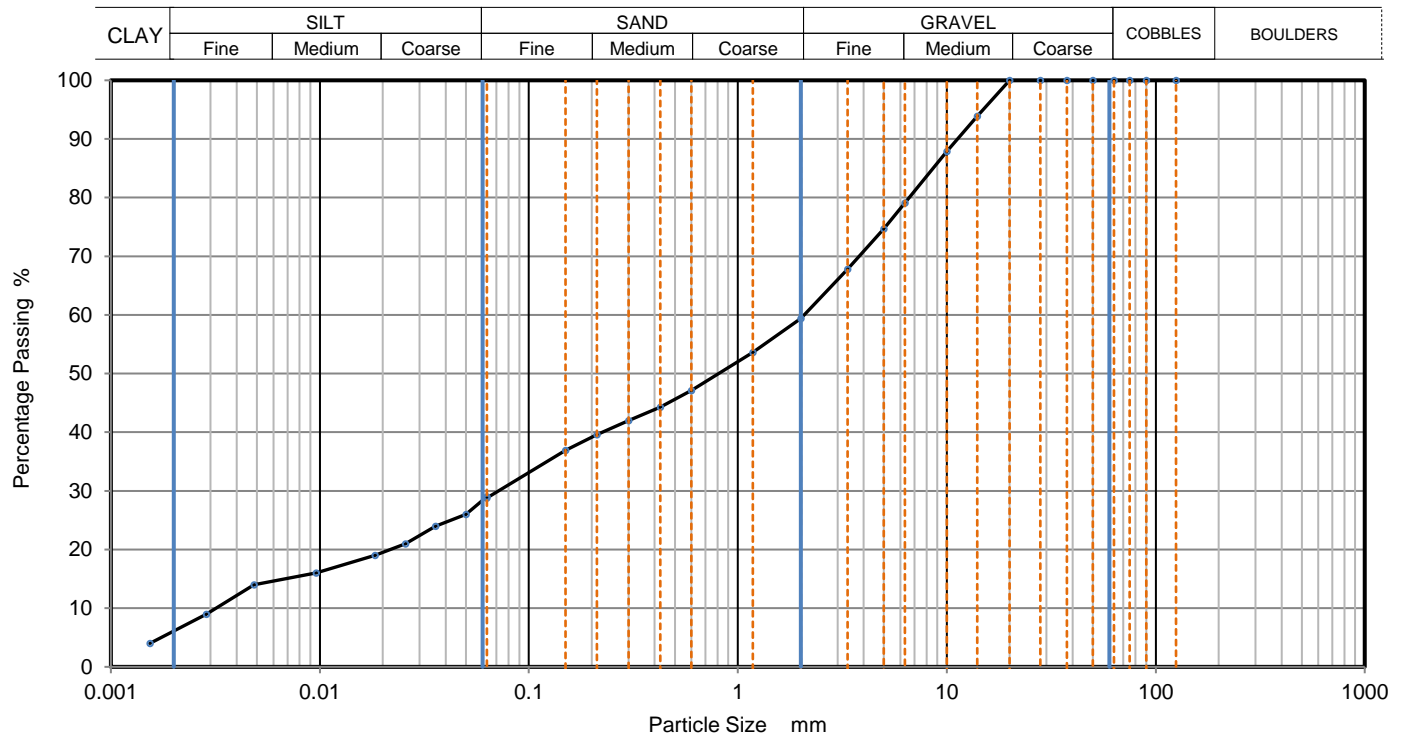
Remarks

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	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
				Borehole/Pit No.	BH07
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	7.30
Specimen Reference	9	Specimen Depth	7.3 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022042814



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	29
90	100	0.05002	26
75	100	0.03581	24
63	100	0.02563	21
50	100	0.01834	19
37.5	100	0.00958	16
28	100	0.00485	14
20	100	0.00286	9
14	94	0.00154	4
10	88		
6.3	79		
5	75		
3.35	68		
2	59		
1.18	54		
0.6	47	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	44		
0.3	42		
0.212	40		
0.15	37		
0.063	29		


Dry Mass of sample, g 513

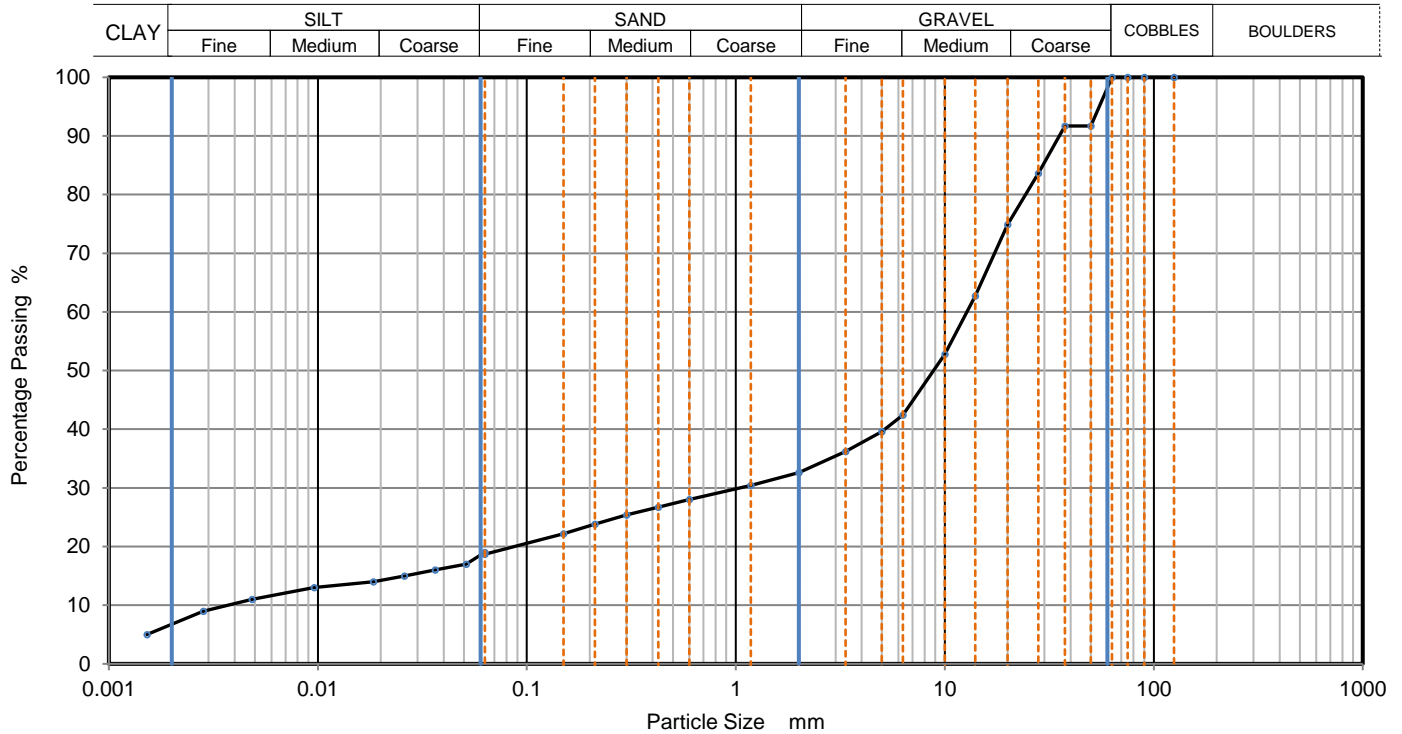
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	40.6
Sand	30.6
Silt	22.9
Clay	5.9

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	640
Curvature Coefficient	0.76

Remarks  
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH18
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	3.70
Specimen Reference	9	Specimen Depth	3.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022042810



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	19
90	100	0.05127	17
75	100	0.03647	16
63	100	0.02594	15
50	92	0.01845	14
37.5	92	0.00958	13
28	84	0.00485	11
20	75	0.00283	9
14	63	0.00152	5
10	53		
6.3	42		
5	40		
3.35	36		
2	33		
1.18	30		
0.6	28	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	27		
0.3	25		
0.212	24		
0.15	22		
0.063	19		

Dry Mass of sample, g

4533

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	67.4
Sand	13.9
Silt	12.0
Clay	6.7

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	3300
Curvature Coefficient	22


Remarks

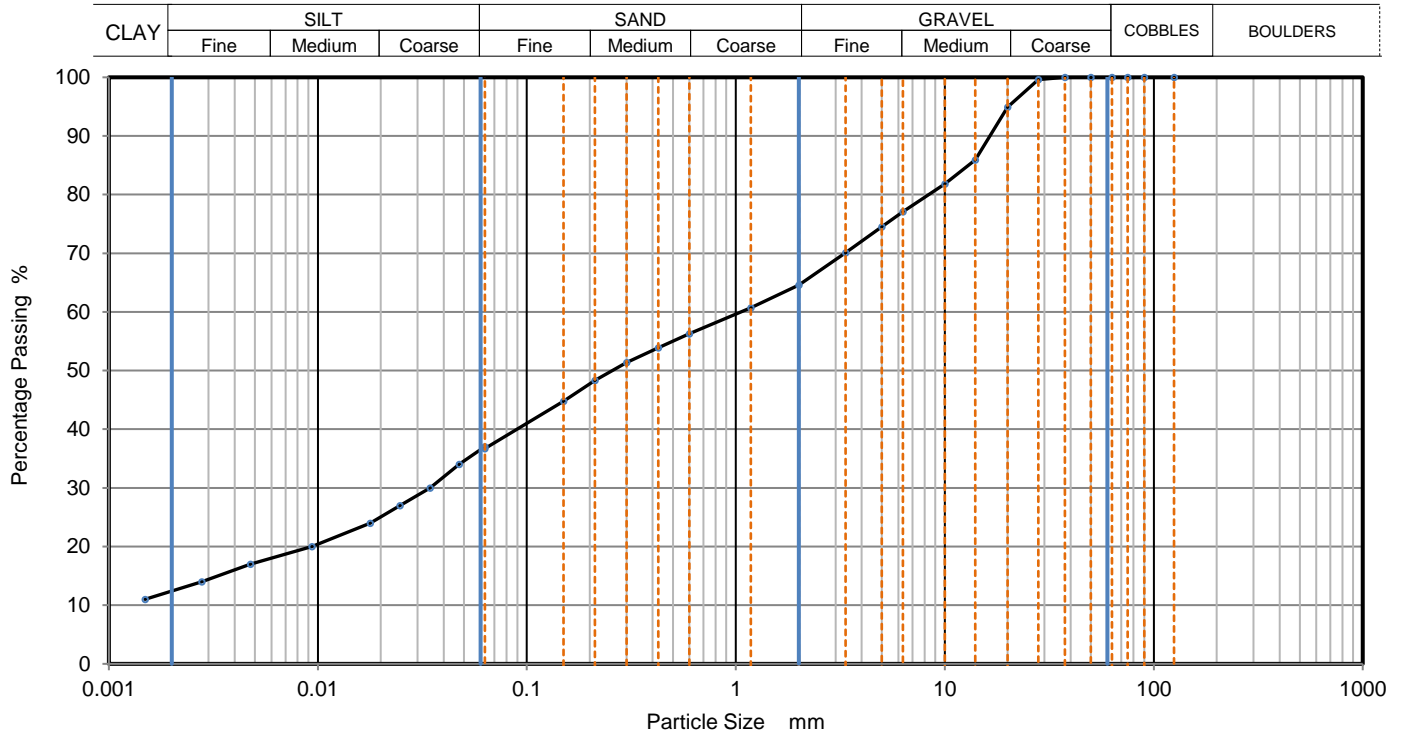
Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH18
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	5.20
Specimen Reference	9	Specimen Depth	5.2 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022042811



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06290	37
90	100	0.04744	34
75	100	0.03447	30
63	100	0.02470	27
50	100	0.01780	24
37.5	100	0.00936	20
28	100	0.00476	17
20	95	0.00278	14
14	86	0.00149	11
10	82		
6.3	77		
5	75		
3.35	70		
2	65		
1.18	61		
0.6	56	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	54		
0.3	51		
0.212	48		
0.15	45		
0.063	37		

Dry Mass of sample, g

3230

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	35.4
Sand	27.9
Silt	24.4
Clay	12.3

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122





# LABORATORY REPORT



4043

**Contract Number: PSL22/3162**

Report Date: 24 May 2022  
Client's Reference: 21-1619  
Client Name: Causeway Geotech  
8 Drumahiskey Road  
Ballymoney  
Co. Antrim  
BT53 7QL

**For the attention of: Stephen Watson**

Contract Title: North Irish Sea Array (NISA)  
Date Received: 4/5/2022  
Date Commenced: 4/5/2022  
Date Completed: 24/5/2022

**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  
(Senior Technician)

S Eyre  
(Senior Technician)

  
D Burton  
(Advanced Testing Manager)

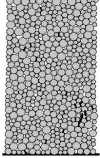
5 – 7 Hexthorpe Road, Hexthorpe,  
Doncaster DN4 0AR  
tel: +44 (0)844 815 6641  
fax: +44 (0)844 815 6642  
e-mail: rberriman@prosoils.co.uk  
awatkins@prosoils.co.uk

Page 1 of

# Effective Stress Triaxial Compression

## Consolidated Undrained

### Summary Report


<b>Sample Details</b>  <i>sketch showing specimen location in original sample</i>	Depth	7.00-7.30m		
	Description Type	Brown gravelly sandy CLAY. Undisturbed, vertical orientation.		
	Initial Sample Length	L <sub>0</sub>	(mm)	140.0
	Initial Sample Diameter	D <sub>0</sub>	(mm)	70.1
	Initial Sample Weight	W <sub>0</sub>	(gr)	1115.0
	Initial Bulk Density	ρ <sub>0</sub>	(Mg/m <sup>3</sup> )	2.06
	Particle Density	ρ <sub>s</sub>	(Mg/m <sup>3</sup> )	2.66

Initial Conditions		Stage 1	2	3	4
Initial Cell Pressure	σ <sub>3i</sub> (kPa)	850	900	1000	
Initial Back Pressure	U <sub>bi</sub> (kPa)	800	800	800	
Membrane Thickness	m <sub>b</sub> (mm)	0.600			
Displacement Input	L <sub>IP</sub> (mm)	CH 2			
Load Input	N <sub>IP</sub> (N)	CH 1			
Pore Water Pressure Input	u <sub>pwp</sub> (kPa)	CH 3			
Sample Volume	V (cc)	CH 2			
Initial Moisture	ω <sub>i</sub> (%)	11			
Initial Dry Density	ρ <sub>di</sub> (Mg/m <sup>3</sup> )	1.86			
Initial Voids Ratio	e <sub>i</sub>	0.432			
Initial Degree of Saturation	S <sub>i</sub> (%)	68			
B Value	B	0.95			

Final Conditions		Stage 1	2	3	4
Final Moisture	ω <sub>f</sub> (%)	15			
Final Dry Density	ρ <sub>df</sub> (Mg/m <sup>3</sup> )	1.95			
Final Voids Ratio	e <sub>f</sub>	0.367			
Final Degree of Saturation	S <sub>f</sub> (%)	100.0			
Failure Criteria		Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress	
Strain At Failure	ε <sub>f</sub> (%)	0.93	8.01	19.85	
Stress At Failure	(σ <sub>1</sub> - σ <sub>3</sub> ) (kPa)	54.7	110.3	336.6	
Minor Stress At Failure	σ <sub>3</sub> ' (kPa)	13.3	36.2	127.0	
Major Stress At Failure	σ <sub>1</sub> ' (kPa)	68.0	146.5	463.6	
Principal Stress Ratio At Failure	σ <sub>1</sub> ' / σ <sub>3</sub> '	5.111	4.048	3.650	

Notes	

Plastic

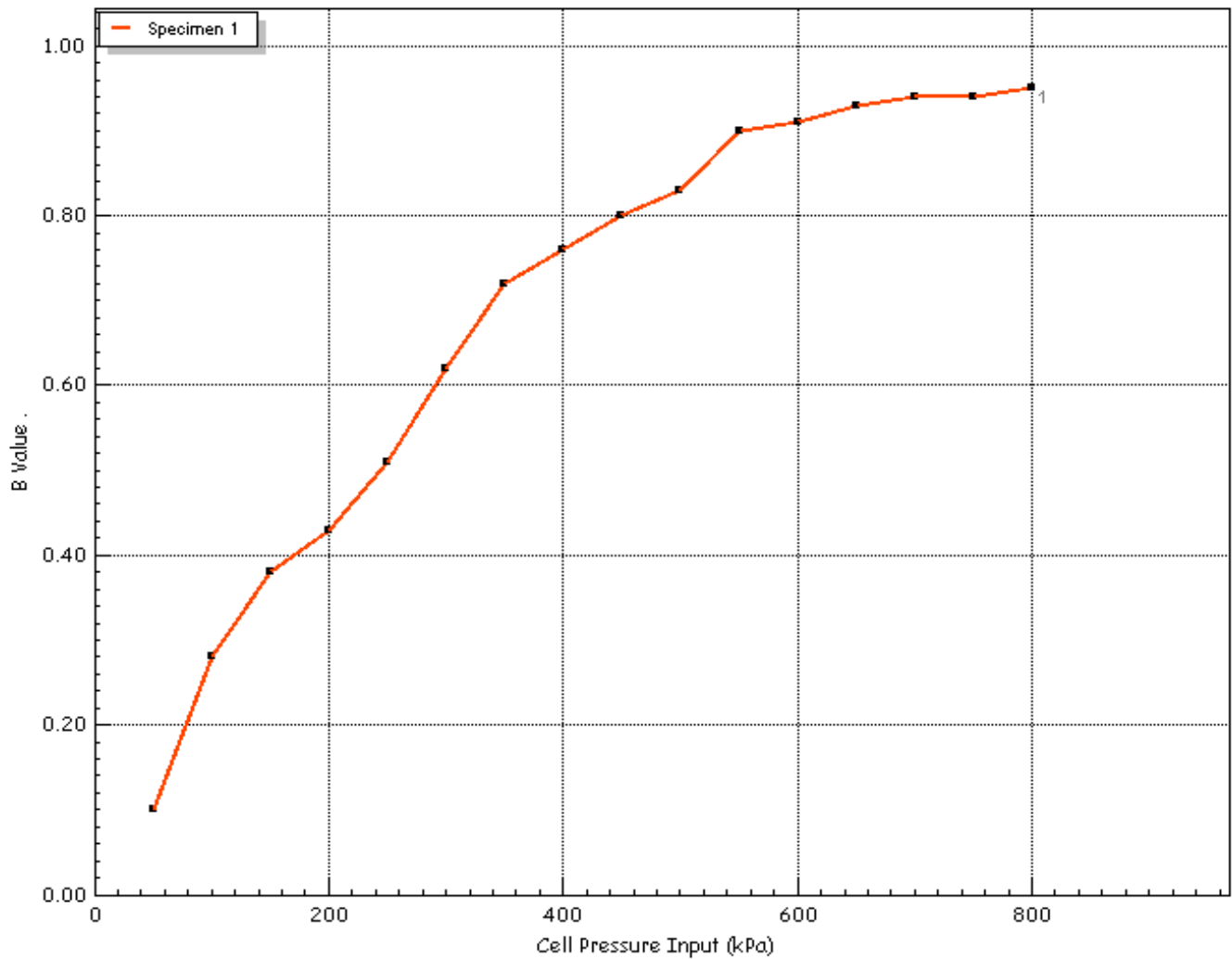
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH07 7.00-7.30m C
			Test Date	12/05/2022
	Jobfile	North Irish Sea Array NISA	Borehole	BH07
	Client	Causeway	Sample	7.00-7.30m C
			Depth	7.00-7.30m


# Effective Stress Triaxial Compression

## Consolidated Undrained

Saturation Plots

Saturation Method		Stepped
Cell Pressure Input	$\sigma$ (kPa)	800
Pore Water Pressure Input	$u_{pwp}$ (kPa)	790
B Value	B	0.95



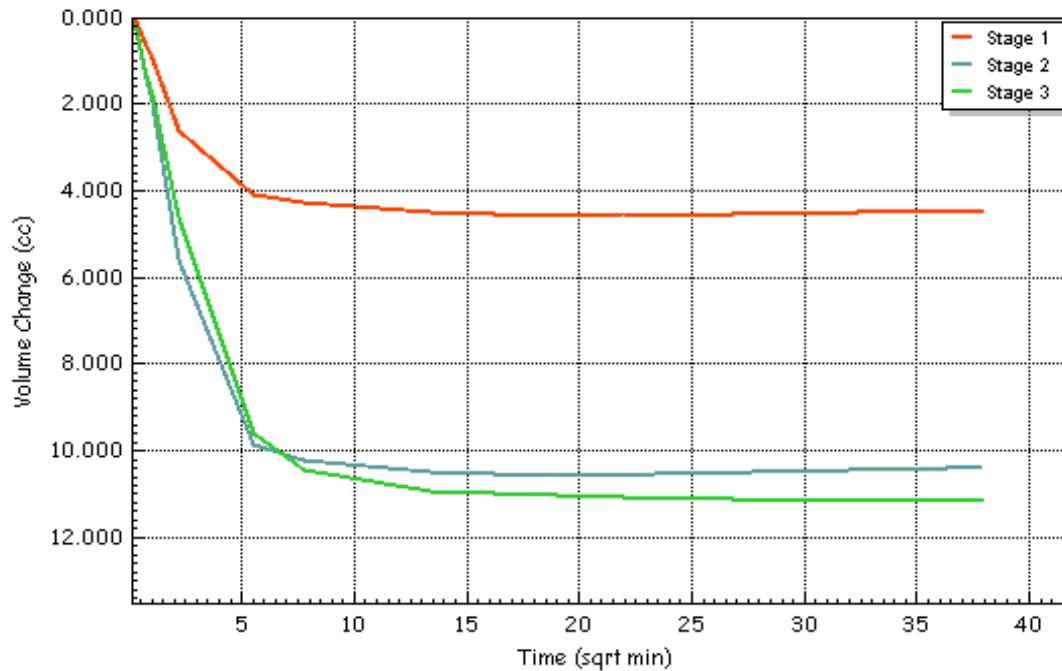
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			Test Date	12/05/2022
	Jobfile	North Irish Sea Array NISA	Borehole	BH07
	Client	Causeway	Sample	7.00-7.30m C
			Depth	7.00-7.30m


# Effective Stress Triaxial Compression

## Consolidated Undrained

### Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	$\sigma_3$	(kPa)	850	900	1000
Initial Back Pressure	$u_{bi}$	(kPa)	800	800	800
Pore Water Pressure Input	$u_{pwp}$	(kPa)	837	893	979
Drainage Method	Radial+One End				
Final Conditions			Stage 1	2	3
PWP Dissipation %	$U\%$	(%)	100.00	100.00	100.00
Volumetric Strain	$\epsilon_v\%$	(%)	0.82	1.93	2.07
Corrected Length	$L_c$	(mm)	139.6	135.7	126.6
Corrected Area	$A_c$	(cm <sup>2</sup> )	38.38	38.73	40.63
Corrected Volume	$V_c$	(cc)	535.883	525.463	514.301
t100	$t_{100}$	(min)	13.67	14.89	26.02
Consolidation	$c_v$	(m <sup>2</sup> /year)	7.440	6.831	3.909
Compressibility	$m_v$	(m <sup>2</sup> /MN)	0.220	0.208	0.116
Test Time	$t_F$	(h:m:s)	02:00:00	02:00:00	02:00:00
Estimated Strain to Failure	$\epsilon\%$	(%)	5.0	5.0	5.0
Shear Machine Speed	$d_r$	(mm/min)	0.05817	0.05817	0.05817
Notes					



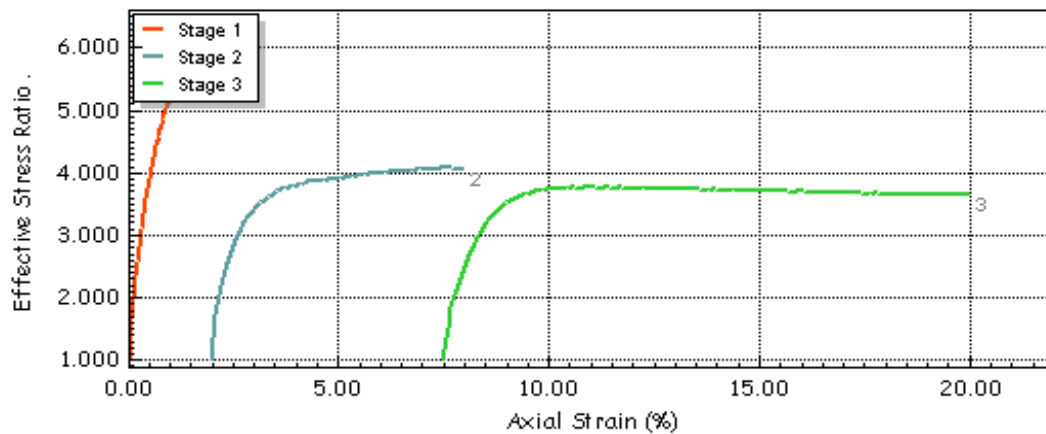
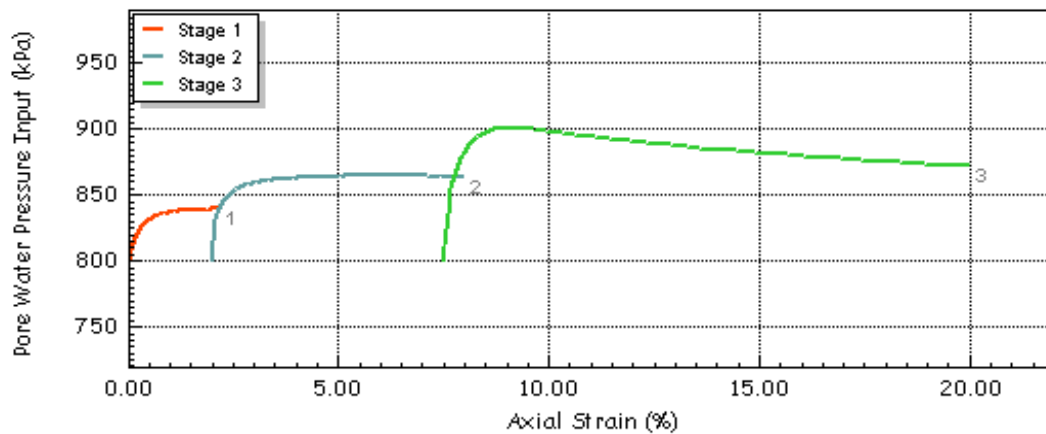
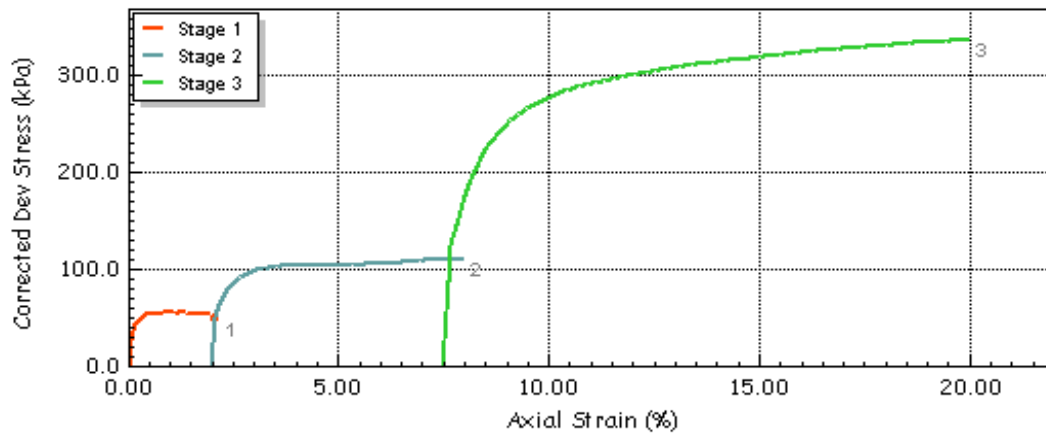
	Test Method	BS1377-8 : 1990 : Clause 7		Test Name	BH07 7.00-7.30m C
				Test Date	12/05/2022
	Jobfile	North Irish Sea Array NISA		Borehole	BH07
	Client	Causeway		Sample	7.00-7.30m C
			Depth	7.00-7.30m	



