

## North Irish Sea Array Cable Route – Ground Investigation

Client: Statkraft Limited

Client's Representative: Arup

Report No.: 21-1619B

Date: December 2022

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## **Document Control Sheet**

Report No.:		21-1619B						
Project Title:		North Irish Sea	Array Cable Route	<del>)</del>				
Client:		Statkraft Limite	d					
Client's Repres	entative:	Arup						
Revision:	A01	Status:	Final Report	Issue Date:	06 <sup>th</sup> December 2022.			
Prepared by:		Reviewed by:		Approved by:				
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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	l 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.
В	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
С	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 Nx5=Cu 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.
$\overline{\hspace{1cm}}$	Water strike: initial depth of strike.
<b>T</b>	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 Cable Route

#### 1 AUTHORITY

On the instructions of Arup, ("the Client's Representative"), acting on the behalf of Statkraft Limted ("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.

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, slit trenches, 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 south of Lusk extending southwards. The site works can be split into four sites; Balbriggan, Blakes Cross, the M1 crossing and Malahide.



The Balbriggan site consists of slit trenches completed along the Drogheda Street, Dublin Street and Chapel Gate roads. The Blakes Cross site is bordered to the east by the R132 and to the north south and west by agricultural lands. The M1 crossing site is divided by the M1 road and is bordered on the remaining sides by agricultural lands. The Malahide site consists of slit trenches completed along the Swords, Belcamp and Malahide roads in Malahide, Co. Dublin.

#### 4 SITE OPERATIONS

### 4.1 Summary of site works

Site operations, which were conducted between the  $22^{nd}$  of February and the  $20^{th}$  of November 2022, comprised:

- two boreholes by light cable percussion extended by rotary follow-on.
- a standpipe installation in one borehole
- eleven machine dug trial pits
- ten machine dug slit trenches; 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

Two boreholes (BH08 and BH09) 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. 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 $_{(s)}$ ) or solid cone attachment (SPT $_{(c)}$ ). 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.

#### 4.3 Standpipe installation

A groundwater monitoring standpipe was installed in BH09.

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

#### 4.4 Trial Pits

Eleven trial pits (TP16-TP26) were excavated using a 6t,8t and 13t 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 Slit trenches

Ten slit trenches (SLT02, ST02-ST03, ST06, ST23-ST24, ST27, ST29, ST31 and ST33) were excavated by a combination of hand digging and mechanical excavation using a compact 3t tracked excavator fitted with a 600mm wide toothless bucket, to locate and identify buried services at the site.

Drawing of the trenches and the locations of services encountered during excavation are shown along with the slit trench logs in Appendix F, with photographs presented in Appendix G.





## 4.6 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.

#### 4.7 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)
- 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 I.



### 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	ISRM Suggested Methods (1981) Suggested method for determining
compression	deformability of rock materials in uniaxial compression, Part 2
strength tests	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 mudstone of the Belcamp Formation of the Balbriggan site. Dark limestone and shales of the Malahide and Tober Colleen Formations underly the deposits of the M1 crossing, Blakes Cross and Malahide sites.



#### 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:

- **Paved Surface:** Bitmac surfacing was encountered up to 150mm thickness in all slit trenches. Additionally, ST24 encountered a second layer of bitmac surfacing at 0.45m.
- **Topsoil:** encountered a maximum thickness of 500mm across the site.
- Made Ground (sub-base): sandy gravel fill was encountered beneath the paved surfaces in all slit trenches typically to 300mm thickness.
- **Possible Made Ground (fill):** sandy gravelly clay encountered in ST03 extending to a maximum depth of 1.10m.
- **Fluvioglacial deposits:** typically medium dense sands interspersed with layers of sandy gravelly clay in BH08.
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.
- **Bedrock (Limestone):** Rockhead was encountered at depths ranging from 6.70m in BH09 to 7.20m in BH08.

#### 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)
BH08	3.00
TP18	1.70
TP19	1.00
TP20	1.40
TP21	1.10



TP22	1.70
TP25	2.00
TP26	1.10

Groundwater was not noted during drilling at BH09 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) -	Round 2 (08/06/2022)-	Round 3 (15/09/2022) -
	mbgl	mbgl	mbgl
BH09	3.65	5.38	5.31

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.



## APPENDIX A SITE AND EXPLORATORY HOLE LOCATION PLANS





Client:

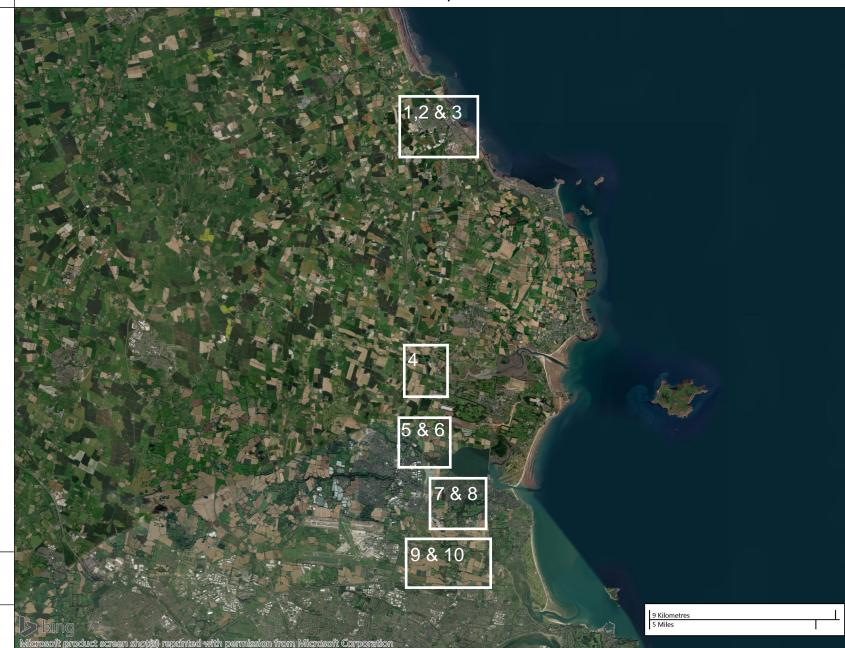
Client's

**Project Name:** 

North Irish Sea Array Cable Route Representative: Arup

Statkraft Limited

Legend Key



Title:

Site Location Plan



Client: Statkraft Limited

**Project Name:** 

North Irish Sea Array Cable Route

Client's Arup Representative:

## Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan

Last Revised: Scale: 05/12/2022

1:500



Client: Statkraft Limited

**Project Name:** 

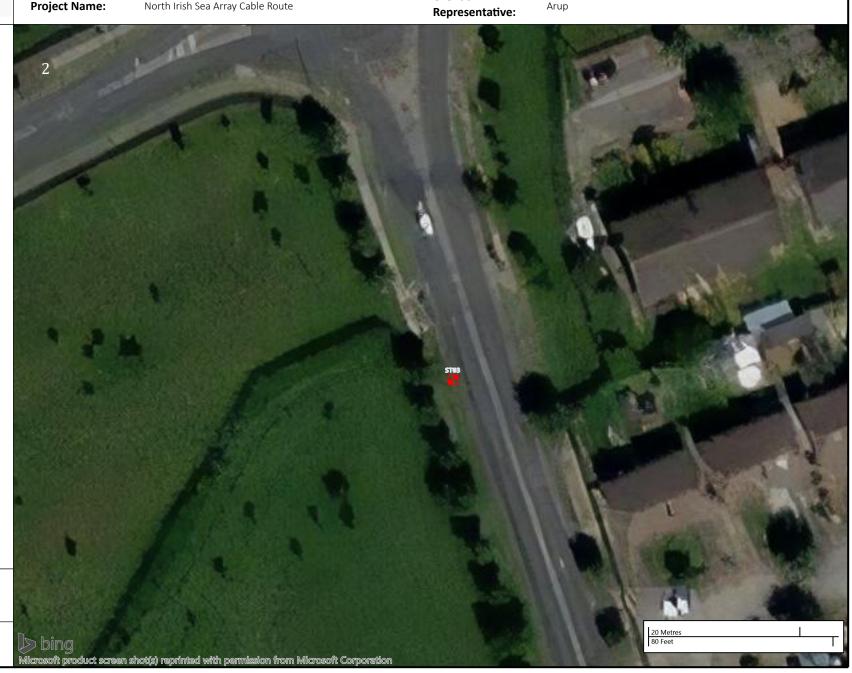
North Irish Sea Array Cable Route

Client's

## Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan

Last Revised: 05/12/2022

1:500

Scale:



Client: Statkraft Limited

**Project Name:** 

North Irish Sea Array Cable Route

Client's Arup Representative:

## Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



Client: Statkraft Limited

Arup

Client's

**Project Name:** 

North Irish Sea Array Cable Route Representative:

Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



Client: Statkraft Limited

Arup

**Project Name:** 

North Irish Sea Array Cable Route Representative:

Client's

#### Legend Key

Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



Client: Client's Statkraft Limited

Arup

**Project Name:** 

North Irish Sea Array Cable Route

Representative:

#### Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan

Last Revised: 05/12/2022

Scale: 1:3000



Client: Statkraft Limited

Client's

**Project Name:** 

North Irish Sea Array Cable Route

Arup

## Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



Client: Statkraft Limited

**Project Name:** 

North Irish Sea Array Cable Route

Client's

Arup Representative:

## Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



Client: Statkraft Limited

Client's

**Project Name:** 

North Irish Sea Array Cable Route Representative: Arup

## Legend Key

★ Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



Client: Statkraft Limited

**Project Name:** 

North Irish Sea Array Cable Route

Arup Representative:

Client's

#### Legend Key

Locations By Type - CP+RC

Locations By Type - TP



Title:

Exploratory Hole Location Plan



APPENDIX B
BOREHOLE LOGS



			EC	OTE	CF	-			-	ect No. L <b>619B</b>	Project Client: Client's			y Cable Rout	e		В	orehole II BH08
Metho Cable Perc		Plant U Dando 3			<b>Top (</b>		<b>Base</b> 6.0	_	Coor	dinates	Final De	<b>epth:</b> 20.00 m	Start Date:	22/02/2022	Driller:	MW+CB		heet 1 of 3
Rotary Dr Rotary Co	rilling	Comacch Comacch	io 60	1	6.0 7.2	0	7.2	20		88.12 E 85.77 N	Elevatio	on: 10.54 mOD	End Date:	28/02/2022	Logger:	: CH+TH		Scale: 1:50 FINAL
Depth (m)	Sample / Tests	Fie	ld Rec	ords			Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	,	Des	cription		1	Water	Backfill
0.20 - 1.20	В3								10.24	0.30		TOPSOIL- Brown sai						
0.50	ES1								10.24	0.30		Soft brown slightly	sandy CLAY. Sa	nd is fine to coa	irse.			0.
L.00 L.20 - 2.00	ES2 B4								9.54	1.00		Stiff grey slightly gra Gravel is fine to me		dy CLAY. Sand is	fine to co	arse.		1.
1.20 - 1.65		N=16 (3,3/4,3	3,4,5)					Dry				Graver is fille to file	ululii.					1
																		1.
2.00 - 3.00	B5																	2.
2.00 - 2.45	SPT (C)	N=18 (4,4/4,4	4,5,5)				1.70	Dry										
										Ē								2.
										[								
.00 - 4.00	B6									E							≖	3.
.00 - 3.45	SPI (S)	N=21 (4,6/6,5 Water strike a					3.00	Dry										
									7.04	3.50	7	Medium dense sligh	ntly clayey gra	velly fine to coar	rse SAND.	Gravel is		3.
											7	subangular to subro	ounded fine to	coarse.				
.00 - 4.45	SPT (C)	N=20 (4,6/4,5	5,5,6)							F	7							4.
.30 - 5.00	В7								6.24	4.30		Medium dense grey	fine to coars	e SAND.				
.00 - 5.45	SPT (C)	N=28 (4,6/6,7	7,7,8)						5.04	5.50		Grey angular fractu	red weathered	d mudstone (d	riller's des	scription)		5.
.00 - 6.22	SPT (C)	N=50 (25 for 120mm)	105m	nm/50	) for													6.
				- 1					3.34	7.20		Medium strong ma	ssive dark grev	/ LIMESTONE wi	th rare gre	vish white		
.00			86	71	36	12			0.0	(1.00)		calcite veins of pred Partially weathered discolouration on so degree joints, close	dominately sul : slightly close ome fracture s ly spaced (25/	overtical orienta r fracture spacir surfaces. Discon 83/160), planar,	tion (2-6m ng, grey itinuities: 1	nm thick).		7.
.00					7				2.34	8.20		discolouration on so Strong massive darl			Largely			8.
												unweathered: faint	dark orangish	brown discolou	ration on			8.
			100	100	91							fracture surfaces. E spaced (70/310/480	0), planar, rou					
												staining on some jo	int surfaces.					9.
										E								
	Wate	Strikes	TCR	SCR	RQD		Chise	elling	g Detail:	s	Remarks							
	asing to (m	) Time (min)	Rose	to (m	) Fro			To (		ne (hh:mm)		inspection pit excava	ted to 1.20m	Location: M1 Cr	ossing.			
Casing D To (m) D 6.00	3.00  etails  biam (mm 200	Water (1) From (m) 0.00	То	ed (m)														
7.20 12.50	200 130				С	ore	Barr	el	Flush	Туре	Termina	tion Reason				Last Up	date	d
12.30	130	1										d at scheduled depth				29/11/		

	C	AUS	E	W DTE	A	Y			-	ct No. 619B	Client:	Name: North Iri		y Cable Route	2		В	orehol BH0	
B.O. alb							<b>.</b>	()			Client's	Rep: Arup	I						
Meth Cable Pero Rotary D	cussion Orilling	Plant I Dando Comacch	3000 nio 60	) )1	0.0 6.0	00 00	<b>Base</b> 6.0 7.2	00 20		8.12 E	Final De	<b>20.00</b> m	Start Date:	22/02/2022	Driller:	MW+CB		Sheet 2 Scale: 1	
Rotary C		Comacch			7.:	I	20.0		74938 Level	5.77 N Depth	Elevatio	n: 10.54 mOD		28/02/2022	Logger:	CH+TH	ar	FINA	_
(m)	Samples	/ Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	mOD	(m)	Legend	Strong massive darl		ription	. Laurahi		Water	Backfil	i
.50			97	97	92	3				(3.10)		unweathered: faint fracture surfaces. E spaced (70/310/48/ staining on some jo	dark orangish Discontinuities O), planar, roug	brown discolou 1. 5-20 degree	ration on s joints, me	dium			9.5
1.00									-0.76	11.30		Strong massive darl	grev I IMFST(	ONE with occasion	onal grevis	h white			11.0 -
			100	100	84							calcite veins of prec Partially weathered discolouration on so degree joints, close	dominantly sul : slightly close ome fracture s ly spaced (15/	overtical orienta r fracture spacin urfaces. Discont 210/235), plana	tion (1-3m g, grey tinuities: 1 r, rough, g	m thick). . 0-20 rey			11.5
2.50						6				(1.70)		discolouration on so 11.48m, 12.64m an			egree joint	s, at			12.5
			100	100	87				-2.46	13.00		Strong indistinctly to occasional greyish weathered discolouration on stdegree bedding fractions.	white calcite we slightly close ome fracture s	eins (1-5mm thio r fracture spacin urfaces. Discon	ck) and rar g, grey tinuities: 1	e fossils. . 10-20			13.0 ·
4.00												rough. 2. 60-70 deg smooth.							14.0
			97	97	83														14.5 15.0
.5.50						4				(7.00)									15.5
7.00			95	95	88														16.5 17.0 -
			97	97	83														17.5
.8.50			-		non	-													18.5
	Water	Strikes	ICR	SCR	KŲD	FI	Chise	elling	g Details		Remarks	i							
3.00 Casing D	3.00	Water From (m)	Add		n) Fi	rom (		To (		e (hh:mm)	Hand dug	inspection pit excava	ted to 1.20m	Location: M1 Cro	ossing.				
6.00 7.20	200 200	0.00		5.00	_	C	Da:	al T	FlL	Tues	Torus!	ion Posser				last II.	de.	.a ==	_
12.50	130				1 '	core	Barre	eı	Flush	ıype	ierminat	tion Reason				Last Up	aate	ea	

	1							Pro	oject No.	Project	Name: North Iri	ish Sea Arra	y Cable Route	9		В	orehole I	ID
	C	AUS	E	W	A	Y		21	-1619B	Client:	Statkraft	Limited					BH08	
			GEC	OTE	CI	Н				Client's	Rep: Arup							
Metho able Pero	cussion	Plant I Dando	3000	)	0.0	00	Base (r 6.00		ordinates	Final De		Start Date:	22/02/2022	Driller:	MW+CB		heet 3 of Scale: 1:50	
Rotary D Rotary C		Comacch Comacch			6.0 7.2		7.20 20.00		9088.12 E 9385.77 N	Elevatio	<b>n:</b> 10.54 mOD	End Date:	28/02/2022	Logger:	CH+TH		FINAL	_
Depth (m)	Samples	/ Field Records	TCR	SCR	RQD	FI	Casing Wat Depth Dep (m) (m	er Leve		Legend		Desc	cription			Water	Backfill	_
(m)	Water	Strikes  Time (min)	100	100	87	FI	Chisell	ing Deta	6 - 20.00	Remarks	Strong indistinctly toccasional greyish we Partially weathered discolouration on so degree bedding frat rough. 2. 60-70 deg smooth.	hinly laminate white calcite vo : slightly close ome fracture s ctures, mediur gree joint, at 1  End of Bore	d greyish black Leins (1-5mm thic r fracture spacin urfaces. Discont n spaced (12/23) 9.25-19.45m, sliji hole at 20.00m	k) and rareg, grey inuities: 1. 0/390), pla ghtly undu	fossils. 10-20 nar,	Water	24 22 22 22 22 22 22 22 22 22 22 22 22 2	9.0 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5
	Diam (mm)		To	o (m)														
6.00 7.20 12.50	200 200 130	0.00	6	5.00	-	Core	Barrel	Flu	sh Type	Terminat	ion Reason				Last Up	date	ed	Ī
		1	1		- 1		K6L	1 .	Water		d at scheduled depth				29/11/			

	C	AUS	E	<b>W</b>	A	Y				ect No. 1619B	Client:			y Cable Route	e		В	orehol BH0	
20.11							<b>.</b>	<i>(</i> )	•		Client's	s Rep: Arup							
Methodology Dynamic Sa Rotary C	ampling	Plant L Dando T Beretta	errie	er	0.	( <b>m)</b> 00 00	<b>Base</b> 6.0 20.	00	7189	91.00 E	Final De	<b>epth:</b> 20.00 m	Start Date:	25/03/2022	Driller:	BM+GT		Sheet 1 Scale: 1	
										37.00 N	Elevatio	on: 10.54 mOD	End Date:	03/05/2022	Logger:	CH+DM	_	FINA	ıL
Depth (m)	Sample / Tests	Fie	eld Re	cords			Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	TOPSOIL- Brown sa		cription			Water	Backfill	Í
0.30 - 0.50 0.50	B3 ES1								10.04	0.50	Ž	Soft brown slightly	, - ,		ne to coarse	e. Gravel			0.5
0.80 - 1.00 1.00	B4 ES2										X	is subangular to sub	orounded fine	to medium.					1.0 -
.20 .20 - 1.65	D9 SPT (S)	N=8 (1,2/2,2 0199	,2,2)	Hamı	mer S	N =	1.00	Dry			X								1.5
1.80 - 2.00 2.00 - 2.45	B5 U14	Ublow=50 80	0%					Dry	8.54	2.00		Firm becoming stiff medium cobble cor to subrounded fine	ntent. Sand is f						2.0 -
3.00 3.00 - 3.45	D10 SPT (S)	N=40 (5,7/8, SN = 0199	10,10	0,12)	Hamr	mer	3.00	Dry											3.0
3.80 - 4.00 1.00 1.00 - 4.45	B6 D11 SPT (S)	N=50 (7,9/9, SN = 0199	12,13	3,16)	Hamr	mer	3.00	Dry											4.0
i.80 - 5.00 i.00 i.00 - 5.45	B7 D12 SPT (S)	N=50 (8,10/1 Hammer SN			7)		3.00	Dry	5.54	5.00		Very stiff brown sar fine to coarse. Grav							5.0
5.80 - 6.00	B8					1													6.0
5.00 5.00 - 6.14	70mm/!	I=50 (28 for 50 for Hammer SN	100	50	25				3.84	6.70		Medium strong (loc LIMESTONE with ex carbonaceous mud strength, slightly cle	tremely close stone. Partiall	y spaced lamina y weathered: slig	itions of da ghtly reduc	rk grey ed			7.0
'.50						15				(3.10)		discolouration on f joints, closely space yellowish brown dis joints, closely space sandy gravelly infill undulating, rough v	racture surfaced (30/75/120 scolouration oed (30/80/200 3. One 45 de	es. Discontinuiti O), clean, smoot n joint surfaces. ), undulating, ro gree joint from 9	es: 1. 5-10 h with som 2. 80-90 do ugh with so ).70-9.80m	degree le egree ome ,			7.5
			100	85	35							8.70-9.10m: Weak with p	ervasive yellowish l	rown discolouration.					8.5
.00			TCR	SCR	ROD	FI													9.0
	Water	Strikes	.51	) J.K	1	•••	Chis	elling	g Detail:	s I	Remarks	<u> </u>						1	
Casing D		Water From (m)	Add			rom (		To (		ne (hh:mm)	Hand dug	inspection pit excava	ted to 1.20m l	ocation: M1 Cro	ossing. Tele	viewer com	plete	ed	
0.00	200						Barr K6L	el		<b>Type</b> ater		tion Reason				<b>Last Up</b> 29/11/			