# Effective Stress Triaxial Compression

## Consolidated Undrained

### Shear Stage Plots



Test Method BS1377-8 : 1990 : Clause 7

Test Name BH07 7.00-7.30m C  
Test Date 12/05/2022

Jobfile North Irish Sea Array NISA  
Client Causeway

Borehole BH07  
Sample 7.00-7.30m C  
Depth 7.00-7.30m

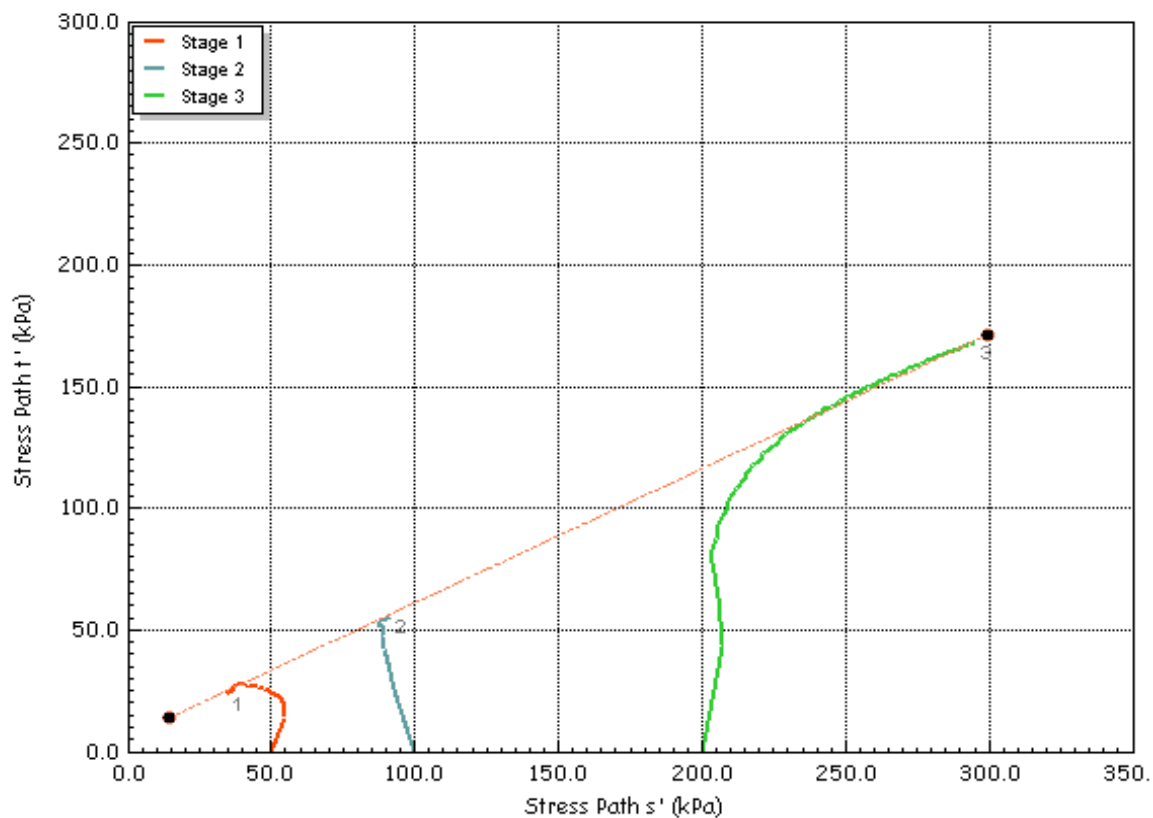
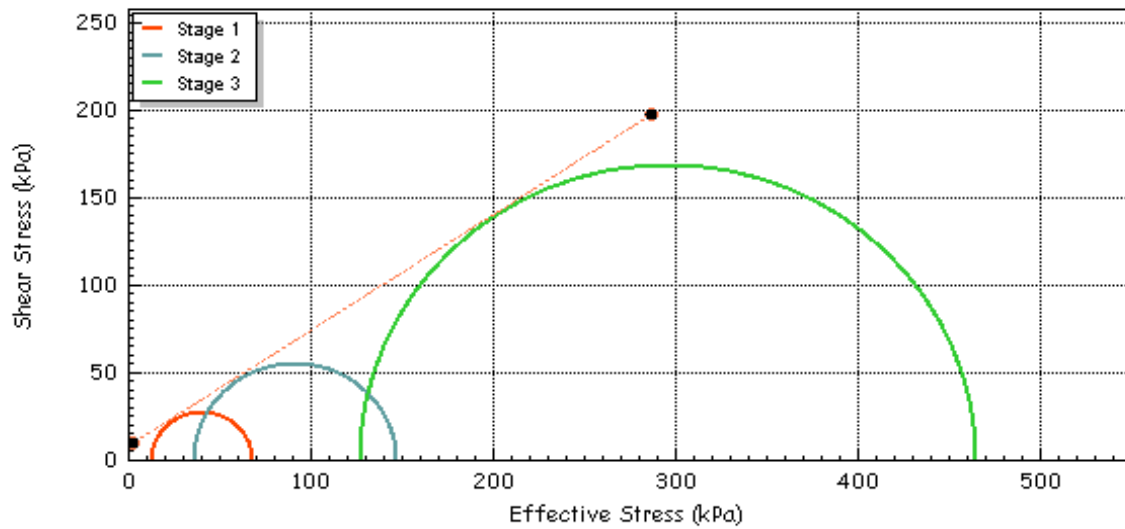



# Effective Stress Triaxial Compression

## Consolidated Undrained

### Shear Stage Plots

Effective	$c'$	(kPa)	7.09	Effective Cohesion $c'$	(kPa)	7.09
Effective Friction	$\phi'$	(deg)	33.6	Effective Friction $\phi'$	(deg)	33.6



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH07 7.00-7.30m C
	Jobfile	North Irish Sea Array NISA	Test Date	12/05/2022
Client	Causeway		Borehole	BH07
			Sample	7.00-7.30m C
			Depth	7.00-7.30m



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Company Number: NI610766

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Registered in Ireland.  
Company Number: 633786

[www.causewaygeotech.com](http://www.causewaygeotech.com)

## SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

16 May 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 29/04/2022 and 16/05/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 10

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	15
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	2
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	12
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	15
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	10



## Summary of Classification Test Results

Project No. 21-1619		Project Name North Irish Sea Array												
Hole No.	Sample				Soil Description	Density		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
BH03	1	5.50	6.80	C	Brownish grey sandy slightly gravelly CLAY.			18.0	63	28	13	15		CL
BH03	2	8.50	9.15	C	Greyish brown gravelly slightly silty fine to coarse SAND.			7.9	40	23	18	5		ML
BH03	3	9.15	9.55	C	Greyish brown subangular fine to coarse GRAVEL.			1.8						
BH03	4	9.55	10.00	C	Greyish brown gravelly slightly clayey fine to coarse SAND.			5.6	31	20 -1pt	13	7		CL
BH03	5	10.00	10.25	C	Greyish brown gravelly slightly clayey fine to coarse SAND.			8.4	38	26	16	10		CL
BH03	6	10.25	11.05	C	Greyish brown gravelly clayey fine to coarse SAND.			13.0	44	27	16	11		CL
BH03	7	11.05	11.50	C	Greyish brown gravelly clayey fine to coarse SAND with cobbles.			5.2	61	24	15	9		CL
BH05	8	7.50	8.50	C	Greyish brown clayey fine to coarse SAND.			19.0	43	27	14	13		CL
BH05	9	8.50	9.00	C	Greyish brown sandy slightly gravelly silty CLAY.			12.0	58	29	15	14		CL
BH05	10	10.50	11.40	C	Greyish brown slightly gravelly clayey fine to coarse SAND.			39.0	79	26	18	8		CL
BH05	11	11.40	12.50	C	Dark greyish brown very gravelly silty fine to coarse SAND with cobbles.			6.6	34	25 -1pt	16	9		CL
BH06	12	7.00	7.35	C	Brown sandy gravelly silty CLAY.			17.0	69	23	15	8		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 5

**Key**

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

16/05/2022

Approved By

Stephen.Watson



10122



Project No.

21-1619

Project Name

## North Irish Sea Array

All tests performed in accordance with BS1377:1990 unless specified otherwise

## Key

### Density test

Linear measurement unless :

wd - water displacement

wi - immersion in water

### Liquid Limit

4pt cone unless :

cas - Casagrande method

1pt - single point test

Particle density

sp - small pyknometer

gj - gas jar

Date Printed

16/05/2022

Approved By

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

1

Soil Description

Brownish grey sandy slightly gravelly CLAY.

Depth, m

5.50

Specimen Reference

9

Specimen  
Depth

5.5

m

Sample Type

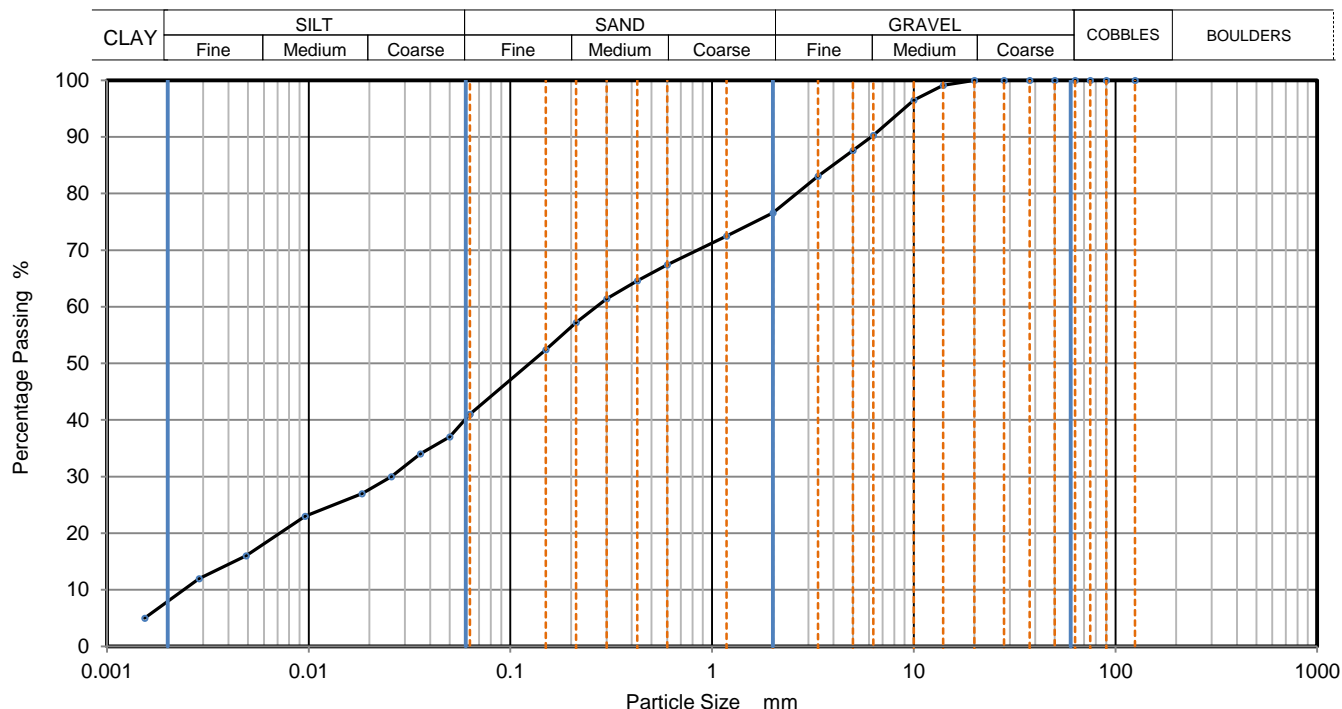
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Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503149





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

2

Soil Description

Greyish brown gravelly slightly silty fine to coarse SAND.

Depth, m

8.50

Specimen Reference

9

Specimen  
Depth

8.5

m

Sample Type

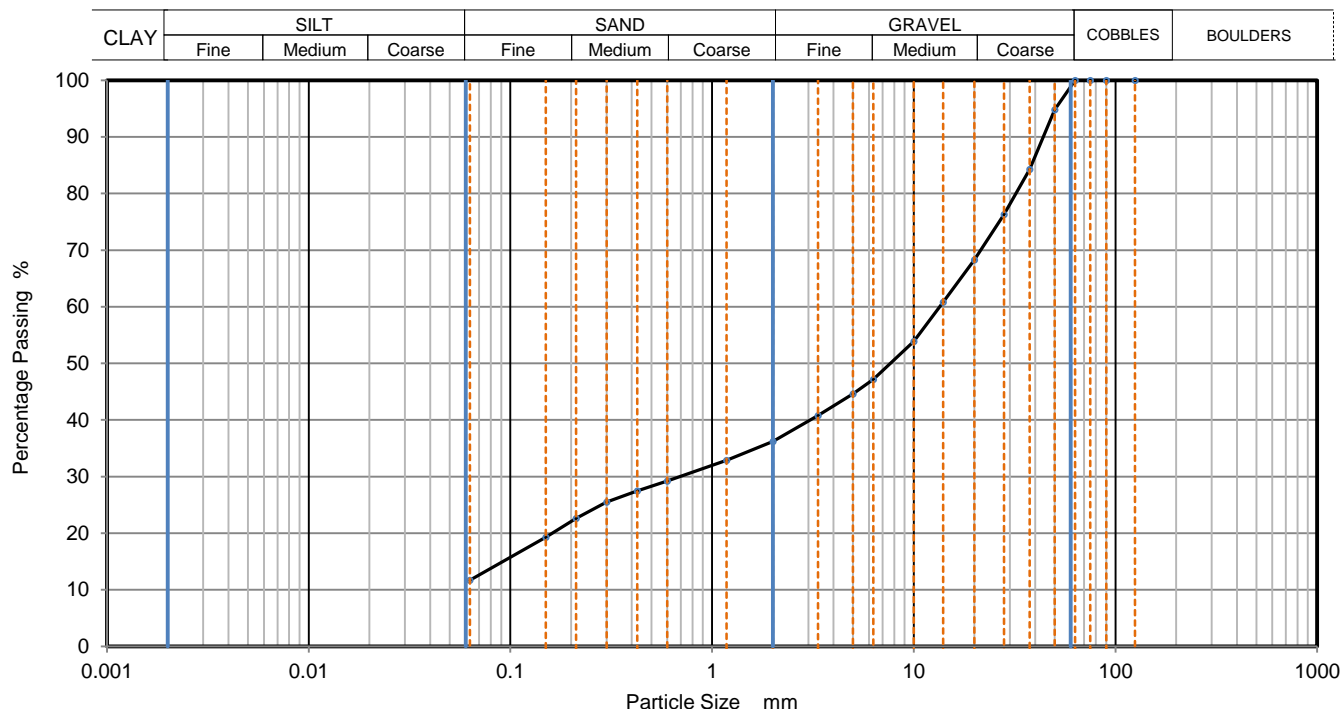
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Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

Caus20220503150



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	84		
28	76		
20	68		
14	61		
10	54		
6.3	47		
5	45		
3.35	41		
2	36		
1.18	33		
0.6	29		
0.425	28		
0.3	26		
0.212	23		
0.15	19		
0.063	12		

Dry Mass of sample, g

9833

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	63.8
Sand	24.6
Fines <0.063mm	12.0

Grading Analysis		
D100	mm	
D60	mm	13.4
D30	mm	0.696
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

3

Soil Description

Greyish brown subangular fine to coarse GRAVEL.

Depth, m

9.15

Specimen Reference

9

Specimen  
Depth

9.15

m

Sample Type

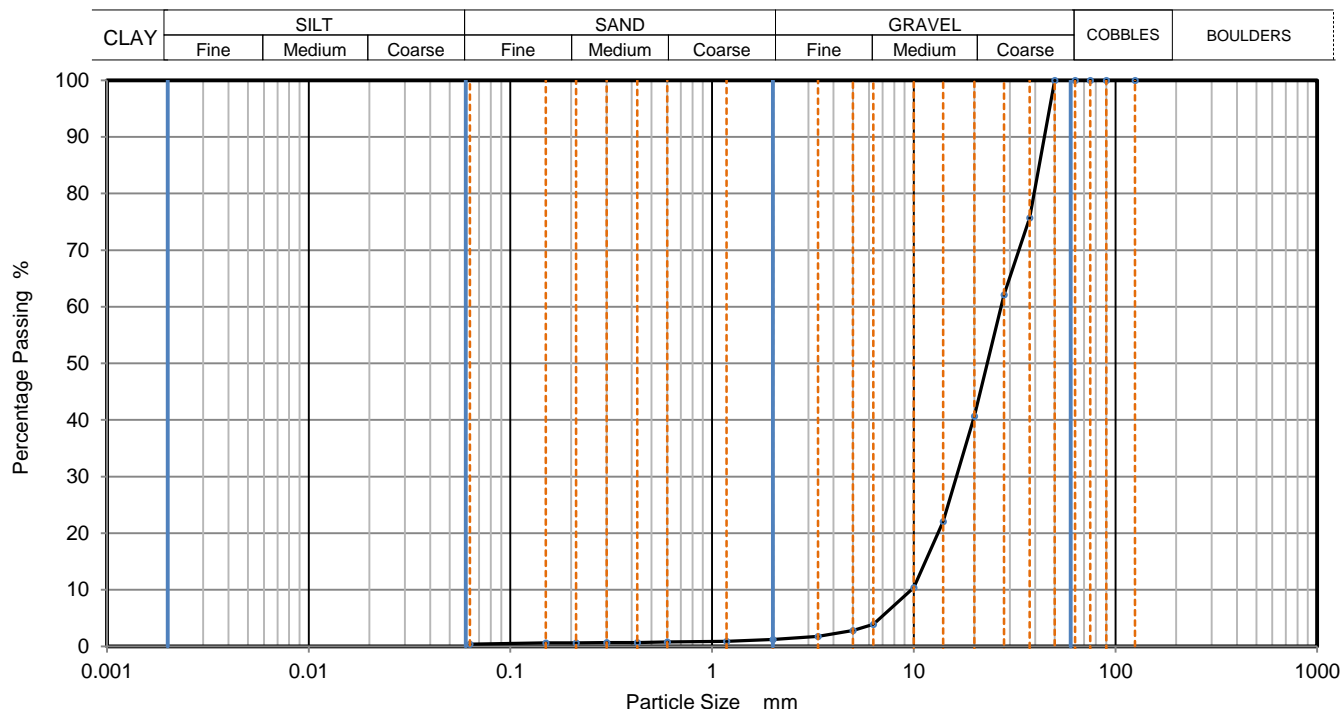
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Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

Caus20220503151



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	76		
28	62		
20	41		
14	22		
10	10		
6.3	4		
5	3		
3.35	2		
2	1		
1.18	1		
0.6	1		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	0		

Dry Mass of sample, g

5175

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	98.8
Sand	0.8
Fines <0.063mm	0.0

Grading Analysis		
D100	mm	
D60	mm	27.1
D30	mm	16.3
D10	mm	9.72
Uniformity Coefficient		2.8
Curvature Coefficient		1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

4

Soil Description

Greyish brown gravelly slightly clayey fine to coarse SAND.

Depth, m

9.55

Specimen Reference

9

Specimen  
Depth

9.55

m

Sample Type

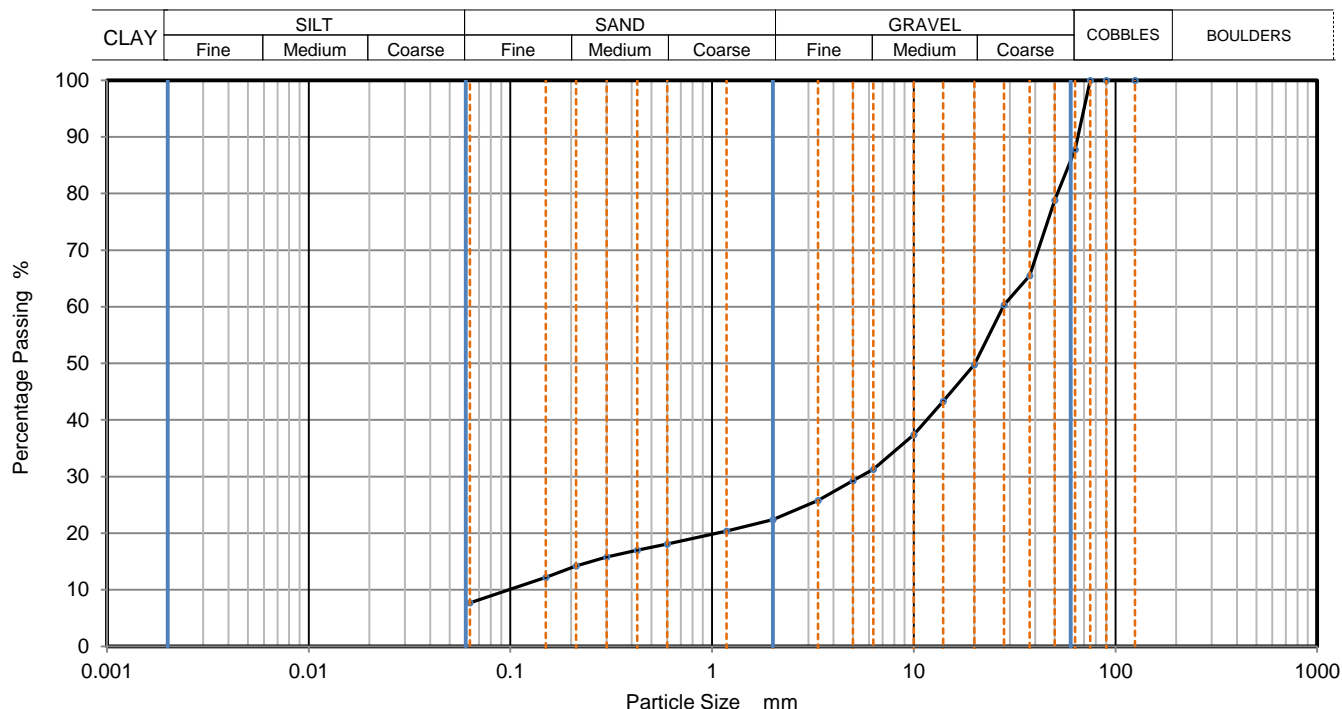
C

Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

Caus20220503152



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	88		
50	79		
37.5	66		
28	60		
20	50		
14	43		
10	37		
6.3	31		
5	29		
3.35	26		
2	22		
1.18	20		
0.6	18		
0.425	17		
0.3	16		
0.212	14		
0.15	12		
0.063	8		

Dry Mass of sample, g

4556

Sample Proportions	% dry mass
Cobbles	12.2
Gravel	65.5
Sand	14.6
Fines <0.063mm	8.0

Grading Analysis		
D100	mm	
D60	mm	27.8
D30	mm	5.42
D10	mm	0.0978
Uniformity Coefficient		280
Curvature Coefficient		11

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

5

Soil Description

Greyish brown gravelly slightly clayey fine to coarse SAND.

Depth, m

10.00

Specimen Reference

9

Specimen  
Depth

10

m

Sample Type

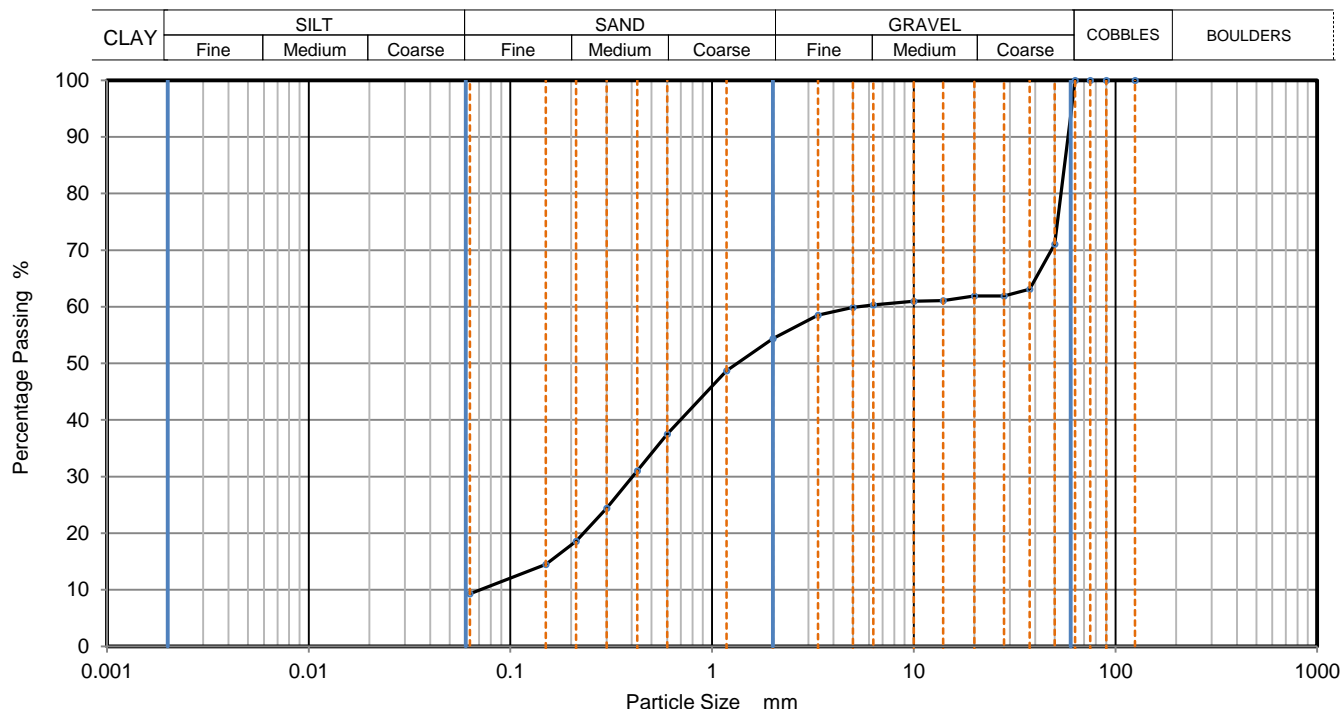
C

Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

Caus20220503153



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	71		
37.5	63		
28	62		
20	62		
14	61		
10	61		
6.3	60		
5	60		
3.35	59		
2	54		
1.18	49		
0.6	38		
0.425	31		
0.3	24		
0.212	19		
0.15	15		
0.063	9		

Dry Mass of sample, g

3415

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	45.6
Sand	45.1
Fines <0.063mm	9.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	74
Curvature Coefficient	0.45

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

6

Soil Description

Greyish brown gravelly clayey fine to coarse SAND.

Depth, m

10.25

Specimen Reference

9

Specimen  
Depth

10.25

m

Sample Type

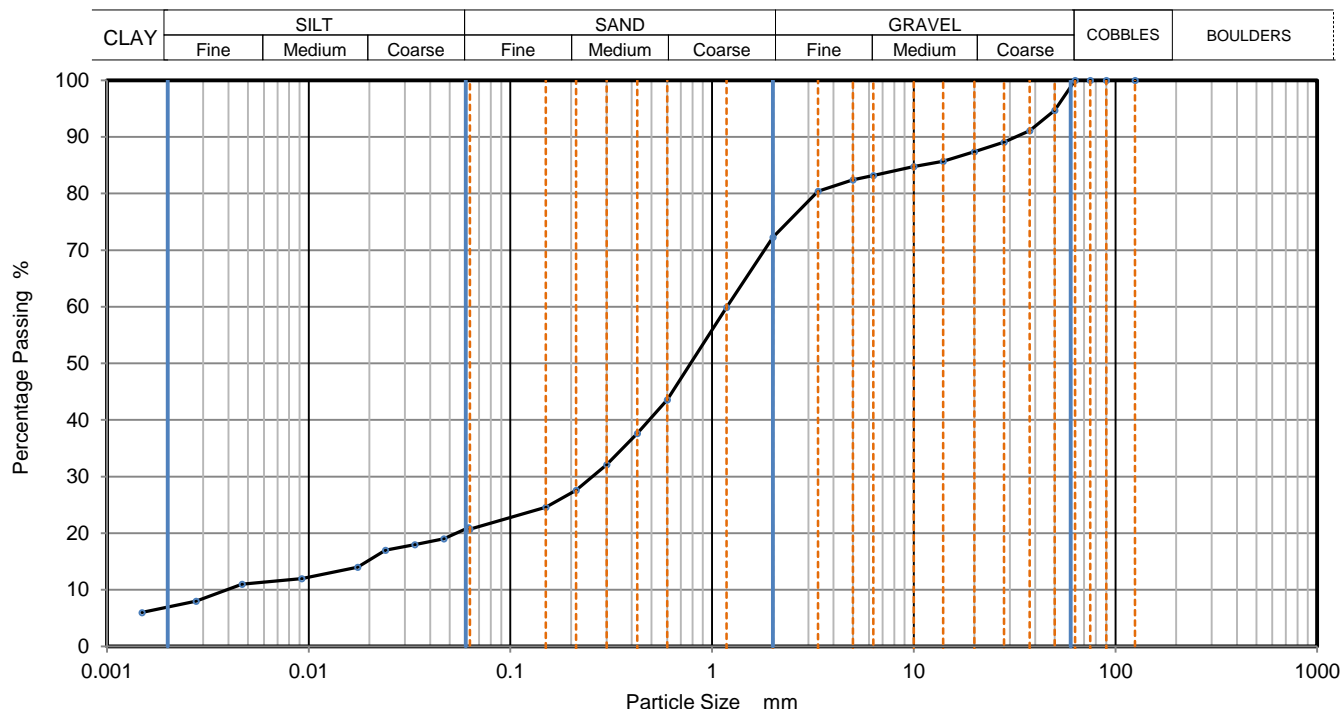
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503154



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06199	21
90	100	0.04677	19
75	100	0.03355	18
63	100	0.02405	17
50	95	0.01746	14
37.5	91	0.00925	12
28	89	0.00468	11
20	87	0.00277	8
14	86	0.00149	6
10	85		
6.3	83		
5	82		
3.35	80		
2	72		
1.18	60		
0.6	44	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	38		
0.3	32		
0.212	28		
0.15	25		
0.063	21		

Dry Mass of sample, g

9153

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	27.7
Sand	51.5
Silt	14.0
Clay	6.8

Grading Analysis		
D100	mm	
D60	mm	1.19
D30	mm	0.255
D10	mm	0.00407
Uniformity Coefficient		290
Curvature Coefficient		13

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH03

Site Name

North Irish Sea Array

Sample No.

7

Soil Description

Greyish brown gravelly clayey fine to coarse SAND with cobbles.

Depth, m

11.05

Specimen Reference

9

Specimen  
Depth

11.05

m

Sample Type

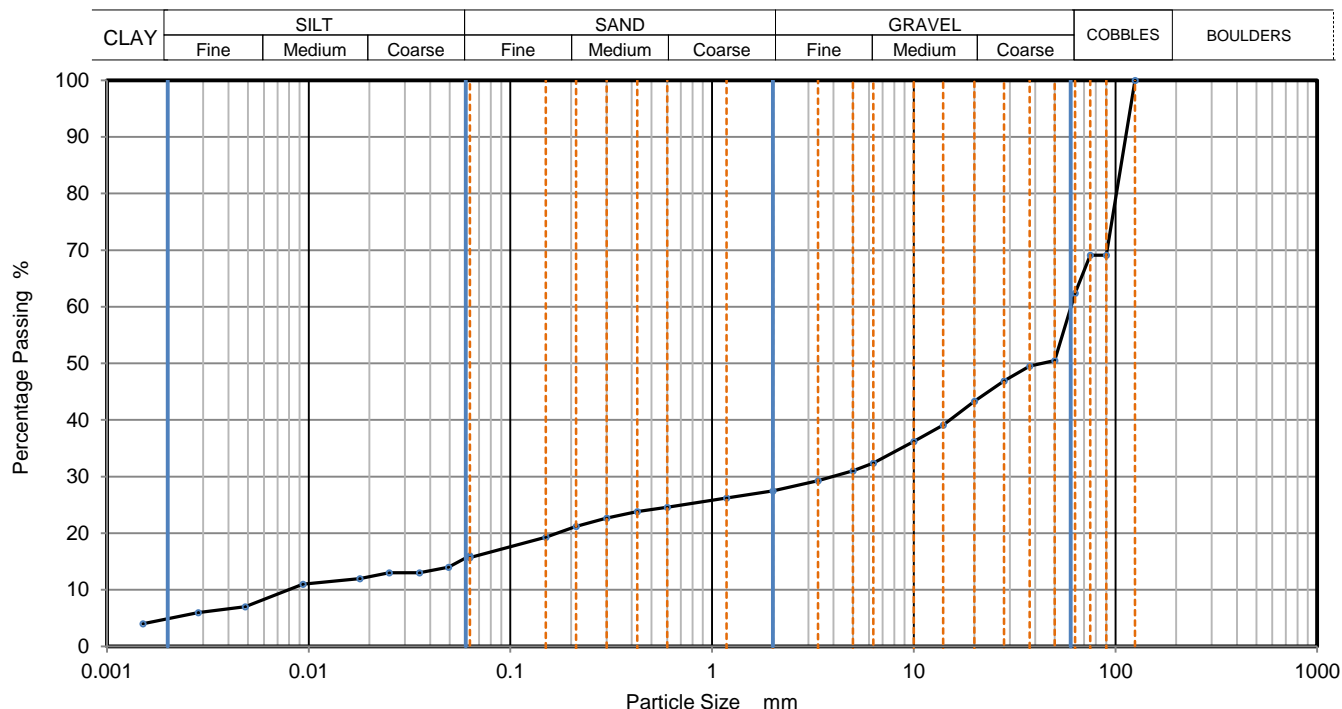
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503155



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	16
90	69	0.04939	14
75	69	0.03537	13
63	62	0.02501	13
50	51	0.01791	12
37.5	50	0.00936	11
28	47	0.00485	7
20	43	0.00283	6
14	39	0.00150	4
10	36		
6.3	32		
5	31		
3.35	29		
2	28		
1.18	26		
0.6	25	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	24		
0.3	23		
0.212	21		
0.15	19		
0.063	16		

Dry Mass of sample, g

8823

Sample Proportions	% dry mass
Cobbles	37.6
Gravel	35.0
Sand	11.8
Silt	10.6
Clay	5.0

Grading Analysis		
D100	mm	125
D60	mm	60.1
D30	mm	3.94
D10	mm	0.00832
Uniformity Coefficient		7200
Curvature Coefficient		31

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

8

Soil Description

Greyish brown clayey fine to coarse SAND.

Depth, m

7.50

Specimen Reference

9

Specimen  
Depth

7.5

m

Sample Type

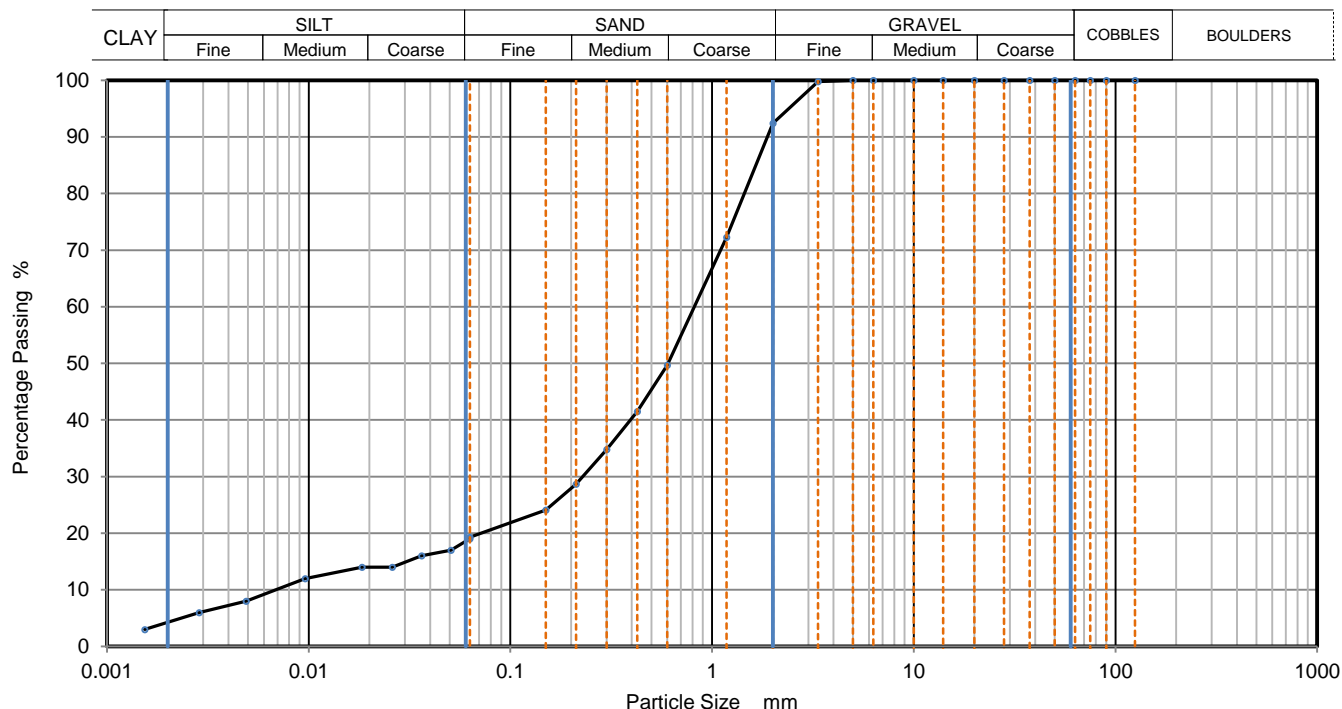
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503156



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	19
90	100	0.05065	17
75	100	0.03625	16
63	100	0.02594	14
50	100	0.01834	14
37.5	100	0.00958	12
28	100	0.00490	8
20	100	0.00286	6
14	100	0.00154	3
10	100		
6.3	100		
5	100		
3.35	100		
2	92		
1.18	72		
0.6	50	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	42		
0.3	35		
0.212	29		
0.15	24		
0.063	19		

Dry Mass of sample, g

220

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	7.6
Sand	73.1
Silt	15.0
Clay	4.3

Grading Analysis		
D100	mm	
D60	mm	0.817
D30	mm	0.228
D10	mm	0.00672
Uniformity Coefficient		120
Curvature Coefficient		9.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

LAB 05R - Version 5



## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

9

Soil Description

Greyish brown sandy slightly gravelly silty CLAY.

Depth, m

8.50

Specimen Reference

9

Specimen  
Depth

8.5

m

Sample Type

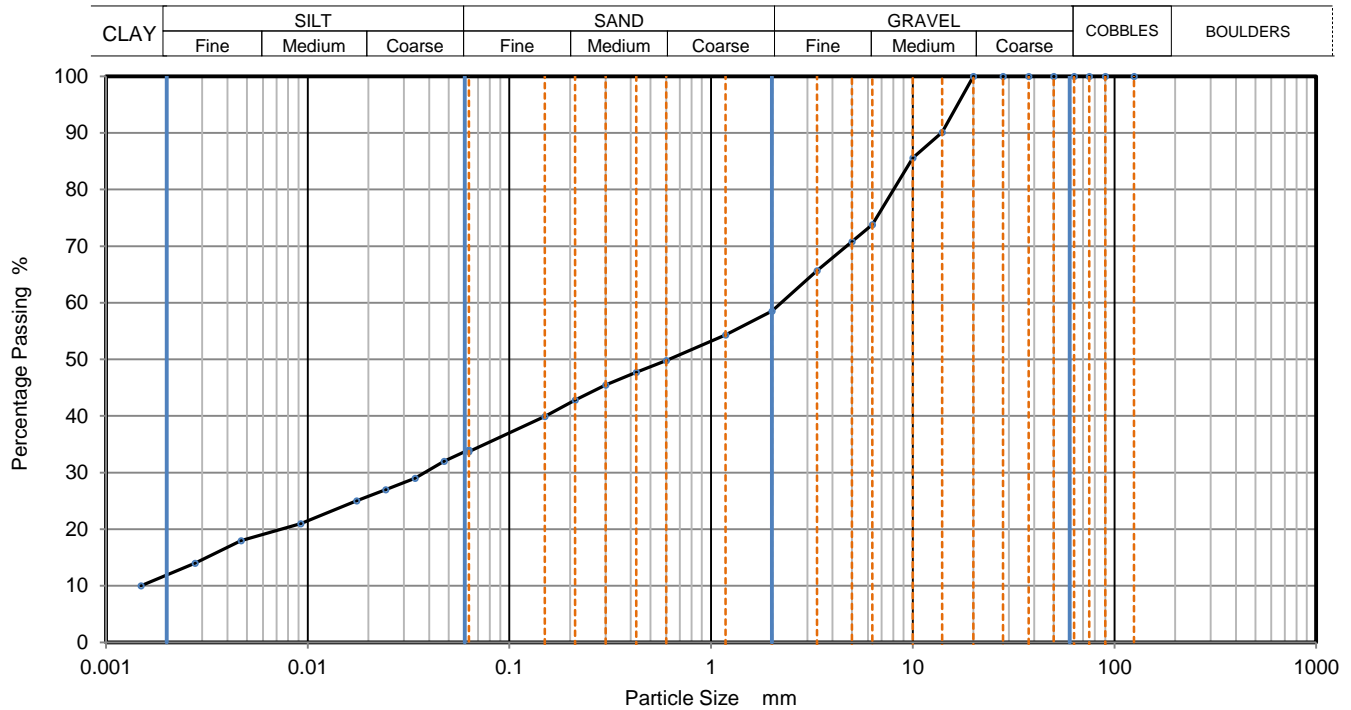
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503157



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06290	34
90	100	0.04744	32
75	100	0.03401	29
63	100	0.02437	27
50	100	0.01746	25
37.5	100	0.00925	21
28	100	0.00468	18
20	100	0.00277	14
14	90	0.00149	10
10	86		
6.3	74		
5	71		
3.35	66		
2	59		
1.18	54		
0.6	50	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	48		
0.3	46		
0.212	43		
0.15	40		
0.063	34		

Dry Mass of sample, g

506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	41.5
Sand	24.8
Silt	21.8
Clay	11.9

Grading Analysis		
D100	mm	
D60	mm	2.23
D30	mm	0.0376
D10	mm	0.00154
Uniformity Coefficient		1500
Curvature Coefficient		0.41

Remarks

Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

10

Soil Description

Greyish brown slightly gravelly clayey fine to coarse SAND.

Depth, m

10.50

Specimen Reference

9

Specimen  
Depth

10.5

m

Sample Type

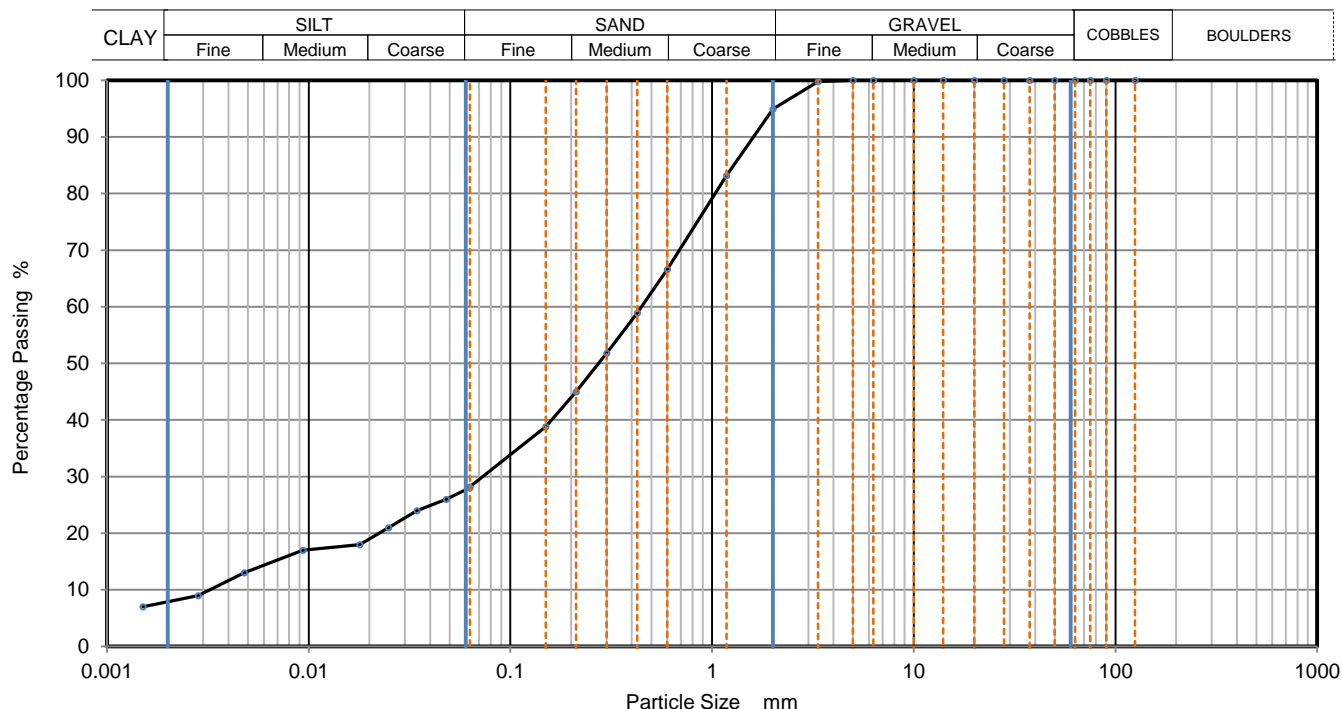
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503158



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	28
90	100	0.04810	26
75	100	0.03447	24
63	100	0.02485	21
50	100	0.01791	18
37.5	100	0.00936	17
28	100	0.00479	13
20	100	0.00283	9
14	100	0.00150	7
10	100		
6.3	100		
5	100		
3.35	100		
2	95		
1.18	83		
0.6	67	Particle density (assumed) 2.65 Mg/m3	
0.425	59		
0.3	52		
0.212	45		
0.15	39		
0.063	28		

Dry Mass of sample, g

210

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	5.1
Sand	66.7
Silt	20.5
Clay	7.7

Grading Analysis		
D100	mm	
D60	mm	0.446
D30	mm	0.073
D10	mm	0.00335
Uniformity Coefficient		130
Curvature Coefficient		3.6

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson





## PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH05

Site Name

North Irish Sea Array

Sample No.

11

Soil Description

Dark greyish brown very gravelly silty fine to coarse SAND with cobbles.

Depth, m

11.40

Specimen Reference

9

Specimen  
Depth

11.4

m

Sample Type

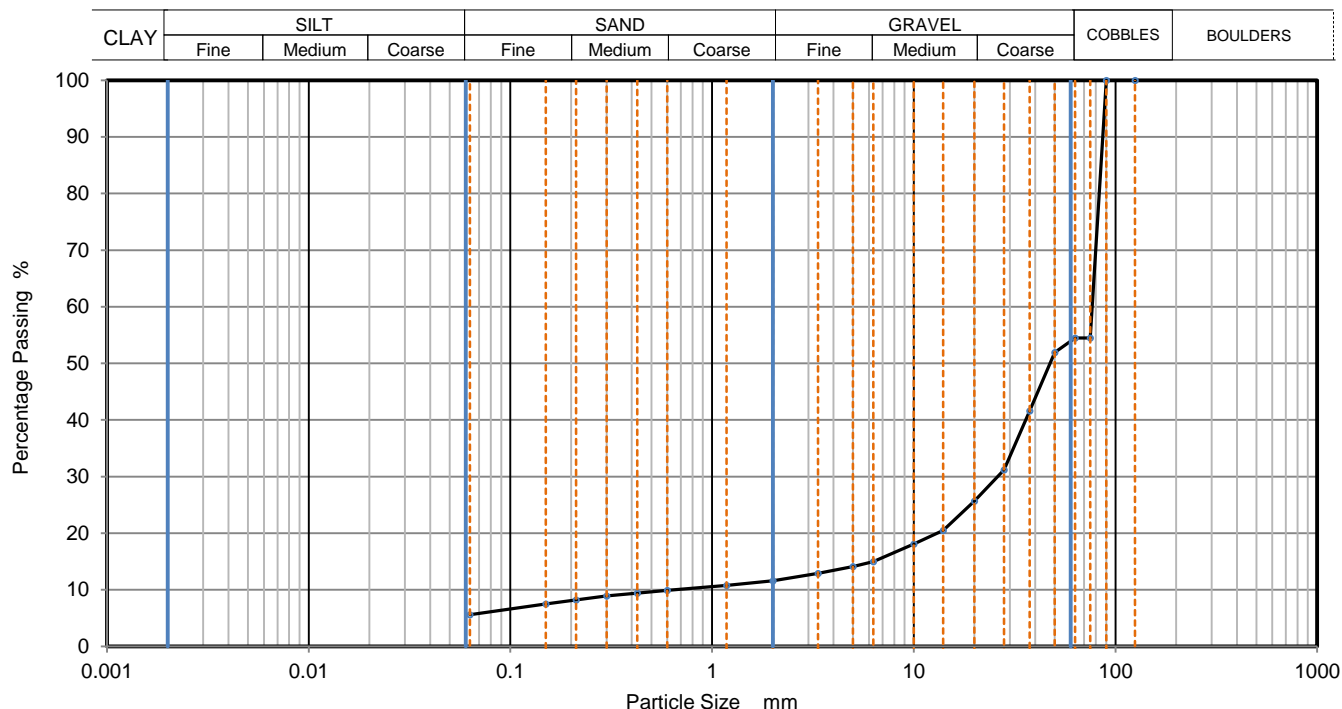
C

Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

Caus20220503159



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	55		
63	55		
50	52		
37.5	42		
28	31		
20	26		
14	21		
10	18		
6.3	15		
5	14		
3.35	13		
2	12		
1.18	11		
0.6	10		
0.425	9		
0.3	9		
0.212	8		
0.15	8		
0.063	6		

Dry Mass of sample, g

8100

Sample Proportions	% dry mass
Cobbles	45.5
Gravel	42.9
Sand	6.0
Fines <0.063mm	6.0

Grading Analysis		
D100	mm	
D60	mm	76.7
D30	mm	26.1
D10	mm	0.642
Uniformity Coefficient		120
Curvature Coefficient		14

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

LAB 05R - Version 5

10122

# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH06

Site Name

North Irish Sea Array

Sample No.

12

Soil Description

Brown sandy gravelly silty CLAY.

Depth, m

7.00

Specimen Reference

9

Specimen  
Depth

7

m

Sample Type

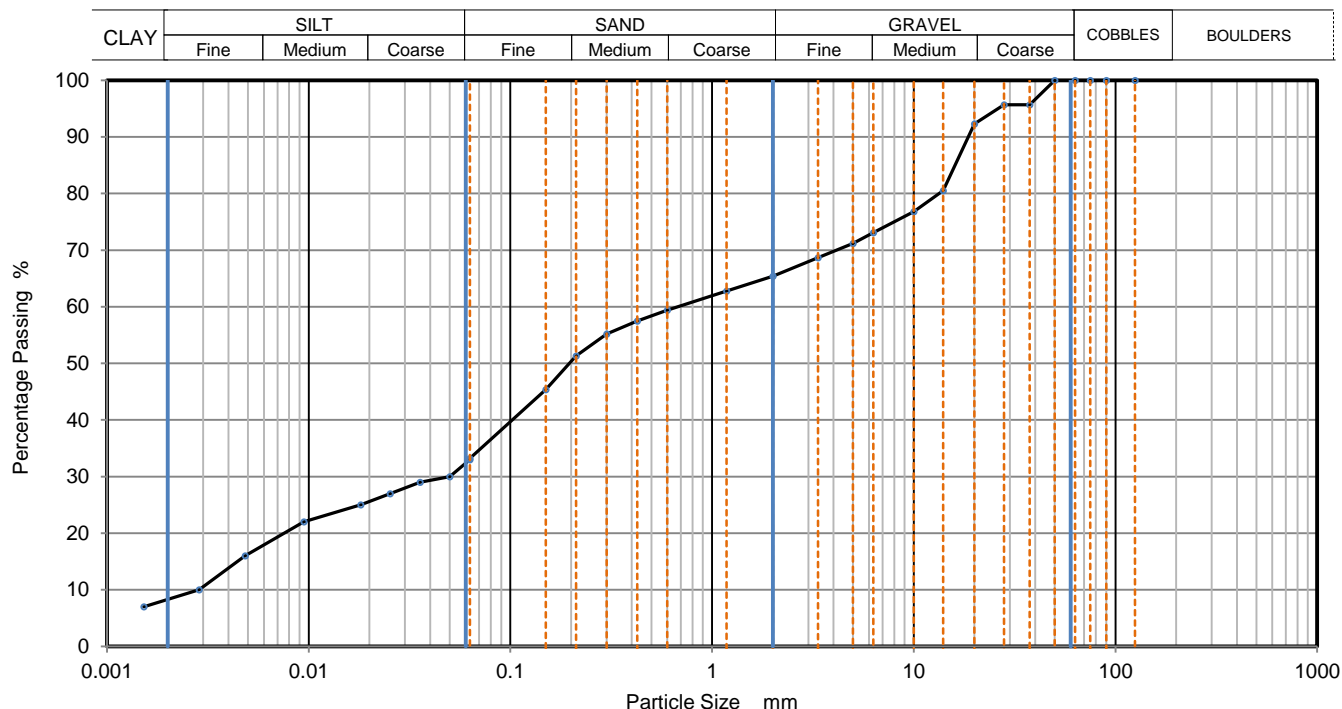
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503160



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	33
90	100	0.05002	30
75	100	0.03559	29
63	100	0.02532	27
50	100	0.01813	25
37.5	96	0.00947	22
28	96	0.00485	16
20	92	0.00286	10
14	81	0.00152	7
10	77		
6.3	73		
5	71		
3.35	69		
2	65		
1.18	63		
0.6	59	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	58		
0.3	55		
0.212	51		
0.15	45		
0.063	33		

Dry Mass of sample, g

4087

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	34.6
Sand	32.2
Silt	24.7
Clay	8.5

Grading Analysis		
D100	mm	
D60	mm	0.674
D30	mm	0.0465
D10	mm	0.00279
Uniformity Coefficient		240
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH06

Site Name

North Irish Sea Array

Sample No.

14

Soil Description

Brown sandy gravelly silty CLAY.

Depth, m

14.90

Specimen Reference

9

Specimen  
Depth

14.9

m

Sample Type

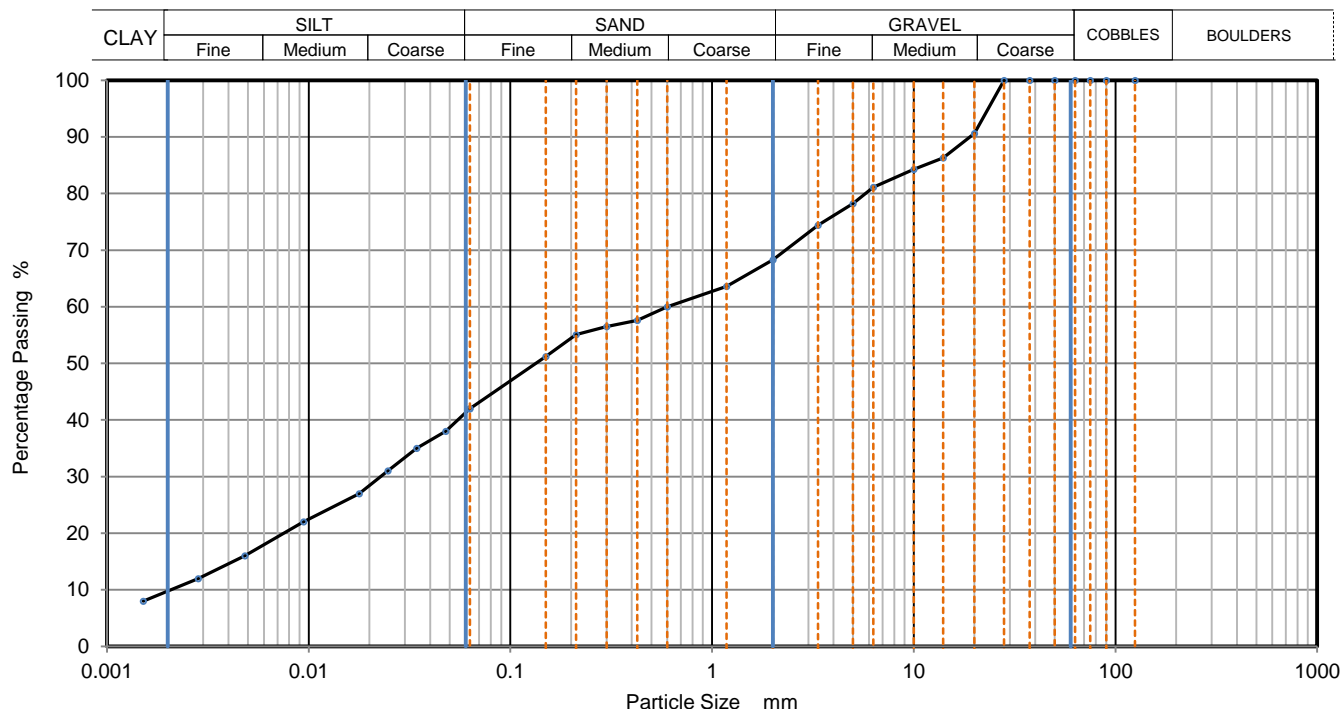
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503162



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06290	42
90	100	0.04777	38
75	100	0.03424	35
63	100	0.02470	31
50	100	0.01780	27
37.5	100	0.00942	22
28	100	0.00482	16
20	91	0.00283	12
14	86	0.00151	8
10	84		
6.3	81		
5	78		
3.35	74		
2	68		
1.18	64		
0.6	60	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	58		
0.3	57		
0.212	55		
0.15	51		
0.063	42		

Dry Mass of sample, g

598

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	31.7
Sand	26.3
Silt	32.1
Clay	9.9

Grading Analysis		
D100	mm	
D60	mm	0.602
D30	mm	0.0225
D10	mm	0.00202
Uniformity Coefficient		300
Curvature Coefficient		0.42

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson



# PARTICLE SIZE DISTRIBUTION

Job Ref

21-1619

Borehole/Pit No.

BH06

Site Name

North Irish Sea Array

Sample No.

15

Soil Description

Brown slightly sandy clayey subangular fine to coarse GRAVEL with cobbles.