CAUSEWAY GEOTECH  Method Plant Used Top (m) Base (m)							21-3	ect No. 1619B	Project Name: North Irish Sea Array Cable Route  Client: Statkraft Limited  Client's Rep: Arup	Borehole ID BH09		
Method  Dynamic Sampli  Rotary Coring	<u> </u>	errie		0.0		6.00 20.00	7189	91.00 E 37.00 N	Final Depth: 20.00 m Start Date: 25/03/2022 Driller: BM+GT  Elevation: 10.54 mOD End Date: 03/05/2022 Logger: CH+DM	Sheet 2 of 3 Scale: 1:50 FINAL		
Depth (m) Sar	mples / Field Records	TCR	SCR	RQD	FI	Casing Water Depth Depth (m) (m)	Level mOD	Depth (m)	Legend Description	Backfill		
10.50		100	95	45			0.74	9.80	Medium strong (locally weak) thinly laminated dark greyish black LIMESTONE with extremely closely spaced laminations of dark grey carbonaceous mudstone. Partially weathered: slightly reduced strength, slightly closer fracture spacing with pervasive light brown discolouration on fracture surfaces. Discontinuities: 1. 5-10 degree joints, closely spaced (30/75/1200), clean, smooth with some yellowish brown discolouration on joint surfaces. 2. 80-90 degree joints, closely spaced (30/80/200), undulating, rough with some sandy gravelly infill. 3. One 45 degree joint from 9.70-9.80m,	9.5 -		
12.00		100	100	45	13			(4.05)	undulating, rough with brown discolouration on joint surface.  Medium strong thinly laminated dark greyish black LIMESTONE with extremely closely spaced laminations of dark grey carbonaceous mudstone. Partially weathered: slightly reduced strength, slightly reduced fracture spacing. Discontinuities: 1. 5-10 degree joints, closely spaced (40/80/200), clean, smooth with some brown discolouration on joint surfaces. 2. Two 40-50 degree joints at 11.40m and 12.65m, undulating, rough with brown discolouration on joint surfaces. 3. Two 80-90 joints at 13.65m and 13.80m, undulating,	11.5		
12.00		100	100	50					rough with orangish brown discolouration on joint surfaces	12.5		
13.50		100	100	70			-3.31	13.85	Medium strong thinly laminated dark greyish black LIMESTONE with extremely closely spaced laminations of dark grey carbonaceous mudstone and white calcite veins at various orientations. Partially weathered: slightly reduced strength, slightly greater fracture spacing. Discontinuities: 1. 5-10 degree joints, medium spaced (40/220/800), clean, smooth with some dark brown discolouration on joint surfaces. 2. One 45 degree joint at 16.35m, undulating,	13.5		
15.00		100	100	75	5			(4.15)	rough.	15.0 ————————————————————————————————————		
16.50		100	100	90						16.5 — - - - 17.0 — - - - 17.5 —		
18.00		TCR	SCR	RQD	FI		-7.46	18.00	Medium strong grey LIMESTONE with medium spaced very thin beds of weak dark greyish black mudstone and white calcite veins at various orientations. Partially weathered: slightly reduced strength, slightly reduced fracture spacing. Discontinuities: 1. 5-10 degree joints, closely spaced (50/125/300), clean, smooth.  18.00-18.20m: Bed of weak dark greyish black mudstone	18.0 — — — — — — — — — —		
Casing Detail To (m) Diam ( 6.00 20	s Water	Add				m) To		me (hh:mm)	Remarks Hand dug inspection pit excavated to 1.20m Location: M1 Crossing. Televiewer comple			
						<b>Barrel</b> K6L		ater	Termination Reason     Last Upda       Terminated at scheduled depth.     29/11/20			

Method //namic Sampling Rotary Coring  Depth (m) Samp  .50	Beretta T44	er 4	0.00 6.00 RQD FI	6.0 20.	00	71899 74933	1.00 E		<b>pth:</b> 20.00 m	Start Date:	25/03/2022	Driller:	BM+GT			
(m) Samp			RQD FI	Casing Depth (m)		74933	7.00 N	Final Depth: 20.00 m Start Date: 25/03/2022 Driller: Bit						Scale: 1:		
(m) Samp			RQD FI	Depth (m)	749337.00		Depth					CH+DM	'n	FINAL		
	100	100	J		Water Depth (m)	mOD	(m)	Legend	Medium strong gree		cription	ced very	thin heds	Water	Backfill	$\vdash$
		100	90 8				(2.00)		of weak dark greyis various orientations slightly reduced frag joints, closely space	h black mudst s. Partially wea cture spacing.	one and white ca athered: slightly i Discontinuities:	alcite veins reduced st 1. 5-10 de	s at trength,			19.0 ·
.00	100	100	15													19.5
						-9.46	20.00			End of Bore	hole at 20.00m					20.0
																20.5
																21.0
																21.5
																22.0
																22.5
																23.0
																23.5
																24.0
																24.5
																25.0
																25.5
																26.0
																26.5
																27.0
																27.5
	TOR	SCR F	RQD FI	$\mid \cdot \mid$												
	er Strikes m) Time (min) Ros			Chis	elling	Details	e (hh:mm)	Remarks								_



# APPENDIX C CORE PHOTOGRAPHS





BH08 (Box 1) 7.20-8.00m



BH08 (Box 2) 8.00-9.50m



BH08 (Box 3) 9.50-11.00m



BH08 (Box 4) 11.00-12.50m





BH08 (Box 5) 12.50-14.00m



BH08 (Box 6) 14.00-15.50m



BH08 (Box 7) 15.50-17.00m



BH08 (Box 8) 17.00-18.50m

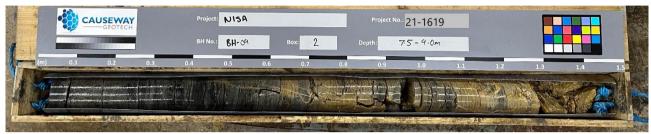


BH08 (Box 9) 18.50-20.00m

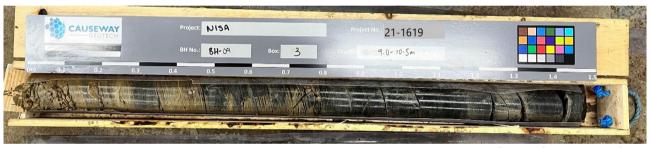




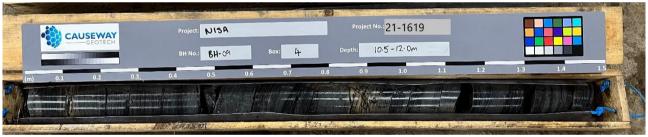
BH09 (Box 1) 6.00-7.50 m



BH09 (Box 2) 7.50-9.00m



BH09 (Box 3) 9.00-10.50m



BH09 (Box 4) 10.50-12.00m



BH09 (Box 5) 12.00-13.50m





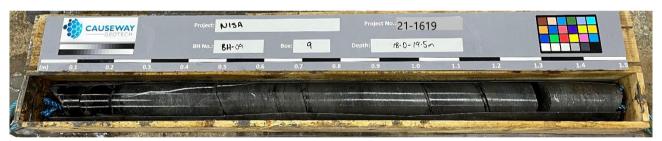
BH09 (Box 6) 13.50-15.00m



BH09 (Box 7) 15.00-16.50m



BH09 (Box 8) 16.50-18.00m



BH09 (Box 9) 18.00-19.50m



BH09 (Box 10) 19.50-20.00m





APPENDIX D
TRIAL PIT LOGS



0-0			Proj	ect No.	Project	Name:		Т	rial Pit ID
	CALIC	TIA/AV		1619B	1	rish Sea Array Cable Route			
	CAUS	EWAY SEOTECH	Coor	dinates	Client:				TP16
		BEOTECH			Statkra	ft Limited			
Method:				94.50 E	Client's	Representative:		Sh	eet 1 of 1
Trial Pitting			/524	67.00 N	Arup			S	cale: 1:25
Plant:				vation	Date:		ger:		FINAL
8T Tracked Ex				3 mOD	07/03/	2022 MR	kG		FINAL
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water	
0.50 0.50 1.00 1.50 1.50	ES ES1		11.38	0.45		Firm greyish brown slightly sandy slightly gravelly CLAY with cobble content. Sand is fine to coarse. Gravel is subngular to fine to medium. Cobbles are subangular to subrounded of lithologies.	to subrounded		1.5 —
2.50	В4		9.58	2.25	8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Stiff blackish grey slightly sandy slightly gravelly CLAY with a cobble content. Sand is fine to coarse. Gravel is subangular subrounded fine to medium. Cobbles are subangular to sul limestone.  End of trial pit at 2.65m	to		2.5 —
				-					3.0 —
									3.5 —
				-					4.0 —
									4.5 — — — —
	er Strikes	<b>Depth:</b> 2.65	1	narks:	er enco	ntered Location: Onchoro cable route		_	
Struck at (m)	Remarks	<b>Width:</b> 1.00	NO 8	groundwat	er encou	ntered. Location: Onshore cable route.			
		Length: 3.30							
				minetie P			lactii	da+-	
		Stability:		mination R			Last Upo		
ĺ		Stable	Tern	ninated on p	ossible lar	ge boulder	29/11/2	2022	PHA!

0-0			Proj	ect No.	Project	: Name:		T	rial Pit ID
	CALIS	EVAVAV		1619B		rish Sea Array Cable Route			
H	CAUS	EWAY SEOTECH	Coor	dinates	Client:				TP17
		BLOTECTI	7196	57.00 E		ft Limited			
Method:				46.00 N		s Representative:			eet 1 of 1
Trial Pitting  Plant:			Flo	vation	Arup  Date:	lo	gger:	S	cale: 1:25
8T Tracked Ex	cavator			7 mOD	07/03/				FINAL
Depth	Sample /	Field Records	Level	Depth	Legend	Description		Water	
(m)	Tests		(mOD)	(m)		TOPSOIL- Brown sandy gravelly CLAY.		3	
				-					
									_
			10.27	0.40		Soft to firm light brown slightly silty slightly sandy slightly	gravelly CLAY		-
0.50 0.50	ES ES1				0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	with low cobble content. Sand is fine to coarse. Gravel is s subrounded. Cobbles are subangular to subrounded.	ubangular to		0.5
					× × 0	, and the second			_
				-	× × 0				-
1.00	B3				20.75				1.0
1.00					× × 0				_
				-	× × 0				-
			9.37	1.30	A 000	Soft greyish brown with orange mottling slightly grvelly sa			
1.50	ES			-		medium cobble content. Sand is fine to coarse. Gravel is s to medium. Cobbles are subangular to subrounded.	upangular line		1.5 —
1.50 1.60	ES2 B4			-					-
				ŀ					
			8.77	1.90		Stiff blackish grey slightly sandy gravelly CLAY with high co	hhlo contont		_
				-	0.0	and low boulder content. Sand is fine to coarse. Gravel is	subangular to		2.0
					700	subrounded fine to coarse. Cobbles are subangular to sub coarse of limestone.	rounded fine to		
									_
				-	0-0-				-
					0.00				2.5
2.70	B5				0.20				_
			7.87	2.80		End of trial pit at 2.80m			-
				-					3.0
									_
				-					-
				-					3.5 —
				<u> </u>					-
				-					
				ŀ					-
				-					4.0
				-					
				<u> </u>					-
				}					-
				-					4.5 —
				<u> </u>					-
				}					$\dashv$
				-					
Wate	er Strikes		Ren	narks:					
Struck at (m)	Remarks	Depth: 2.80 Width: 1.10	No	groundwat	er encou	ntered . Location: Onshore cable route.			
		Width: 1.10  Length: 3.40							
		Stability:	Teri	mination R	eason		Last Upo	late	
		Stable		ninated on p		rge boulder	29/11/2		AGS
	1	1	1			-	,, -	_	

A-N			Proi	ect No.	Project	: Name:	ĺ	Tri	al Pit ID
	CALL	SEVA/AV/		1619B		rish Sea Array Cable Route			
	CAUS	SEWAY GEOTECH	Coor	dinates	Client:				TP18
	(	SEOTECH			Statkra	ft Limited			
Method:				75.56 E	Client's	s Representative:		She	eet 1 of 1
Trial Pitting				02.81 N	Arup			Sc	ale: 1:25
Plant:				vation	Date:	Logger:			INAL
8T Tracked Ex	_			mOD	07/03/	2022 MRG			11 47 12
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water	
		Slow seepage at 1.70m			Legend  State of the state of t	Description  TOPSOIL- Brown sandy gravelly CLAY.  Soft light brown slightly silty slightly sandy slightly gravelly CLAY cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded to content. Sand is fine to coarse. Gravel is subangular to subround to coarse.  Stiff blackish grey slightly gravelly sandy CLAY with high cobble a boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded fine to coarse. Cobbles are subangular to subrounded fine to coarse. Cobbles are subangular to subrounded fine to coarse.	oble led fine	Wate Wate	1.0 — 1.5 — 2.0 — 3.5 — 4.0 — 4.0 — —
				- - - - - -					4.5 —
								_	
	ter Strikes	<b>Depth:</b> 2.70		narks:					
Struck at (m)			Loca	ation: Onsh	nore cabl	e route.			
1.70	Slow seepag 1.70m	Length: 3.90							
		Stability:	Terr	nination R	leason	T	Last Upo	lated	
						rgo houlder			100
		Unstable	ſerm	ninated on p	ossible lar	ge poulder	29/11/2	U22	14156

	Proi	ect No.	Project Name:				Trial Pit ID			
	CALL	CEVAZAN		1619B	1 -	Irish Sea Array Cable Route				
	CAU	SEWAY		dinates	Client:	•			TP19	
		GEOTECH				ft Limited				
Method:				19.63 E		s Representative:		Şh	eet 1 of 1	
Trial Pitting			7517	33.54 N	Arup				cale: 1:25	
Plant:			Ele	vation	Date:	Logge	r:			
8T Tracked Ex	cavator		3.87	7 mOD	09/03/	2022 RS			FINAL	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water		
(111)	iests		(יווטט)	- (111)		TOPSOIL- Brown sandy gravelly CLAY.		>		
				[					]	
			3.57	0.30		AMERICAN AND COLUMN AN				
				•		MADE GROUND: Soft brownish yellow very sandy gravelly SILT. fine to coarse. Gravel is subrounded fine to coarse of mixed liti			_	
0.50	ES .			-			-		0.5 —	
0.50	ES1			<u> </u>					-	
			3.07	0.80						
			3.07	- 0.80		Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine Gravel is subrounded to subangular fine to medium mudstone	to coarse.			
1.00	В3			-		a sasangaan mic to meatan maastane		≖	1.0	
1.00 1.00	ES ES2			}					_	
1.00		HVP=72, HVR=0		<u> </u>					-	
		Groundwater encountered at 1.00m.		[					]	
				-					1.5 —	
			2.27	1.60		Dark grey very sandy very clayey subrounded fine to coarse GF	RAVEL of		-	
				[		mudstone with high cobble content. Sand is fine to coarse. Col			=	
				<u> </u>		of mudstone.			-	
2.00	B4		1.87	2.00					2.0 —	
2.00	54		1.07	- 2.00		Stiff dark grey lightly sandy gravelly CLAY. Sand is fine to coarse subangular fine to medium.	e. Gravel is			
				<u> </u>					-	
				}					-	
				-					-	
				[					2.5 —	
				<u> </u>						
				<u> </u>					-	
				}					-	
3.00	B5		0.87	3.00		End of trial pit at 3.00m			3.0	
				-						
				-					_	
				-					-	
				[					3.5 —	
				<u> </u>					-	
				-						
				<u> </u>					]	
				-					4.0	
				}					-	
				<u> </u>					-	
				[						
				}					4.5 —	
				ŀ					-	
				[					-	
				<u> </u>					-	
				-						
\A/a+-	er Strikes		Ren	narks:						
Struck at (m)	Remark	<b>Depth:</b> 3.00	l		mpleted.	Location: Onshore cable route.				
1.00	Groundwa	width: 1.00								
	encountere 1.00m.	"								
	1.00111.	Stability:	Terr	mination R	eason		Last Up	date		
		Unstable	Tern	ninated at so	cheduled o	depth	29/11/	2022	AGS	

			Proj	ect No.	Project	: Name:			Trial Pit ID
	CAUS	SEWAY	21-	1619B		rish Sea Array Cable Route			
		SEWAY GEOTECH	Coor	dinates	Client:				TP20
Method:			7197	58.15 E		ft Limited s Representative:			
Trial Pitting			7514	69.71 N	Arup	, nepresentative.			Sheet 1 of 1 Scale: 1:25
Plant:			Ele	vation	Date:		Logger:		
6T Tracked Ex	cavator		3.15	5 mOD	15/03/	2022	RS		FINAL
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water	
		Field Records  HVP=86, HVR=23  Fast seepage at 1.40m			Legend The Control of	TOPSOIL- Brown sandy gravelly CLAY.  Soft brown slightly sandy slightly gravelly CLAY. Sand Gravel is subrounded fine of mudstone.  Grey sandy subrounded to subangular fine to coarse lithologies. Sand is fine to coarse.  End of trial pit at 1.70m		se.	0.5 —
				-					-
				-					4.5 —
				<u> </u>					-
			<u> </u>	<u> </u>					
	er Strikes	<b>Depth:</b> 1.70		narks: ar vane co	mpleted	Location: Onshore cable route.			
Struck at (m) 1.40	Remark Fast seepag	S urill occ	3116	ar varie col	impieteu.	Education. On Shore cable route.			
20	1.40m								
		Stability:	Terr	nination R	leason			Last Updat	ed
		Unstable	Term	ninated due	to pit wall	s collapsing.		29/11/202	2 AGS
	1	1	1						

1.08				Proj	ect No.	Project	t Name:		T	rial Pit ID
Method:		CALI	SEM/AV	1						
Trispect   Trispect		CAU	GEOTECH	Coor	dinates	Client:				TP21
Plant			GLOTECTI	7197	90.34 F					
	i						s Representative:			
ST   Tracker   Execution   E				Flex	vation		Logge		<u>S</u>	cale: 1:25
Tests	1	cavator		1				•		FINAL
2.53   0.10   0.50			Field Records			Legend	Description		/ater	
No.   Control   Control	(m)	iests					TOPSOIL- Brown sandy gravelly CLAY.		>	
1.00   85   1.00   1.00   1.10   1.				2.53	0.10			RAVEL of		
1-98					-		initiatione. Sund is time to course.			-
1-98					-					-
1.00   23   1.00   1.	0.50 0.50			2.13	0.50					0.5 —
Note   Struck at (m)   Semarks:   Struck at (m)   Semarks:   Semarks:   Struck at (m)   Semarks:   Semarks:   Struck at (m)   Struck at (m)				1.98	0.65		sub angular fine to coase of mixed lithologies. Cobbles are of n			_
1.00   83   1.00   1.					-	XXXX	Soft grey slightly gravelly sandy SILT. Sand is fine to coarse. Gra	vel is		-
1.00   SS   SS   1.00   SS   SS   SS   SS   SS   SS   SS	1 00	B3				××××	subangular fine to medium.			1.0
Mater Strikes   Pepth: 110   Pepth: 120     Pepth: 120	1.00	ES		1.53	1.10	×××			•	_
Water Strikes	1.00	E32	1		-					-
Water Strikes			Slow seepage at 1.10m		-					
Vater Strikes					- -					1.5 —
Vater Strikes					-					-
Vater Strikes					-					
Vater Strikes					-					_
Mater Strikes					_					2.0
Mater Strikes					-					
Mater Strikes					-					_
Mater Strikes					-					-
Water Strikes					-					2.5 —
Water Strikes					-					-
Water Strikes					-					-
Water Strikes         Depth: 1.10         Remarks:           Struck at (m)         Remarks         Uidth: 1.00         Length: 2.50         Shear vane completed. Location: Onshore cable route.					-					3.0
Water Strikes         Depth: 1.10         Remarks:           Struck at (m)         Remarks         Uidth: 1.00         Length: 2.50         Shear vane completed. Location: Onshore cable route.					-					_
Water Strikes         Depth: 1.10         Remarks:           Struck at (m)         Remarks         Uidth: 1.00         Length: 2.50         Shear vane completed. Location: Onshore cable route.					-					_
Water Strikes         Depth: 1.10         Remarks:           Struck at (m)         Remarks         Uidth: 1.00         Length: 2.50         Shear vane completed. Location: Onshore cable route.										
Water Strikes					-					3.5 —
Water Strikes					-					-
Mater Strikes					-					
Mater Strikes					-					4
Water Strikes Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50  Remarks: Shear vane completed. Location: Onshore cable route.					_					4.0
Water Strikes Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50  Remarks: Shear vane completed. Location: Onshore cable route.					-					
Water Strikes Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50  Remarks: Shear vane completed. Location: Onshore cable route.										-
Water Strikes Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50  Remarks: Shear vane completed. Location: Onshore cable route.					-					-
Struck at (m) Remarks 1.10 Slow seepage at 1.10m Length: 2.50  Depth: 1.10 Shear vane completed. Location: Onshore cable route.					-					4.5 —
Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50  Depth: 1.10 Shear vane completed. Location: Onshore cable route.					-					4
Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50  Depth: 1.10 Shear vane completed. Location: Onshore cable route.					<u>-</u>					-
Struck at (m) Remarks 1.10 Slow seepage at 1.10m Length: 2.50  Depth: 1.10 Shear vane completed. Location: Onshore cable route.					-					
Struck at (m) Remarks 1.10 Slow seepage at 1.10 Length: 2.50 Shear vane completed. Location: Onshore cable route.	Wate	er Strikes	D. H. 110	Rem	narks:	1	I			
1.10 Slow seepage at Length: 2.50	Struck at (m)	Remark	S 100	Shea	ar vane coi	mpleted.	Location: Onshore cable route.			
	1.10		ge at							
Stability: Termination Reason Last Updated	1		Stability:	Terr	nination R	eason		Last Un	date	d <b>E</b>
Unstable Slow progress due to machine size. 29/11/2022 AGS	1						hine size.			