Depth, m

15.45

Specimen Reference

11

Specimen  
Depth

15.45

m

Sample Type

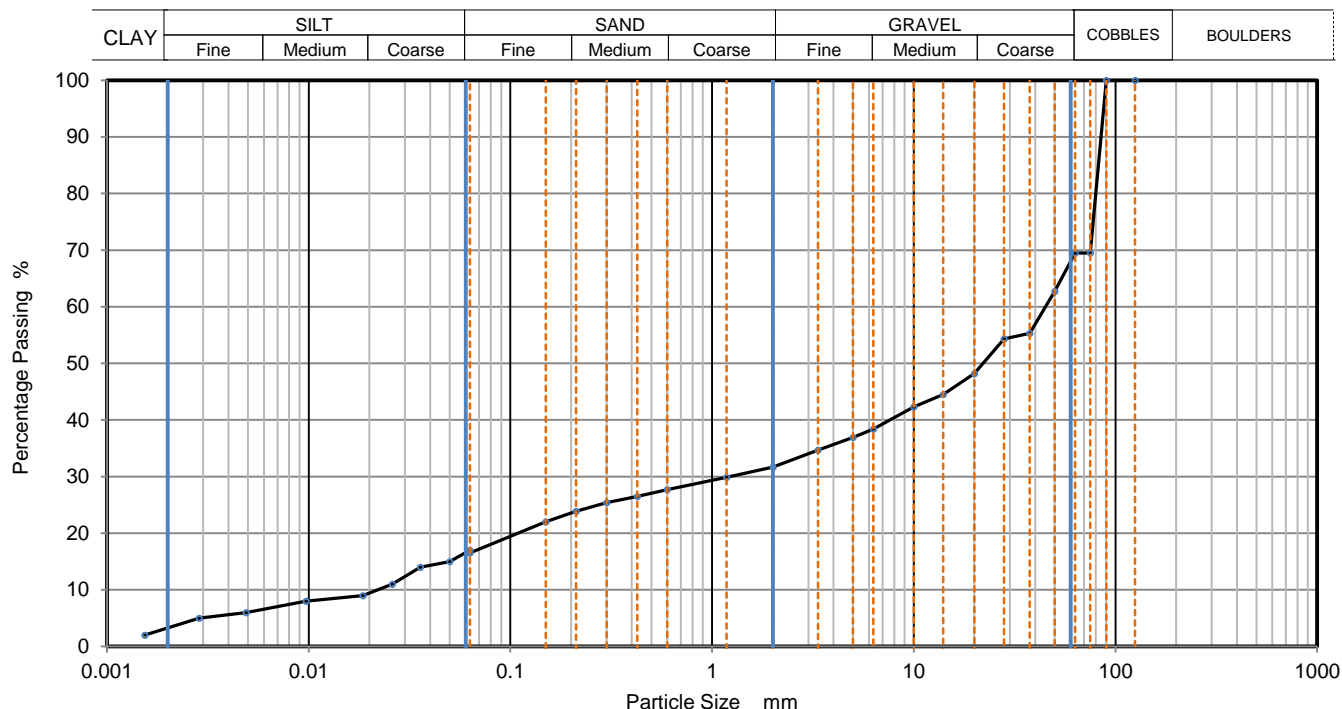
C

Test Method

BS1377:Part 2:1990, clauses 9.2 and 9.5

KeyLAB ID

Caus20220503163



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	17
90	100	0.05002	15
75	70	0.03581	14
63	70	0.02594	11
50	63	0.01855	9
37.5	55	0.00969	8
28	54	0.00490	6
20	48	0.00286	5
14	45	0.00154	2
10	42		
6.3	38		
5	37		
3.35	35		
2	32		
1.18	30		
0.6	28	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	27		
0.3	25		
0.212	24		
0.15	22		
0.063	17		

Dry Mass of sample, g

3154

Sample Proportions	% dry mass
Cobbles	30.5
Gravel	37.8
Sand	15.2
Silt	13.1
Clay	3.4

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2100
Curvature Coefficient	1.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved

Stephen.Watson

**SOIL AND ROCK SAMPLE ANALYSIS  
LABORATORY TEST REPORT**

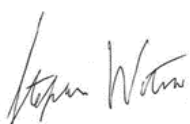
2 June 2022

<b>Project Name:</b>	North Irish Sea Array
<b>Project No.:</b>	21-1619
<b>Client:</b>	Statkraft
<b>Engineer:</b>	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 19/05/2022 and 02/05/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.



Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd



**Project Name:** North Irish Sea Array

**Report Reference:** Schedule 11

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with\* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

<b>Material tested</b>	<b>Type of test/Properties measured/Range of measurement</b>	<b>Standard specifications</b>	<b>No. of results included in the report</b>
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	2
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	2
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	3
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	1



Project Name
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## North Irish Sea Array

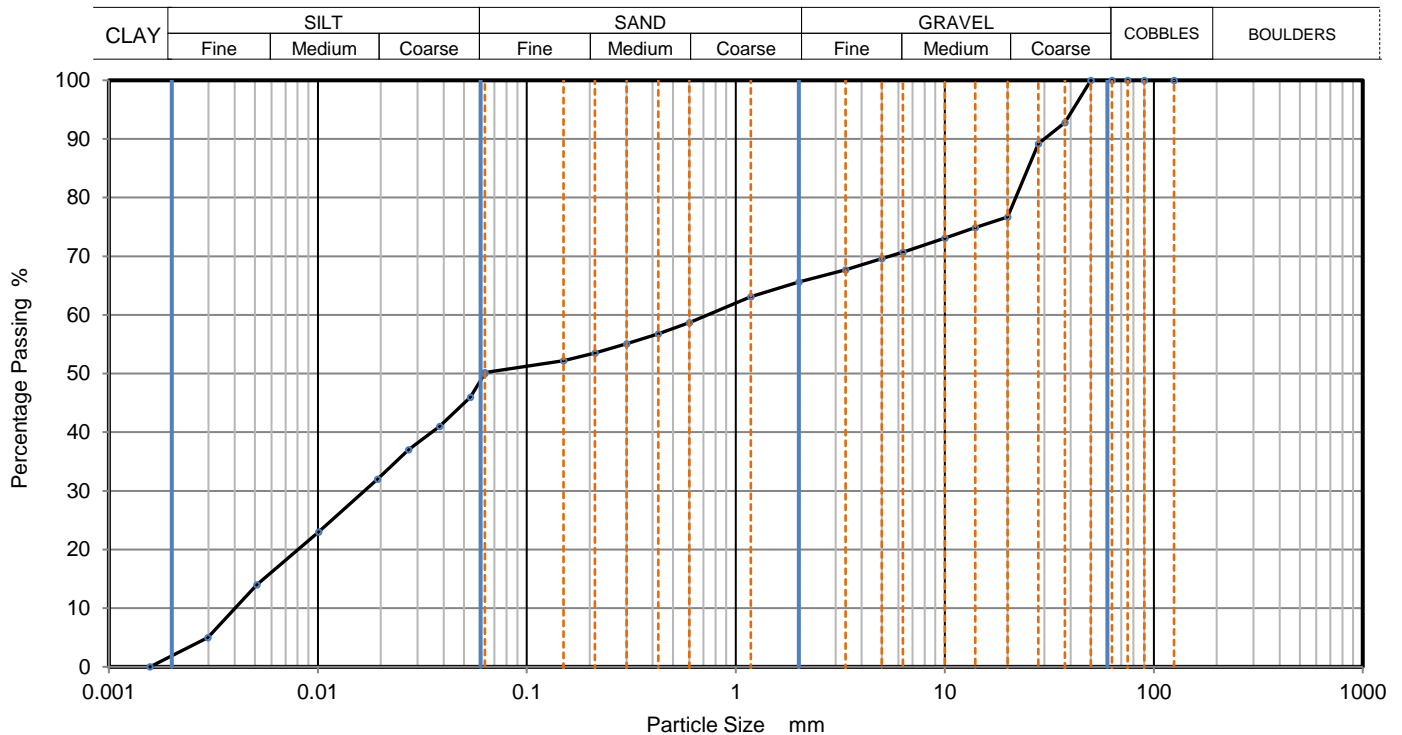
All tests performed in accordance with BS1377:1990 unless specified otherwise

Stephen.Watson





	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
				Borehole/Pit No.	BH02
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	2.50
Specimen Reference	6	Specimen Depth	2.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022051941



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	50
90	100	0.05375	46
75	100	0.03822	41
63	100	0.02717	37
50	100	0.01932	32
37.5	93	0.01008	23
28	89	0.00509	14
20	77	0.00297	5
14	75	0.00157	0
10	73		
6.3	71		
5	70		
3.35	68		
2	66		
1.18	63		
0.6	59	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	57		
0.3	55		
0.212	54		
0.15	52		
0.063	50		

Dry Mass of sample, g

2425

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	34.4
Sand	15.4
Silt	48.5
Clay	1.7

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	180
Curvature Coefficient	0.094


Remarks

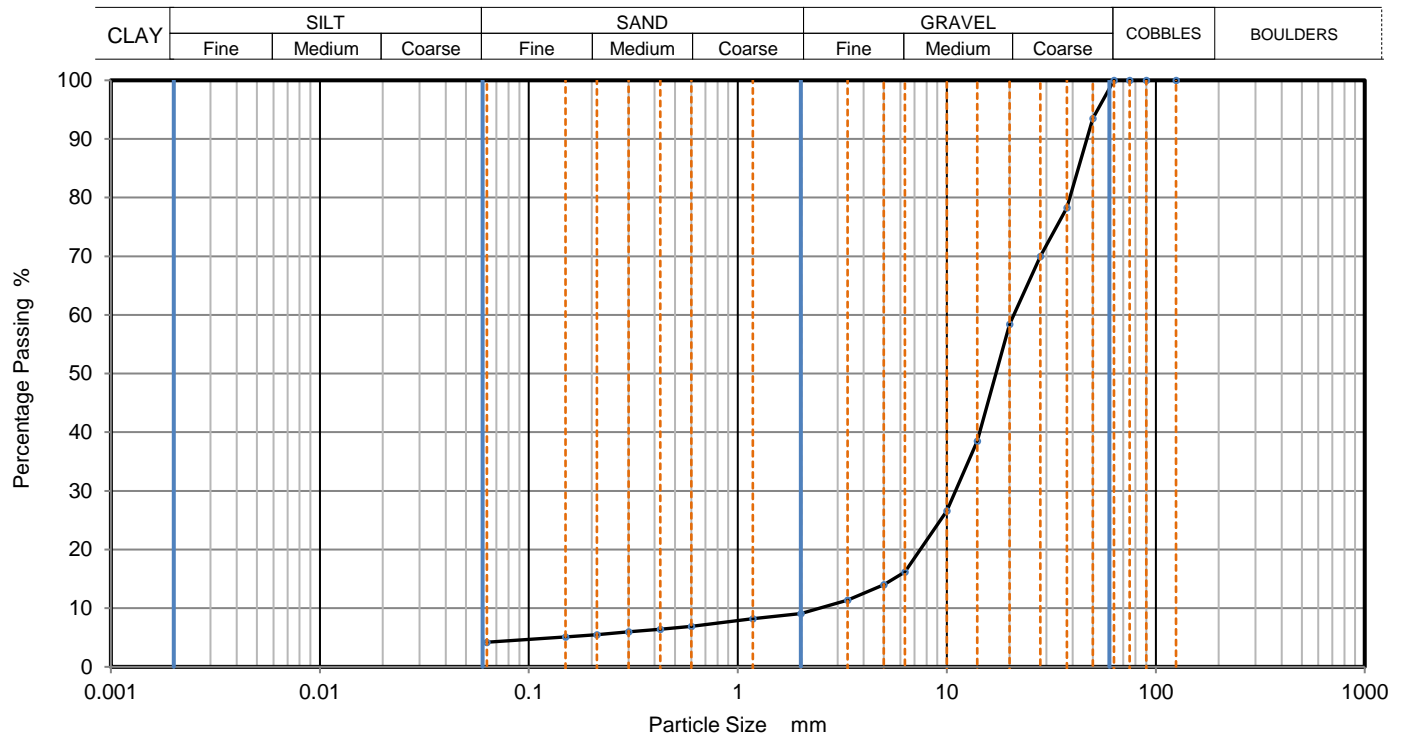
Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved

Stephen.Watson

	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH02
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly clayey subangular fine to coarse GRAVEL.			Depth, m	10.00
Specimen Reference	2	Specimen Depth	10 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022051942



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	78		
28	70		
20	58		
14	39		
10	27		
6.3	16		
5	14		
3.35	11		
2	9		
1.18	8		
0.6	7		
0.425	6		
0.3	6		
0.212	6		
0.15	5		
0.063	4		

Dry Mass of sample, g		3572
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Sample Proportions		% dry mass
Cobbles		0.0
Gravel		90.9
Sand		4.9
Fines <0.063mm		4.0

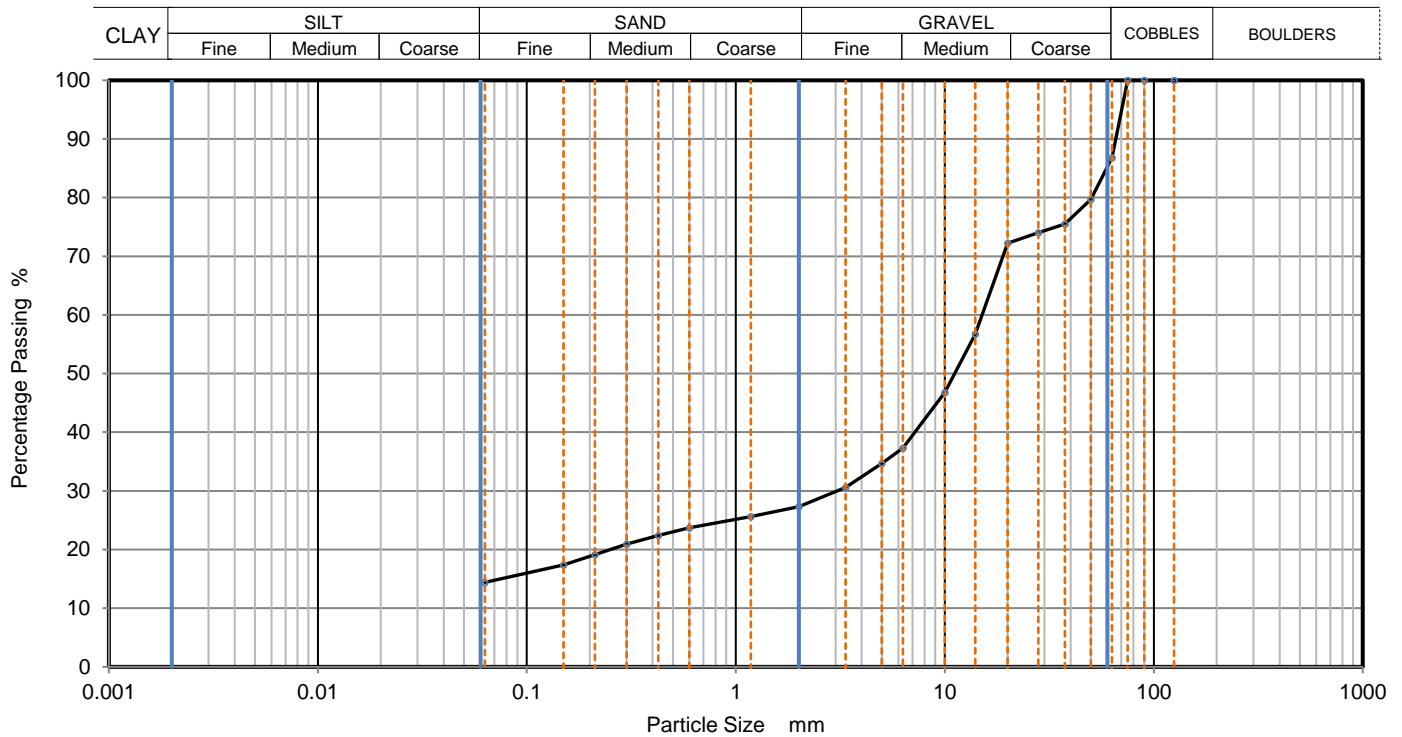
Grading Analysis		
D100	mm	
D60	mm	20.9
D30	mm	11
D10	mm	2.46
Uniformity Coefficient		8.5
Curvature Coefficient		2.3

Remarks  
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson



	<b>PARTICLE SIZE DISTRIBUTION</b>			Job Ref	21-1619
				Borehole/Pit No.	BH16
Site Name	North Irish Sea Array			Sample No.	
Soil Description	Brown sandy slightly clayey subangular fine to coarse GRAVEL.			Depth, m	10.00
Specimen Reference	6	Specimen Depth	10 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022051940



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	87		
50	80		
37.5	76		
28	74		
20	72		
14	57		
10	47		
6.3	37		
5	35		
3.35	31		
2	27		
1.18	26		
0.6	24		
0.425	22		
0.3	21		
0.212	19		
0.15	17		
0.063	14		

Dry Mass of sample, g

4494

Sample Proportions	% dry mass
Cobbles	13.2
Gravel	59.5
Sand	12.9
Fines <0.063mm	14.0

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below



Approved

Stephen.Watson

## LABORATORY RESTRICTION REPORT

Project Reference	21-1619	To	Colm Hurley
Project Name	Nort Irish Sea Array	Position	Project Manager
TR reference	21-1619 / G11	From	Stephen Watson
		Position	Laboratory Manager

The following sample(s) and test(s) are restricted as detailed below. Could you please complete the "Required Action" column and return the completed form to the laboratory.

Hole Number	Sample			Test Type	Reason for Restriction	Required Action
	Number	Depth (m)	Type			
BH02		11.50-13.00	C	PSD	No suitbale sample - rockhead	CANCEL

For electronic reporting a form of electronic signature or printed name is acceptable

Laboratory Signature Stephen Watson	Project Manager Signature Colm Hurley
Date 31 May 2022	Date 31 May 2022





**CAUSEWAY**  
— GEOTECH

**APPENDIX G**  
**ENVIRONMENTAL LABORATORY TEST RESULTS**





2183

# Final Report

**Report No.:** 22-10214-1  
**Initial Date of Issue:** 25-Mar-2022  
**Client** Causeway Geotech Ltd

**Client Address:** 8 Drumahiskey Road  
Balnamore  
Ballymoney  
County Antrim  
BT53 7QL

**Contact(s):** Colm Hurley  
Stephen Watson  
Carin Cornwall  
Darren O'Mahony  
Gabriella Horan  
Joe Gervin  
John Cameron  
Lucy Newland  
Martin Gardiner  
Matthew Gilbert  
Michelle Gaffney  
Neil Haggan  
Paul Dunlop  
Paul McNamara  
Sean Ross  
Stephen Franey  
Stuart Abraham

**Project** 21-1619 North Irish Sea Array

**Quotation No.:** Q21-26199

**Date Received:** 17-Mar-2022

**Order No.:**

**Date Instructed:** 17-Mar-2022

**No. of Samples:** 20

**Turnaround (Wkdays):** 7

**Results Due:** 25-Mar-2022

**Date Approved:** 25-Mar-2022

**Approved By:**



**Details:** Stuart Henderson, Technical  
Manager



## Results - Leachate

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>					22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>					1393655	1393656	1393657	1393658	1393659	1393660	1393661	1393662
	Sample Location:					TP01	TP01	TP02	TP02	TP07	TP07	TP09	TP09
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
	Date Sampled:					15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Type</b>	<b>Units</b>	<b>LOD</b>								
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	100	85	98	78	120	59	78	91
Chloride	U	1220	10:1	mg/l	1.0	3.8	1.9	2.4	1.8	1.7	< 1.0	1.7	2.4
Fluoride	U	1220	10:1	mg/l	0.050	0.51	0.54	0.39	0.31	0.37	0.24	0.44	0.82
Sulphate	U	1220	10:1	mg/l	1.0	15	14	9.3	6.3	18	4.1	12	13
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0007	< 0.0002
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	0.006	0.006	0.006	< 0.005	0.006	< 0.005	< 0.005	< 0.005
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0007	0.0005	0.0009	0.0008	0.0006	0.0005	0.0009	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0024	< 0.0005
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0020	0.0078	0.0033	0.0080	0.0030	0.0066	0.0013	0.0044
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0009	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0011	0.0056
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	16	12	14	12	16	11	18	14
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030



## Results - Leachate

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>					22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>					1393663	1393664	1393665	1393666	1393667	1393668	1393669	1393670
	Sample Location:					TP08	TP08	TP12	TP12	TP05	TP05	TP04	TP04
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
	Date Sampled:					14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Type</b>	<b>Units</b>	<b>LOD</b>								
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	65	72	85	78	33	65	52	59
Chloride	U	1220	10:1	mg/l	1.0	1.1	1.4	1.5	1.2	1.0	1.5	3.2	1.2
Fluoride	U	1220	10:1	mg/l	0.050	0.33	0.29	0.40	0.76	0.20	0.24	0.25	0.34
Sulphate	U	1220	10:1	mg/l	1.0	7.0	6.3	3.9	7.0	8.5	10	18	4.7
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0003	< 0.0002	0.0011	< 0.0002	0.0020	< 0.0002	0.0006	< 0.0002
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	0.005	0.007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0011	0.0013	0.0010	0.0006	0.0022	0.0005	0.0009	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0013	< 0.0005	0.0024	< 0.0005	0.0035	< 0.0005	0.0014	< 0.0005
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0007	0.0059	0.0021	0.0088	0.0006	0.0006	0.0003	0.0048
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	0.0015	< 0.0005	0.0035	< 0.0005	0.0010	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	0.0006	< 0.0005	0.0017	< 0.0005	< 0.0005	< 0.0005
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	0.0019	0.0006	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	< 0.003	< 0.003	0.003	< 0.003	0.006	< 0.003	< 0.003	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	24	13	23	13	16	9.2	11	8.7
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

## Results - Leachate

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>					22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>					1393671	1393672	1393673	1393674
	Sample Location:					TP11	TP11	TP03	TP03
	Sample Type:					SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.0	0.5	1.0
	Date Sampled:					14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Type</b>	<b>Units</b>	<b>LOD</b>				
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	26	59	33	26
Chloride	U	1220	10:1	mg/l	1.0	5.7	2.0	1.2	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.16	0.27	0.55	0.40
Sulphate	U	1220	10:1	mg/l	1.0	9.3	7.3	11	3.1
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0021	< 0.0002	0.0017	< 0.0002
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	< 0.005	< 0.005	0.005	< 0.005
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0019	0.0006	0.0021	0.0006
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0034	< 0.0005	0.0037	0.0006
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0004	0.0003	0.0008	0.0012
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0037	< 0.0005	0.0028	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0008	< 0.0005	0.0010	< 0.0005
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	0.005	< 0.003	0.007	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	13	8.8	18	5.5
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030

## Results - Soil

### Project: 21-1619 North Irish Sea Array

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>		22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>		1393655	1393656	1393657	1393658	1393659	1393660	1393661	1393662	1393663		
	Sample Location:		TP01	TP01	TP02	TP02	TP07	TP07	TP09	TP09	TP08		
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
	Top Depth (m):		0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5		
	Date Sampled:		15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	14-Mar-2022		
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY		
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	18	16	16	11	16	16	27	18	18
pH	U	2010		4.0	8.5	8.5	8.5	8.7	8.6	8.7	8.2	8.5	8.5
Arsenic	U	2450	mg/kg	1.0	11	12	13	12	9.9	14	6.9	15	1.9
Barium	U	2450	mg/kg	10	54	58	68	50	57	66	60	83	62
Cadmium	U	2450	mg/kg	0.10	0.85	1.1	1.2	0.82	0.89	0.96	0.88	1.5	0.66
Mercury Low Level	U	2450	mg/kg	0.05	0.06	0.08	0.09	< 0.05	0.08	0.08	0.06	0.09	< 0.05
Molybdenum	U	2450	mg/kg	2.0	2.4	2.5	2.3	< 2.0	< 2.0	2.8	< 2.0	3.0	< 2.0
Antimony	N	2450	mg/kg	2.0	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	22	29	31	20	26	24	18	34	15
Nickel	U	2450	mg/kg	0.50	33	44	54	34	39	38	25	62	25
Lead	U	2450	mg/kg	0.50	19	15	18	10	12	13	15	20	6.8
Selenium	U	2450	mg/kg	0.20	0.61	0.57	0.43	0.29	0.24	0.21	0.91	2.0	< 0.20
Zinc	U	2450	mg/kg	0.50	50	56	59	37	44	49	48	67	32
Chromium (Trivalent)	N	2490	mg/kg	1.0	18	19	22	18	17	21	18	24	20
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	4.8	3.4	4.0	2.6	4.2	2.4	10	5.0	3.6
Total Organic Carbon	U	2625	%	0.20	1.8	1.1	1.1	0.57	1.3	0.66	3.3	1.2	0.94
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

## Results - Soil

### Project: 21-1619 North Irish Sea Array

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>					22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>					1393655	1393656	1393657	1393658	1393659	1393660	1393661	1393662
	Sample Location:					TP01	TP01	TP02	TP02	TP07	TP07	TP09	TP09
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
	Date Sampled:					15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	15-Mar-2022	14-Mar-2022
	Asbestos Lab:					COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>									
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m & p-Xylene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Naphthalene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.17	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.15	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.32	< 0.20	< 0.20	< 0.20	< 0.20
PCB 28	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 52	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 153	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 138	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010



## Results - Soil

### Project: 21-1619 North Irish Sea Array

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>		22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>		1393664	1393665	1393666	1393667	1393668	1393669	1393670	1393671	1393672		
	Sample Location:		TP08	TP12	TP12	TP05	TP05	TP04	TP04	TP11	TP11		
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
	Top Depth (m):		1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0		
	Date Sampled:		14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022		
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY		
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	14	20	20	17	17	17	9.5	15	16
pH	U	2010		4.0	8.5	8.5	8.5	7.8	8.2	8.1	8.5	8.0	8.2
Arsenic	U	2450	mg/kg	1.0	7.7	12	11	9.8	12	15	15	16	16
Barium	U	2450	mg/kg	10	42	62	46	65	32	53	60	63	50
Cadmium	U	2450	mg/kg	0.10	0.58	1.2	0.94	0.70	0.61	0.87	0.90	0.92	0.70
Mercury Low Level	U	2450	mg/kg	0.05	0.06	0.06	0.07	< 0.05	0.05	0.09	0.05	0.08	0.05
Molybdenum	U	2450	mg/kg	2.0	< 2.0	2.3	2.7	< 2.0	< 2.0	2.3	2.5	2.1	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	19	28	28	17	19	31	23	27	28
Nickel	U	2450	mg/kg	0.50	32	49	51	28	30	48	38	52	44
Lead	U	2450	mg/kg	0.50	11	20	16	16	9.0	12	11	14	13
Selenium	U	2450	mg/kg	0.20	0.84	0.80	0.62	0.38	0.26	0.37	< 0.20	0.34	0.32
Zinc	U	2450	mg/kg	0.50	44	66	57	59	36	61	41	62	54
Chromium (Trivalent)	N	2490	mg/kg	1.0	22	23	17	22	15	31	23	31	27
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	3.1	5.0	4.3	3.2	3.6	3.8	2.6	3.7	3.3
Total Organic Carbon	U	2625	%	0.20	0.90	1.4	1.1	1.1	0.90	0.99	0.55	0.99	0.70
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

## Results - Soil

### Project: 21-1619 North Irish Sea Array

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>		22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>		1393664	1393665	1393666	1393667	1393668	1393669	1393670	1393671	1393672	
	Sample Location:		TP08	TP12	TP12	TP05	TP05	TP04	TP04	TP11	TP11	
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
	Top Depth (m):		1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	
	Date Sampled:		14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	14-Mar-2022	
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>								
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m & p-Xylene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Naphthalene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
PCB 28	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 52	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 153	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 138	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

## Results - Soil

### Project: 21-1619 North Irish Sea Array

Client: Causeway Geotech Ltd			Chemtest Job No.:		22-10214	22-10214
Quotation No.: Q21-26199			Chemtest Sample ID.:		1393673	1393674
			Sample Location:		TP03	TP03
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.5	1.0
			Date Sampled:		14-Mar-2022	14-Mar-2022
			Asbestos Lab:		COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	16	11
pH	U	2010		4.0	7.6	8.1
Arsenic	U	2450	mg/kg	1.0	12	13
Barium	U	2450	mg/kg	10	47	56
Cadmium	U	2450	mg/kg	0.10	0.81	0.31
Mercury Low Level	U	2450	mg/kg	0.05	0.06	< 0.05
Molybdenum	U	2450	mg/kg	2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	22	32
Nickel	U	2450	mg/kg	0.50	32	39
Lead	U	2450	mg/kg	0.50	17	7.0
Selenium	U	2450	mg/kg	0.20	0.29	< 0.20
Zinc	U	2450	mg/kg	0.50	53	48
Chromium (Trivalent)	N	2490	mg/kg	1.0	24	35
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	4.2	2.4
Total Organic Carbon	U	2625	%	0.20	1.4	0.40
Mineral Oil	N	2670	mg/kg	10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0

## Results - Soil

### Project: 21-1619 North Irish Sea Array

Client: Causeway Geotech Ltd	Chemtest Job No.:				22-10214	22-10214
Quotation No.: Q21-26199	Chemtest Sample ID.:				1393673	1393674
	Sample Location:				TP03	TP03
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.5	1.0
	Date Sampled:				14-Mar-2022	14-Mar-2022
	Asbestos Lab:				COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Benzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Toluene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010
m & p-Xylene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010
o-Xylene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Naphthalene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Acenaphthylene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Acenaphthene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	< 0.20	< 0.20
PCB 28	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
PCB 52	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
PCB 153	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
PCB 138	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010



## 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
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
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	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
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
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.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

## **Test Methods**

<b>SOP</b>	<b>Title</b>	<b>Parameters included</b>	<b>Method summary</b>
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
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**

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### **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

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### **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)

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### **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](mailto:customerservices@chemtest.com)



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# Final Report

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<b>Report No.:</b>	22-10615-1		
<b>Initial Date of Issue:</b>	04-Apr-2022		
<b>Client</b>	Causeway Geotech Ltd		
<b>Client Address:</b>	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
<b>Contact(s):</b>	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllister		
<b>Project</b>	21-1619 North Irish Sea Array		
<b>Quotation No.:</b>	Q21-26199	<b>Date Received:</b>	21-Mar-2022
<b>Order No.:</b>		<b>Date Instructed:</b>	22-Mar-2022
<b>No. of Samples:</b>	6		
<b>Turnaround (Wkdays):</b>	7	<b>Results Due:</b>	30-Mar-2022
<b>Date Approved:</b>	04-Apr-2022		
<b>Approved By:</b>			
<b>Details:</b>	Stuart Henderson, Technical Manager		