0-0			Proi	ect No.	Project	Name:		Т	rial Pit ID
				1619B	1	rish Sea Array Cable Route			
	CAUS	EWAY	-	dinates	Client:	•			TP22
		SEOTECH			Statkra	ft Limited			
Method:			7192	75.27 E		s Representative:		SI	neet 1 of 1
Trial Pitting			7494	20.85 N	Arup	·			cale: 1:25
Plant:			Ele	vation	Date:		Logger:	+	
8T Tracked Exc	avator		11.19	9 mOD	07/03/	2022	MRG		FINAL
Depth	Sample /	Field Records	Level	Depth	Legend	Description		Water	
(m)	Tests	Tiela Necoras	(mOD)	(m)	Zegena	TOPSOIL- Brown sandy gravelly CLAY.		Š	
				ŀ		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			-
									_
			10.70	0.40					
0.50	ES		10.79	0.40	× × 0	Firm to stiff light brown slightly silty slightly gravelly sl with low cobble content. Sand is fine to coarse. Gravel			0.5
0.50	ES1			<u> </u>	× × ×	subrounded fine to coarse. Cobbles are subangular to			_
				-	× × ×				_
0.80	В3			[	×-0				-
			10.29	0.90	× × 0	Firm to stiff greyish brown slightly gravelly sandy CLAY			-
				-	× × ×	cobble content. Sand i fine to coarse. Gravel is subang fine to coarse. Cobbles are subangular to subrounded.			1.0
					× 20	The to course. Cobbles are subangular to subrounded.	•		
				ŀ	X 0 X				_
					0 70				_
1.50	B4			E	X 0 0				1.5 —
1.50 1.50	ES ES2			-	0 0				_
				-	× ^ 0				_
				-	× × 0				
					× × 0				2.0
				-	× × 0				_
				ļ.	× × 0				_
				ŀ	× × 0				_
				[	× × 0				_
			8.69	2.50	× × 0	Stiff blackish grey slightly silty slightly sandy gravelly C			2.5 —
				ŀ	× × 0	cobble content. Sand is fine to coarse. gravel is subang subrounded fine to coarse. Cobbles are subangular to			
2.80	B5			[	× × .	sasiounaea ille to coalsel coastes are sasangalar to	sub. curiucur		
			8.29	2.90	~ <u>&gt;</u> > .	End of trial pit at 2.90m			_
				-		End of that pit at 2.30m			3.0
				[					-
				-					_
				-					
				-					3.5 —
				-					_
				E					-
				[					-
				<u> </u>					-
				F					4.0
				[					
				ţ.					
				‡					_
				E					4.5
				ţ					-
				<u> </u>					-
				ļ.					-
				-					
\Alat=	r Strikes		Ron	narks:					
Struck at (m)	Remarks	<b>Depth:</b> 2.90			er encou	ntered . Location: M1 Crossing			
on den de (III)	Remarks	<b>Width:</b> 3.75				-			
		Length: 1.25							
		Stability:	Teri	mination R	eason		Last U	pdate	d
		Stable	Tern	ninated on p	ossible lar	rge boulder	29/11	/2022	AGS

A.N			Proi	ect No.	Project	: Name:		Tı	ial Pit ID				
	CALL			1619B		rish Sea Array Cable Route							
	CAU	SEWAY GEOTECH	_	dinates	Client:				TP23				
		GEOTECH			Statkra	ft Limited							
Method:				48.32 E	Client's	s Representative:		Sh	eet 1 of 1				
Trial Pitting				46.49 N	Arup			S	cale: 1:25				
Plant:				vation	Date:	Logger	:		FINAL				
8T Tracked Ex		1		O mOD	07/03/	2022 MRG			1111/12				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water					
0.50 0.50 0.50 0.50 1.50 1.50	B3 ES ES1  B4 ES ES2	Slow flow at 1.70m	8.40 8.20	0.40 - 0.70 - 2.00		TOPSOIL- Brown sandy gravelly CLAY.  Firm light brown slightly sandy slightly gravelly CLAY with low content. Sand is fine to coarse. Gravel is subangular to subrount to medium.  Firm to stiff greyish brown slightly slity slightly sandy gravelly C medium cobble content. Sand is fine to coarse. Gravel is subangular to coarse.  Stiff blackish grey slightly sandy slightly gravelly CLAY with high and boulder content. Sand is fine to coarse. Gravel is subangular subrounded fine to medium. Cobbles are subangular to subrounded fine to medium. Cobbles are subangular to subrou End of trial pit at 2.20m	LAY with gular to	m N	1.0 — 1.5 — 2.0 — 2.5 — 4.0 — 4.5 —				
				[					-				
				<u> </u>					-				
	1		1,_										
	er Strikes ) Remark	<b>Depth:</b> 2.20		<b>narks:</b> ation: M1 (	Crossing.								
Struck at (m) 1.70	Slow flow	140 111 4 40			- 2011/01								
	1.70m												
		Stability:	Teri	mination R	eason		Last Up	date					
		Stable	Tern	ninated on p	ossible lar	rge boulder	Termination Reason Last Up  Terminated on possible large boulder 29/11/						

A N			Proi	ect No.	Project	t Name:		Tri	al Pit ID
8				1619B	1	Irish Sea Array Cable Route			
	CAUS	EWAY SEOTECH		rdinates	Client:			7	ГР24
	(	SEOTECH			Statkra	ft Limited			
Method:				23.32 E	Client'	s Representative:		She	et 1 of 1
Trial Pitting			/492	91.33 N	Arup			Sca	le: 1:25
Plant:				vation	Date:	Logger	:		INAL
8T Tracked Ex				8 mOD	09/03/	2022 RS			IIVAL
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		water	
				-		TOPSOIL- Brown sandy gravelly CLAY.			_
				-					_
			6.48	0.30		Stiff yellowish brown slightly sandy slightly gravelly CLAY. Sand i	is fine to		_
0.50	FC			-		coarse. Gravel is subangular fine to coarse of mudstone.			0.5 —
0.50 0.50	ES ES1			-					0.5
				-					-
			5.98	0.80	××××	Firm grey slightly sandy gravelly CLAY with high cobbler content	t. Sand is		-
1.00	В3			_	××××	fine to coarse. Gravel is subangular fine to medium of mudston	e.		1.0
1.00	ES			-	× × × ×				_
1.00	ES2				( × × × × ×				_
				-	(	1 q			-
					( × × × )				1.5 —
				-	(				_
				-	× × × ×				_
				-	× × × ×				-
2.00	B4			_	×××>				2.0
2.00	J-4			-	×××				_
					× × × >				-
				-	× × × >				_
				-	× × × >				2.5 —
			4.18	2.60	× × × >	End of trial pit at 2.60m			-
				-					-
				-					
				-					3.0
									_
				-					
				-					_
									3.5 —
				-					_
				-					
				Ė					-
				-					4.0
				-					_
				-					
				-					_
				-					4.5
				-					
				-					]
				-					-
		· · · · · · · · · · · · · · · · · · ·	1						
Wat Struck at (m	ter Strikes  Remarks	<b>Depth:</b> 2.60	1	<b>narks:</b> groundwat	er encou	intered Location:M1 Crossing.			
Struck at (III	, nemarks	<b>Width:</b> 1.00				Č			
		Length: 4.00							
		Stability:	Teri	mination R	Reason		Last Upda		
		Unstable	Tern	ninated due	to pit wal	ls collapsing	29/11/20	22	AGS

			Proi	ect No.	Project	t Name:		Tr	ial Pit ID				
200			1	1619B	1	rish Sea Array Cable Route		1112111111					
	CAU	SEWAY GEOTECH		dinates	Client:				TP25				
		GEOTECH			Statkra	ft Limited							
Method:				38.75 E	Client's	s Representative:		Sh	eet 1 of 1				
Trial Pitting			7491	39.56 N	Arup				cale: 1:25				
Plant:				vation	Date:	Logger:			FINAL				
13T Tracked E	_			O mOD	09/03/	2022 RS			FINAL				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water					
0.50 0.50	ES ES1		5.60	0.30		TOPSOIL- Brown sandy gravelly CLAY.  Firm orangish brown slightly sandy slightly gravelly CLAY. Sand is coarse. Gravel is subrounded fine to coarse of mudstone.			0.5 —				
			5.00	0.90		Soft purplish brown slightly sandy slightly gravelly CLAY. Sand is coarse. Gravel is subrounded fine to coarse of mudstone.			-				
1.00 1.00 1.00	B3 ES ES2		4.20	1.70		Dark grey gravelly very silty fine to coarse SAND. Gravel is suban to coarse of various lithologies.			1.5 —				
2.00	B4	Slow seepage at 2.00		-		Yellowish grey gravelly silty fine to coarse SAND. Gravel is suban to medium of various lithologies.		•	2.0 —				
			3.40	2.50		Stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Grave subangular fine to medium.	vel is		2.5 —				
2.80	B5		3.10	2.80		End of trial pit at 2.80m			3.0 —				
									3.5 — —				
				-					4.0				
				-					4.5 —				
				<u> </u>					-				
	- · · ·		1	norks:									
Wate Struck at (m)	er Strikes Remark	<b>Depth:</b> 2.80	l	<b>narks:</b> ation: M1 (	Crossing.								
2.00	Slow seepa	140' 111 4 00											
	2.00	Length: 4.00											
		Stability:	Terr	mination R	leason		Last Upo	lated					
		Unstable	Tern	ninated due	to pit wal	Termination Reason  Last Up  Terminated due to pit walls collapsing  29/11/							

			Droi	ect No.	Droject	t Name:		Tri	al Pit ID
200				1619B	1	rish Sea Array Cable Route		1116	מודונום
	CAU	SEWAY GEOTECH	<b></b>		Client:			7	гР26
		GEOTECH	Coor	dinates		ft Limited			0
Method:			7189	93.16 E		s Representative:		Sho	et 1 of 1
Trial Pitting			7488	69.16 N	Arup				ale: 1:25
Plant:			Ele	vation	Date:	Logger:			110. 1.25
6T Tracked Ex	cavator			0 mOD	15/03/			F	INAL
Depth	Sample /	Field Records	Level	Depth	Legend	Description		Water	
(m)	Tests	Tield Records	(mOD) 5.45	(m) - 0.05	******	MADE GROUND: Grey medium to coarse GRAVEL		Š	
				0.03		Greyish brown very sandy very clayey subrounded to subangular f			-
				-		coarse GRAVEL of mixed lithologies with high cobble content and gravel sized pieces of rebar. Sand is fine to coarse. Cobbles are of			_
				[		lithologies.			
0.50	ES1			<u>-</u>					0.5
				E					_
				-					-
				-					_
1.00	В3								1.0
1.00	ES2	Clause 15.15	4.40	1.10		End of trial pit at 1.10m			_
		Slow seepage at 1.10m		[		End of that picat 1.10m			_
				<u>-</u>					-
				_					1.5 —
				-					-
				-					_
				-					_
				-					-
				[					2.0
				-					_
				Ė					_
				[					_
				-					2.5 —
				[					
				-					_
				[					=
				-					3.0
				[					
				-					_
				E					_
				-					3.5 —
				<u> </u>					-
				-					
				ŧ					_
				_					4.0
				<del> </del>					-
				[					
				-					_
				<u> </u>					4.5 —
				-					-
				<u> </u>					_
				-					
				-				+	
Wate	er Strikes	<b>Depth:</b> 1.10		narks:	1	1			
Struck at (m)		(S	Loca	ation: M1 (	Crossing.				
1.10	Slow seepa 1.10m	ige at							
		Stability:	Torr	nination R	ason	Т	Last Upda	ted	
									A O O
ĺ		Unstable	Slow	progress d	ue to mac	nine size.	29/11/20	122	14156



**TP16** 



**TP16** 





**TP16** 





**TP16** 



**TP16** 





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## APPENDIX E TRIAL PIT PHOTOGRAPHS





## APPENDIX F SLIT TRENCH LOGS AND DRAWINGS



			Proi	ect No.	Project	Name:		Trial Pit ID											
A Real	SALISE VALVA			21-1619B		Project Name:  North Irish Sea Array Cable Route													
CAUSEWAY GEOTECH  Method: Slit Trenching				Coordinates 719296.86 E 764773.15 N		Client: Statkraft Limited Client's Representative: Arup													
										Plant:				Elevation		Date: Logger:			
										3T Tracked Excavator				20.52 mOD		2022 MMC		FINAL	
										Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	<b>Description</b> BITMAC	Water		
0.15	ES1					Tar at 0.15m in various parts of the slit trench. Strong hydrocarbon of	odour.	-											
			20.24	0.28		MADE GROUND: Grey slightly sandy subangular fine to coarse G	RAV/FI												
						minute dicords. Grey singhtly subungular file to course of	10.00	-											
			20.02	- 0.50		Light brown slightly sandy slightly gravelly CLAY with low cobble	content.	0.5											
0.70	B1			[ -		Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbli subangular.	es are	]											
0.70 0.70	ES2 ES4			-				-											
0.70	154			-				-											
					0 0 0 0 a : 0 0 1			1.0											
					0 0 0 0 a 0 0 0			_											
			19.26	1.26		Light brown slightly clayey fine to medium SAND.		-											
1.40	B3		19.02	1.50				1.5 —											
			13.02			End of trial pit at 1.50m		-											
								-											
				-				2.0											
								-											
				-															
								2.5 —											
				į															
				-															
								-											
				-				3.0 —											
				-															
								-											
								3.5 —											
				-				-											
				-				-											
				-															
				-				4.0											
				-				-											
				-				]											
				-				-											
				-				4.5											
				-															
				-				-											
				-				-											
***	on Shuile -		Pon	narks:															
Struck at (m)	er Strikes Remarks	<b>Depth:</b> 1.50		<b>narкs:</b> groundwat	er encou	ntered.													
()	,	<b>Width:</b> 1.05																	
		<b>Length:</b> 3.05																	
		Stability: Stable		mination R			Last Updat												
		No services encountered. 05/12					/2022 <b>AGS</b>												

			Proi	ect No.	Project	Name:		Т	rial Pit ID	
2	CAUSEWAY GEOTECH			21-1619B		Project Name:  North Irish Sea Array Cable Route				
	Coordinates		Client:				ST02			
		719288.68 E 764761.40 N		Statkraft Limited  Client's Representative:  Arup						
Method: Slit Trenching Plant: 3T Tracked Excavator										
								7647		
			Elevation		Date: Logger:			FINAL		
				20.73 mOD		2022 MM0				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water		
						BITMAC				
			20.58	0.15		MADE GROUND: Grey slightly sandy angular fine to coarse G	RAVEL. Sand		_	
			20.48	0.25		\text{is fine to coarse.}  Brown slightly sandy slightly gravelly CLAY with low cobble co	ntent. Sand		-	
				<u>-</u>		is fine to coarse. Gravel is subrounded to angular fine to coar litholgies. Cobble are subrounded to subangular of limestone	se of various		-	
0.50 0.50	B3 ES1			-		introlgies. Coubic are subrounded to subangular of finitestone			0.5 —	
				-					-	
				-					_	
1.00	B4			-					1.0 —	
1.00	ES2			-					1.0	
1.20	B5			-					-	
				-					-	
			19.23	- - 1.50					1.5 —	
			19.23	- 1.30		End of trial pit at 1.50m			1.3	
				-					-	
				-					-	
				-					2.0	
				-					_	
									-	
				-					-	
				-					2.5 —	
				-					-	
				-					-	
				-						
				-					3.0	
									-	
				-					_	
				-					3.5 —	
				-					-	
				-					-	
				-						
				-					4.0	
				-					-	
				-					-	
				-					4.5 —	
				<u>-</u>					-	
				-						
				<u>-</u>					-	
	ter Strikes	<b>Depth:</b> 1.50	ı	n <b>arks:</b> groundwat	er encou	ntered				
Struck at (m)	) Remarks	<b>Width:</b> 0.50	""	,	2					
		Length: 3.10								
		Stability:	Terr	nination R	leason		Last Up	date	d I	
Stable								2/2022 AGS		

			Proi	ect No.	Project	Name.		Tri	al Pit ID
-320				21-1619B		Project Name:  North Irish Sea Array Cable Route			
CAUSEWAY ——GEOTECH				Coordinates		Client: Statkraft Limited			
Slit Trenching  Plant: 3T Tracked Excavator			7640						
			Ele	Date: Logger:			ale: 1:25		
				08/08/2022 MM0			INAL		
Depth	Sample /	Field Records	Level	Depth	Legend	Description		Water	
(m)	Tests		(mOD)	(m)	8	MADE GROUND: BITMAC		}	
			17.79	0.15		MADE GROUND: Grey slightly sandy angular fine to coarse GRAV	El Cond		-
						is fine to coarse.	EL. Sallu		
			17.58	0.36		MADE GROUND: Grey subangular fine to coarse GRAVEL.			
0.50	В3			-		, ,			0.5 —
0.50	ES1		17.38	0.56		Possible MADE GROUND: Dark grey sandy very gravelly CLAY with			$\dashv$
				-		medium cobble content. Sand is fine to coarse. Gravel is subangu angular fine to coarse of sandstone. Cobbles are subangular to a			
				-		sandstone.			
1.00	B4			-					1.0
1.00	ES2		16.84	1.10		Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coa	arco		-
						Gravel is subangular fine to coarse of sandstone.	arse.		-
1.30 1.30	B5 ES3			-					-
			16.44	1.50					٦,
1.50	В6		16.44	1.50		End of trial pit at 1.50m			1.5 —
				-					4
				-					-
									-
				-					2.0
				-					
				-					4
				-					2.5 —
				-					-
				-					- 1
				-					
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				-					4.5
				[					
				_					
				-					_
				-				+	
Wat	ter Strikes	<b>Depth:</b> 1.50		narks:					
Struck at (m	) Remarks	Width: 0.50	No	groundwat	er encou	ntered.			
		Length: 3.90							
		Stability:	Tor	mination R	leason	T	Last Upd	ated	<b>—</b>
		Stabile Stable							<b>A C C</b>
i		Serv	rices expose	u.		05/12/20	122		

			Proi	ect No.	Project	t Name:		T 7	rial Pit ID	
A ROA				1619B		rish Sea Array Cable Route				
CAUSEWAY GEOTECH  Method: Slit Trenching			Coordinates		Client:		ST06			
					Statkra					
				720134.72 E 762964.68 N		Client's Representative:				
			7629						heet 1 of 1 Scale: 1:25	
Plant:				Elevation			Logger:	FINAL		
3T Tracked Ex				1 mOD	09/08/	2022	MMC		FINAL	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water		
				-		MADE GROUND: BITMAC				
			21.06	0.15		MADE GROUND: Grey slightly sandy angular fine to coa	rse GRAVEL. San	d	_	
			20.91	0.30		is fine to coarse. Stiff brown slightly sandy slightly gravelly CLAY. Sand is	fine to coarse.		-	
				=		Gavel is subangular to subrounded fine to coarse of lim sandstone.	estone and		-	
0.50 0.50	B3 ES1			-		sanustone.			0.5 —	
				-					_	
				-					_	
				-					-	
1.00 1.00	B4 ES2								1.0	
1.20	B5			-					_	
									_	
				-					-	
			19.71	1.50		End of trial pit at 1.50m			1.5	
				-					_	
				-					_	
									_	
				-					2.0	
				-					_	
									-	
				-					2.5	
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				-					4.5 —	
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				<u> </u>					-	
<u> </u>										
	ter Strikes	<b>Depth:</b> 1.50		narks:	tor co	ntorod				
Struck at (m	) Remarks	<b>Width:</b> 0.50	No !	groundwat	ter encou	mered.				
		Length: 3.92								
		Stability:	Terr	mination R	Reason		Last	Jpdate	ed <b>E</b>	
		Stable	Serv	vices expose	d.			12/2022		
i	1	1	1	,			1 -3/:		•    •    •    •    •    •    •	

			Proje	ect No.	Project	Name:		Т	rial Pit ID	
2	CALIS	SEWAY		1619B		rish Sea Array Cable Route				
	CAU	GEOTECH	Coor	dinates	Client:				ST23	
/lethod:			71883	17.98 E		ft Limited				
lit Trenching			74795	56.55 N	Arup	s Representative:		Sheet 1 of 1 Scale: 1:25		
lant:			Elev	ation	Date:	Logge	r:			
T Tracked Ex	cavator		3.41 mOD		09/08/				FINAL	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description		Water		
.50	В3		3.29	0.12		MADE GROUND: BITMAC  MADE GROUND: Grey slightly clayey sandy subrounded to rou to coarse GRAVEL of various lithologies with low cobble conte fine to coarse. Cobbles are subrounded of various lithologies.  Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to Gravel is subrounded fine to coarse.	nt. Sand is		0.5 -	
.00 .00 .00 .20	B4 ES2 B5	Groundwater encountered at 1.50m						•	1.0 —	
			2.01	1.40		End of trial pit at 1.40m			1.5 -	
									2.0 — 2.5 - 3.0 — 3.5 -	
<b>Wate</b> Struck at (m)	er Strikes Remarks	<b>Depth:</b> 1.40	Rem	arks:					4.5 -	
1.05	Groundwa	ter Width: 0.50								
	encountere 1.50m						Т.			
		Stability:	Tern	nination F	reason		Last Up			
		Stable	No se	ervices enc	ountered.		05/12	/2022	AG	

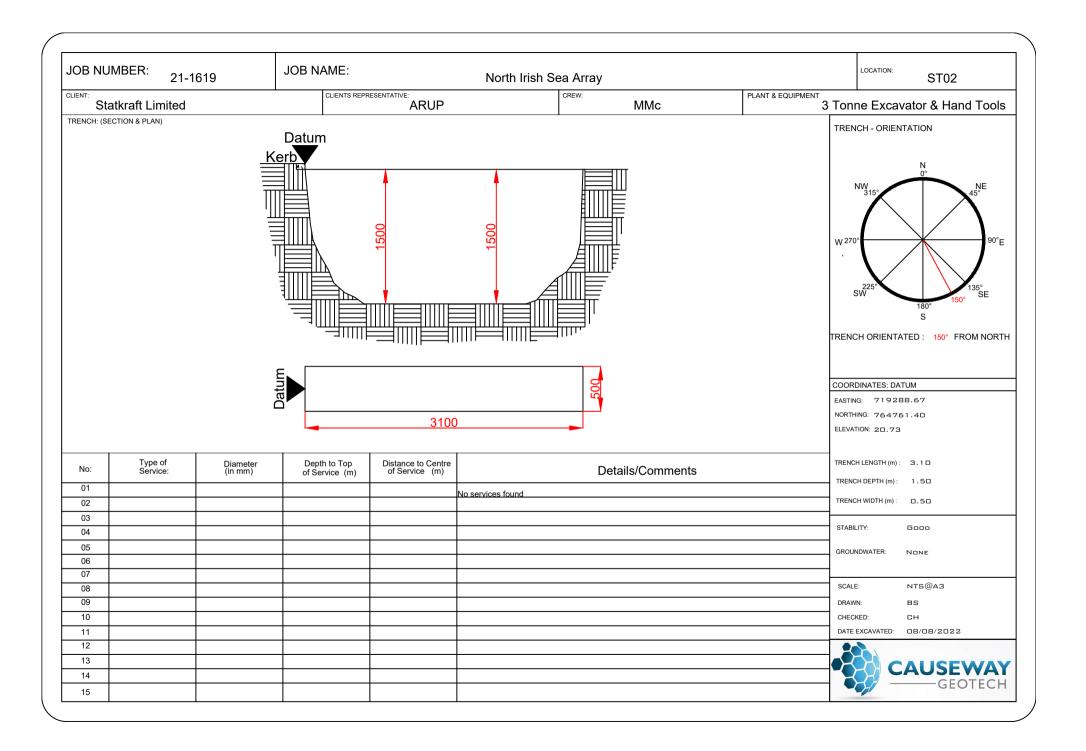
			Proj	ect No.	Project	t Name:	1	rial Pit ID	
	CALI	SEWAY	21-	1619B	North I	rish Sea Array Cable Route			
3	CAU	GEOTECH	Coor	dinates	Client:			ST24	
Analog I			7191	88.85 E		ft Limited			
<b>/lethod:</b> lit Trenching				82.05 N	Client's Arup	s Representative:		neet 1 of 1	
lant:			Ele	Elevation		Logger:	- 5	Scale: 1:25	
Tracked Exc	avator			2.17 mOD		2022 MMC		FINAL	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water		
(,	10303		(05)	,		BITMAC			
			2.02	0.15		MADE GROUND: Grey slightly sandy angular fine to coarse GRAVEL. San	d		
			1.92	0.25		\is fine to coarse.  MADE GROUND: Grey subangular fine to coarse GRAVEL of limestone.	1		
50	В3		1.72	8:48		MADE GROUND: BITMAC		0.5	
50	ES1		1.69 1.54	0.63		MADE GROUND: Grey slightly sandy angular fine to coarse GRAVEL. San is fine to coarse.	d		
			1.5			Firm greyish brown sandy very gravelly CLAY. Sand is fine to coarse.			
				-		Gravel is subangular to subrounded fine to coarse of various lithologies.			
.00	B4			-			•	1.0 -	
.00	ES2	Groundwater	1.07	1.10		Greyish brown very clayey fine to coarse SAND and subrounded fine to	-		
.20	B5	encountered at 1.05m		-		coarse GRAVEL.			
			0.77	1.40		End of trial pit at 1.40m	$\dashv$		
				<u> </u>		, ,		1.5	
				[					
				-					
				-				2.0 -	
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				<u> </u>				4.3	
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				-	1				
Wate	er Strikes	Donath 1 40	Ren	narks:	1	L			
Struck at (m)	Remark	14/: - 4  O CO							
1.05	Groundwa encountere	itei							
	1.05m		Terr	mination R	Reason	Last I	Jpdate	d = =	
		Stable		ervices enc			.2/2022		
		Stable	INO S	oci vices elic	ountered.	05/1	. ∠ / ∠UZZ	AU	

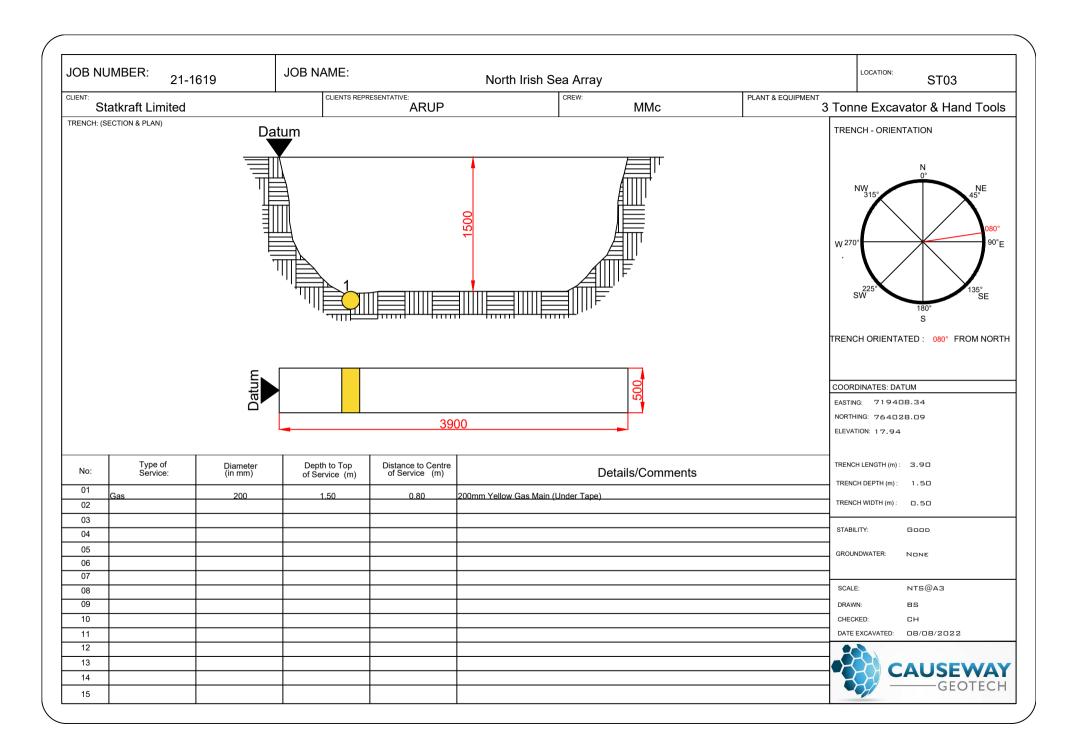
			Proi	ect No.	Project	: Name:	<del></del>	Trial Pit ID		
201				1619B		rish Sea Array Cable Route		IIIai i itib		
CAUSEWAY GEOTECH			Coordinates		Client:		ST27			
——GEOTECH						Statkraft Limited				
Method: Slit Trenching				720526.58 E 745983.03 N		Client's Representative:				
								Sheet 1 of 1 Scale: 1:25		
Plant:				Elevation		Logger:		FINAL		
3T Tracked Exca				1 mOD	11/08/	2022 MMC				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water			
				-		MADE GROUND: BITMAC		_		
			11.51	0.20		MADE GROUND: Grey slightly sandy angular fine to coarse GRAVE	-I Sand	-		
				-		is fine to coarse.		-		
			11.21	0.50				0.5		
			11.21	- 0.30		Firm to stiff brown slightly sandy slightly gravelly CLAY. Sand is fine coarse. Grave is subangular to subrounded fine to coarse of limest	e to tone.	-		
						Ğ		-		
				-				-		
				-				1.0		
				Ē				-		
				-				-		
			10.41	1.30		End of trial pit at 1.30m				
				-				1.5 —		
				- -				-		
				-						
				-						
				-				2.0		
				-				-		
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				-				2.5 —		
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				-				-		
Water Struck at (m)	Strikes Remarks	<b>Depth:</b> 1.30		<b>narks:</b> groundwat	er encou	ntered.				
Struck at (III)	nemarks	<b>Width:</b> 0.50								
		<b>Length:</b> 3.30								
		Stability:	Teri	mination R	eason		Last Update			
		Stable	Serv	rices expose	d.		05/12/2022			

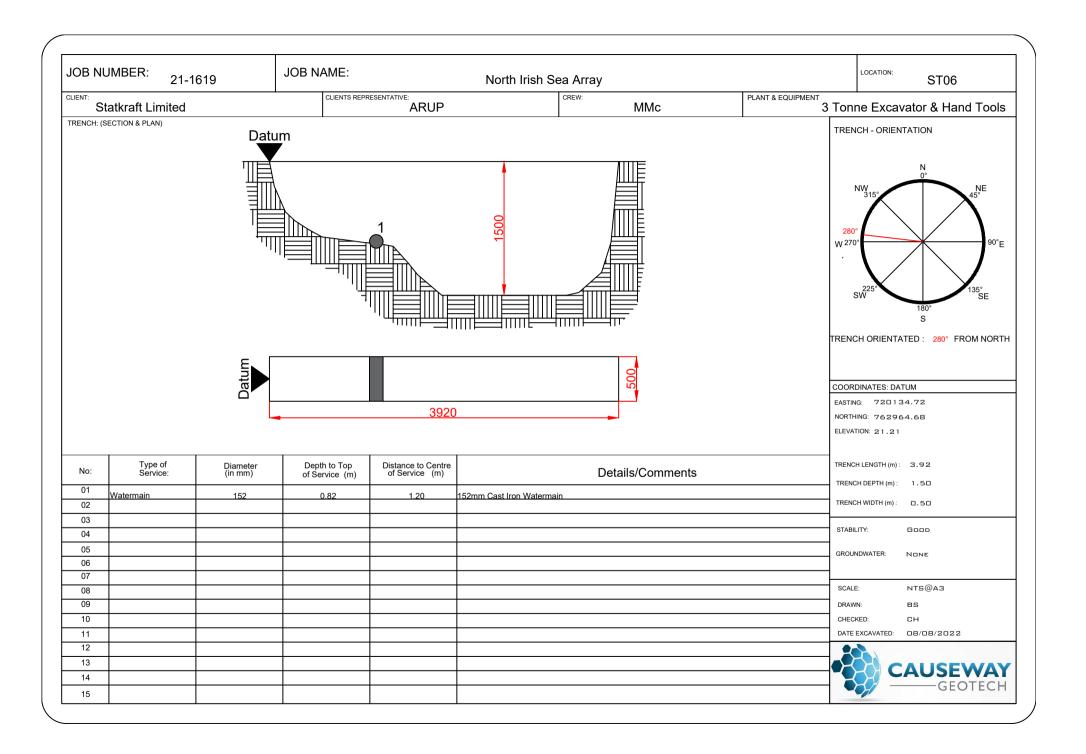
A N			Proi	ect No.	Project	: Name:		Т	rial Pit ID	
CAUSEWAY —GEOTECH  Method: Slit Trenching  Plant: 3T Tracked Excavator			21-1619B  Coordinates  721126.24 E		North I					
					Client:	ST29				
					Statkra					
				721126.24 E 744432.30 N Elevation		Client's Representative: Arup				
			8.75 mOD		<b>Date:</b> Logger: 10/08/2022 MMC			FINAL		
Depth	Sample /	Field Records	Level	Depth	Legend	Description		Water		
(m)	Tests		(mOD)	(m)		MADE GROUND: BITMAC		>		
			8.60	0.15		MADE GROUND: Grey slightly sandy angular fine to coar	se GRAVEL. Sand	-	]	
						is fine to coarse.			_	
0.50	В3			Ŀ					0.5 —	
0.50	ES1		8.15	0.60		Firm brown slightly sandy very gravelly CLAY with low co	hhla contant	-	-	
				-		Sand is fine to coarse. Gravel is subangular to rounded fi	ne to coarse of		-	
				-		various lithologies. Cobbles are subrounded to rounded lithologies.	of various			
1.00	В4			-					1.0	
1.00	ES2			-					-	
1.20	B5			-						
									-	
			7.15	1.60					1.5	
			7.15	1.00		End of trial pit at 1.60m			_	
									-	
				-					2.0 —	
				-					-	
									-	
				[					_	
				-					2.5 —	
				<u> </u>					-	
				-					3.0	
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			<u> </u>	<u> </u>						
Wat Struck at (m	ter Strikes  Remarks	<b>Depth:</b> 1.60		<b>narks:</b> groundwat	er encou	ntered.				
Strack at (III	, itematks	<b>Width:</b> 0.60								
		Length: 3.00								
		Stability:		mination R			Last Up			
ĺ		Stable	Serv	ices expose	d.		05/12,	/2022		

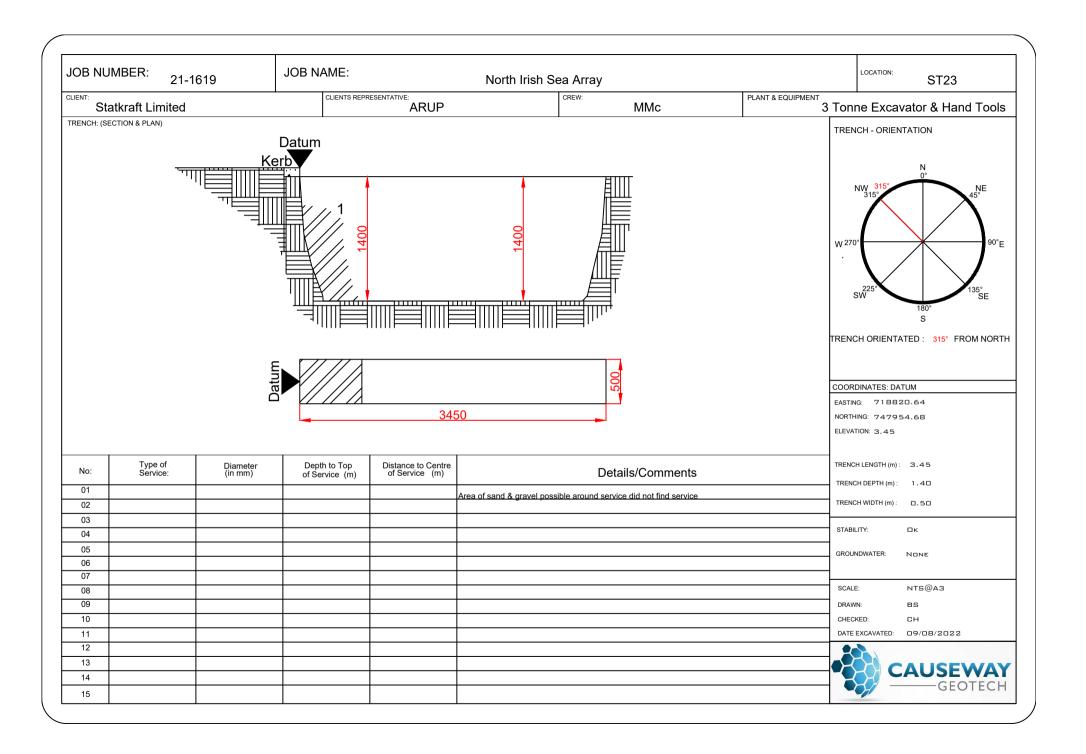
			Proi	ect No.	Project	Name:	-	Trial Pit ID
CAUSEWAY GEOTECH Method:				1619B	North I			
			<b>Coordinates</b> 721045.43 E		Client:		ST31	
					Statkra			
					Client's	Client's Representative:		
Stable				741874.50 N  Elevation				Scale: 1:25
Plant:						Logger:		FINAL
3T Tracked Ex				5 mOD	10/08/	2022 MMC	_	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water	
				-		MADE GROUND: BITMAC		-
								-
			27.19	0.27		MADE GROUND: Grey slightly sandy angular fine to coarse GRAVEL. is fine to coarse.	Sand	-
0.50	В3			[		is the to coarse.		0.5
0.50	ES1			-				_
			26.71	0.75				-
			20.72	- 0.73		Stiff to very stiff brown slightly sandy slightly gravelly CLAY. Sand is f coarse. Gravel is subangular fine to coarse of limestone.	ine to	-
1.00	B4			[_				1.0
1.00	ES2			-				
1.20	B5			[				-
				-				
			25.96	1.50		End of trial pit at 1.50m		1.5
						End of that pit at 1.50m		-
				-				
				-				2.0
				[				-
				Ė				
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								2.5
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				[				4.5
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				[				]
				-	1			
	er Strikes	<b>Depth:</b> 1.50	1	narks:	,			
Struck at (m)	) Remarks	Width: 0.50	No §	groundwat	er encou	ntered.		
		Length: 3.00						
		Stability:	Terr	nination R	Reason	L	ast Update	ed
		Stable	No s	ervices enc	ountered.		05/12/2022	2 AGS

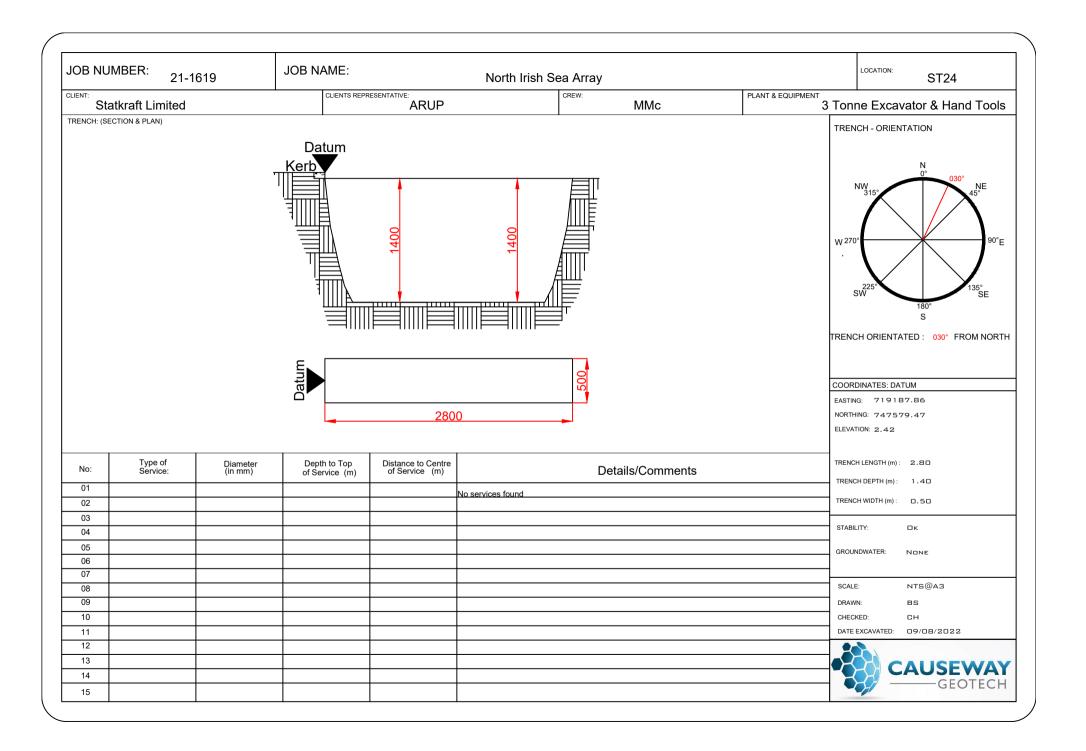
			Proi	ect No.	Droiec	t Name:		Tria	l Pit ID	
- 20				-1619B		rish Sea Array Cable Route		IIIa	ווווו	
CAUSEWAY ——GEOTECH				Coordinates		Client:				
						Statkraft Limited				
Method: Slit Trenching Plant:				719230.85 E 741306.18 N <b>Elevation</b> 39.69 mOD		Client's Representative:				
			7413						et 1 of 1 e: 1:25	
			Ele			Logger:				
3T Tracked Excavator		39.6	2022 CW				H	NAL		
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water			
(111)	16363		(IIIOD)	- (,		BITMAC				
				-						
			39.39	0.30		MADE CROUND Light and lighthy and the second of the second	SDAVEL		_	
				-		MADE GROUND: Light grey slightly sandy angular fine to coarse G Sand is fine to coarse.	JRAVEL.		-	
0.50 0.50	B1 D2			-					0.5 —	
0.50			39.09	0.60		MADE GROUND: Dark bluish grey slightly sandy angular fine to co	oarse			
				-		GRAVEL. Sand is fine to coarse.			_	
			38.74	0.95					_	
1.00 1.00	B3 D4		30.74	- 0.55		Firm dark brownish black slightly gravelly CLAY. Gravel is subangu subrounded fine to coarse.	ılar to		1.0	
1.00	D4			_						
			38.44	1.25		End of trial pit at 1.25m				
				-					-	
									1.5 —	
				-					_	
				-					_	
				_					2.0	
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			+	-	-			+		
Wate	er Strikes	<b>Depth:</b> 1.25	1	narks:	1					
Struck at (m)	Remarks	Width: 0.40	No	groundwat	er encou	ntered.				
		Length: 2.90								
		Stability:	Torr	mination R	leason		Last Upda	ted		
									V C O	
Stable				services enco	ountered.		05/12/202	<u>'</u>	1/2/15/27	