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## Results - Leachate

**Project: 21-1619 North Irish Sea Array**

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>					22-10615	22-10615	22-10615	22-10615	22-10615	22-10615
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>					1395603	1395604	1395605	1395606	1395607	1395608
	Sample Location:					BH03	BH03	TP20	TP20	TP21	TP21
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.50	1.00	0.50	1.00	0.50	1.00
	Date Sampled:					15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Type</b>	<b>Units</b>	<b>LOD</b>						
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	33	33	13	26	91	52
Chloride	U	1220	10:1	mg/l	1.0	18	1.5	< 1.0	< 1.0	7.0	3.7
Fluoride	U	1220	10:1	mg/l	0.050	0.11	0.11	0.12	0.21	0.13	0.11
Sulphate	U	1220	10:1	mg/l	1.0	1.4	1.9	< 1.0	2.1	13	< 1.0
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0006	< 0.0002	< 0.0002	< 0.0002	0.0012	0.0012
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	0.014	< 0.005	< 0.005	< 0.005	0.015	0.011
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0013	0.0015	0.0008	0.0016	0.0013	0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0009	0.0008	< 0.0005	0.0009	0.0010	0.0012
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0006	0.0006	0.0002	0.0003	0.0019	0.0015
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0008	0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0016	0.0010
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0010	0.0005
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	0.030	0.006	0.003	0.013	0.012	0.005
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	8.0	8.4	5.7	6.3	14	12
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

## Results - Soil

### Project: 21-1619 North Irish Sea Array

<b>Client: Causeway Geotech Ltd</b>	<b>Chemtest Job No.:</b>					22-10615	22-10615	22-10615	22-10615	22-10615	22-10615
Quotation No.: Q21-26199	<b>Chemtest Sample ID.:</b>					1395603	1395604	1395605	1395606	1395607	1395608
	Sample Location:					BH03	BH03	TP20	TP20	TP21	TP21
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.50	1.00	0.50	1.00	0.50	1.00
	Date Sampled:					15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022
	Asbestos Lab:					COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>							
ACM Type	U	2192		N/A	-	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	18	11	30	25	24	36	
pH	U	2010		4.0	[B] 8.3	[B] 8.6	[B] 8.2	[B] 8.2	[B] 8.2	[B] 8.1	
Arsenic	U	2450	mg/kg	1.0	12	11	6.0	4.8	13	10	
Barium	U	2450	mg/kg	10	91	56	91	82	190	97	
Cadmium	U	2450	mg/kg	0.10	1.3	0.78	0.75	0.89	1.9	1.2	
Mercury Low Level	U	2450	mg/kg	0.05	0.05	< 0.05	< 0.05	< 0.05	0.07	0.09	
Molybdenum	U	2450	mg/kg	2.0	2.0	< 2.0	< 2.0	< 2.0	3.1	< 2.0	
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.0	< 2.0	
Copper	U	2450	mg/kg	0.50	20	21	16	14	30	27	
Nickel	U	2450	mg/kg	0.50	47	29	22	18	38	25	
Lead	U	2450	mg/kg	0.50	16	9.2	12	11	24	24	
Selenium	U	2450	mg/kg	0.20	0.30	< 0.20	0.72	0.59	1.2	1.3	
Zinc	U	2450	mg/kg	0.50	56	43	47	45	93	110	
Chromium (Trivalent)	N	2490	mg/kg	1.0	20	17	18	15	34	16	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
LOI	U	2610	%	0.10	4.1	1.9	9.0	5.1	13	7.6	
Total Organic Carbon	U	2625	%	0.20	[B] 1.0	[B] 0.30	[B] 2.4	[B] 1.1	[B] 4.4	[B] 2.4	
Mineral Oil	N	2670	mg/kg	10	[B] < 10	[B] < 10	[B] < 10	[B] < 10	[B] < 10	[B] 110	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] 110	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] 110	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] 19	
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] 460	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] 480	

## Results - Soil

### Project: 21-1619 North Irish Sea Array

Client: Causeway Geotech Ltd	Chemtest Job No.:				22-10615	22-10615	22-10615	22-10615	22-10615	22-10615
Quotation No.: Q21-26199	Chemtest Sample ID.:				1395603	1395604	1395605	1395606	1395607	1395608
	Sample Location:				BH03	BH03	TP20	TP20	TP21	TP21
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	1.00	0.50	1.00	0.50	1.00
	Date Sampled:				15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022	15-Feb-2022
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD						
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[B] < 10	[B] < 10	[B] < 10	[B] < 10	[B] < 10	[B] 590
Benzene	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
Toluene	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
m & p-Xylene	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
o-Xylene	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
Naphthalene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 0.12	[B] 0.22
Acenaphthylene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 0.11	[B] 0.44
Acenaphthene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 0.099	[B] 0.11
Fluorene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 0.081	[B] 0.16
Phenanthrene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] 0.13	[B] < 0.010	[B] 0.56	[B] 1.4
Anthracene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] 0.068	[B] < 0.010	[B] 0.18	[B] 0.56
Fluoranthene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] 0.14	[B] 0.070	[B] 2.3	[B] 8.3
Pyrene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] 0.16	[B] 0.088	[B] 2.3	[B] 8.5
Benzo[a]anthracene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] 0.14	[B] < 0.010	[B] 1.6	[B] 5.5
Chrysene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] 0.085	[B] < 0.010	[B] 1.7	[B] 6.2
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 3.4	[B] 12
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 1.2	[B] 4.2
Benzo[a]pyrene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 3.4	[B] 11
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 2.9	[B] 11
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 0.48	[B] 1.4
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] 2.7	[B] 9.1
Coronene	N	2800	mg/kg	0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010	[B] < 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	[B] < 0.20	[B] < 0.20	[B] 0.72	[B] < 0.20	[B] 23	[B] 80
PCB 28	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
PCB 52	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
PCB 118	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
PCB 153	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
PCB 138	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
PCB 180	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010	[B] < 0.0010



## Deviations

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:
1395603			BH03	15-Feb-2022	B	Amber Glass 250ml
1395603			BH03	15-Feb-2022	B	Amber Glass 60ml
1395603			BH03	15-Feb-2022	B	Plastic Tub 500g
1395604			BH03	15-Feb-2022	B	Amber Glass 250ml
1395604			BH03	15-Feb-2022	B	Amber Glass 60ml
1395604			BH03	15-Feb-2022	B	Plastic Tub 500g
1395605			TP20	15-Feb-2022	B	Amber Glass 250ml
1395605			TP20	15-Feb-2022	B	Amber Glass 60ml
1395605			TP20	15-Feb-2022	B	Plastic Tub 500g
1395606			TP20	15-Feb-2022	B	Amber Glass 250ml
1395606			TP20	15-Feb-2022	B	Amber Glass 60ml
1395606			TP20	15-Feb-2022	B	Plastic Tub 500g
1395607			TP21	15-Feb-2022	B	Amber Glass 250ml
1395607			TP21	15-Feb-2022	B	Amber Glass 60ml
1395607			TP21	15-Feb-2022	B	Plastic Tub 500g
1395608			TP21	15-Feb-2022	B	Amber Glass 250ml
1395608			TP21	15-Feb-2022	B	Amber Glass 60ml
1395608			TP21	15-Feb-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
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
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	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
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
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.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

## **Test Methods**

<b>SOP</b>	<b>Title</b>	<b>Parameters included</b>	<b>Method summary</b>
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
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

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### **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)

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### **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](mailto:customerservices@chemtest.com)





**CAUSEWAY**  
— GEOTECH

**APPENDIX H**  
**SPT HAMMER ENERGY MEASUREMENT REPORT**



**Southern Testing**  
**Unit 11**  
**Charlwoods Road**  
**East Grinstead**  
**West Sussex**  
**RH19 2HU**

SPT Hammer Ref: 0208  
Test Date: 12/02/2022  
Report Date: 14/02/2022  
File Name: 0208.spt  
Test Operator: NPB

### Instrumented Rod Data

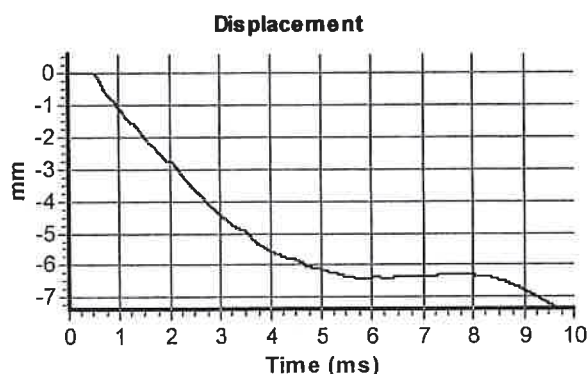
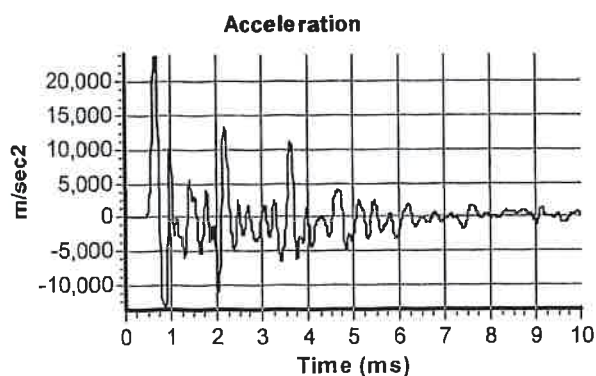
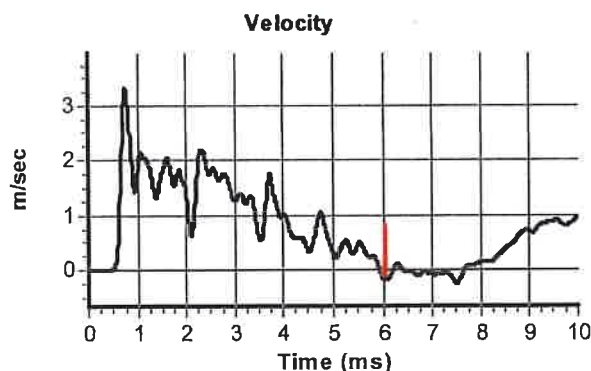
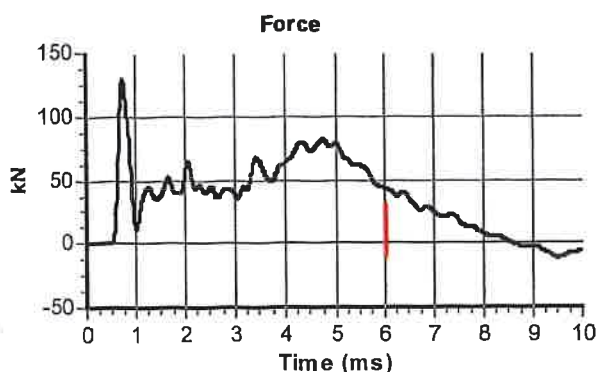
Diameter  $d_r$  (mm): 54  
Wall Thickness  $t_r$  (mm): 6.0  
Assumed Modulus  $E_a$  (GPa): 200  
Accelerometer No.1: 64786  
Accelerometer No.2: 64789

### SPT Hammer Information

Hammer Mass  $m$  (kg): 63.0  
Falling Height  $h$  (mm): 760  
SPT String Length  $L$  (m): 12.0

### Comments / Location

CAUSEWAY



### Calculations

Area of Rod  $A$  (mm<sup>2</sup>): 905  
Theoretical Energy  $E_{\text{theor}}$  (J): 473  
Measured Energy  $E_{\text{meas}}$  (J): 357

**Energy Ratio  $E_r$  (%):** **76**

*NPBurrows*

Signed: N Burrows  
Title: FOC Manager

The recommended calibration interval is 12 months

**Southern Testing**  
**Unit 11**  
**Charlwoods Road**  
**East Grinstead**  
**West Sussex**  
**RH19 2HU**

SPT Hammer Ref: 0643  
Test Date: 12/02/2022  
Report Date: 14/02/2022  
File Name: 0643.spt  
Test Operator: NPB

### Instrumented Rod Data

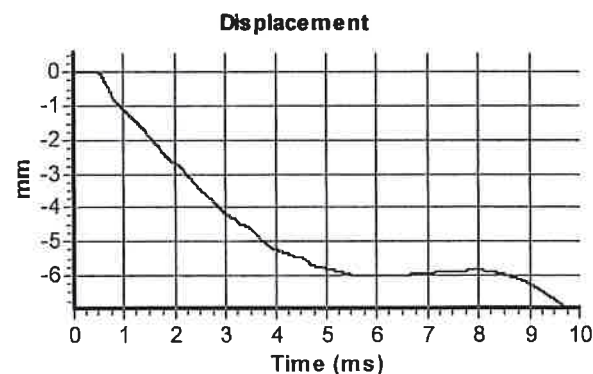
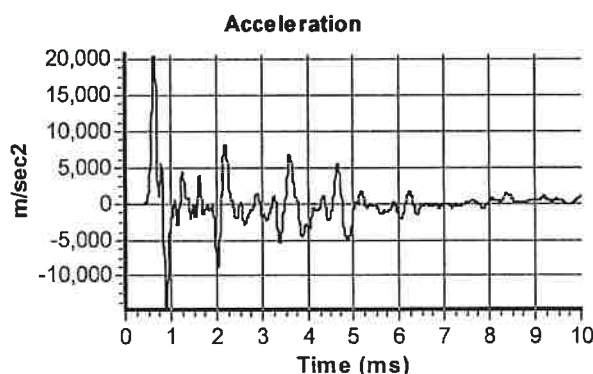
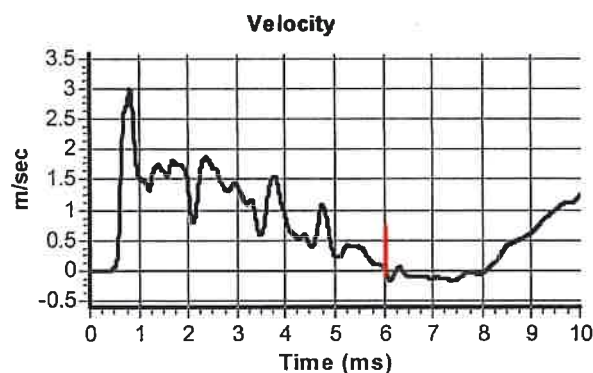
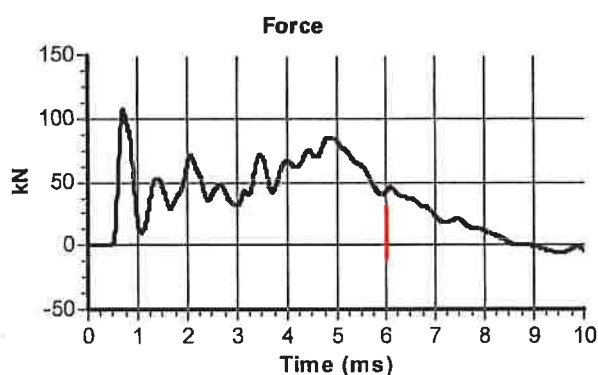
Diameter  $d_r$  (mm): 54  
Wall Thickness  $t_r$  (mm): 6.0  
Assumed Modulus  $E_a$  (GPa): 200  
Accelerometer No.1: 64786  
Accelerometer No.2: 64789

### SPT Hammer Information

Hammer Mass  $m$  (kg): 63.0  
Falling Height  $h$  (mm): 760  
SPT String Length  $L$  (m): 12.0

### Comments / Location

CAUSEWAY



### Calculations

Area of Rod  $A$  (mm<sup>2</sup>): 905  
Theoretical Energy  $E_{\text{theor}}$  (J): 473  
Measured Energy  $E_{\text{meas}}$  (J): 340

**Energy Ratio  $E_r$  (%):** **72**

Signed: N Burrows  
Title: FOC Manager

The recommended calibration interval is 12 months

**Southern Testing**  
**Unit 11**  
**Charlwoods Road**  
**East Grinstead**  
**West Sussex**  
**RH19 2HU**

SPT Hammer Ref: 1387  
Test Date: 12/02/2022  
Report Date: 14/02/2022  
File Name: 1387.spt  
Test Operator: NPB

### Instrumented Rod Data

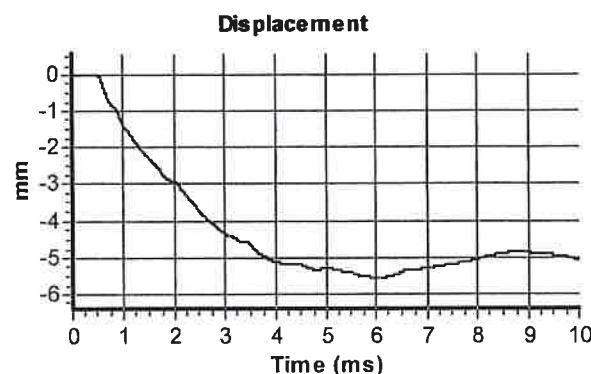
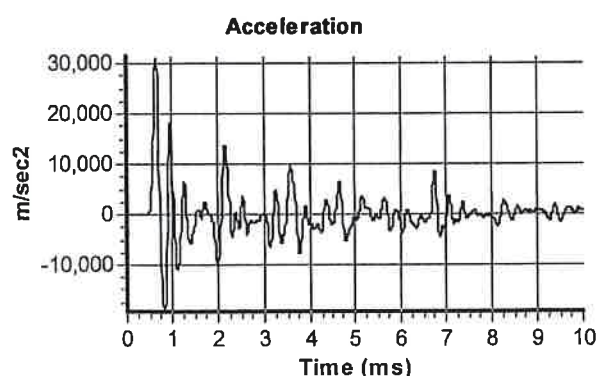
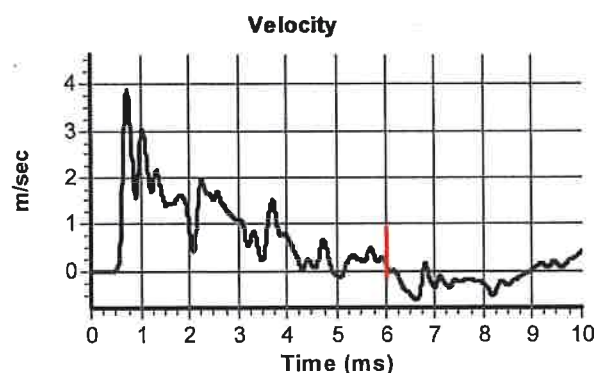
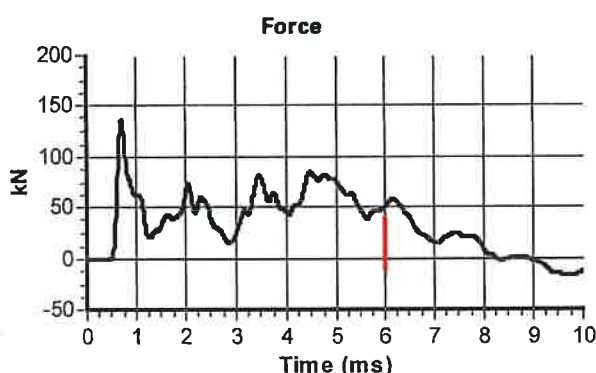
Diameter  $d_r$  (mm): 54  
Wall Thickness  $t_r$  (mm): 6.0  
Assumed Modulus  $E_a$  (GPa): 200  
Accelerometer No.1: 64786  
Accelerometer No.2: 64789

### SPT Hammer Information

Hammer Mass  $m$  (kg): 63.0  
Falling Height  $h$  (mm): 760  
SPT String Length  $L$  (m): 12.0

### Comments / Location

CAUSEWAY



### Calculations

Area of Rod  $A$  (mm<sup>2</sup>): 905  
Theoretical Energy  $E_{\text{theor}}$  (J): 473  
Measured Energy  $E_{\text{meas}}$  (J): 308

**Energy Ratio  $E_r$  (%):**

**65**

Signed: N Burrows  
Title: FOC Manager

The recommended calibration interval is 12 months



**Southern Testing**  
**Unit 11**  
**Charlwoods Road**  
**East Grinstead**  
**West Sussex**  
**RH19 2HU**

SPT Hammer Ref: 1376  
Test Date: 14/02/2022  
Report Date: 14/02/2022  
File Name: 1376.spt  
Test Operator: NPB

**Instrumented Rod Data**

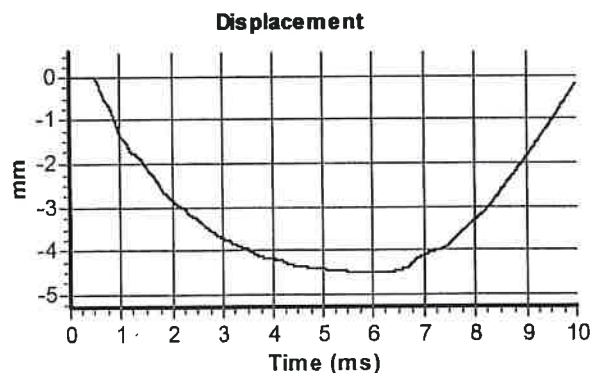
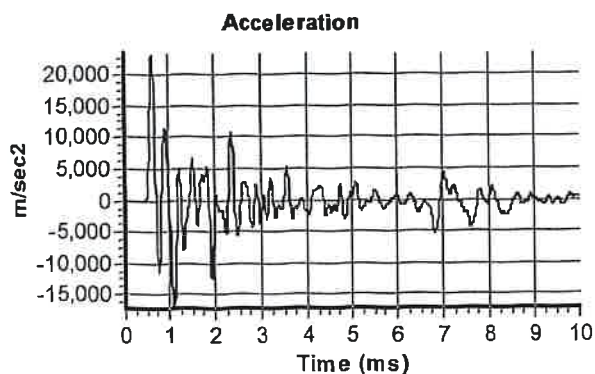
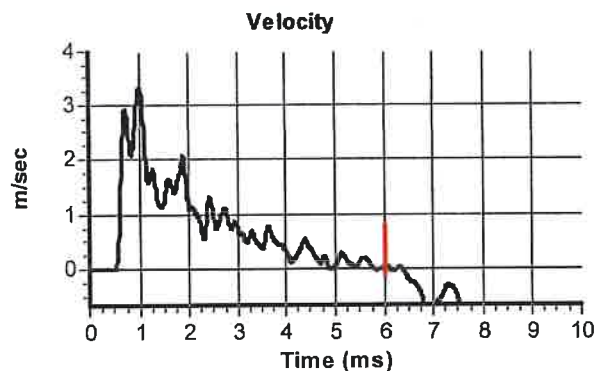
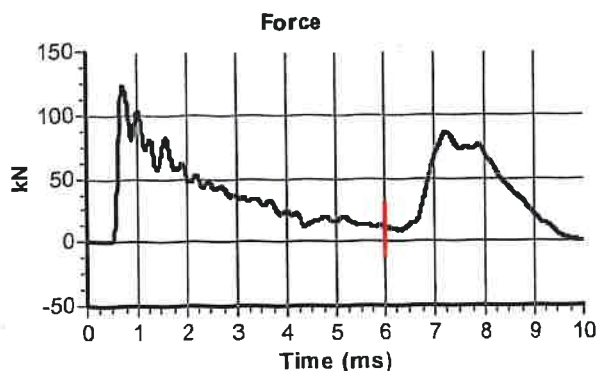
Diameter  $d_r$  (mm): 54  
Wall Thickness  $t_r$  (mm): 6.0  
Assumed Modulus  $E_a$  (GPa): 200  
Accelerometer No.1: 64786  
Accelerometer No.2: 64789

**SPT Hammer Information**

Hammer Mass  $m$  (kg): 63.0  
Falling Height  $h$  (mm): 760  
SPT String Length  $L$  (m): 12.0

**Comments / Location**

CAUSEWAY



**Calculations**

Area of Rod  $A$  (mm<sup>2</sup>): 905  
Theoretical Energy  $E_{\text{theor}}$  (J): 473  
Measured Energy  $E_{\text{meas}}$  (J): 301

**Energy Ratio  $E_r$  (%):** **64**

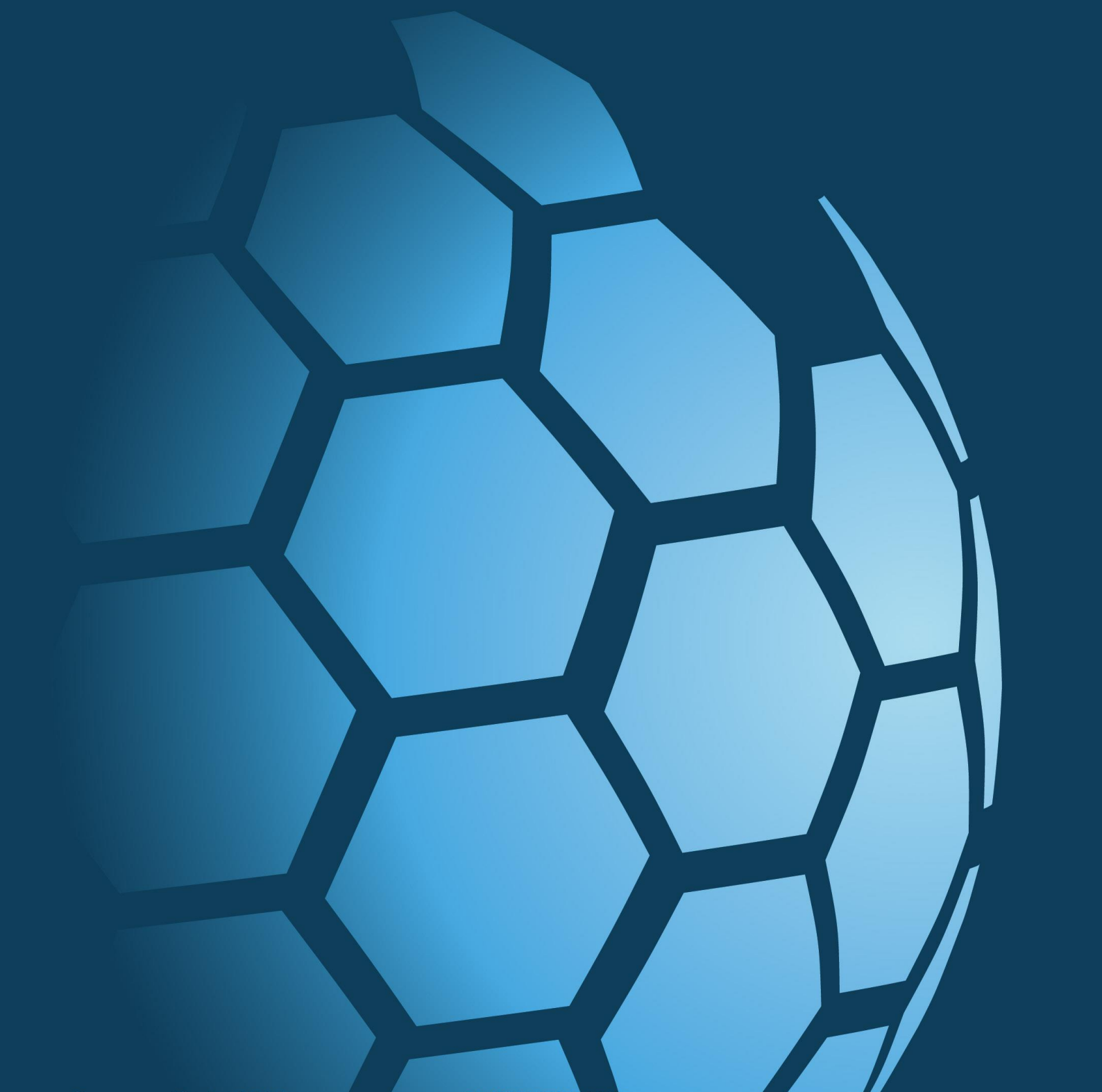
Signed: N Burrows  
Title: FOC Manager

The recommended calibration interval is 12 months



**CAUSEWAY**  
— GEOTECH

**APPENDIX I**  
**DOWNHOLE GEOPHYSICS**



**REPORT ON THE  
GEOPHYSICAL LOGGING  
OF  
SIX BOREHOLES  
FOR THE  
NORTH IRISH SEA ARRAY  
NEAR BALBRIGGAN, NORTHERN IRELAND**

**Prepared For:**



**8 DRUMAHISKEY ROAD  
BALLYMONEY  
CO. ANTRIM  
BT53 7QL**

**MAY2022/CAUSE2022\_NISA\_Report**

	Name	Date
Logged by:	M. Hand	04.05.2022 06.05.2022
Report by:	M. Hand	07.06.2022
Checked by:	M. Kynaston	17.06.2022

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2. THE GEOPHYSICAL LOGGING METHODS.....	2
3. SITE DETAILS.....	5
4. BOREHOLE LOGGING CONSTRAINTS.....	7

## LIST OF FIGURES

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Figure 3.1	Location map showing the main area of investigation highlighted by the red striped area.
Figure 3.2	Aerial image showing the location of five of the six boreholes, just north of Balbriggan.
Figure 3.3	Location map showing the location of borehole 9, just North of Swords (highlighted by a red striped circle).
Figure 3.4	Aerial map showing borehole 9's location.

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Figure 4	Geophysical Logs
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Appendix 1	Geophysical Logs
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## 1.0 INTRODUCTION

At the request of Causeway Geotech geophysical logging was carried out in the following boreholes.

The work was carried out by European Geophysical Services on the 4<sup>th</sup> May 2022 and the 6<sup>th</sup> May 2022.

The following logs were run:

BH	Logs	From (m)	To (m)
1	Natural Gamma (GV NGRS) 3-Arm Caliper (GV CAL3) Focused Resistivity (GV DLL3) Sonic Velocity (GV ASNC) Fluid Temperature & Conductivity (GV TCIS) Fluid Velocity (GV IFM)	0.6	22.2
2		0.9	28
4		0.6	17.7
9		1	19.6
17		1	25
18		1	27

## **2.0 THE GEOPHYSICAL LOGGING METHODS**

### **The Equipment and Field Procedure**

A fully digital logging system with a 600m capacity motorised winch mounted in a 4x4 van was used.