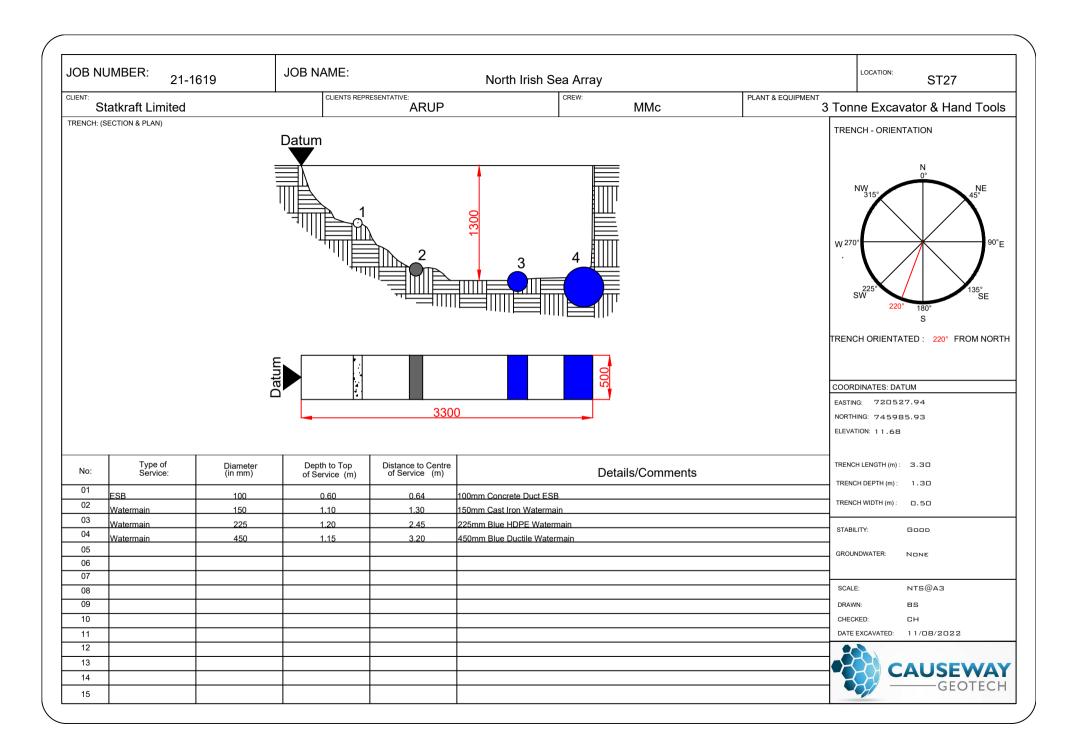


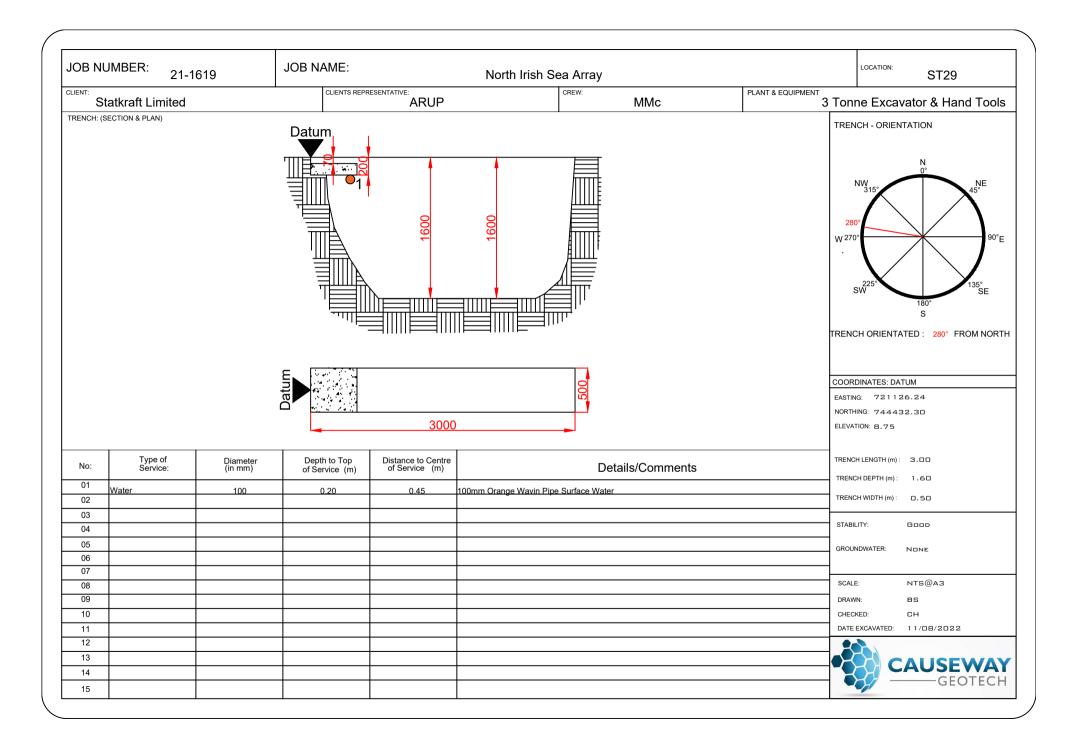


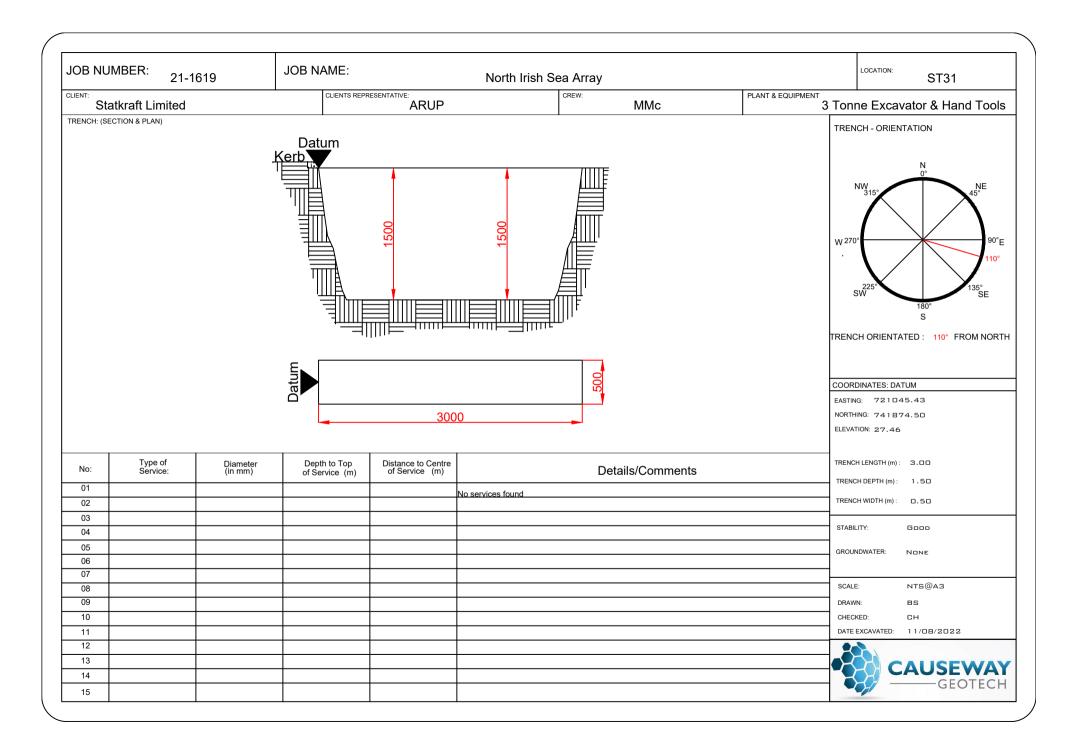














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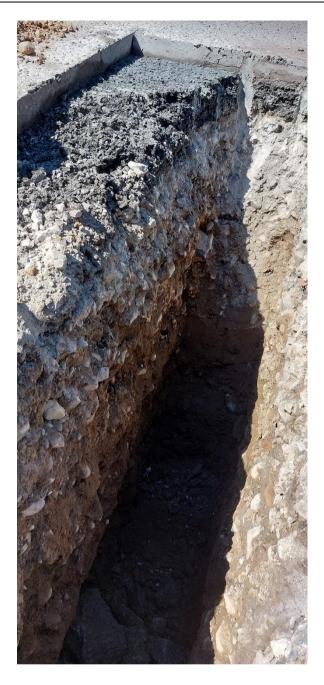
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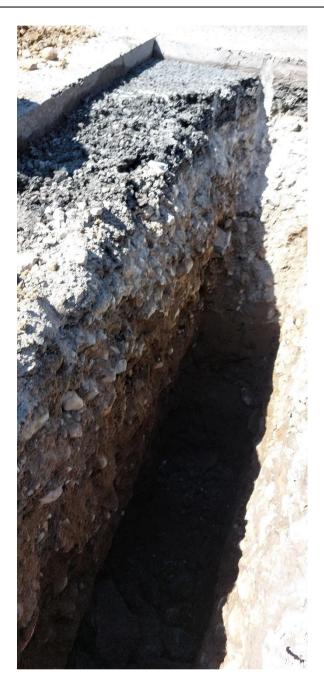
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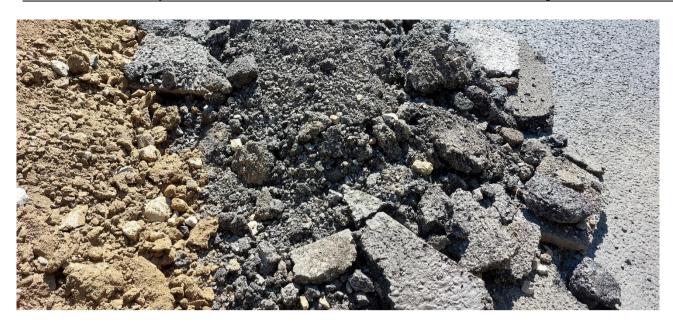
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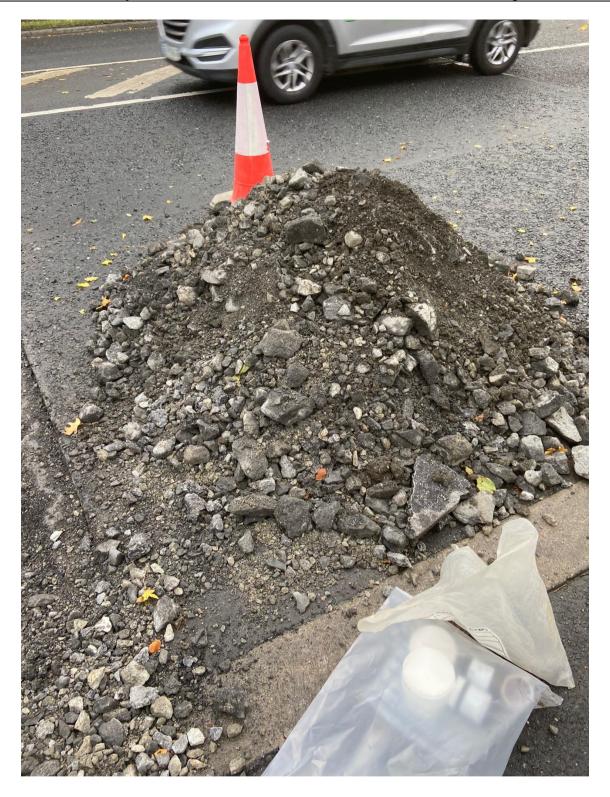
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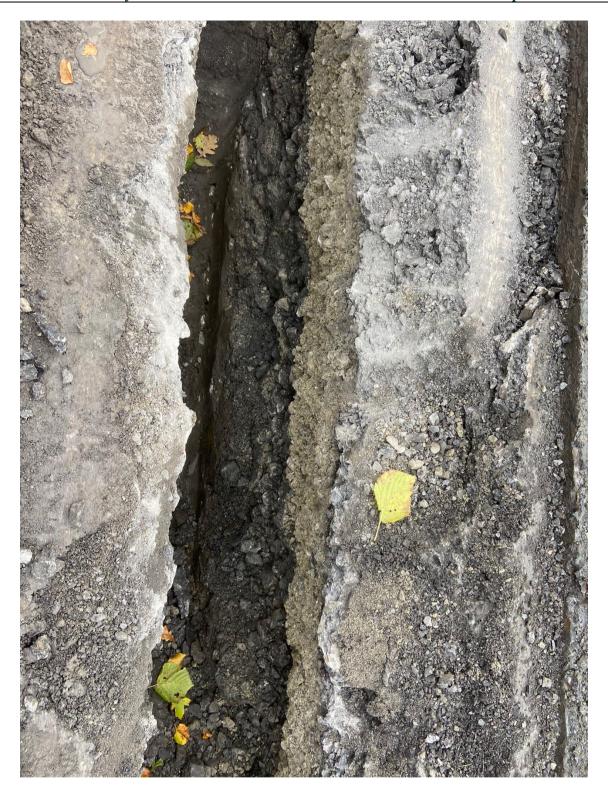
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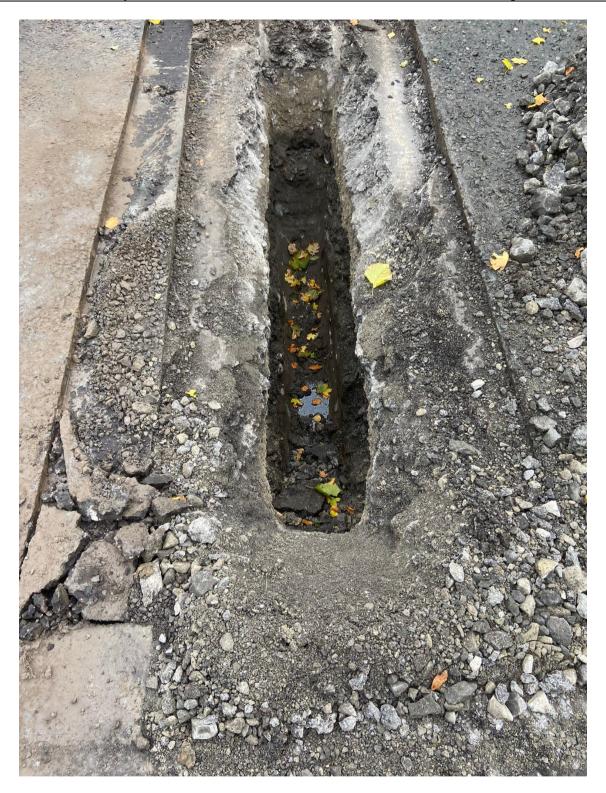
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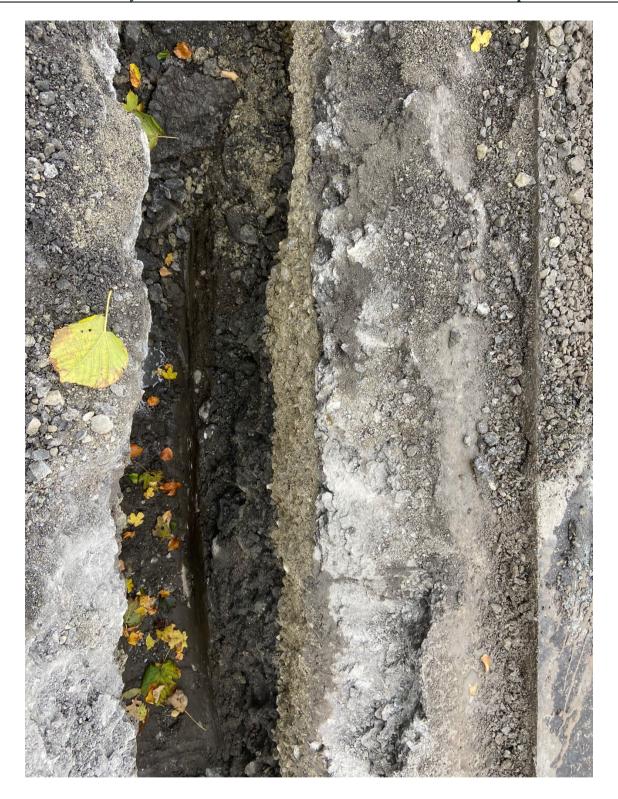
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# APPENDIX G SLIT TRENCH PHOTOGRAPHS





# APPENDIX H GEOTECHNICAL LABORATORY TEST RESULTS





## HEAD OFFICE Causeway Geotech Ltd

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> 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

8 June 2022

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 08/06/2022.

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:** Rock Schedule 1

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
ROCK	Point load index	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985	4

#### 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
ROCK – subcontracted to MATtest Limited (UKAS 2643)	Uniaxial Compressive Strength (UCS)	ASTM D7012 - 14	2

C	AUSEW GEOTE			Point Load Strength Index Tests Summary of Results														
Project No.	1-1619			Proje	ect Nam	e					rish Se							
Borehole	Sample			Spe	ecimen	'		Type ISRM	alid (Y/N)		Dime	nsions		Force P	Equivalent diameter, De	Point Strengtl		Remarks (including
No.	Depth	Ref.	Туре	Ref.	Depth	Rock Type	Type (D, A, I, B)	Direction (L, P or U)	Failure Valid (Y/N)	Lne	W	Dps mm	Dps'	kN	a Equival	Is MPa	Is(5 0) <sub>MPa</sub>	water content if measured)
BH08	8.90		С	1	8.90	LIMESTONE	А	U	YES		100.7	102.0	101.0	6.7	113.8		0.7	
BH08	9.40		С	1	9.40	LIMESTONE	D	U	YES	42.4	100.3	100.3	99.0	10.6	99.6	1.1	1.5	
BH08	13.27		С	1	13.27	LIMESTONE	А	U	YES		100.4	76.0	72.0	27.9	95.9	3.0	4.1	
BH08	13.83		С	1	13.83	LIMESTONE	D	U	NO	57.3	100.3	100.3	99.0	20.9	99.6	2.1	2.9	
Test Type D - Diametral, A - Direction L - parallel to plan P - perpendicular U - unknown or ra Dimensions Dps - Distance be Dps' - at failure ( s Lne - Length from W - Width of sho	es of weakr to planes of ndom tween plate see ISRM no platens to r	ness weakr ns ( pla ote 6) nearest	ness aten se	paratio	D <sub>ps</sub>	ametral P	D <sub>ps</sub> ↓	Axial	P	L <sub>I</sub>	ne 🖈	Bloc			D <sub>ps</sub>	Irregul	ar lump	P D <sub>ps</sub>
Test performed in	accordance	e with I	SRM S	ugges	ed Metho	ods : 2007, unless not	ed othe	rwise			Date F	Printed		Appro	ved B	y		
Detailed legend for Size factor, F = (E				ased or	n ISRM, is		4B 17	'R - \/	arsio	n 5	13	3/05/20	22			/atson	Į	JKAS TESTING 10122



#### LABORATORY TEST CERTIFICATE

Certificate No: 22/524 - 04

To: Stephen Watson

Client : Causeway Geotech Limited

8 Drumahiskey Road

Ballymoney Co. Antrim BT53 7QL 10 Queenslie Point Queenslie Industrial Estate 120 Stepps Road Glasgow G33 3NQ

Tel: 0141 774 4032

email: info@mattest.org Website: www.mattest.org

#### LABORATORY TESTING OF ROCK

#### Introduction

We refer to samples taken from North Irish Sea Array (NISA) and delivered to our laboratory on 09th May 2022.

#### **Material & Source**

Sample Reference : See Report Plates

Sampled By : Client

Sampling Certificate : Not Supplied

Location : See Report Plates

Description : Rock Cores

Date Sampled : Not Supplied

Date Tested : 09th May 2022 Onwards

Source : 21-1619 - North Irish Sea Array (NISA)

#### **Test Results**

As Detailed On Page 2

## Comments

The results contained in this report relate to the sample(s) as received Opinions and interpretations expressed herein are outside the scope of UKAS accreditation This report should not be reproduced except in full without the written approval of the laboratory All remaining samples for this project will be disposed of 28 days after issue of this test certificate

#### Remarks

Approved for Issue

T McLelland (Director)

Date

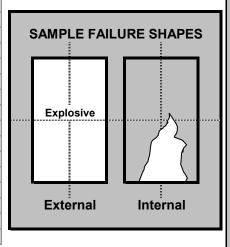
08/06/2022



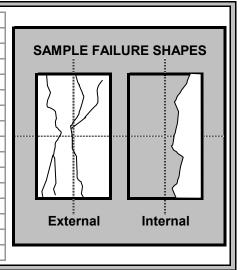
Issue No. 01 Page 1 of 2



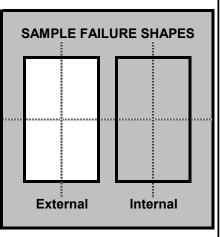
BOREHOLE		BH08
SAMPLE		C2
DEPTH	m	9.00-9.40
SAMPLE DIAMETER	mm	101.70
SAMPLE HEIGHT	mm	209.68
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.5
TEST DURATION	min.sec	8.10
DATE OF TESTING		08/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	733.2
UNCONFINED COMPRESSIVE STRENGTH	MPa	90.3
WATER CONTENT (ISRM Suggested Methods)	%	0.5
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.68
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.67



BOREHOLE		BH08
SAMPLE		C5
DEPTH	m	13.60-13.83
SAMPLE DIAMETER	mm	101.79
SAMPLE HEIGHT	mm	203.90
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.2
TEST DURATION	min.sec	10.15
DATE OF TESTING		08/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	744.9
UNCONFINED COMPRESSIVE STRENGTH	MPa	91.5
WATER CONTENT (ISRM Suggested Methods)	%	0.1
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.67
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.67



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	



Tested in accordance with ASTM D7012 - 14



HEAD OFFICE Causeway Geotech Ltd

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> Registered in Ireland. Company Number: 633786

www.causewaygeotech.com

22 June 2022

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 14/05/2022 and 22/06/2022.

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:** Rock Schedule 4

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
ROCK	Point load index	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985	40

#### **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
ROCK – subcontracted to MATtest Limited (UKAS 2643)	Uniaxial Compressive Strength (UCS)	ASTM D7012 - 14	15

CAUSEWAY		
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# Point Load Strength Index Tests Summary of Results

Project No. Project Name

21-1619

North Irish Sea Array

Borehole	Sa	mple		Spe	ecimen			Type ISRM	lid (Y/N)		Dime	ensions		Force P	Equivalent diameter, De	Point Strength		Remarks (including
No.	Depth	Ref.	Туре	Ref.	Depth	Rock Type	Type (D, A, I, B)	Direction (L, P or U)	Failure Valid (Y/N)	Lne	W	Dps	Dps'		Equivale	Is	Is(5 0)	water content if measured)
	m				m	LIMESTONE				mm	mm	mm	mm	kN	mm	MPa	MPa	
BH01	3.25		С	1	3.25		D	U	NO	132.1	100.9	100.9	99.0	24.0	99.9	2.4	3.3	
BH01	6.20		С	1	6.20	LIMESTONE	Α	U	YES		101.2	31.0	28.0	10.7	60.1	3.0	3.2	
BH01	7.85		С	1	7.85	LIMESTONE	D	U	YES	133.7	101.1	101.1	100.0	9.3	100.5	0.9	1.3	
BH01	10.50		С	1	10.50	LIMESTONE	А	U	YES		101.0	83.0	80.0	32.1	101.4	3.1	4.3	
BH01	12.70		С	1	12.70	LIMESTONE	Α	U	NO		101.0	82.0	78.0	22.1	100.2	2.2	3.0	
BH01	14.90		С	1	14.90	LIMESTONE	D	U	NO	90.5	101.2	101.2	99.0	16.5	100.1	1.6	2.3	
BH01	16.20		С	1	16.20	LIMESTONE	Α	U	YES		101.0	67.0	64.0	16.2	90.7	2.0	2.6	
BH01	18.70		С	1	18.70	LIMESTONE	А	U	YES		101.1	83.0	81.0	31.8	102.1	3.0	4.2	
BH01	19.40		С	1	19.40	LIMESTONE	D	U	YES	65.4	100.9	100.9	100.0	3.5	100.4	0.3	0.5	
BH01	24.20		С	1	24.20	LIMESTONE	Α	U	YES		101.0	88.0	83.0	9.5	103.3	0.9	1.2	
BH01	24.40		С	1	24.40	LIMESTONE	D	U	YES	56.4	101.2	101.2	98.0	16.0	99.6	1.6	2.2	
BH01	24.80		С	1	24.80	LIMESTONE	Α	U	YES		100.9	91.0	90.0	1.1	107.5	0.1	0.1	
BH01	28.55		С	1	28.50	LIMESTONE	D	U	NO	138.4	85.8	85.8	83.0	22.4	84.4	3.1	4.0	
BH02	6.20		С	1	6.20	LIMESTONE	D	U	YES	43.2	100.2	100.2	99.0	0.6	99.6	0.1	0.1	
BH02	10.80		С	1	10.80	LIMESTONE	D	U	YES	120.5	100.3	100.3	99.0	9.2	99.6	0.9	1.3	
BH02	12.30		С	1	12.30	LIMESTONE	Α	U	YES		100.2	107.0	105.0	8.8	115.7	0.7	1.0	
BH02	13.70		С	1	13.70	LIMESTONE	D	U	NO	123.0	100.4	100.4	97.0	28.4	98.7	2.9	4.0	
BH02	13.95		С	1	13.95	LIMESTONE	А	U	YES		101.0	102.0	97.0	26.7	111.7	2.1	3.1	

Test Type

D - Diametral, A - Axial, I - Irregular Lump, B - Block

Direction

L - parallel to planes of weakness

P - perpendicular to planes of weakness

U - unknown or random

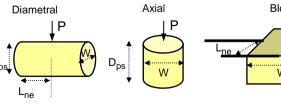
Dimensions

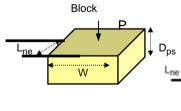
Dps - Distance between platens ( platen separation )

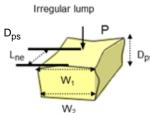
Dps' - at failure ( see ISRM note 6)

Lne - Length from platens to nearest free end

W - Width of shortest dimension perpendicular to load, P







Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise

Detailed legend for test and dimensions, based on ISRM, is shown above.

Size factor, F = (De/50)0.45 for all tests.

LAB 17R - Version 5

Date Printed Approved By

06/02/2022 00:00



Stephen.Watson

CAUSEWAY	
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# **Point Load Strength Index Tests Summary of Results**

Project No. Project Name

21-1619

North Irish Sea Array

Borehole	Sa	ımple		Spe	ecimen		Test Type see ISRM		lid (Y/N)		Dime	nsions		Force P	Equivalent diameter, De	Point Strengtl		Remarks (including
No.	Depth	Ref.	Туре	Ref.	Depth	Rock Type	Type (D, A, I, B)	Direction (L, P or U)	Failure Valid (Y/N)	Lne	W	Dps	Dps'		Equivale	Is	Is(5 0)	water content if measured)
	m				m		ט			mm	mm	mm	mm	kN	mm	MPa	MPa	
BH02	15.60		С	1	15.60	LIMESTONE	Α	U	YES		101.0	89.0	86.0	19.3	105.2	1.7	2.4	
BH02	16.65		С	1	16.65	LIMESTONE	D	U	YES	77.9	101.1	101.1	99.0	10.0	100.0	1.0	1.4	
BH02	19.00		С	1	19.00	LIMESTONE	Α	U	NO		100.9	93.0	89.0	25.2	106.9	2.2	3.1	
BH02	19.30		С	1	19.30	LIMESTONE	D	U	NO	137.7	100.5	100.5	96.0	22.7	98.2	2.4	3.2	
BH02	24.00		С	1	24.00	LIMESTONE	D	U	NO	117.7	101.2	101.2	100.0	33.3	100.6	3.3	4.5	
BH02	25.35		С	1	25.35	LIMESTONE	Α	U	NO		100.9	94.0	92.0	26.5	108.7	2.2	3.2	
BH02	25.80		С	1	25.80	LIMESTONE	D	U	NO	95.8	100.9	100.9	99.0	23.0	99.9	2.3	3.1	
BH09	6.65		С	1	6.65	LIMESTONE	Α	U	YES		101.0	88.0	83.0	5.5	103.3	0.5	0.7	
BH09	7.75		С	1	7.75	LIMESTONE	D	U	YES	56.2	100.9	100.9	100.0	3.2	100.4	0.3	0.4	
BH09	10.10		С	1	10.10	LIMESTONE	А	U	YES		101.3	69.0	57.0	16.9	85.7	2.3	2.9	
BH09	10.75		С	1	10.75	LIMESTONE	D	U	YES	56.2	100.8	100.8	99.0	9.9	99.9	1.0	1.4	
BH09	11.70		С	1	11.70	LIMESTONE	Α	U	YES		101.3	59.0	54.0	25.1	83.5	3.6	4.5	
BH09	13.00		С	1	13.00	LIMESTONE	D	U	NO	67.2	100.5	100.5	99.0	21.9	99.7	2.2	3.0	
BH09	14.20		С	1	14.20	LIMESTONE	А	U	YES		100.8	74.0	71.0	10.0	95.5	1.1	1.5	
BH09	15.75		С	1	15.75	LIMESTONE	А	U	YES		101.1	51.0	48.0	19.6	78.6	3.2	3.9	
BH09	18.55		С	1	18.55	LIMESTONE	D	U	YES	83.2	101.3	101.3	100.0	5.1	100.6	0.5	0.7	
BH09	19.20		С	1	19.20	LIMESTONE	А	U	NO		101.1	84.0	82.0	16.8	102.7	1.6	2.2	
BH15	9.10		С	1	9.10	LIMESTONE	I	U	YES	103.2	77.7	45.0	42.0	0.5	64.5	0.1	0.1	

Test Type

D - Diametral, A - Axial, I - Irregular Lump, B - Block

Direction

L - parallel to planes of weakness

P - perpendicular to planes of weakness

U - unknown or random

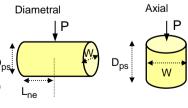
Dimensions

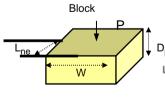
Dps - Distance between platens ( platen separation )

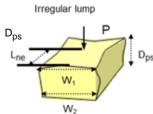
Dps' - at failure ( see ISRM note 6)

Lne - Length from platens to nearest free end

W - Width of shortest dimension perpendicular to load, P







Test performed in accordance with ISRM Suggested Methods: 2007, unless noted otherwise

Detailed legend for test and dimensions, based on ISRM, is shown above.

Size factor, F = (De/50)0.45 for all tests.

LAB 17R - Version 5

Date Printed Approved By

06/02/2022 00:00



Stephen.Watson

	AUSEW GEOTE						Poi				reng ry of			Test	S			
Project No.	21-1619			Proje	ect Nam	е					rish Se							
Borehole		Sample		Spe	Specimen				Dimensions				·		Equivalent diameter, De	Point Strengtl		Remarks (including
No.	Depth m	Ref.	Туре	Ref.	Depth m	Rock Type	Type (D, A, I, B)	Direction (L, P or U)	Failure Valid (Y/N)	Lne	W	Dps	Dps'	P kN	a Equivale	Is MPa	Is(5 0) MPa	water content if measured)
BH15	12.10		С	1	12.10	LIMESTONE	ı	U	YES	94.7	80.9	67.0	58.0	3.6	77.3	0.6	0.7	
BH16	11.75		С	1	11.75	LIMESTONE	ı	U	YES	65.1	74.3	40.0	38.0	1.6	60.0	0.4	0.5	
BH16	12.40		С	1	12.40	LIMESTONE	D	U	YES	122.5	100.1	100.1	97.0	3.0	98.5	0.3	0.4	
BH16	14.85		С	1	14.85	LIMESTONE	Α	U	YES		100.6	99.0	94.0	5.0	109.7	0.4	0.6	
Test Type D - Diametral, A Direction L - parallel to plai P - perpendicular U - unknown or r Dimensions Dps - Distance b Dps' - at failure ( Lne - Length fron W - Width of sh	nes of weakr r to planes of andom etween plate see ISRM no n platens to r	ness weakr ens ( pla ote 6) nearest	ness aten se	paratio	D <sub>ps</sub>	ametral P	D <sub>ps</sub> ↓	Axial	P	L <sub>r</sub>	ne 🖈	Bloo	k tk	<b>→</b>	D <sub>ps</sub>	4	ar lump	P D <sub>ps</sub>
Test performed in Detailed legend f	or test and d	limensi	ons, ba				ed othe		ersio	n 5	Date F 06/02	Printed 2/2022	00:00	Appro Steph		y Vatson	lundumi	JKAS TESTING



#### LABORATORY TEST CERTIFICATE

**Certificate No:** 22/524 - 05

To: Stephen Watson

Client : Causeway Geotech Limited

8 Drumahiskey Road

Ballymoney Co. Antrim BT53 7QL 10 Queenslie Point Queenslie Industrial Estate 120 Stepps Road Glasgow G33 3NQ

Tel: 0141 774 4032

email: info@mattest.org Website: www.mattest.org

#### LABORATORY TESTING OF ROCK

#### Introduction

We refer to samples taken from North Irish Sea Array (NISA) and delivered to our laboratory on 23rd May 2022.

#### **Material & Source**

Sample Reference : See Report Plates

Sampled By : Client

Sampling Certificate : Not Supplied

Location : See Report Plates

Description : Rock Cores

Date Sampled : Not Supplied

Date Tested : 23rd May 2022 Onwards

Source : 21-1619 - North Irish Sea Array (NISA)

#### **Test Results**

As Detailed On Page 2 to Page 7 inclusive

## Comments

The results contained in this report relate to the sample(s) as received Opinions and interpretations expressed herein are outside the scope of UKAS accreditation This report should not be reproduced except in full without the written approval of the laboratory All remaining samples for this project will be disposed of 28 days after issue of this test certificate

#### Remarks

Approved for Issue

T McLelland (Director)

Date

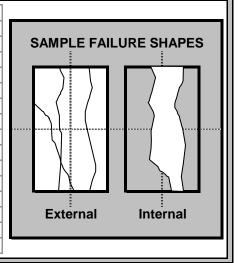
22/06/2022



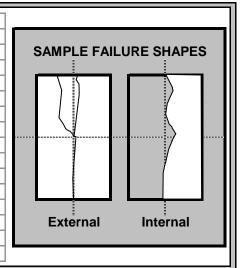
Issue No. 01 Page 1 of 7



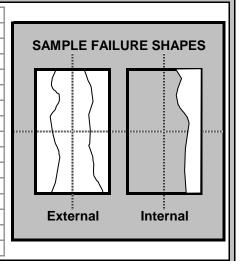
BOREHOLE		BH01
SAMPLE		C2
DEPTH	m	5.80-6.20
SAMPLE DIAMETER	mm	101.50
SAMPLE HEIGHT	mm	210.88
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	min.sec	7.06
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	450.5
UNCONFINED COMPRESSIVE STRENGTH	MPa	55.7
WATER CONTENT (ISRM Suggested Methods)	%	0.3
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.74
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.73



BOREHOLE		BH01
SAMPLE		C5
DEPTH	m	10.00-10.50
SAMPLE DIAMETER	mm	101.50
SAMPLE HEIGHT	mm	213.77
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.2
TEST DURATION	min.sec	7.58
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	541.7
UNCONFINED COMPRESSIVE STRENGTH	MPa	66.9
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.72
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.72



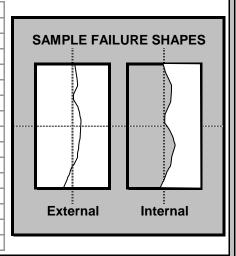
BOREHOLE		BH01
SAMPLE		C7
DEPTH	m	13.00-13.40
SAMPLE DIAMETER	mm	101.52
SAMPLE HEIGHT	mm	209.52
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.4
TEST DURATION	min.sec	9.37
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	770.8
UNCONFINED COMPRESSIVE STRENGTH	MPa	95.2
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.76
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.76
LOAD FRAME USED LOAD DIRECTION WITH RESPECT TO LITHOLOGY FAILURE LOAD UNCONFINED COMPRESSIVE STRENGTH WATER CONTENT (ISRM Suggested Methods) BULK DENSITY (ISRM Suggested Methods)	MPa % Mg/m³	2000kN Unknown 770.8 95.2 0.2 2.76



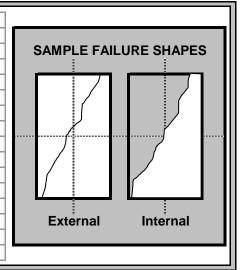
Tested in accordance with ASTM D7012 - 14



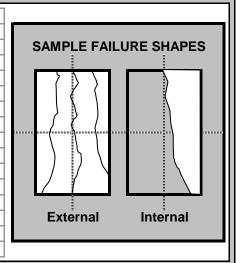
BOREHOLE		BH01
SAMPLE		C10
DEPTH	m	15.80-16.20
SAMPLE DIAMETER	mm	101.44
SAMPLE HEIGHT	mm	208.26
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	min.sec	7.29
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	493.4
UNCONFINED COMPRESSIVE STRENGTH	MPa	61.1
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.75
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.74
	·	



BOREHOLE		BH01
SAMPLE		C13
DEPTH	m	18.85-19.40
SAMPLE DIAMETER	mm	101.42
SAMPLE HEIGHT	mm	212.92
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	min.sec	4.12
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	261.8
UNCONFINED COMPRESSIVE STRENGTH	MPa	32.4
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.71
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.71



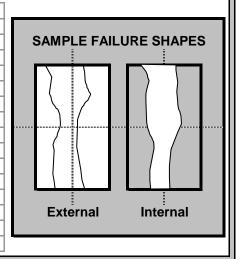
	BH01
	C16
m	23.20-23.60
mm	101.49
mm	198.26
	As Received
kN/s	1.0
min.sec	2.30
	20/06/2022
	2000kN
	Unknown
kN	135.4
MPa	16.7
%	0.3
Mg/m <sup>3</sup>	2.59
Mg/m <sup>3</sup>	2.58
	mm mm kN/s min.sec kN MPa % Mg/m³



Tested in accordance with ASTM D7012 - 14



Ш	BOREHOLE		BH01
Ш	SAMPLE		C19
Ш	DEPTH	m	25.00-25.50
Ш	SAMPLE DIAMETER	mm	101.60
	SAMPLE HEIGHT	mm	214.48
	TEST CONDITION		As Received
	RATE OF LOADING	kN/s	1.2
	TEST DURATION	min.sec	7.14
	DATE OF TESTING		20/06/2022
	LOAD FRAME USED		2000kN
Ш	LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
Ш	FAILURE LOAD	kN	530.4
Ш	UNCONFINED COMPRESSIVE STRENGTH	MPa	65.4
Ш	WATER CONTENT (ISRM Suggested Methods)	%	0.2
	BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.77
	DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.77



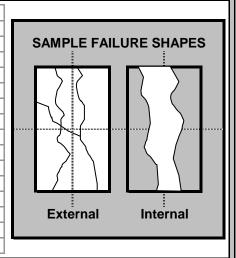
BOREHOLE			
SAMPLE			
DEPTH	m	SAMPLE FAILURE SHA	PES
SAMPLE DIAMETER	mm		
SAMPLE HEIGHT	mm		
TEST CONDITION			
RATE OF LOADING	kN/s		
TEST DURATION	min.sec		
DATE OF TESTING			
LOAD FRAME USED			
LOAD DIRECTION WITH RESPECT TO LITHOLOGY			
FAILURE LOAD	kN		
UNCONFINED COMPRESSIVE STRENGTH	MPa		
WATER CONTENT (ISRM Suggested Methods)	%	External Interna	al
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>		
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>		

[			
BOREHOLE			
SAMPLE			
DEPTH	m	SAMPLE FAIL	URE SHAPES
SAMPLE DIAMETER	mm		
SAMPLE HEIGHT	mm		
TEST CONDITION			
RATE OF LOADING	kN/s		
TEST DURATION	min.sec		
DATE OF TESTING			
LOAD FRAME USED			
LOAD DIRECTION WITH RESPECT TO LITHOLOGY			
FAILURE LOAD	kN		
UNCONFINED COMPRESSIVE STRENGTH	MPa		
WATER CONTENT (ISRM Suggested Methods)	%	External	Internal
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>		
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>		

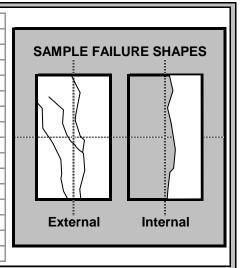
Tested in accordance with ASTM D7012 - 14



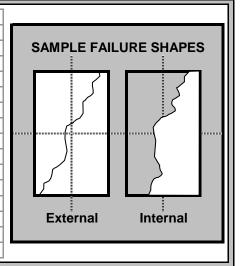
BOREHOLE	T	BH02
BOREHOLE		БПО2
SAMPLE		C3
DEPTH	m	11.20-11.50
SAMPLE DIAMETER	mm	101.02
SAMPLE HEIGHT	mm	213.78
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	min.sec	7.06
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	458.8
UNCONFINED COMPRESSIVE STRENGTH	MPa	57.2
WATER CONTENT (ISRM Suggested Methods)	%	0.3
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.72
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.71



BOREHOLE		BH02
SAMPLE		C6
DEPTH	m	13.30-13.70
SAMPLE DIAMETER	mm	101.17
SAMPLE HEIGHT	mm	206.62
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	min.sec	7.48
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	497.9
UNCONFINED COMPRESSIVE STRENGTH	MPa	61.9
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.75
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.74



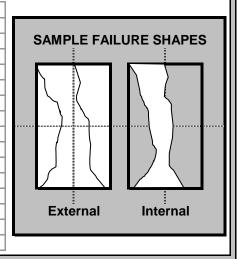
В	OREHOLE		BH02
S	AMPLE		C9
D	EPTH	m	16.25-16.50
S	AMPLE DIAMETER	mm	101.29
S	AMPLE HEIGHT	mm	199.93
T	EST CONDITION		As Received
R	ATE OF LOADING	kN/s	1.0
T	EST DURATION	min.sec	5.29
D	ATE OF TESTING		20/06/2022
L	OAD FRAME USED		2000kN
L	OAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
F	AILURE LOAD	kN	323.7
U	NCONFINED COMPRESSIVE STRENGTH	MPa	40.2
W	/ATER CONTENT (ISRM Suggested Methods)	%	0.2
В	ULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.71
D	RY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.70
D LC F U W B	ATE OF TESTING  OAD FRAME USED  OAD DIRECTION WITH RESPECT TO LITHOLOGY  AILURE LOAD  NCONFINED COMPRESSIVE STRENGTH  /ATER CONTENT (ISRM Suggested Methods)  ULK DENSITY (ISRM Suggested Methods)	kN MPa % Mg/m³	20/06/2022 2000kN Unknown 323.7 40.2 0.2 2.71



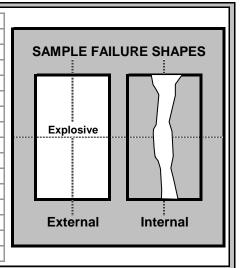
Tested in accordance with ASTM D7012 - 14



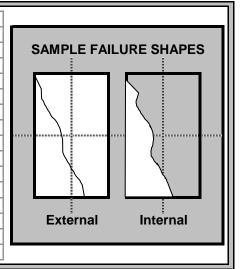
BOREHOLE		BH02
SAMPLE		C12
DEPTH	m	19.10-19.30
SAMPLE DIAMETER	mm	101.38
SAMPLE HEIGHT	mm	205.61
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	min.sec	8.42
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	563.9
UNCONFINED COMPRESSIVE STRENGTH	MPa	69.9
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.84
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.84



BOREHOLE		BH02
SAMPLE		C14
DEPTH	m	20.95-21.20
SAMPLE DIAMETER	mm	101.40
SAMPLE HEIGHT	mm	206.61
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.0
TEST DURATION	min.sec	12.29
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	729.6
UNCONFINED COMPRESSIVE STRENGTH	MPa	90.3
WATER CONTENT (ISRM Suggested Methods)	%	0.1
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.77
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.77



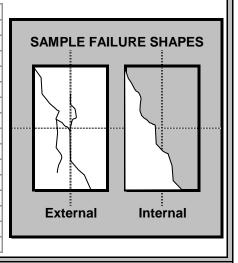
BH02
C17
25.55-25.80
101.39
206.63
As Received
1.3
10.50
20/06/2022
2000kN
Unknown
812.1
100.6
0.1
2.75
2.75



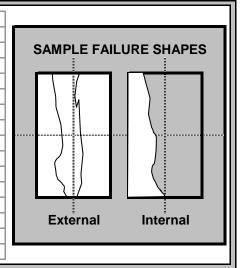
Tested in accordance with ASTM D7012 - 14



BOREHOLE	I	BH09
SAMPLE		C8
DEPTH	m	16.00-16.50
SAMPLE DIAMETER	mm	101.53
SAMPLE HEIGHT	mm	203.28
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.0
TEST DURATION	min.sec	3.10
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	177.1
UNCONFINED COMPRESSIVE STRENGTH	MPa	21.9
WATER CONTENT (ISRM Suggested Methods)	%	0.6
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.69
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.68



BOREHOLE		BH09
SAMPLE		C11
DEPTH	m	18.70-19.00
SAMPLE DIAMETER	mm	101.60
SAMPLE HEIGHT	mm	210.62
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.0
TEST DURATION	min.sec	7.51
DATE OF TESTING		20/06/2022
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	464.3
UNCONFINED COMPRESSIVE STRENGTH	MPa	57.3
WATER CONTENT (ISRM Suggested Methods)	%	0.1
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.71
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>	2.70



BOREHOLE			
SAMPLE			
DEPTH	m	SAMPLE FAIL	URE SHAPES
SAMPLE DIAMETER	mm		
SAMPLE HEIGHT	mm		
TEST CONDITION			
RATE OF LOADING	kN/s		
TEST DURATION	min.sec		
DATE OF TESTING			
LOAD FRAME USED			
LOAD DIRECTION WITH RESPECT TO LITHOLOGY			
FAILURE LOAD	kN		
UNCONFINED COMPRESSIVE STRENGTH	MPa		
WATER CONTENT (ISRM Suggested Methods)	%	External	Internal
BULK DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>		
DRY DENSITY (ISRM Suggested Methods)	Mg/m <sup>3</sup>		

Tested in accordance with ASTM D7012 - 14



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> Registered in Northern Ireland. Company Number: NI610766

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24 March 2022

Registered in Ireland. Company Number: 633786

www.causewaygeotech.com

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 04/03/2022 and 24/03/2022.

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 1

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	3		
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	1		
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	2		
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	1		



# **Summary of Classification Test Results**

Project No. Project Name

21-1619

North Irish Sea Array

		Sar	nple			Density		w	Passing	LL	PL	PI	Particle	Casagrande
Hole No.	Ref	Тор	Base	Туре	Soil Description	bulk d Mg/m3	ry	%	425μm %	%	%	%	density Mg/m3	Classification
BH08	3	0.20	1.20	В	Greyish brown sandy slightly gravelly silty CLAY.	ge		4.0					, c	
BH08	5	2.00	3.00	В	Greyish brown sandy slightly gravelly silty CLAY.		1:	2.0	49	23 -1pt	16	7		CL
BH08	7	4.30	5.00	В	Greyish brown slightly gravelly silty fine to coarse SAND.		2	0.0						

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

Key Density test

Liquid Limit

Particle density

gj - gas jar

Approved By

Linear measurement unless:

wd - water displacement

4pt cone unless: sp - small pyknometer

cas - Casagrande method

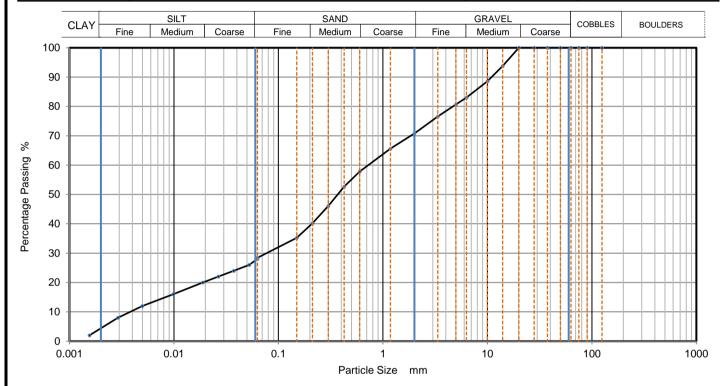
Date Printed

24/03/2022

wi - immersion in water 1pt - single point test

Stephen.Watson

CAUSEWAY	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619
——— GEOTECH				Borehole/Pit No.	вн08
Site Name	North Irish Sea Array			Sample No.	5
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	2.00
Specimen Reference	6 Specimen 2 m			Sample Type	В
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022022820



Siev	/ing	Sedimentation		
Particle Size mm	% Passing	Particle Size mm	% Passing	
125	100	0.06300	28	
90	100	0.05252	26	
75	100	0.03736	24	
63	100	0.02657	22	
50	100	0.01889	20	
37.5	100	0.00987	16	
28	100	0.00499	12	
20	100	0.00291	8	
14	94	0.00156	2	
10	89			
6.3	83			
5	81			
3.35	77			
2	71			
1.18	66			
0.6	58	Particle density	(assumed)	
0.425	53	2.65	Mg/m3	
0.3	46			
0.212	40	]		
0.15	35	]		
0.063	28			

Sample Proportions	% dry mass		
Cobbles	0.0		
Gravel	29.2		
Sand	42.3		
Silt	24.0		
Clay	4.5		

Grading Analysis		
D100	mm	
D60	mm	0.724
D30	mm	0.0769
D10	mm	0.00374
Uniformity Coefficient		190
Curvature Coefficient		2.2

#### Remarks

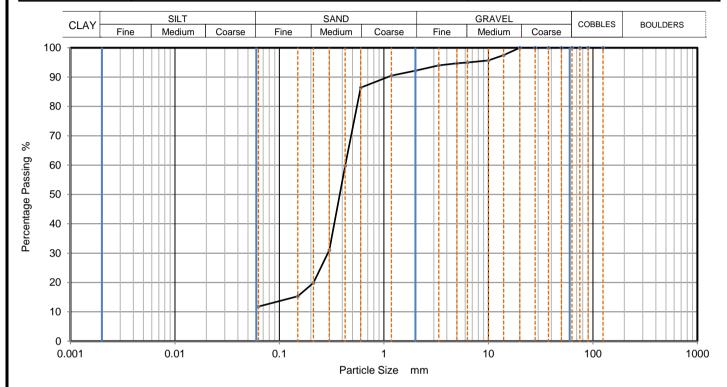
Preparation and testing in accordance with BS1377-2:1990 unless noted below



Approved
Stephen.Watson

LAB 05R Version 4

CAUSEWAY	PARTICLE SIZE DISTRIBUTION			Job Ref	21-1619	
—— GEOTECH				Borehole/Pit No.	внов	
Site Name	North Irish Sea Array			Sample No.	7	
Soil Description	Greyish brown slightly gravelly silty fine to coarse SAND.			Depth, m	4.30	
Specimen Reference	4 Specimen 4.3 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2022022821



Siev	ving	Sedimentation		
Particle Size mm	% Passing	Particle Size mm	% Passing	
125	100			
90	100			
75	100			
63	100			
50	100			
37.5	100			
28	100			
20	100			
14	98			
10	96			
6.3	95			
5	95			
3.35	94			
2	92			
1.18	91			
0.6	86			
0.425	60			
0.3	31			
0.212	20	]		
0.15	15	]		
0.063	12			

Dry Mass of sample, g	529

Sample Proportions	% dry mass	
Cobbles	0.0	
Gravel	7.8	
Sand	80.4	
Fines < 0.063mm	12.0	

Grading Analysis		
D100	mm	
D60	mm	0.426
D30	mm	0.291
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

#### Remarks

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







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> Registered in Northern Ireland. Company Number: NI610766

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28 April 2022

Registered in Ireland. Company Number: 633786

www.causewaygeotech.com

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 2 - 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	8	
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	8	
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	8	
SOIL	Moisture Condition Value at natural moisture content	BS 1377-4: 1990: Cl 5.4	5	
SOIL	Moisture Condition Value / Moisture Content Relationship	BS 1377-4: 1990: Cl 5.5	2	
SOIL	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377-4: 1990: Cl 3.3 & 3.4	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 (UKAS 4043)	Thermal Resistivity		5
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	BRE Test - Suite B		5



# **Summary of Classification Test Results**

Project No.