All logging data was recorded digitally for reprocessing and archiving purposes.

With the exception of the fluid logs, all logs were run from the bottom of the boreholes upward.

#### **Caliper (Cal)**

This tool measures the mean diameter of the borehole. It is used to check the integrity of the borehole lining, and where the borehole is unlined to identify zones of washout, breakout or fissures.

#### **Natural Gamma (Gam)**

The tool measures the naturally occurring gamma radiation found in rocks and sediments. It is mainly used to detect the clays that contain potassium  $K^{40}$ , though the  $U^{238}$  series of elements and the  $Th^{232}$  series of elements also emit gamma radiation.

The higher the concentration of these clay minerals the greater the responses on the natural gamma log.

#### **Focused Resistivity Log (Res Deep and Res Shallow)**

The Focused Resistivity tool uses Guard Electrodes to focus the current into the formation. This gives excellent vertical resolution and good penetration, especially in highly conductive borehole fluids where a Normal Resistivity Sonde would not be as effective.

The tool has two electrode spacing's to allow a deep and shallow depth of investigation.

The response of this log is a function of porosity, type of formation / mineralogy and its pore water quality. These logs aid in the identification of strata and quality of the pore water.

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## 2.0 THE GEOPHYSICAL LOGGING METHODS

### **Full Wave Sonic (FWS)**

This tool has been specially designed to provide a full wave form recording of sonic signals and uses fixed spaced transmitter – receivers.

The received signals are digitised at a fast sampling rate with high resolution. Data may be sampled at typically 5cm or 10cm intervals dependant upon resolution required.

The data is processed for P wave velocity (or transit time) and amplitude. This tool can only be used in fluid filled unlined boreholes.

### **Fluid Temperature (T)**

There is a natural geothermal gradient of increasing temperature with depth. This gradient varies with the thermal conductivity of the geological formation and is modified by water flowing in, out or vertically through the borehole.

This log is used to determine any flow pattern within the borehole and to identify flow zones.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

### **Fluid Conductivity (EC or EC25)**

The electrical conductivity (EC) of the water is related to its salinity and dissolved solids and is therefore a measure of the quality of the borehole water. The shape of the log trace can indicate zones of inflow.

Using data from the temperature log the electrical conductivity is corrected to 25°C (EC25).

This log is used to identify different zones of water quality.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

### **Impeller Flowmeter (FV)**

This log is used to determine any flow pattern within the borehole and identify flow zones. The tool uses an impeller and is normally run at a constant logging speed against the anticipated flow for the best response. The data is corrected for logging speed and a fluid velocity (FV) log is produced. Flow (Q) in l/s may then be derived from the fluid velocity (FV) and caliper (Cal) data.

Optional paragraph  
Where practicable the log may be run in conjunction with a temporary and easily removable pumping system.

---

## 2.0 THE GEOPHYSICAL LOGGING METHODS

### P Wave Velocity ( $V_p$ ) - unlined

Within the unlined section the full wave form is recorded and analysed for the first arrival i.e. P Wave. The time of this arrival is corrected for tool stand off and inverted to produce the P Wave velocity of the formation.

The P Wave velocity log may be used for identifying variations in hardness and porosity.

Estimates of S wave velocity ***may only be obtained under suitable conditions***. These waves are normally identified by higher amplitudes and phase changes after the P wave arrivals.

Shear wave arrivals occur after the P-wave. They are waves that have travelled across the borehole fluid to the rock as P-waves and have undergone P to S conversion. Shear waves which refract at the fluid/rock boundary at the S-wave critical angle travel through the rock at  $V_s$  and if modal conversion back to P wave occurs the waves can be received by the tool.

Results can be affected by the competency of the rock material, low velocity zones, irregular boundary conditions and complex interactions of non-direct P-waves and other fast waves. This last factor can be the main limiter on Shear wave identification in wireline logging.

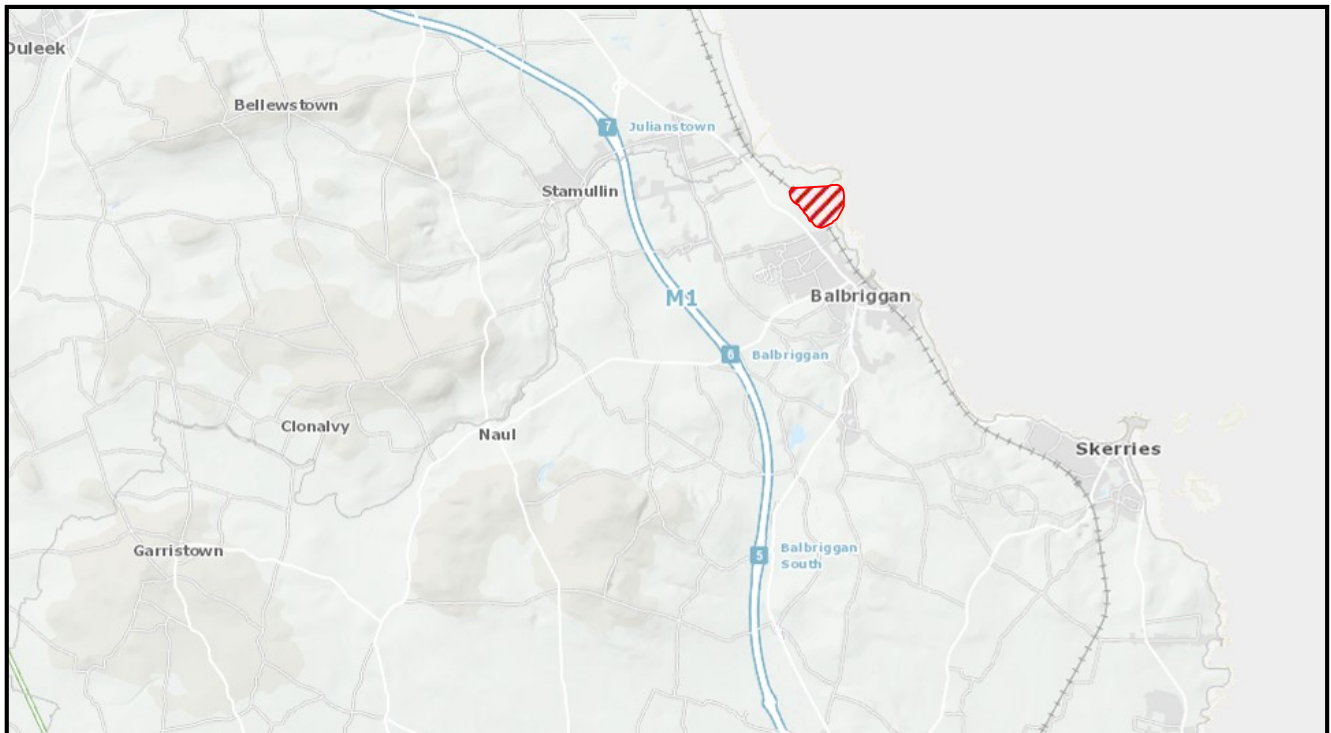
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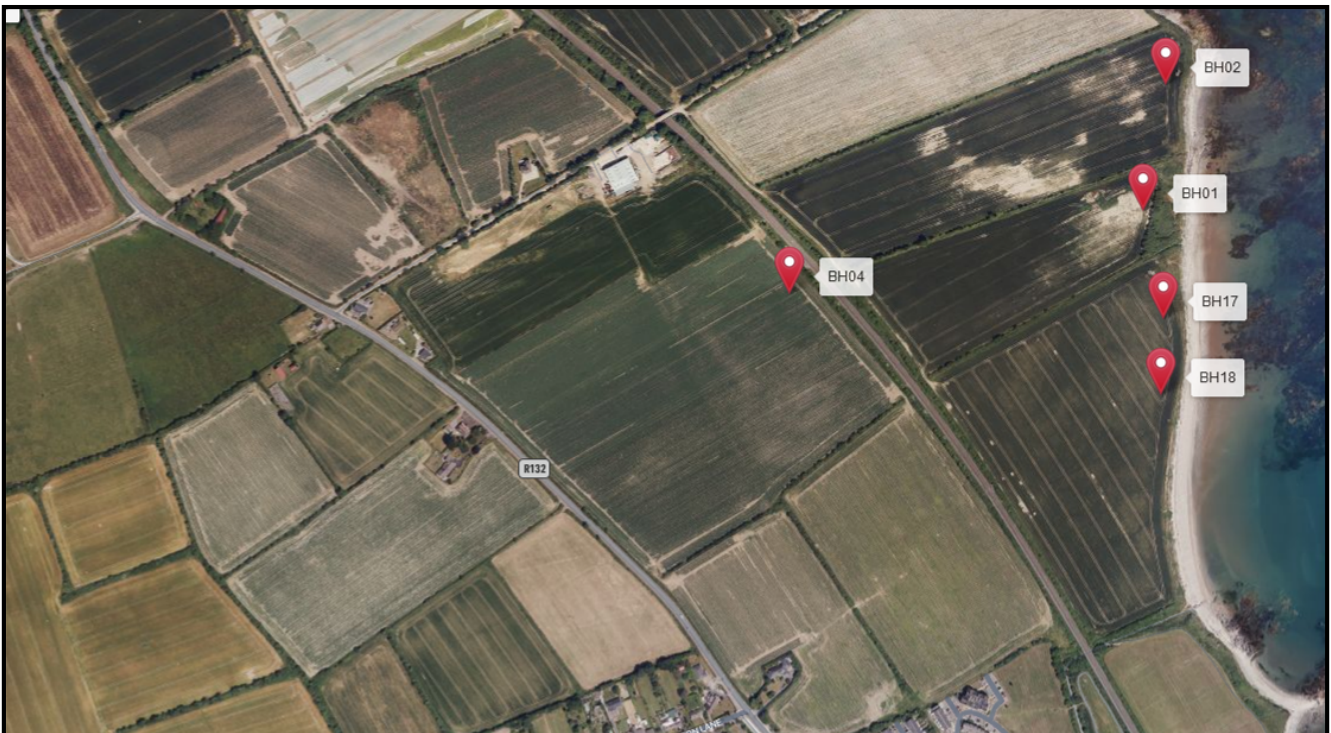
### 3.0 SITE DETAILS

#### North Irish Sea Array, Balbriggan

EIR Code: O16  
Post code: K32 WY80



**Figure 3.1** Location map showing the main area of investigation highlighted by the red striped area © Ordnance Survey Ireland 2022.

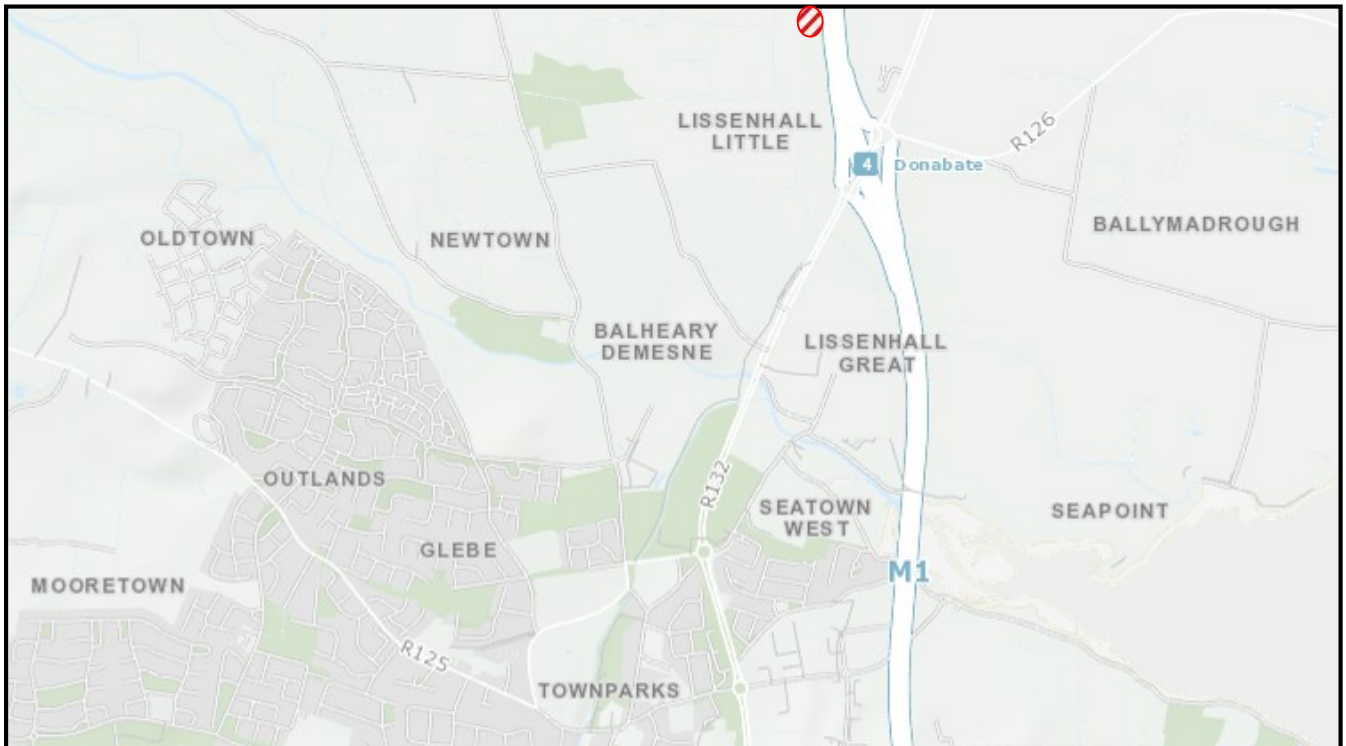


**Figure 3.2** Aerial image showing the location of five of the six boreholes, just north of Balbriggan © Applemaps 2022.

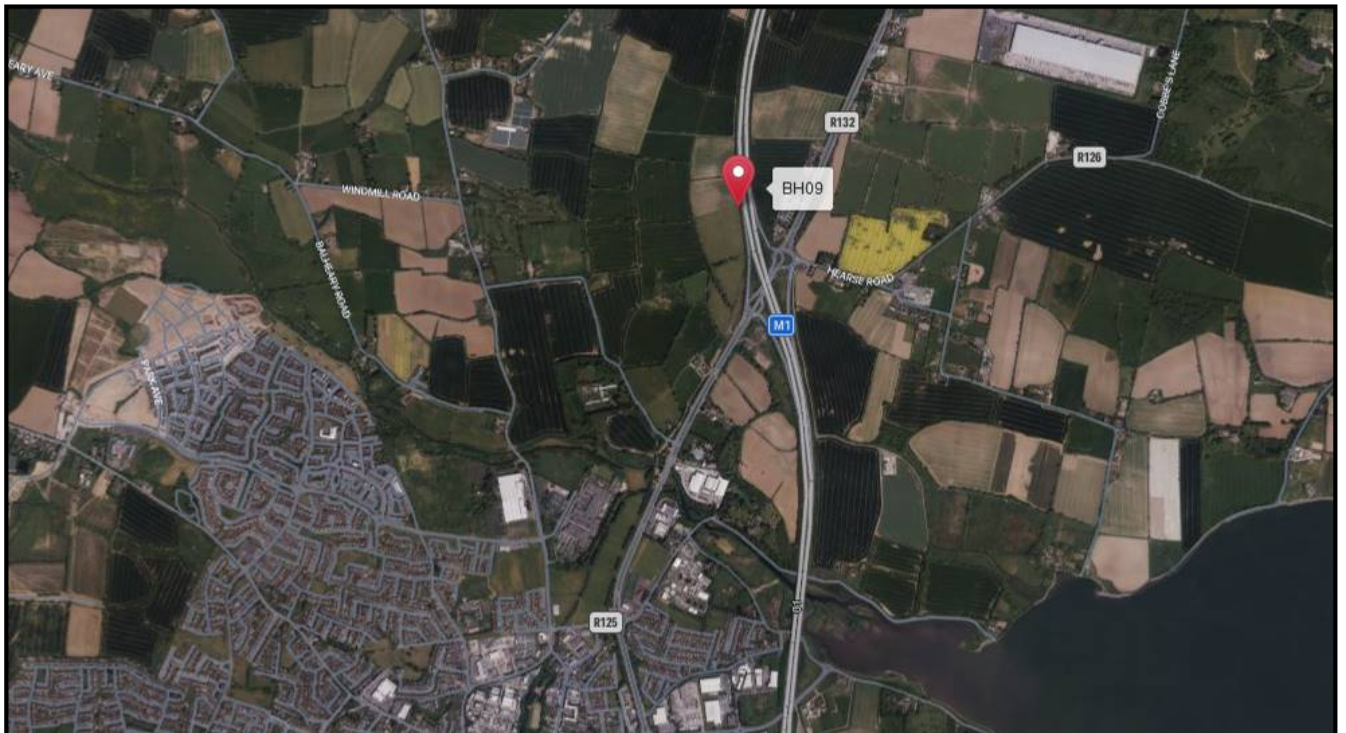
### 3.0 SITE DETAILS

#### North Irish Sea Array

EIR Code: O19  
Post Code: K67 R2K0



**Figure 3.3** Location map showing the location of borehole 9, just north of Swords (highlighted by the red striped circle) © Ordnance Survey Ireland 2022.



**Figure 3.4** Aerial map showing borehole 9's location © Applemaps 2022.

## 5.0 BOREHOLE LOGGING CONSTRAINTS

- **Vehicle access restrictions**  
Offroad
  - **Tool access restrictions**  
None
  - **Borehole conditions**  
Most of the boreholes had either collapsed or silted up slightly from their drilled depths.
  - **Lack of fluid filled column**  
None
  - **Time constraint**  
None
-

## **Appendix 1**

### **Geophysical Logs**





# EUROPEAN GEOPHYSICAL SERVICES LTD

Client:	Causeway Geotech	Log Type:
Borehole:	BH01	Composite Final

## Project: North Irish Sea Array

Location: **Balbriggan** Area: **County Dublin** Grid Ref: **719758.67E 765371.97N** Elevation: **3.53**

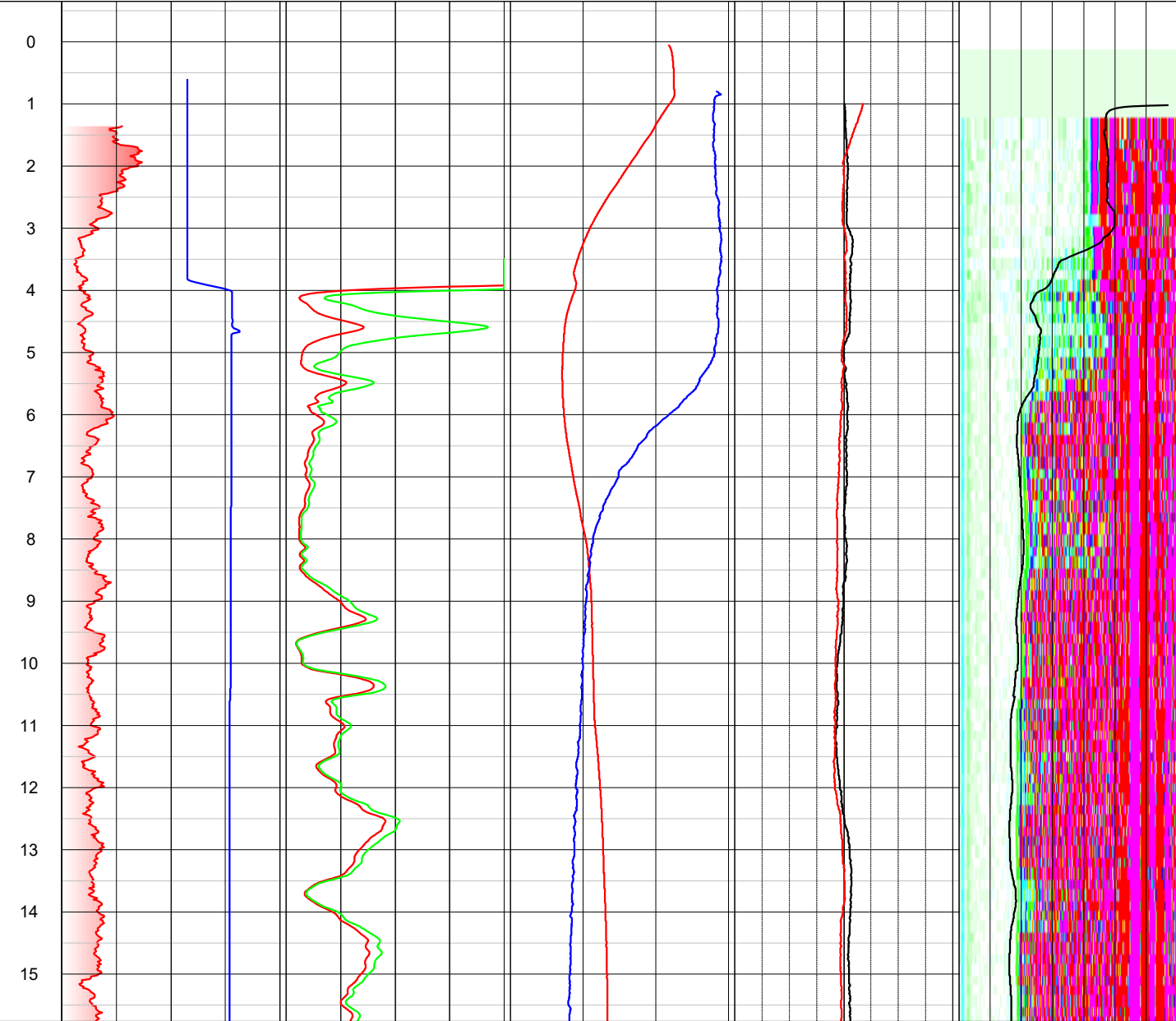
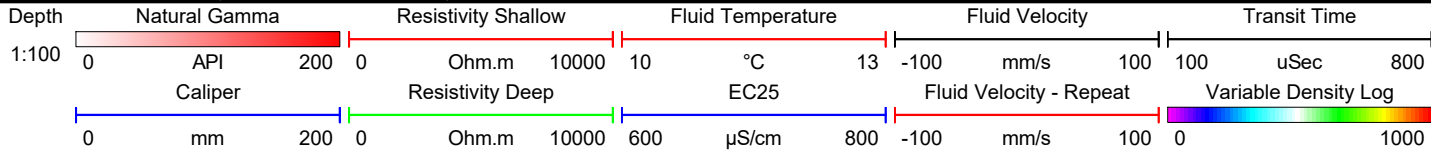
Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	22.2	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: The borehole has collapsed to around 21.5m (dipped on the 29th), some tools could push to approximately 22.5m. Fluid logs terminated at around 20.5m to prevent the impeller from coming into contact with the collapsed material.	
Logged Interval: (m)	0.6 - 22.2		
Fluid Level: (m)	0.8		

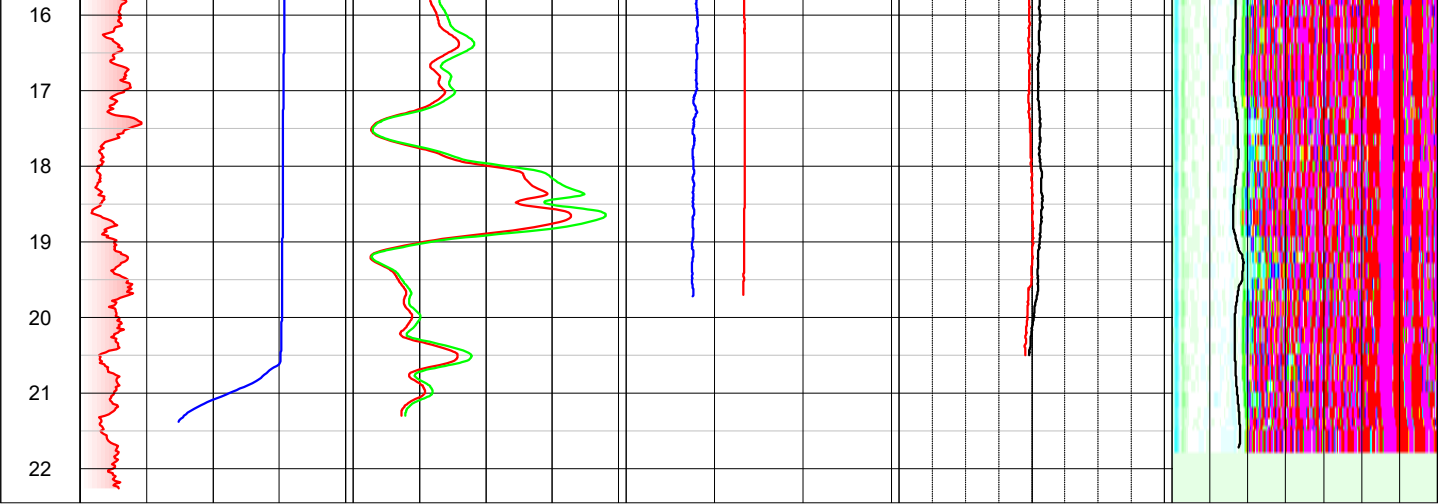
### BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
154	4	30

### CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
PLASTIC	115	-0.19	4







EUROPEAN GEOPHYSICAL SERVICES LTD

Client:	Causeway Geotech	Log Type:
Borehole:	BH02	Composite Final

Project: North Irish Sea Array

Location: Balbriggan      Area: County Dublin      Grid Ref: 719788.43E 765520.35N      Elevation: 5.43

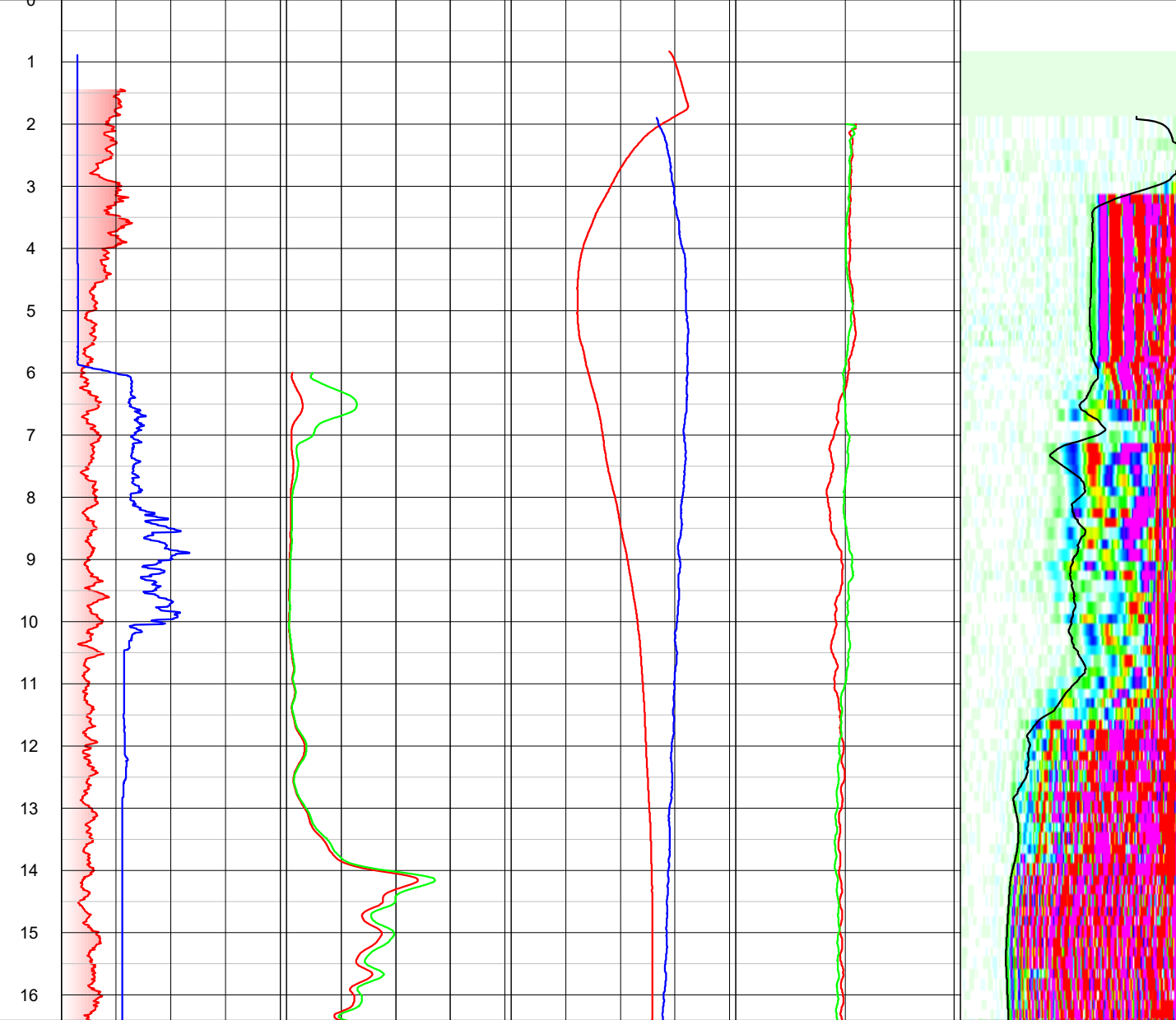
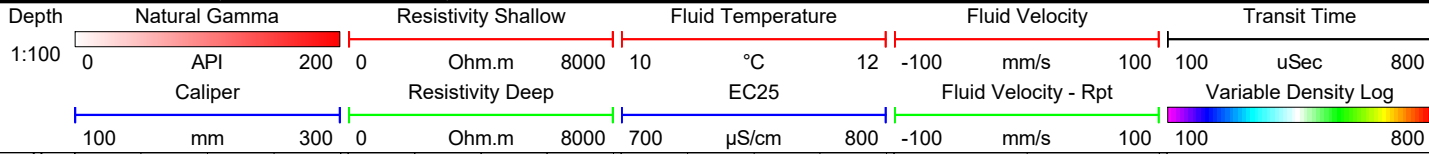
Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	28	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to approximately 28.1m.	
Logged Interval: (m)	0.9 - 28		
Fluid Level: (m)	1.7		

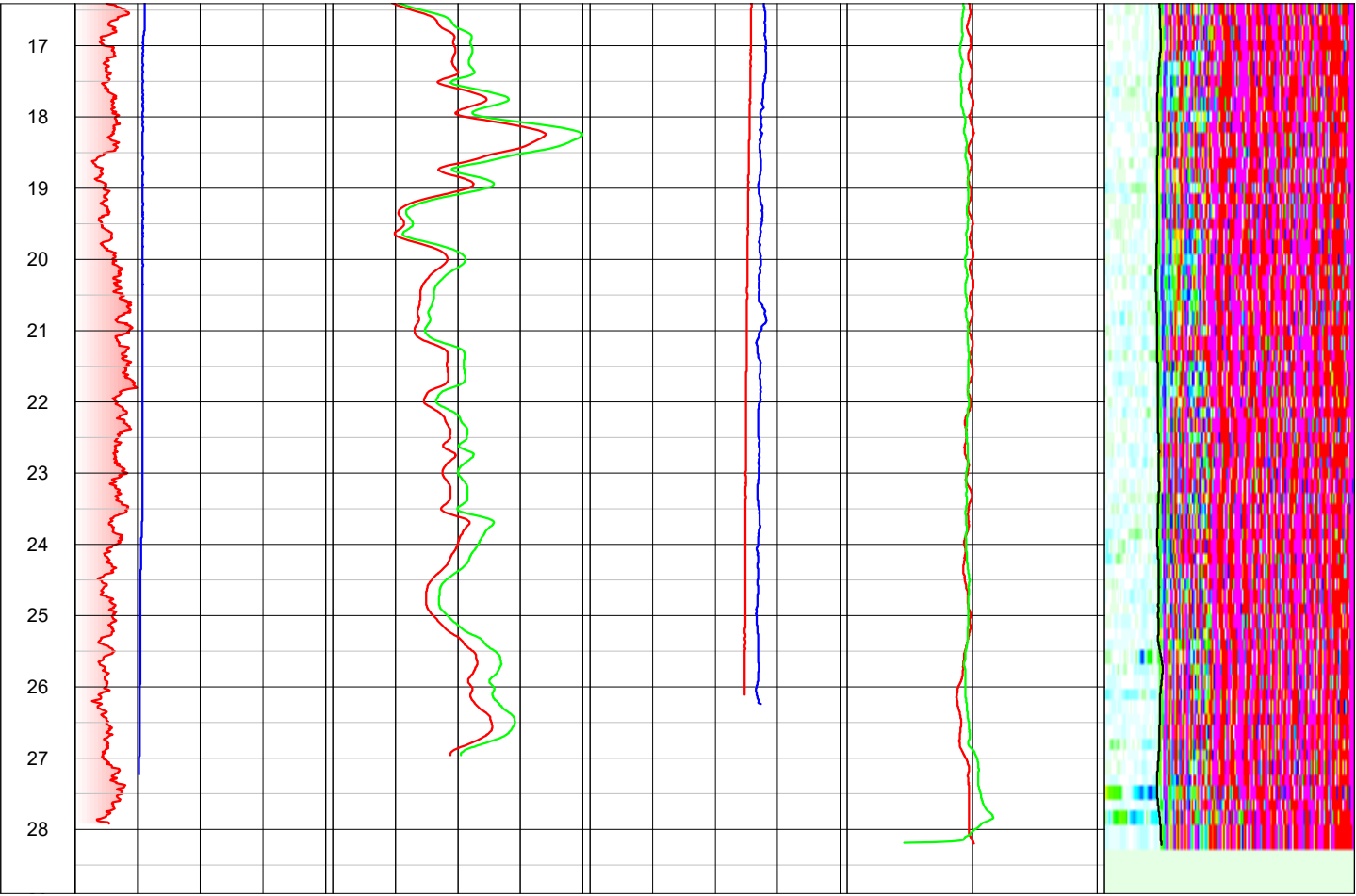
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
154	6	30

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
PLASTIC	115	0	6









# EUROPEAN GEOPHYSICAL SERVICES LTD

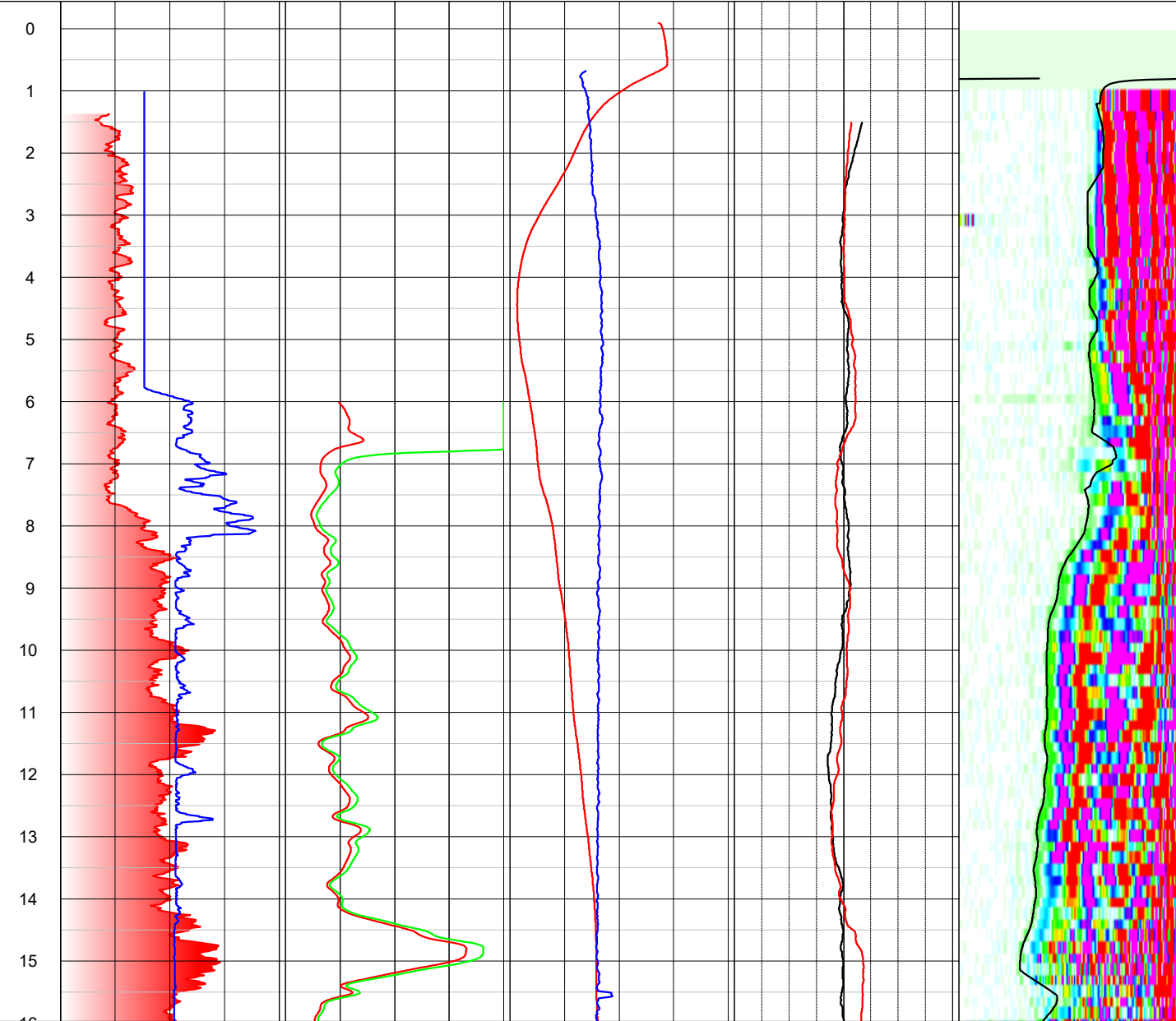
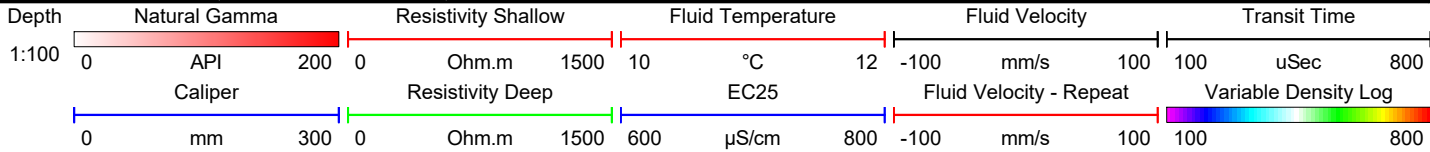
Client:	Causeway Geotech	Log Type:
Borehole:	BH04	Composite Final

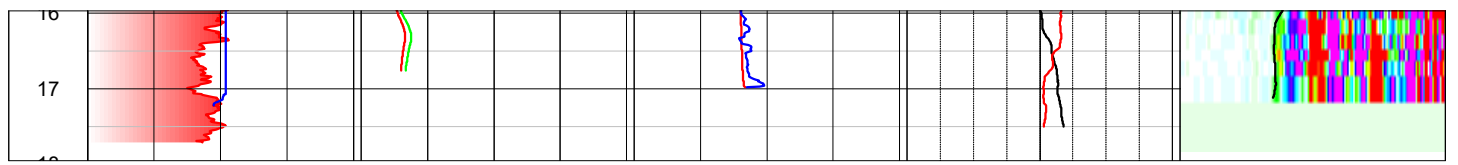
## Project: North Irish Sea Array

Location: **Balbriggan** Area: **County Dublin** Grid Ref: **719338.6E 765263.53N** Elevation: **13.04**

Drilled Depth: (m)	20	Date:	04.05.2022
Logged Depth: (m)	17.7	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to approximately 18m.	
Logged Interval: (m)	0.6 - 17.7		
Fluid Level: (m)	0.6		

BOREHOLE RECORD			CASING RECORD			
Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	6	20	PLASTIC	115	-0.3	6







# EUROPEAN GEOPHYSICAL SERVICES LTD

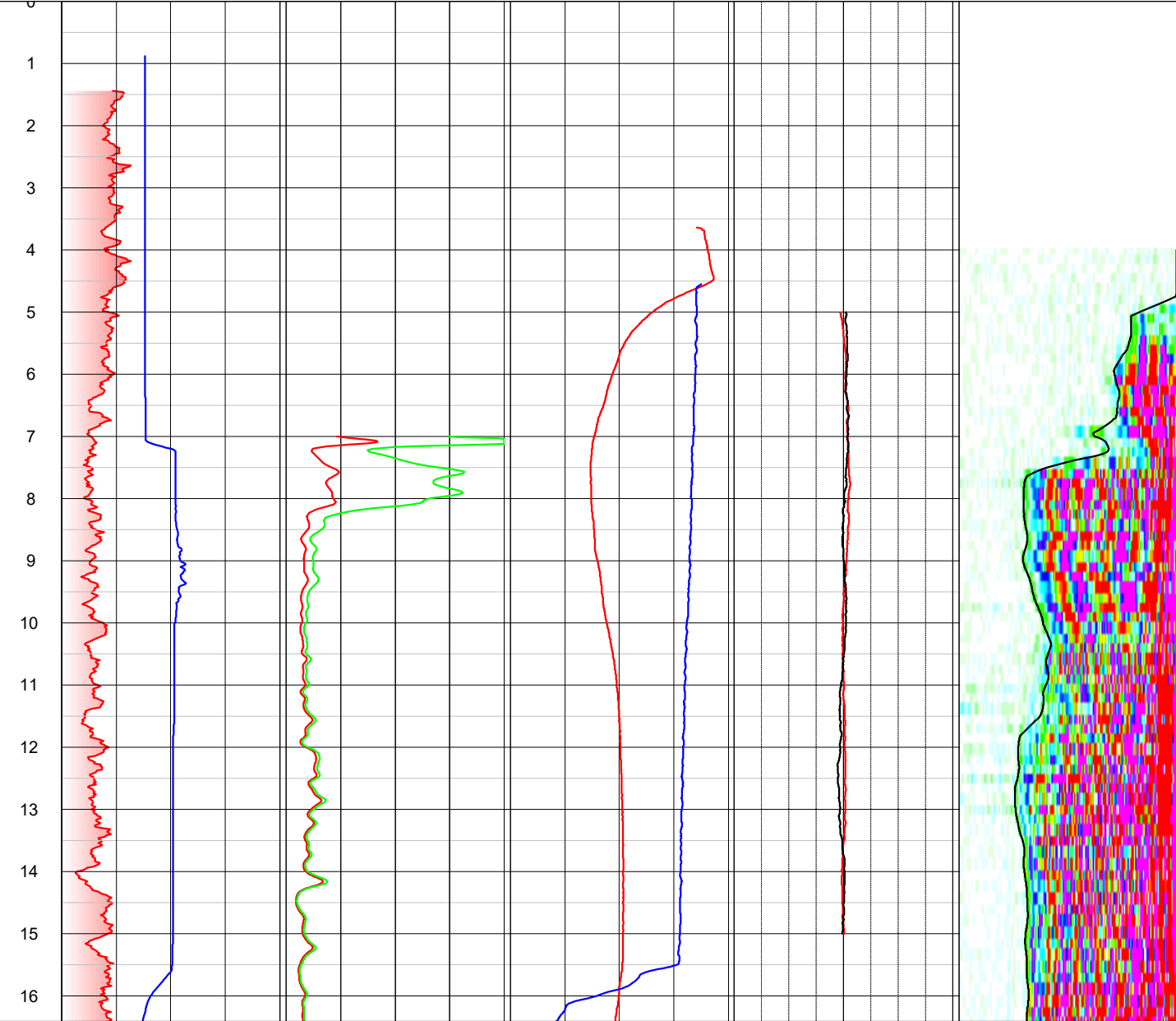
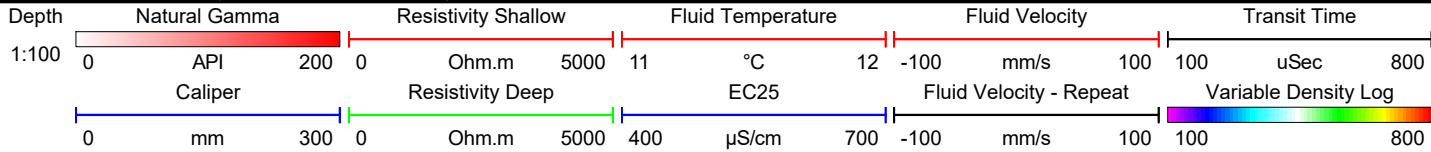
Client:	Causeway Geotech	Log Type:
Borehole:	BH09	Composite Final

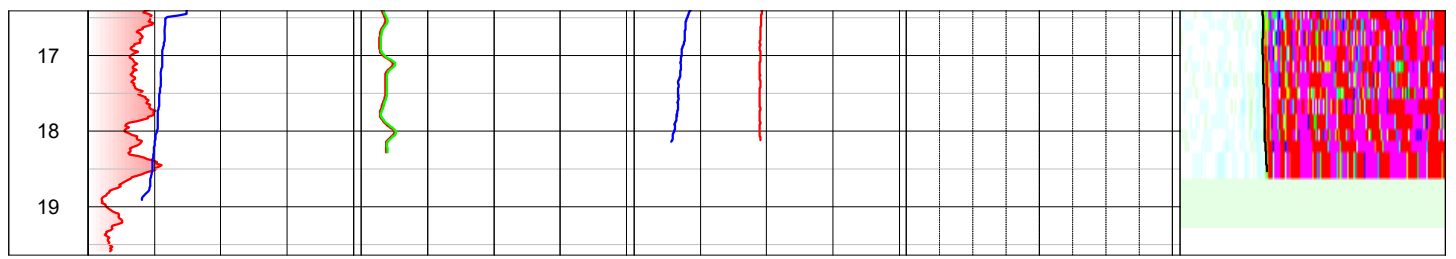
## Project: North Irish Sea Array

Location: Swords Area: County Dublin Grid Ref: 718991E 749337N Elevation: 10.54

Drilled Depth: (m)	20	Date:	06.05.2022
Logged Depth: (m)	19.6	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Heavy mud below 15.5m. Fluid velocity logs terminated at 15m due to the impeller becoming completely blocked when passing below this depth.	
Logged Interval: (m)	0.9 - 19.6		
Fluid Level: (m)	4.5		

BOREHOLE RECORD			CASING RECORD			
Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	7.2	20	PLASTIC	115	-0.36	7.2









EUROPEAN GEOPHYSICAL SERVICES LTD

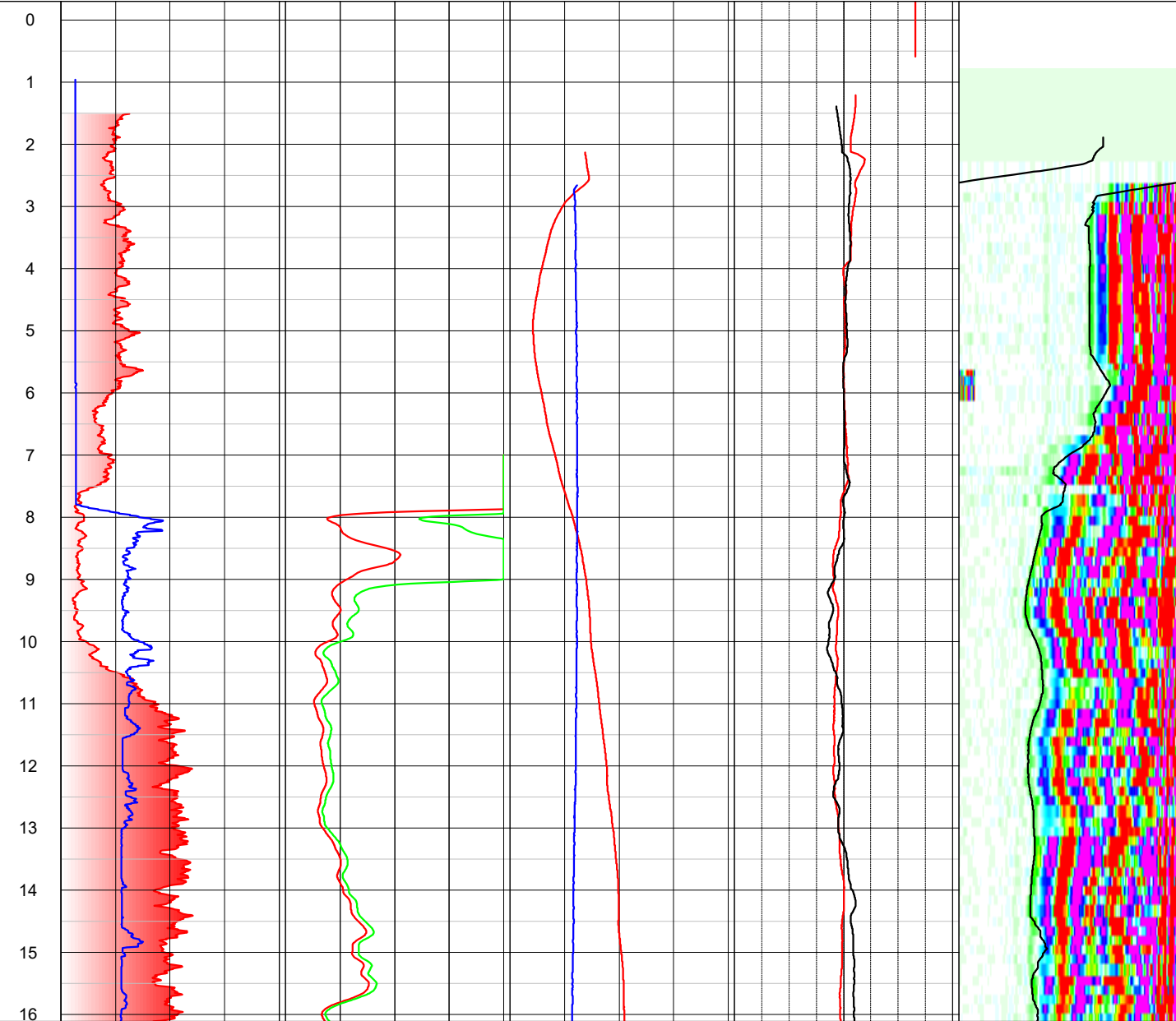
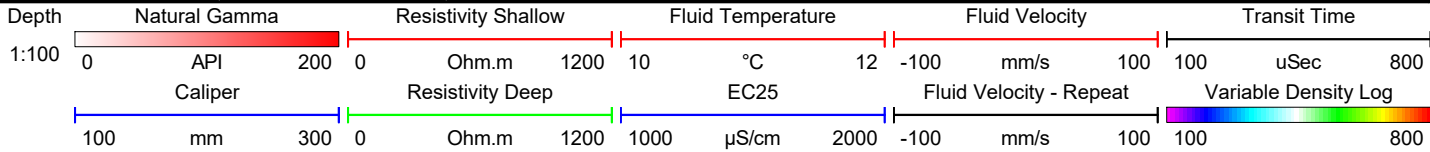
Client:	Causeway Geotech	Log Type:
Borehole:	BH17	Composite Final

Project: North Irish Sea Array

Location: Balbriggan      Area: County Dublin      Grid Ref: 719790.17E 765252.88N      Elevation: 5.85

Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	25	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to approximately 25m.	
Logged Interval: (m)	1 - 25		
Fluid Level: (m)	2.5		

BOREHOLE RECORD			CASING RECORD			
Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	8	30	Plastic	112	0	8







# EUROPEAN GEOPHYSICAL SERVICES LTD

Client:	Causeway Geotech	Log Type:
Borehole:	BH18	Composite Final

## Project: North Irish Sea Array

Location: **Balbriggan** Area: **County Dublin** Grid Ref: **719790.13E 765252.97N** Elevation: **8.09**

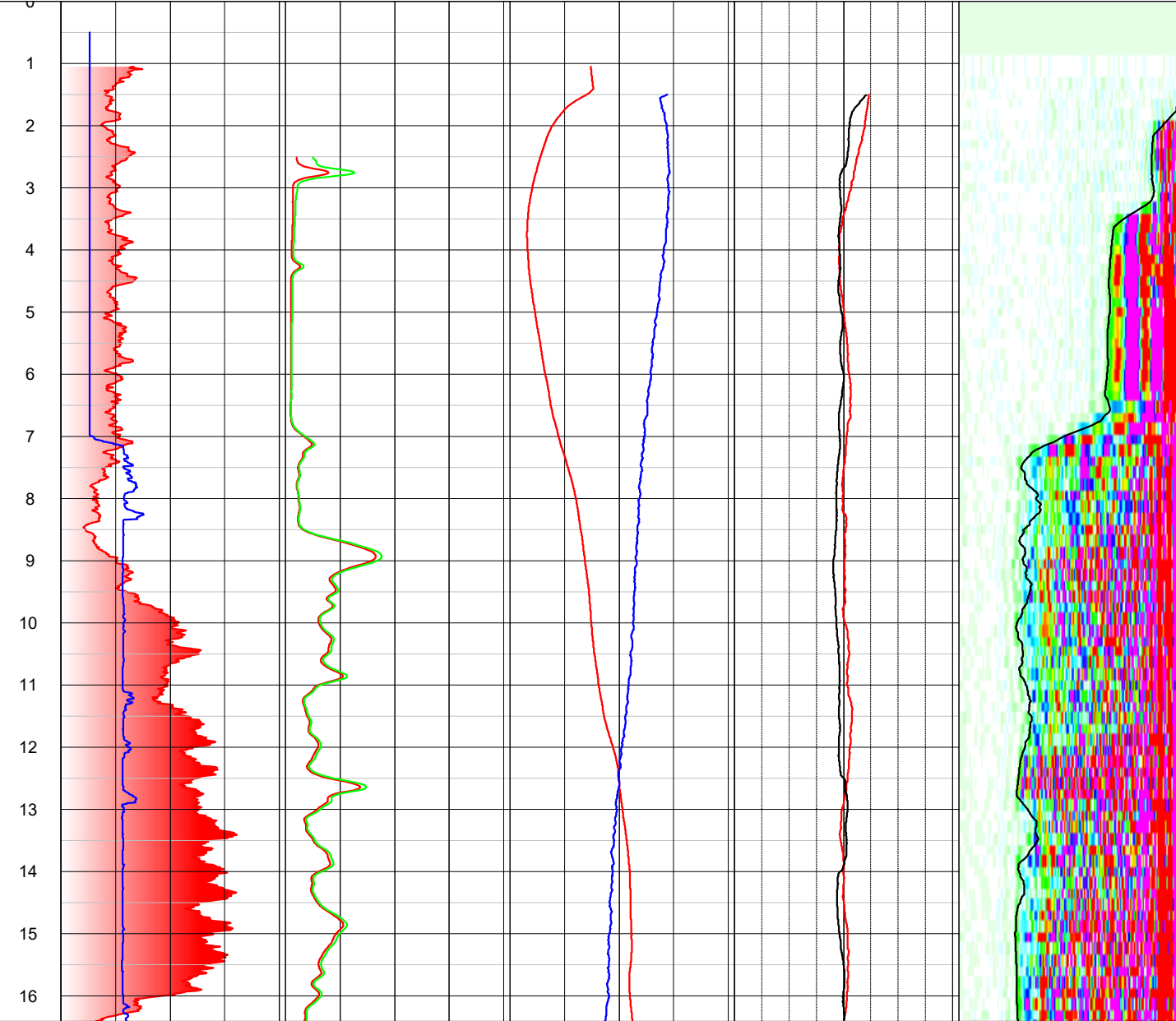
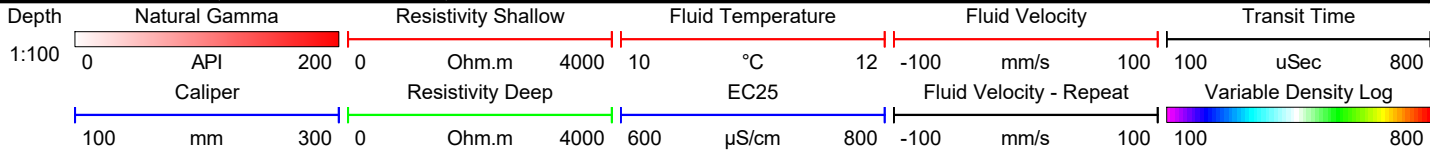
Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	27	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to around 27.5m.	
Logged Interval: (m)	1 - 27		
Fluid Level: (m)	1.4		

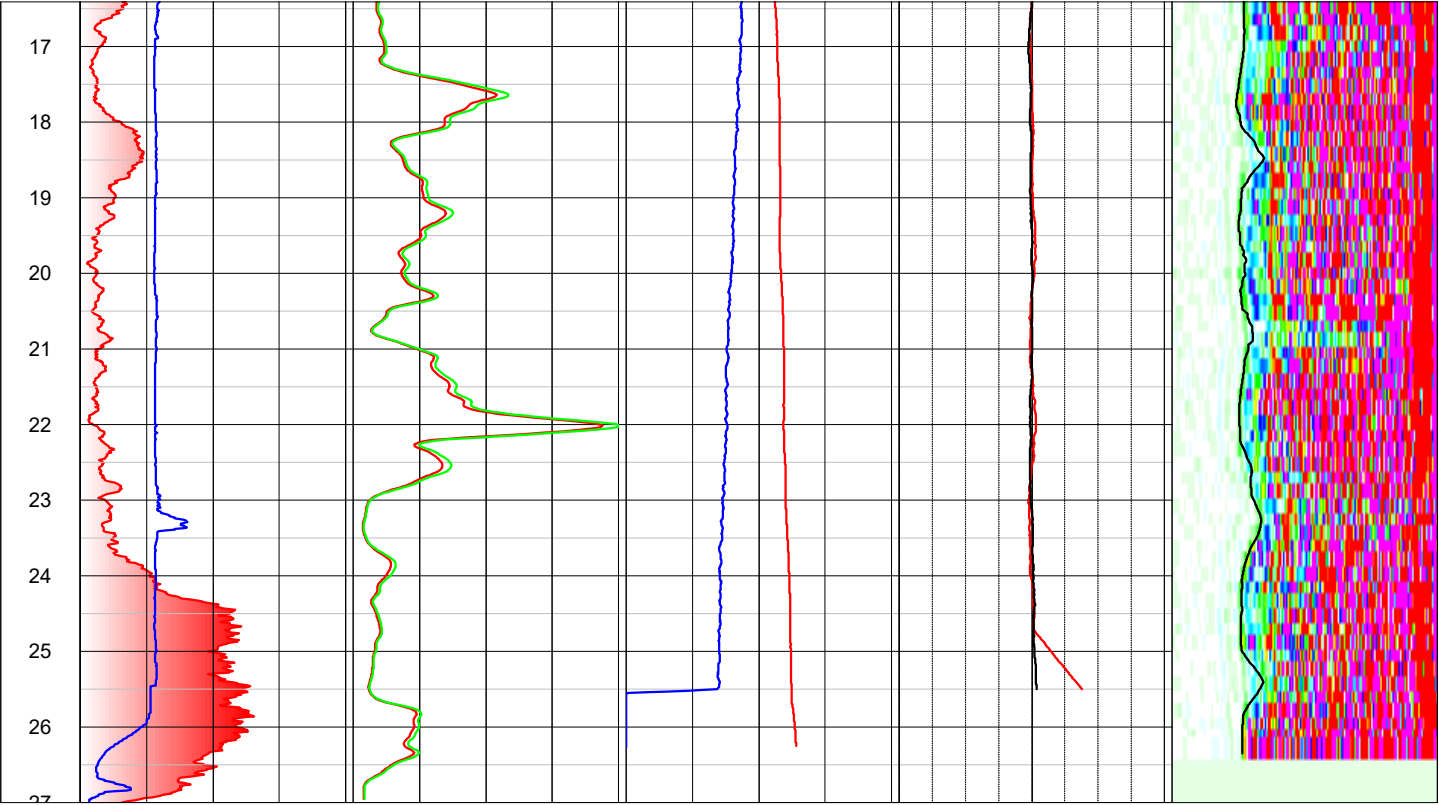
### BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
154	7	30

### CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
PLASTIC	126	-0.28	7









# EUROPEAN GEOPHYSICAL SERVICES LTD

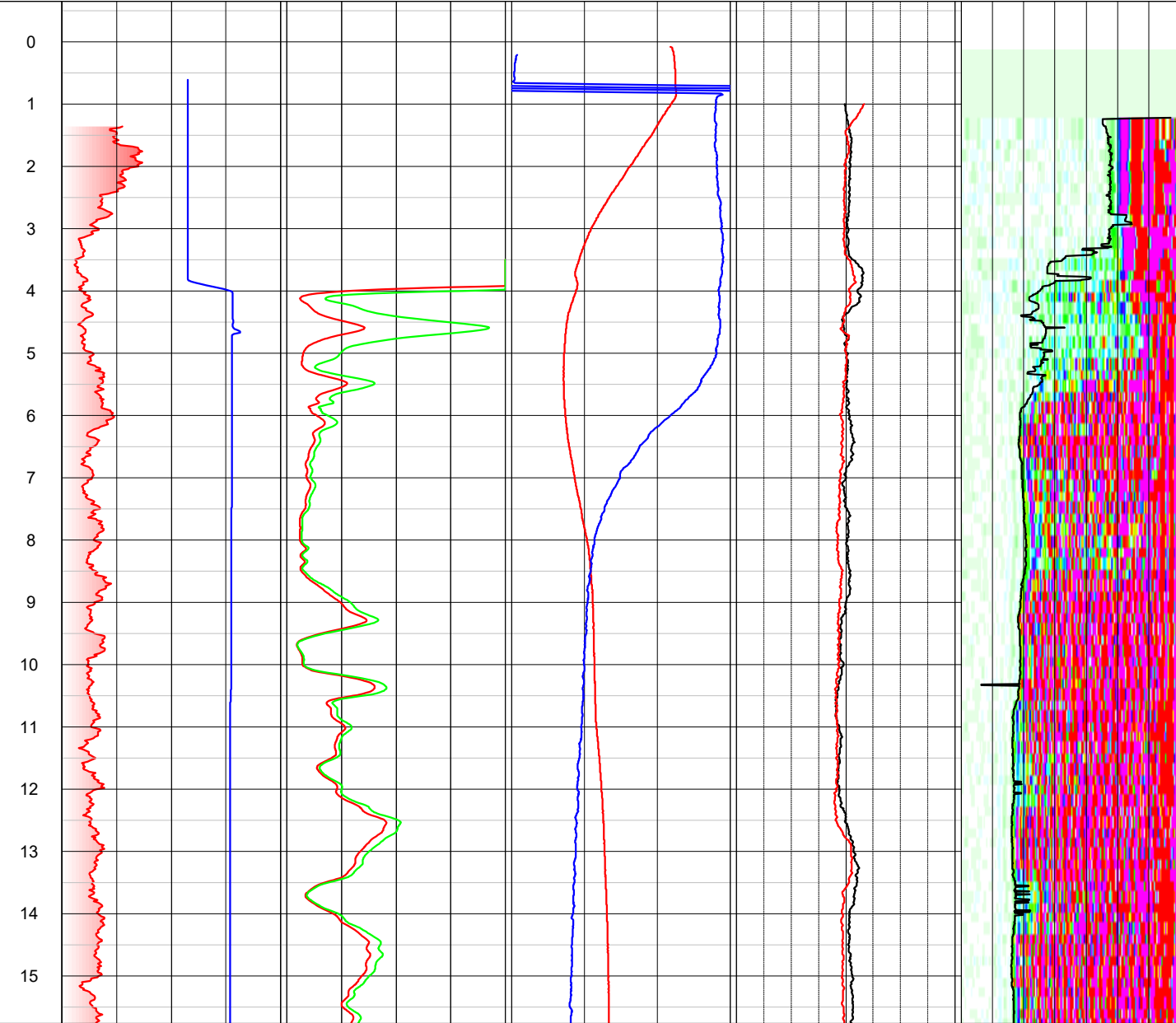
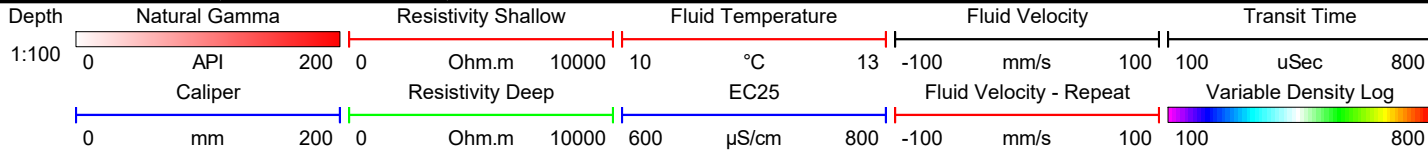
Client:	Causeway Geotech	Log Type:
Borehole:	BH01	FIELD

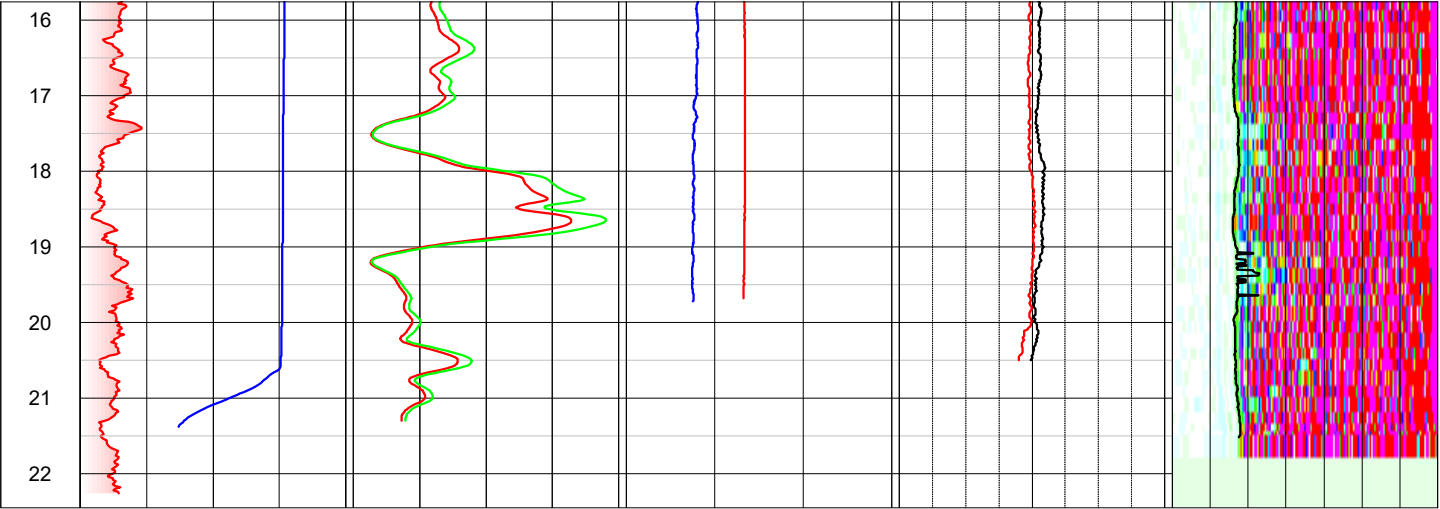
## FIELD LOG (SUBJECT TO FINAL QA CHANGES)

Location: **Balbriggan**      Area: **County Dublin**      Grid Ref:      Elevation:

Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	22.2	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: The borehole has collapsed to around 21.5m (dipped on the 29th), some tools could push to approximately 22.5m. Fluid logs terminated at around 20.5m to prevent the impeller from coming into contact with the collapsed material.	
Logged Interval: (m)	0.6 - 22.2		
Fluid Level: (m)	0.8		

BOREHOLE RECORD			CASING RECORD			
Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	4	30	PLASTIC	115	-0.19	4







EUROPEAN GEOPHYSICAL SERVICES LTD

Client: Causeway Geotech

Borehole: BH02

Log Type:

FIELD

FIELD LOG (SUBJECT TO FINAL QA CHANGES)

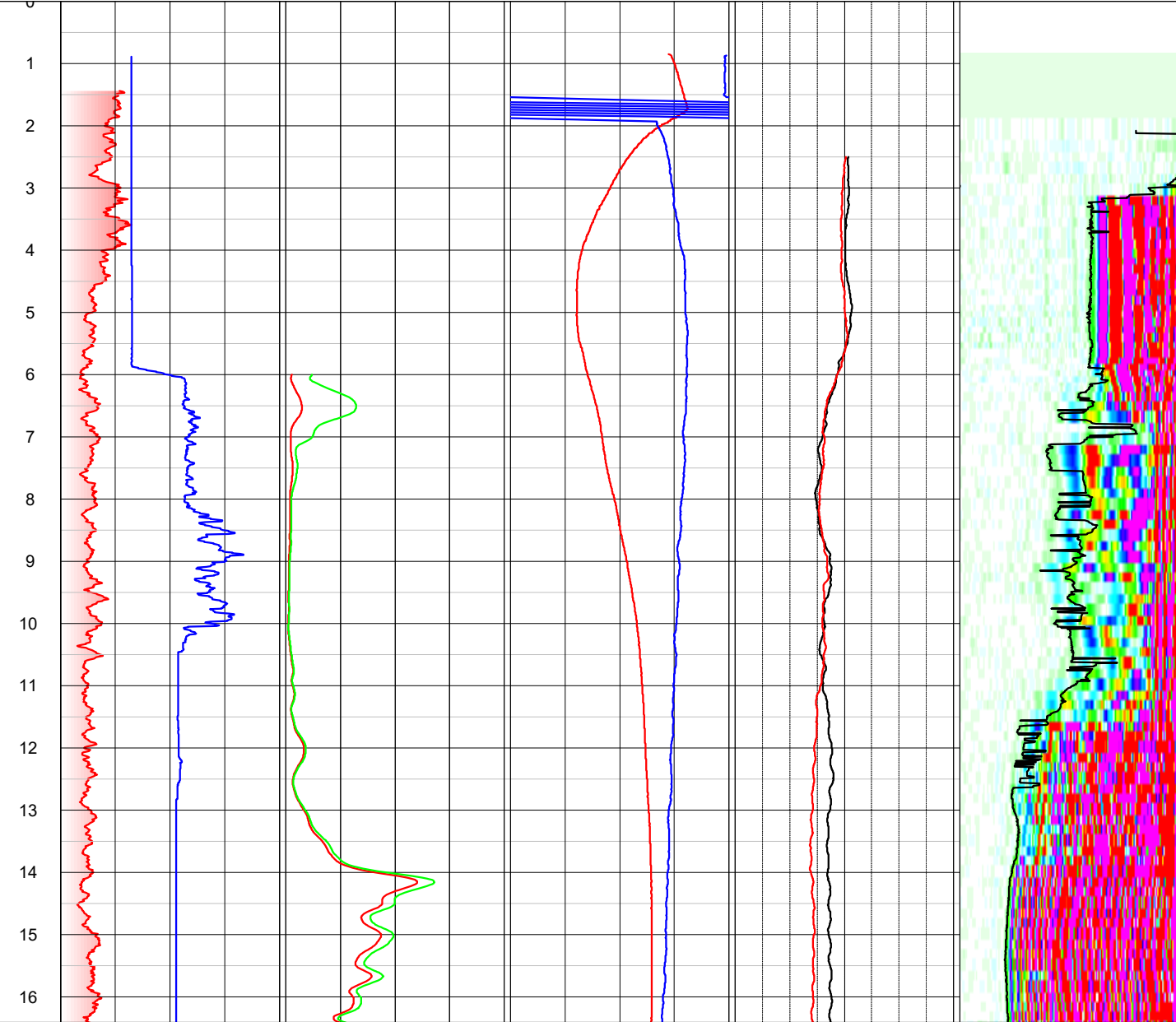
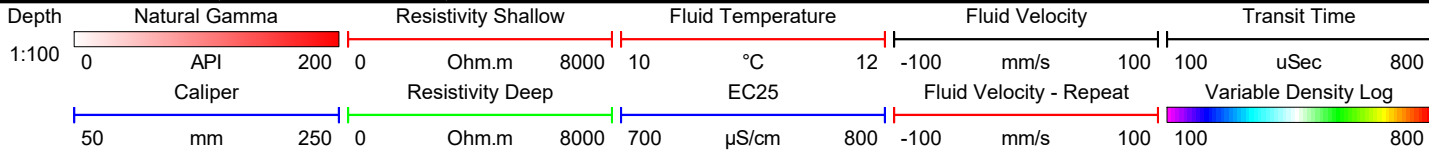
Location: Balbriggan Area: County Dublin Grid Ref: Elevation:

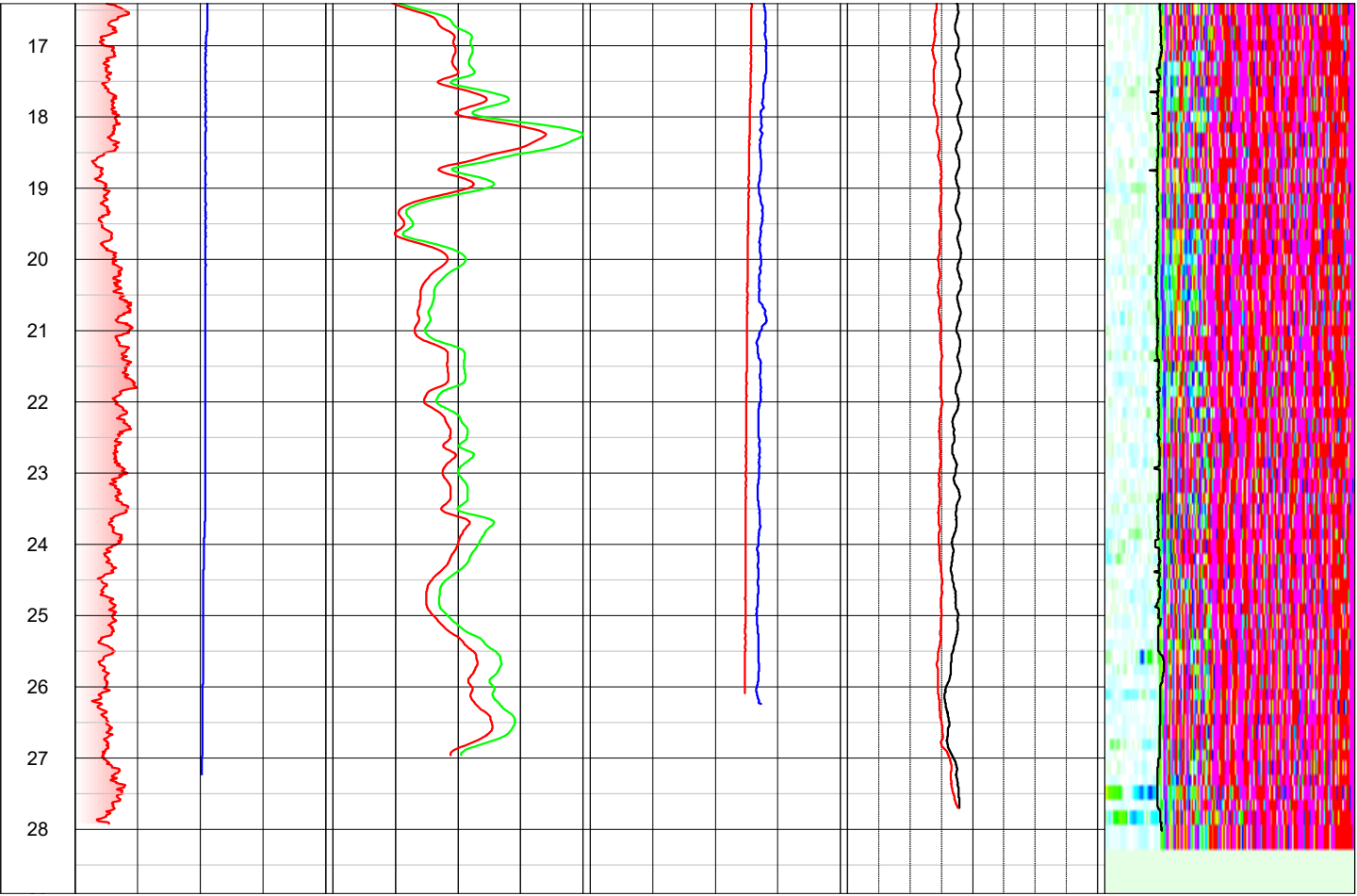
Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	28	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to approximately 28.1m.	
Logged Interval: (m)	0.9 - 28		
Fluid Level: (m)	1.7		

BOREHOLE RECORD

CASING RECORD

Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	6	30	PLASTIC	115	0	6









# EUROPEAN GEOPHYSICAL SERVICES LTD

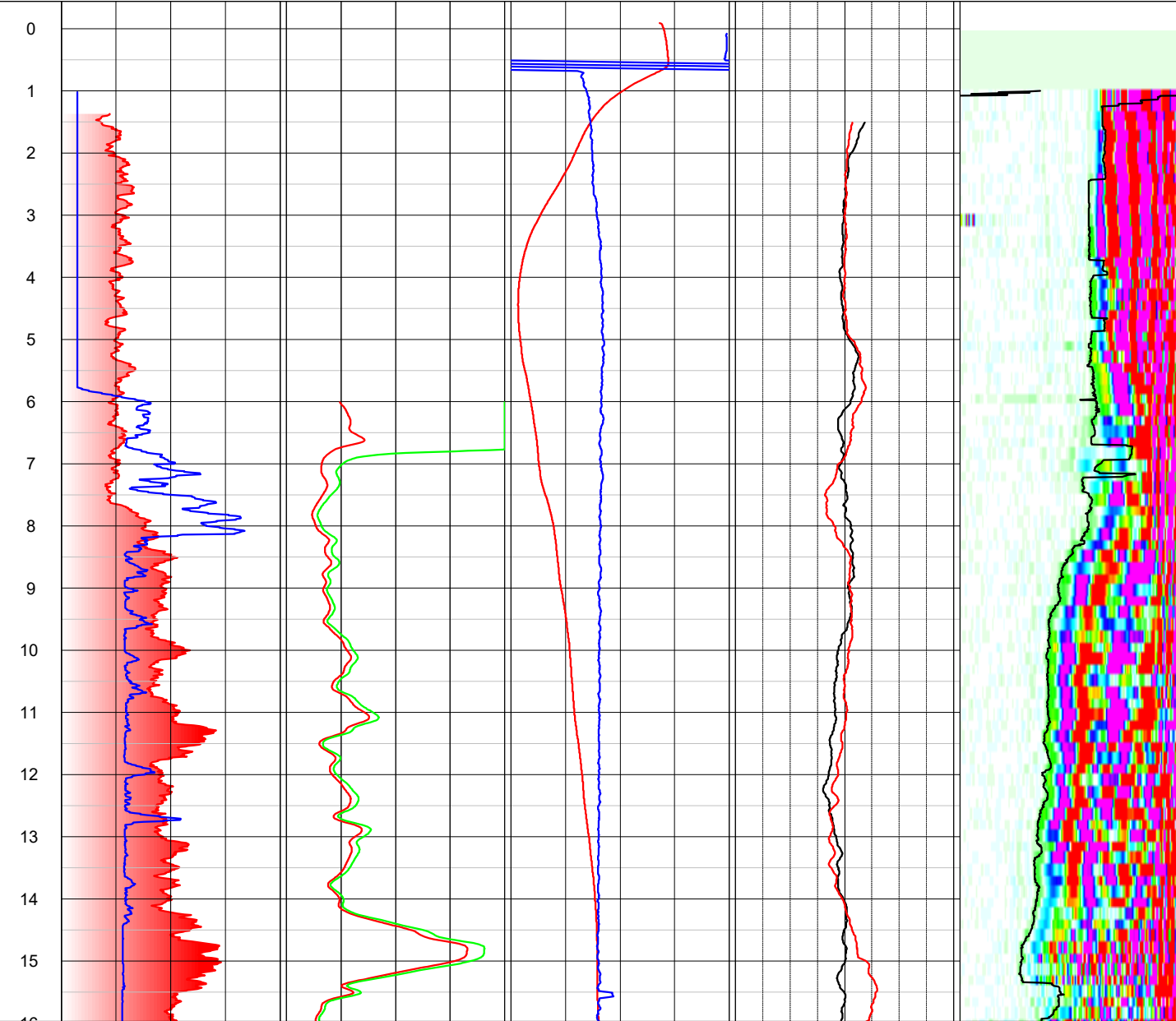
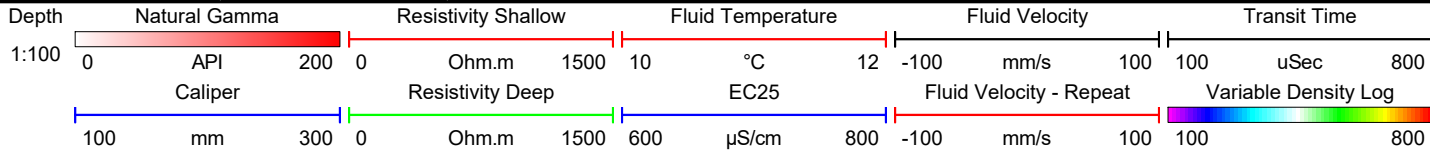
Client:	Causeway Geotech	Log Type:
Borehole:	BH04	FIELD

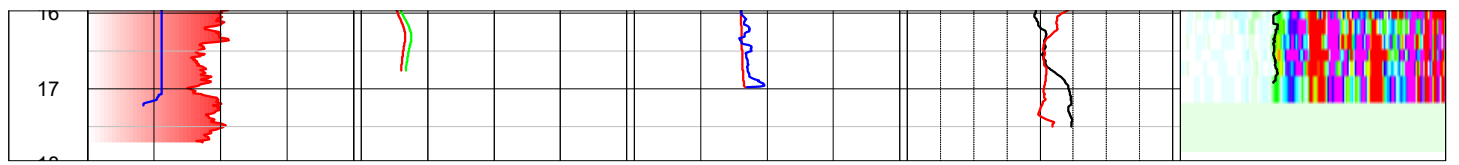
## FIELD LOG (SUBJECT TO FINAL QA CHANGES)

Location: **Balbriggan**      Area: **County Dublin**      Grid Ref:      Elevation:

Drilled Depth: (m)	20	Date:	04.05.2022
Logged Depth: (m)	17.7	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to approximately 18m.	
Logged Interval: (m)	0.6 - 17.7		
Fluid Level: (m)	0.6		

BOREHOLE RECORD			CASING RECORD			
Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	6	20	PLASTIC	115	-0.3	6







EUROPEAN GEOPHYSICAL SERVICES LTD

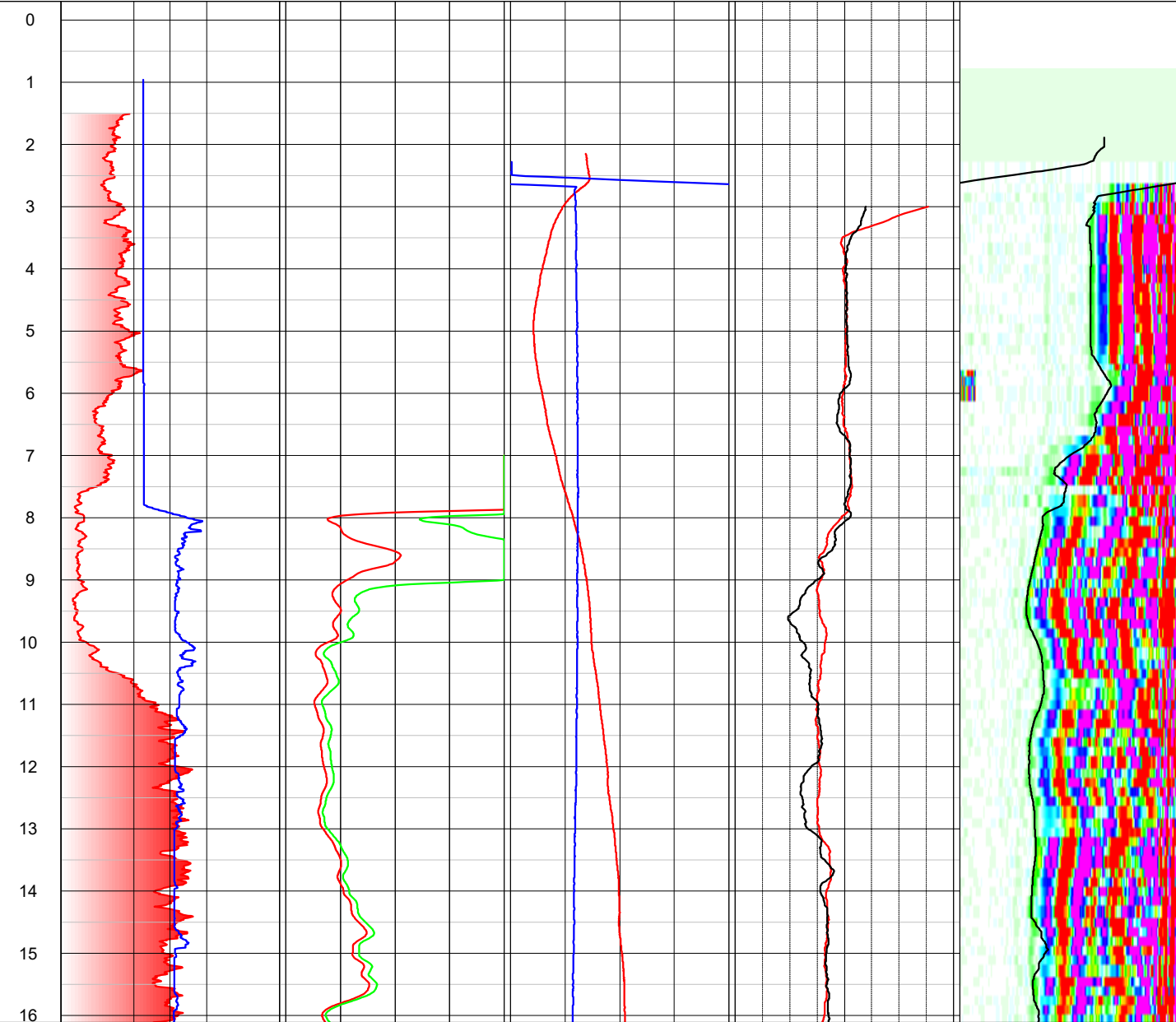
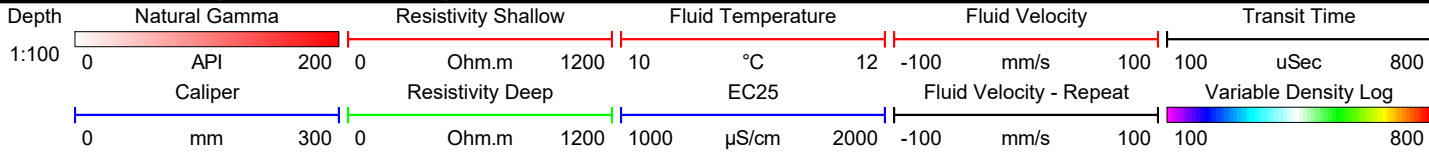
Client:	Causeway Geotech	Log Type:
Borehole:	BH17	FIELD

FIELD LOG (SUBJECT TO FINAL QA CHANGES)

Location: Balbriggan      Area: County Dublin      Grid Ref:      Elevation:

Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	25	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Borehole has collapsed to approximately 25m.	
Logged Interval: (m)	1 - 25		
Fluid Level: (m)	2.5		

BOREHOLE RECORD			CASING RECORD			
Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	8	30	Plastic	112	0	8









# EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Causeway Geotech**

Log Type:

Borehole: **BH18**

**FIELD**

## FIELD LOG (SUBJECT TO FINAL QA CHANGES)

Location: **Balbriggan** Area: **County Dublin** Grid Ref: Elevation:

Drilled Depth: (m)	30	Date:	04.05.2022
Logged Depth: (m)	27	Recorded By:	M. Hand
Logging Datum:	Ground level	Remarks: Significant amount of material in the borehole water column. Borehole has collapsed to around 27.5m.	
Logged Interval: (m)	1 - 27		
Fluid Level: (m)	1.4		

### BOREHOLE RECORD

### CASING RECORD

Bit: (mm)	From: (m)	To: (m)	Type	Size: (mm)	From: (m)	To: (m)
154	7	30	PLASTIC	126	-0.28	7