Project Name

21-1619

North Irish Sea Array

									,					
		Sar	nple			Dens		W	Passing	LL	PL	ΡI	Particle	Casagrande
Hole No.	Ref	Тор	Base	Туре	Soil Description	bulk Mg/m	dry	%	425μm %	%	%	%	density Mg/m3	Classification
TP16	3	1.00		В	Brown sandy slightly gravelly silty CLAY.	IVIg/II		18.0	74	41	25	16	Wg/III3	CI
TP16	4	2.50		В	Brown sandy slightly gravelly silty CLAY.			11.0	70	33	18	15		CL
TP17	3	1.00		В	Brown sandy slightly gravelly silty CLAY.			37.0						
TP17	4	1.60		В	Brown sandy slightly gravelly silty CLAY.			20.0	83	29	16	13		CL
TP17	5	2.70		В	Brown sandy slightly gravelly silty CLAY.			14.0						
TP18	3	0.80		В	Brown sandy slightly gravelly silty CLAY.			24.0						
TP18	4	1.50		В	Brown sandy slightly gravelly silty CLAY.			25.0	80	38	20	18		CI
TP18	5	2.60		В	Brown sandy slightly gravelly silty CLAY.			8.5	67	38	20	18		CI
TP22	3	0.80		В	Brown sandy slightly gravelly silty CLAY.			18.0	85	41	24	17		CI
TP22	4	1.50		В	Brown sandy slightly gravelly silty CLAY.			15.0						
TP22	5	2.80		В	Brown sandy slightly gravelly silty CLAY.			11.0						
TP23	3	0.50		В	Brown sandy slightly gravelly silty CLAY.			16.0	79	29	16	13		CL

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

LAB 01R Version 5

Key Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 13/04/2022 wd - water displacement cas - Casagrande method gj - gas jar 10122 wi - immersion in water 1pt - single point test Stephen.Watsor



# **Summary of Classification Test Results**

Project Name

21-1619

North Irish Sea Array

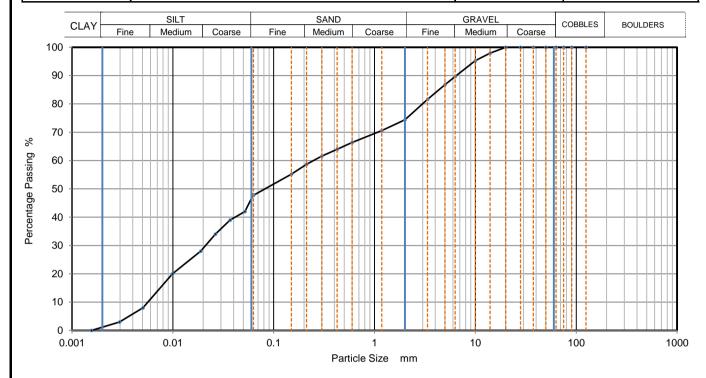
21-1	619			North Irish Sea Array										
Hole No.			nple	Soil Description bul		Dens bulk	ity dry	W	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
11010110.	Ref	Тор	Base	Туре	Con Bocompuon	Mg/m		%	%	%	%	%	Mg/m3	Classification
TP23	4	1.50		В	Brown sandy slightly gravelly silty CLAY.			11.0						
TP23	5	2.20		В	Brown sandy slightly gravelly silty CLAY.			12.0	70	33	19	14		CL

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

LAB 01R Version 5

Key Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 13/04/2022 wd - water displacement cas - Casagrande method gj - gas jar wi - immersion in water 1pt - single point test Stephen.Watsor

CAUSEWAY PARTICLE SIZE DISTRIBUTION -				Job Ref	21-1619	
— БЕОТЕСН	PAN	PARTICLE SIZE DISTRIBUTION			Borehole/Pit No.	TP16
Site Name	North Irish Sea Array			Sample No.	3	
Soil Description	Brown sandy slightly gr	avelly silty CLAY.	Depth, m	1.00		
Specimen Reference	7	Specimen Depth	Sample Type	В		
Test Method	BS1377:Part 2:1990, cla	nuses 9.2 and 9.5		KeyLAB ID	Caus2022031519	



Siev	ving	Sedimentation				
Particle Size mm	% Passing	Particle Size mm	% Passing			
125	100	0.06300	48			
90	100	0.05188	42			
75	100	0.03690	39			
63	100	0.02639	34			
50	100	0.01887	28			
37.5	100	0.00990	20			
28	100	0.00506	8			
20	100	0.00295	3			
14	98	0.00156	0			
10	95					
6.3	90					
5	87					
3.35	82					
2	74					
1.18	71					
0.6	66	Particle density	(assumed)			
0.425	64	2.65	Mg/m3			
0.3	62					
0.212	59					
0.15	55					
0.063	48					

Dry Mass of sample, g	526
'	

Sample Proportions	% dry mass			
Cobbles	0.0			
Gravel	25.6			
Sand	26.7			
Silt	46.6			
Clay	1.1			

Grading Analysis		
D100	mm	
D60	mm	0.248
D30	mm	0.0212
D10	mm	0.00556
Uniformity Coefficient		45
Curvature Coefficient		0.33

#### Remarks

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

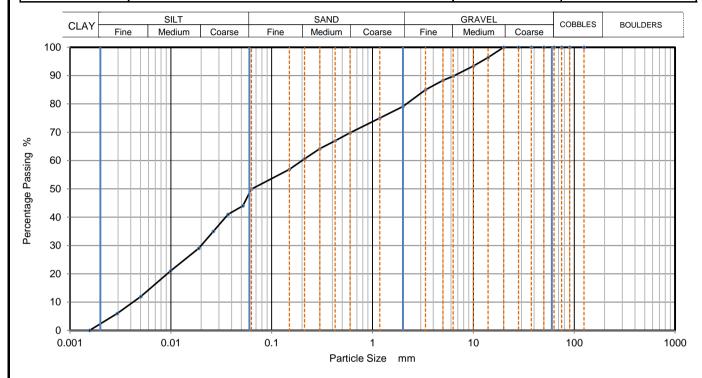




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10122

CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
GEOTECH	PAN	TICLE SIZE DIS	: SIZE DISTRIBUTION -		Borehole/Pit No.	TP16
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	4
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	2.50	
Specimen Reference	7	Specimen Depth	2.5	m	Sample Type	В
Test Method	BS1377:Part 2:1990, cla	nuses 9.2 and 9.5			KeyLAB ID	Caus2022031520



Sievi	ing	Sedimo	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	50
90	100	0.05188	44
75	100	0.03690	41
63	100	0.02639	35
50	100	0.01887	29
37.5	100	0.00990	21
28	100	0.00503	12
20	100	0.00293	6
14	96	0.00156	0
10	93		
6.3	90		
5	88		
3.35	85		
2	79		
1.18	75		
0.6	70	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	64		
0.212	61	1	
0.15	57	1	
0.063	50	1	

Dry Mass of sample, g	502

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.9
Sand	29.2
Silt	47.6
Clay	2.3

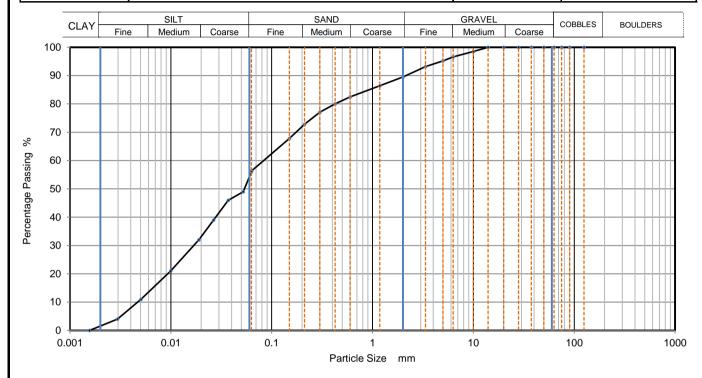
Grading Analysis		
D100	mm	
D60	mm	0.2
D30	mm	0.0196
D10	mm	0.00429
Uniformity Coefficient		47
Curvature Coefficient		0.45

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
GEOTECH	PAN	TICLE SIZE DIS	: SIZE DISTRIBUTION -		Borehole/Pit No.	TP17
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	4
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	1.60	
Specimen Reference	6	Specimen Depth	1.6	m	Sample Type	В
Test Method	BS1377:Part 2:1990, cla	nuses 9.2 and 9.5			KeyLAB ID	Caus2022031522



Siev	ving	Sedimentation		
Particle Size mm	% Passing	Particle Size mm	% Passing	
125	100	0.06300	56	
90	100	0.05218	49	
75	100	0.03711	46	
63	100	0.02654	39	
50	100	0.01897	32	
37.5	100	0.00996	21	
28	100	0.00506	11	
20	100	0.00295	4	
14	100	0.00156	0	
10	99			
6.3	97			
5	95			
3.35	93			
2	90			
1.18	86			
0.6	83	Particle density	(assumed)	
0.425	80	2.65	Mg/m3	
0.3	77			
0.212	73			
0.15	68			
0.063	56			

Dry Mass of sample, g	540	
Sample Proportions	% dry mass	
Cobbles	0.0	
Gravel	10.5	

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	10.5
Sand	33.1
Silt	55.0
Clay	1.4

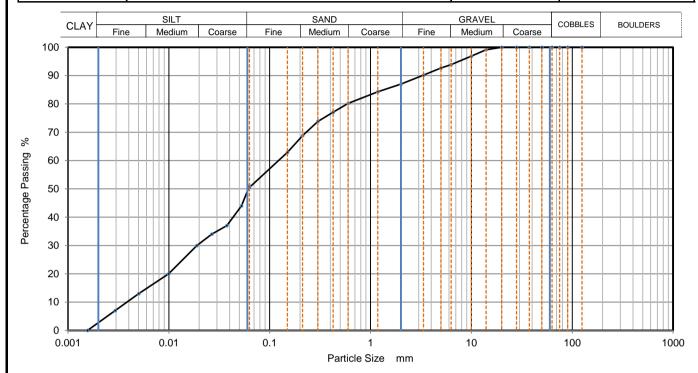
Grading Analysis		
D100	mm	
D60	mm	0.083
D30	mm	0.0171
D10	mm	0.00485
Uniformity Coefficient		17
Curvature Coefficient		0.73

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





CAUSEWAY	DAG	TICLE CIZE DISTRIBUTION			Job Ref	21-1619
—— GEOTECH	PARTICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP18		
Site Name	North Irish Sea Arra	North Irish Sea Array			Sample No.	4
Soil Description	Brown sandy slightly	Brown sandy slightly gravelly silty CLAY.			Depth, m	1.50
Specimen Reference	6	Specimen Depth	1.5	m	Sample Type	В
Test Method	BS1377:Part 2:1990,	clauses 9.2 and 9.5			KeyLAB ID	Caus2022031525



Siev	/ing	Sedime	entation				
Particle Size mm	% Passing	Particle Size mm	% Passing				
125	100	0.06300	51				
90	100	0.05248	44				
75	100	0.03753	37				
63	100	0.02669	34				
50	100	0.01897	30				
37.5	100	0.00996	20				
28	100	0.00503	13				
20	100	0.00293	7				
14	99	0.00156	0				
10	97						
6.3	94						
5	93						
3.35	90						
2	87						
1.18	84						
0.6	80	Particle density	(assumed)				
0.425	77	2.65	Mg/m3				
0.3	74						
0.212	69	1					
0.15	63	1					
0.063	51	1					

Dry Mass of sample, g	502
	•

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	13.0
Sand	36.5
Silt	47.9
Clay	2.6

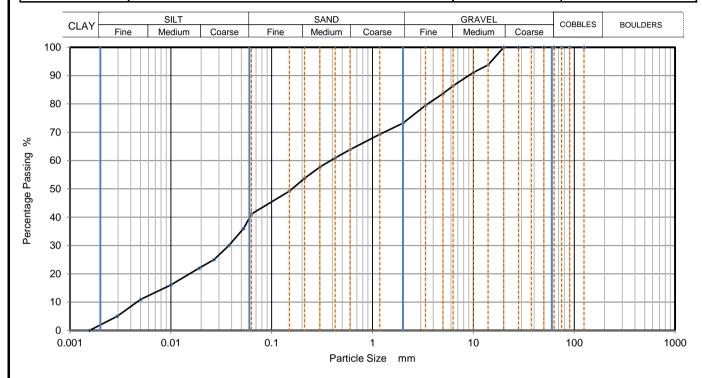
Grading Analysis		
D100	mm	
D60	mm	0.122
D30	mm	0.0186
D10	mm	0.00381
Uniformity Coefficient		32
Curvature Coefficient		0.74

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619	
GEOTECH GEOTECH			Borehole/Pit No.	TP18	
Site Name	North Irish Sea Array			Sample No.	5
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	2.60
Specimen Reference	6 Specimen 2.6 m			Sample Type	В
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022031526



Sieving		Sedimo	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.05248	36
75	100	0.03753	30
63	100	0.02683	25
50	100	0.01908	22
37.5	100	0.00996	16
28	100	0.00503	11
20	100	0.00293	5
14	94	0.00156	0
10	91		
6.3	86		
5	84		
3.35	80		
2	73		
1.18	69		
0.6	64	Particle density	(assumed)
0.425	61	2.65	Mg/m3
0.3	58		
0.212	54	1	
0.15	49	1	
0.063	41	1	

Dry Mass of sample, g	505
	·

Sample Proportions	% dry mass	
Cobbles	0.0	
Gravel	26.8	
Sand	32.2	
Silt	38.8	
Clay	2.2	

Grading Analysis		
D100	mm	
D60	mm	0.384
D30	mm	0.0372
D10	mm	0.00458
Uniformity Coefficient		84
Curvature Coefficient		0.79

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

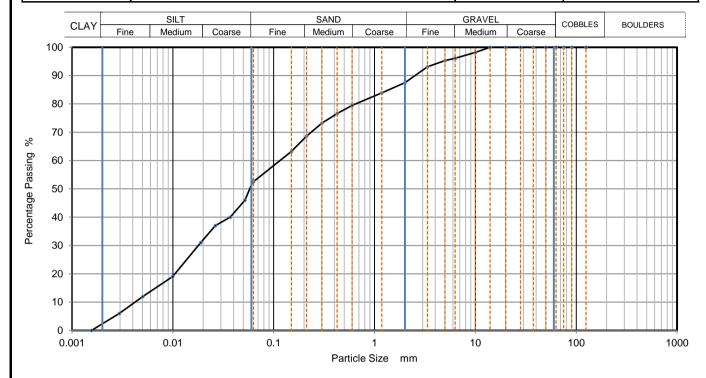




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CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619	
—— GEOTECH			Borehole/Pit No.	TP22	
Site Name	North Irish Sea Array			Sample No.	3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	0.80
Specimen Reference	6 Specimen 0.8 m			Sample Type	В
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022031527



Sieving		Sedimo	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	53
90	100	0.05188	46
75	100	0.03711	40
63	100	0.02639	37
50	100	0.01887	31
37.5	100	0.00996	19
28	100	0.00503	12
20	100	0.00293	6
14	100	0.00156	0
10	98		
6.3	96		
5	95		
3.35	93		
2	88		
1.18	84		
0.6	80	Particle density	(assumed)
0.425	77	2.65	Mg/m3
0.3	73		
0.212	69		
0.15	63		
0.063	53		

Dry Mass of sample, g	366
•	

Sample Proportions	% dry mass	
Cobbles	0.0	
Gravel	12.5	
Sand	35.0	
Silt	50.1	
Clay	2.4	

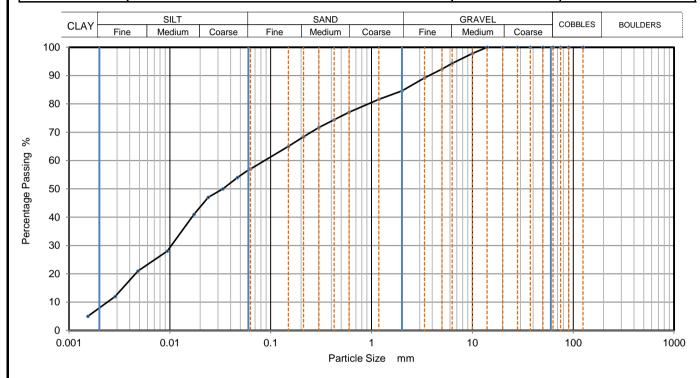
Grading Analysis		
D100	mm	
D60	mm	0.116
D30	mm	0.018
D10	mm	0.0041
Uniformity Coefficient		28
Curvature Coefficient		0.69

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





CAUSEWAY PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619			
GEOTECH GEOTECH	PARTICLE SIZE DISTRIBUTION			Borehole/Pit No.	TP23	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	0.50	
Specimen Reference	7 Specimen 0.5 m		Sample Type	В		
Test Method	BS1377:Part 2:1990, cla	nuses 9.2 and 9.5			KeyLAB ID	Caus2022031530



Sieving		Sedimentation		
Particle Size mm	% Passing	Particle Size mm	% Passing	
125	100	0.06199	57	
90	100	0.04677	54	
75	100	0.03355	50	
63	100	0.02405	47	
50	100	0.01735	41	
37.5	100	0.00942	28	
28	100	0.00482	21	
20	100	0.00286	12	
14	100	0.00154	5	
10	98			
6.3	94			
5	92			
3.35	89			
2	85			
1.18	82			
0.6	77	Particle density	(assumed)	
0.425	74	2.65	Mg/m3	
0.3	72		_	
0.212	68			
0.15	65			
0.063	57			

Dry Mass of sample, g	331
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Sample Proportions % dry mass	
Cobbles	0.0
Gravel	15.4
Sand	27.6
Silt	48.9
Clay	8.1

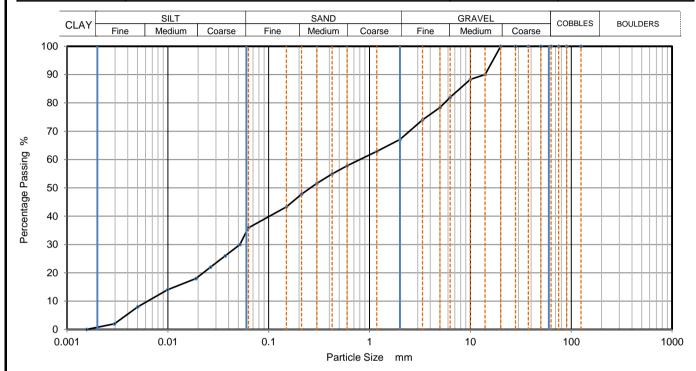
Grading Analysis		
D100	mm	
D60	mm	0.0875
D30	mm	0.0105
D10	mm	0.00237
Uniformity Coefficient		37
Curvature Coefficient		0.53

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





CAUSEWAY PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619			
—— GEOTECH	PARTICLE SIZE DISTRIBUTION			Borehole/Pit No.	TP23	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	5
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	2.20	
Specimen Reference	6 Specimen 2.2 m		Sample Type	В		
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus2022031532



Siev	/ing	Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	36
90	100	0.05188	30
75	100	0.03711	26
63	100	0.02654	22
50	100	0.01897	18
37.5	100	0.00990	14
28	100	0.00503	8
20	100	0.00295	2
14	90	0.00156	0
10	88		
6.3	82		
5	78		
3.35	74		
2	67		
1.18	63		
0.6	58	Particle density	(assumed)
0.425	55	2.65	Mg/m3
0.3	52		_
0.212	48		
0.15	43		
0.063	36		

Dry Mass of sample, g	505

Sample Proportions % dry mass	
Cobbles	0.0
Gravel	32.9
Sand	31.2
Silt	35.1
Clay	0.8

Grading Analysis		
D100	mm	
D60	mm	0.804
D30	mm	0.052
D10	mm	0.00633
Uniformity Coefficient		130
Curvature Coefficient		0.53

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

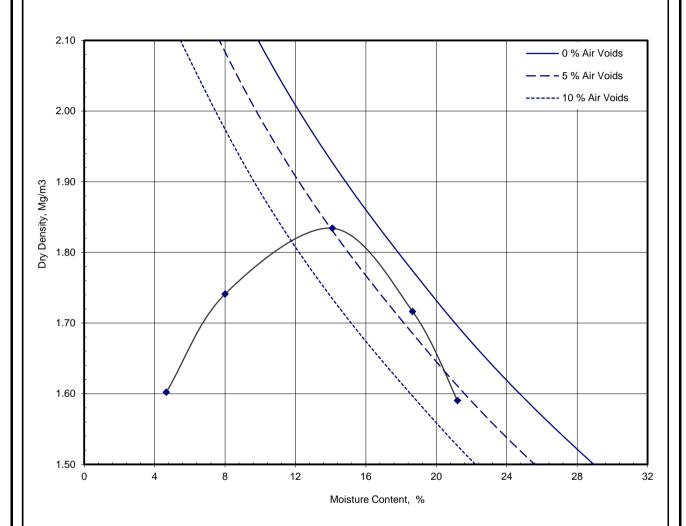




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CALISEWAY	Dry Density / Moisture Content Relationship		Job Ref	21-1619		
Light Compaction	Borehole / Pit No	TP17				
Site Name	North Irish Sea Array			Sample No	5	
Soil Description	Brown sandy slightly gravelly silty CLAY.		Depth	2.70	m	
Specimen Ref.	4 Specimen Depth m		Sample Type	В		
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer		Keylab ID	Caus202203	31523	



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	%	1
Particle Density - Assumed	Mg/m³	2.65

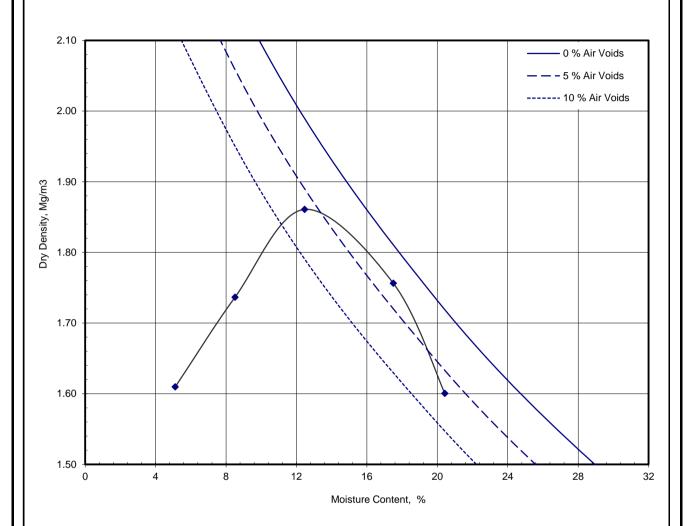
Maximum Dry Density	Mg/m³	1.83
Optimum Moisture Content	%	14

Approved

Stephen.Watson



CALISEWAY	Dry Density / Moisture Content Relationship		Job Ref	21-161	9	
GEOTECH		Light Compaction		Borehole / Pit No	TP22	
Site Name	North Irish Sea Array			Sample No	4	
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth	1.50	m
Specimen Ref.	4 Specimen Depth m		Sample Type	В		
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer			Keylab ID	Caus202203	31528



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	%	3
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	1.86
Optimum Moisture Content	%	12

Remarks
Approved

Stephen.Watson

UKAS TESTING



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

Project No.

Project Name

21-1619

North Irish Sea Array

								,		
Hole No.	Ref		nple Base	Туре	Soil Description	Retained on 20mm sieve	Moisture Content <20mm	Moisture Condition Value	Method of Interpretation	Remarks
	1101	100	Baoo	1.700		%	%			
TP16	4	2.50		В	Brown sandy slightly gravelly silty CLAY.	0	11	12.8	Best fit line	
TP17	3	1.00		В	Brown sandy slightly gravelly silty CLAY.	1	39	11.3	Best fit line	
TP18	3	0.80		В	Brown sandy slightly gravelly silty CLAY.	0	23	4.7	Best fit line	
TP22	5	2.80		В	Brown sandy slightly gravelly silty CLAY.	0	10	13.2	Best fit line	
TP23	4	1.50		В	Brown sandy slightly gravelly silty CLAY.	4	11	3.1	Best fit line	
			-						LA	B 10R - Version 6

Key

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

Date Printed

Approved By

13/04/2022

Stephen.Watson



CAUSEWAY	Moisture Condition Value / Moisture Content				21-1619
———GEOTECH	Relationship			Borehole/Pit No.	TP16
Site Name	North Irish Sea Array	North Irish Sea Array			3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth	1
Specimen Reference	8	Specimen Depth	1 m	Sample Type	В
Specimen Description	Brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022031519
Test Method	BS1377:Part4:1990:cla	ause 5.5		Date started	

Sample preparation

Amount of material larger than 20mm sieve removed

8 %

Natural Moisture Content of sample

15.4 %

Initial Moisture Content of test sample below 20mm

16.9 %

Separate specimens tested

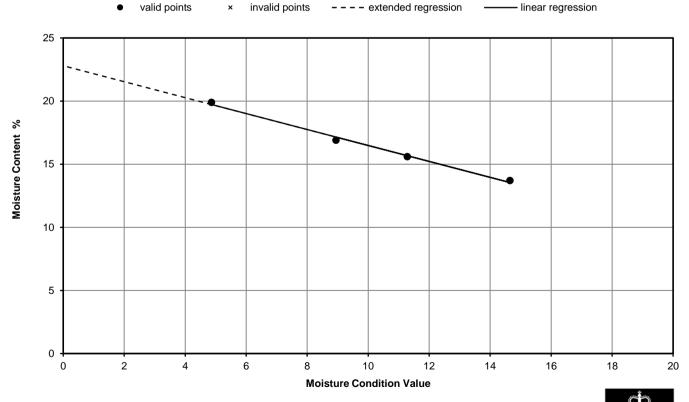
## General remarks

## Table of results

MCV Test Number
Moisture Content, %
Moisture Condition Value
MCV report
Effective / Valid data point

Specimen remarks

1	2	3	4	
17	16	14	20	
8.9	11.3	14.6	4.9	
8.9	11.3	14.6	4.9	
YES	YES	YES	YES	



Approved

Stephen.Watson

LAB 11R - Version 6



10122

CAUSEWAY	Moisture Condition Value / Moisture Content				Ref	21-1619
——— GEOTECH	Relationship			Bore	hole/Pit No.	TP23
Site Name	North Irish Sea Array	North Irish Sea Array			ple No.	3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Dept	h	0.5
Specimen Reference	8	Specimen Depth	0.5 n	n Sam	ple Type	В
Specimen Description	Brown sandy slightly gravelly silty CLAY.			KeyL	AB ID	Caus2022031530
Test Method	BS1377:Part4:1990:cla	S1377:Part4:1990:clause 5.5				

Sample preparation

Amount of material larger than 20mm sieve removed 2 %
Natural Moisture Content of sample 14.2 %
Initial Moisture Content of test sample below 20mm 11.4 %

Separate specimens tested

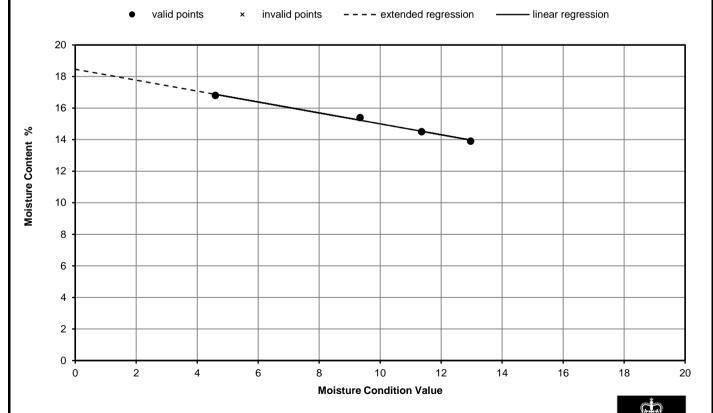
## General remarks

## Table of results

MCV Test Number
Moisture Content, %
Moisture Condition Value
MCV report
Effective / Valid data point

Specimen remarks

1	2	3	4	
15	14	17	15	
11.4	13.0	4.6	9.3	
11.4	13	4.6	9.3	
YES	YES	YES	YES	



Approved
Stephen.Watson
LAB 11R - Version 6

UKAS TESTING

10122



## LABORATORY REPORT



4043

**Contract Number: PSL22/2353** 

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:
 31/3/2022

 Date Commenced:
 31/3/2022

 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 R Berriman

(Director) (Quality Manager) (Laboratory Manager)

L Knight S Eyre T Watkins
(Assistant Laboratory Manager) (Senior Technician) (Senior Technician)

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

8/

S Royle

# **SUMMARY OF LABORATORY SOIL DESCRIPTIONS**

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP16	3	В	1.00		Brown gravelly sandy CLAY.
TP17	3	В	1.00		Brown CLAY.
TP18	3	В	0.80		Brown slightly gravelly slightly sandy CLAY.
TP22	3	В	0.80		Brown gravelly sandy CLAY.
TP23	3	В	0.50		Brown gravelly sandy CLAY.



North Irish Sea Array

Contract No:
PSL22/2353
Client Ref:
21-1619

# **SUMMARY OF THERMAL PROPERTY TESTS**

In accordance with ASTM-D5334

Hole	Sample	Sample	Тор	Base	Moisture Content	Bulk Density	Dry Density	Thermal Conductivity	Thermal Resistivity	
Number	Number	Type	Depth	<b>Dase Depth</b>	%	Mg/m <sup>3</sup>	Mg/m <sup>3</sup>	Conductivity	Resistivity	Remarks
	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-31	m	m	, •	1115/111	1415/111	W/m K	C.cm/W	
TP16	3	В	1.00		20	2.04	1.69	1.803	55.5	
TP17	3	В	1.00		39	1.76	1.27	1.340	74.6	
TP18	3	В	0.80		23	1.95	1.59	1.817	55.1	
TP22	3	В	0.80		18	2.07	1.76	2.150	46.5	
TP23	3	В	0.50		14	2.14	1.88	2.022	49.5	

		Contract No:
	Nouth Ivish Son Annov	PSL22/2353
	North Irish Sea Array	Client Ref:
Professional Soils Laboratory		21-1619



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-12438-1

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: 5

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

Date Approved: 11-Apr-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

## Results - Soil

## Project: 21-1619 North Irish Sea Array

Client: Causeway Geotech Ltd	Chemtest Job No.:		22-12438	22-12438	22-12438	22-12438	22-12438		
Quotation No.:	(	Chemte	st Sam	ple ID.:	1403834	1403835	1403836	1403837	1403838
Order No.:		Clier	nt Samp	le Ref.:	3	5	4	5	4
	Sample Location:			ocation:	TP16	TP17	TP18	TP22	TP23
			Sample	е Туре:	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				1.0	2.7	1.5	2.8	1.5
	Date Sampled:				31-Mar-2022	31-Mar-2022	31-Mar-2022	31-Mar-2022	31-Mar-2022
Determinand	Accred.	SOP	Units	LOD					
Moisture	N	2030	%	0.020	16	7.6	9.9	9.8	9.9
рН	U	2010		4.0	8.6	7.9	8.2	8.4	8.8
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.010	0.048	0.18	0.012
Total Sulphur	U	2175	%	0.010	0.024	0.069	0.032	0.23	0.069
Sulphate (Acid Soluble)	U	2430	%	0.010	0.038	0.016	0.017	0.032	0.030

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	рН	pH Meter
	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## **Report Information**

#### Key **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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



#### 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

28 April 2022

Registered in Ireland. Company Number: 633786

www.causewaygeotech.com

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 3 - 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	8		
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	5		
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	4		
SOIL	Moisture Condition Value at natural moisture content	BS 1377-4: 1990: Cl 5.4	3		
SOIL	Moisture Condition Value / Moisture Content Relationship	BS 1377-4: 1990: Cl 5.5	1		
SOIL	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377-4: 1990: Cl 3.3 & 3.4	1		

## **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 (UKAS 4043)	Thermal Resistivity		2
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	BRE Test - Suite B		3



## **Summary of Classification Test Results**

North Irish Sea Array

Project No. Project

21-1619

Project Name

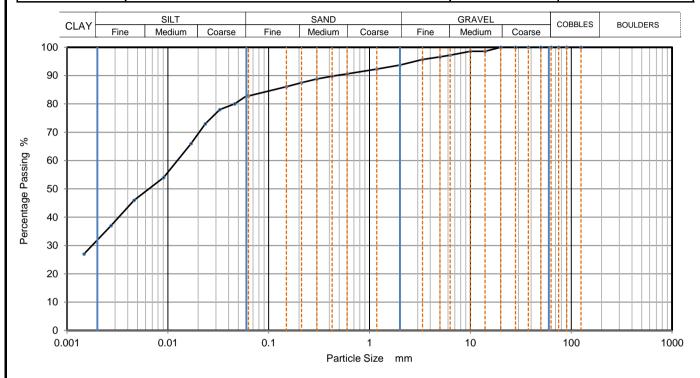
		Sar	nple	ſ	0.115	Dens bulk		W	Passing 425µm	LL	PL	PI	Particle	Casagrande
Hole No.	Ref	Тор	Base	Туре	Soil Description	Mg/m	dry 3	%	% %	%	%	%	density Mg/m3	Classification
TP19	3	1.00		В	Dark grey sandy slightly gravelly silty CLAY.			21.0	93	37	16	21		СІ
TP19	4	2.00		В	Dark grey slightly gravelly clayey fine to coarse SAND.			8.8	39	37	16	21		CI
TP19	5	3.00		В	Dark grey slightly gravelly clayey fine to coarse SAND.			10.0						
TP24	3	1.00		В	Brownish grey sandy slightly gravelly silty CLAY.			20.0	63	31	20	11		CL
TP24	4	2.00		В	Brownish grey sandy slightly gravelly silty CLAY.			13.0	62	31	19	12		CL
TP25	3	1.00		В	Brownish grey sandy slightly gravelly silty CLAY.			25.0	82	27	18	9		CL
TP25	4	2.00		В	Brown slightly gravelly clayey fine to coarse SAND.			8.8						
TP25	5	2.80		В	Dark brown sandy slightly gravelly silty CLAY.			21.0	88	27	14	13		CL

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

LAB 01R Version 5

Key Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 04/12/2022 00:00 wd - water displacement cas - Casagrande method gj - gas jar 10122 wi - immersion in water 1pt - single point test Stephen.Watson

CAUSEWAY	DART	ICLE SIZE DIST	FDIDLITION	Job Ref	21-1619	
—— GEOTECH	PANI	ICLE SIZE DIST	IKIBUTION	Borehole/Pit No.	TP19	
Site Name	North Irish Sea Array			Sample No.	3	
Soil Description	Dark grey sandy slightly	gravelly silty CLAY.		Depth, m	1.00	
Specimen Reference	7	Specimen Depth	1	Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	uses 9.2 and 9.5		KeyLAB ID	Caus2022031533	



Sievi	ng	Sedimentation				
Particle Size mm	% Passing	Particle Size mm	% Passing			
125	100	0.06134	83			
90	100	0.04596	80			
75	100	0.03275	78			
63	100	0.02350	73			
50	100	0.01698	66			
37.5	100	0.00907	54			
28	100	0.00462	46			
20	100	0.00274	37			
14	99	0.00147	27			
10	99					
6.3	97					
5	97					
3.35	96					
2	94					
1.18	92					
0.6	91	Particle density	(assumed)			
0.425	90	2.65	Mg/m3			
0.3	89					
0.212	88					
0.15	86					
0.063	83	1				

Dry Mass of sample, g	504
1	0/ 1

Sample Proportions	% dry mass				
Cobbles	0.0				
Gravel	6.3				
Sand	10.9				
Silt	51.2				
Clay	31.6				

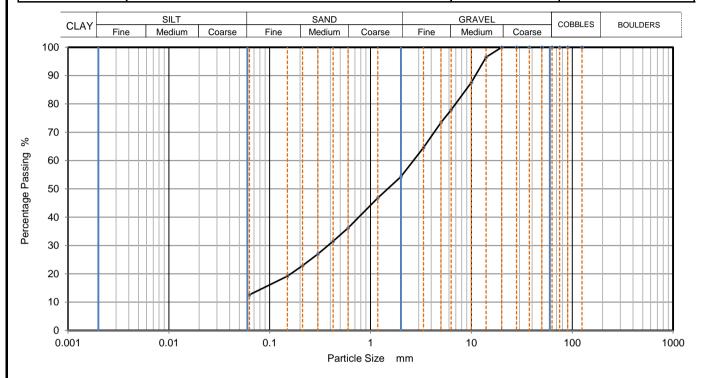
Grading Analysis		
D100	mm	
D60	mm	0.0126
D30	mm	0.00181
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

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





CALISEWAY	CAUSEWAY PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
—— GEOTECH	PANI	TICLE SIZE DISTRIBUTION -		Borehole/Pit No.	TP19	
Site Name	North Irish Sea Array			Sample No.	4	
Soil Description	Dark grey slightly gravelly clayey fine to coarse SAND.			Depth, m	2.00	
Specimen Reference	6 Specimen 2 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	use 9.2			KeyLAB ID	Caus2022031534



Siev	Sieving		ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	97		
10	88		
6.3	78		
5	73		
3.35	65		
2	54		
1.18	47		
0.6	36		
0.425	32		
0.3	27		
0.212	23		
0.15	19		
0.063	13		

Dry Mass of sample, g	502

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	45.7
Sand	41.6
Fines < 0.063 mm	13.0

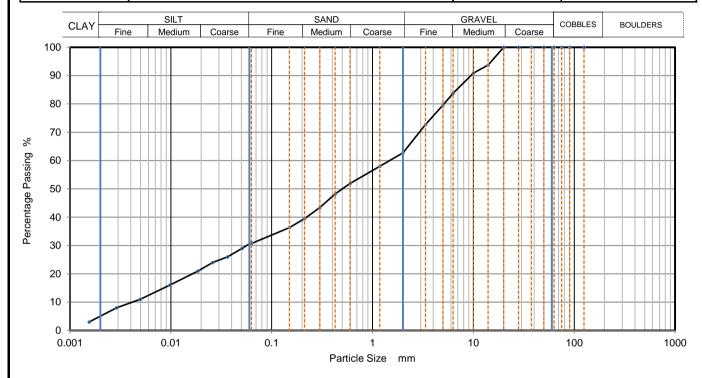
Grading Analysis		
D100	mm	
D60	mm	2.66
D30	mm	0.377
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

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





CAUSEWAY PARTICLE SIZE DISTRIBUTION -		Job Ref	21-1619			
GEOTECH	PANI	ARTICLE SIZE DISTRIBUTION -		Borehole/Pit No.	TP24	
Site Name	North Irish Sea Array			Sample No.	3	
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Depth, m	1.00	
Specimen Reference	8 Specimen 1 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	uses 9.2 and 9.5			KeyLAB ID	Caus2022031536



Sievi	ing	Sedimentation			
Particle Size mm	% Passing	Particle Size mm	% Passing		
125	100	0.06300	31		
90	100	0.05096	29		
75	100	0.03648	26		
63	100	0.02595	24		
50	100	0.01857	21		
37.5	100	0.00976	16		
28	100	0.00496	11		
20	100	0.00289	8		
14	94	0.00155	3		
10	91				
6.3	84				
5	80				
3.35	73				
2	63				
1.18	58				
0.6	52	Particle density	(assumed)		
0.425	48	2.65	Mg/m3		
0.3	43				
0.212	40	1			
0.15	36	1			
0.063	31	1			

Dry Mass of sample, g	509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	37.3
Sand	32.0
Silt	25.5
Clay	5.2

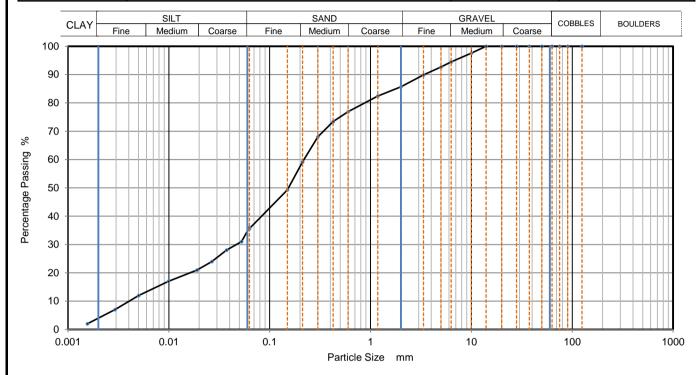
Grading Analysis		
D100	mm	
D60	mm	1.48
D30	mm	0.0574
D10	mm	0.00399
Uniformity Coefficient		370
Curvature Coefficient		0.56

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -		Job Ref	21-1619		
—— GEOTECH	PANII	PARTICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP25	
Site Name	North Irish Sea Array			Sample No.	3	
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Depth, m	1.00	
Specimen Reference	8 Specimen 1 m			Sample Type	В	
Test Method	<u> </u>				KeyLAB ID	Caus2022031538



Sieving		Sedimentation		
Particle Size mm	% Passing	Particle Size mm	% Passing	
125	100	0.06300	36	
90	100	0.05252	31	
75	100	0.03736	28	
63	100	0.02672	24	
50	100	0.01900	21	
37.5	100	0.00992	17	
28	100	0.00501	12	
20	100	0.00293	7	
14	100	0.00156	2	
10	98			
6.3	95			
5	93			
3.35	90			
2	86			
1.18	82			
0.6	77	Particle density	(assumed)	
0.425	73	2.65	Mg/m3	
0.3	68			
0.212	59			
0.15	49			
0.063	36			

Dry Mass of sample, g	508
imple Proportions	% dry mass

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.3
Sand	50.1
Silt	31.3
Clay	4.3

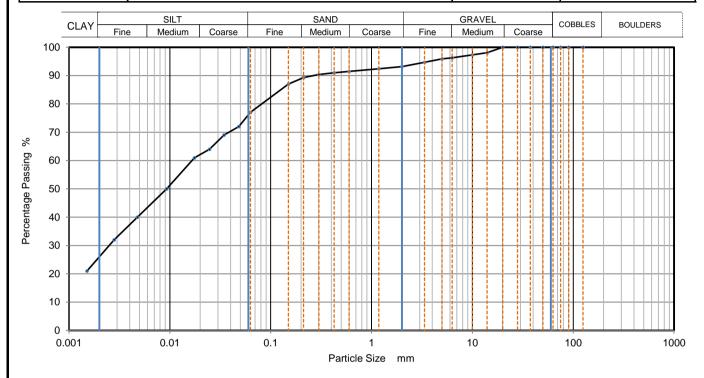
Grading Analysis		
D100	mm	
D60	mm	0.219
D30	mm	0.0465
D10	mm	0.00406
Uniformity Coefficient		54
Curvature Coefficient		2.4

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619	
—— GEOTECH	PANII	PARTICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP25
Site Name	North Irish Sea Array			Sample No.	5
Soil Description	Dark brown sandy slightly gravelly silty CLAY.			Depth, m	2.80
Specimen Reference	6 Specimen 2.8 m			Sample Type	В
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022031540



Sieving		Sedime	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	77
90	100	0.04837	72
75	100	0.03444	69
63	100	0.02468	64
50	100	0.01757	61
37.5	100	0.00931	50
28	100	0.00477	40
20	100	0.00280	32
14	98	0.00151	21
10	97		
6.3	96	1	
5	96	1	
3.35	95		
2	93		
1.18	92		
0.6	92	Particle density	(assumed)
0.425	91	2.65	Mg/m3
0.3	90		
0.212	89	1	
0.15	87	1	
0.063	77	1	

Dry Mass of sample, g	509

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	6.8
Sand	16.2
Silt	50.9
Clay	26.1

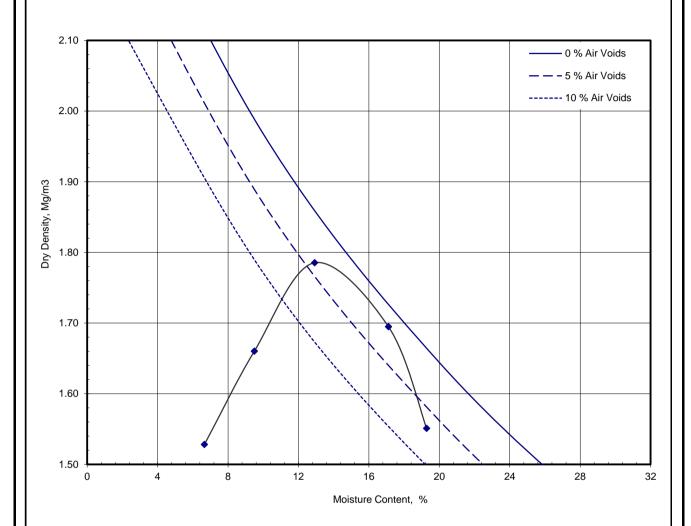
Grading Analysis		
D100	mm	
D60	mm	0.0165
D30	mm	0.00251
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

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





CAUSEWAY	Dry Dens	ity / Moisture Conte	/ Moisture Content Relationship Light Compaction		21-161	9
GEOTECH GEOTECH		Light Compact			TP25	
Site Name	North Irish Sea Array		Sample No	3		
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.		Depth	1.00	m	
Specimen Ref.	10 Specimen Depth m		Sample Type	В		
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer			Keylab ID	Caus202203	31538



Preparation		Material used was air dried
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/m³	2.45

Maximum Dry Density	Mg/m³	1.79
Optimum Moisture Content	%	13

Approved

Stephen.Watson



LAB 08R - Version 5

Remarks



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

Project No.

Project Name

21-1619

North Irish Sea Array

Sample						Retained on Moisture 20mm sieve Content		Moisture	Method	
Hole No.	Ref	Ref Top		Туре	Soil Description	20mm sieve	<20mm	Condition Value	of Interpretation	Remarks
			Base	<u> </u>		%	%			
TP19	3	1.00		В	Dark grey sandy slightly gravelly silty CLAY.	66	21	7.3	Best fit line	
TP24	3	1.00		В	Brownish grey sandy slightly gravelly silty CLAY.	32	19	3.2	Best fit line	
TP25	3	1.00		В	Brownish grey sandy slightly gravelly silty CLAY.	0	27	too wet	Best fit line	
									LA	B 10R - Version 6
					<del></del>				-	

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



CAUSEWAY	Moisture Con	dition Value /	Job Ref	21-1619	
——— GEOTECH		Relationsh	nip	Borehole/Pit No.	TP24
Site Name	North Irish Sea Array			Sample No.	3
Soil Description	Brownish grey sandy s	lightly gravelly silty	y CLAY.	Depth	1
Specimen Reference	10	Specimen Depth	Sample Type	В	
Specimen Description	Brownish grey sandy s	lightly gravelly silty	y CLAY.	KeyLAB ID	Caus2022031536
Test Method	BS1377:Part4:1990:cla	use 5.5		Date started	31/03/2022

Sample preparation

Amount of material larger than 20mm sieve removed 32 %
Natural Moisture Content of sample 12.1 %
Initial Moisture Content of test sample below 20mm 18.9 %
Separate specimens tested

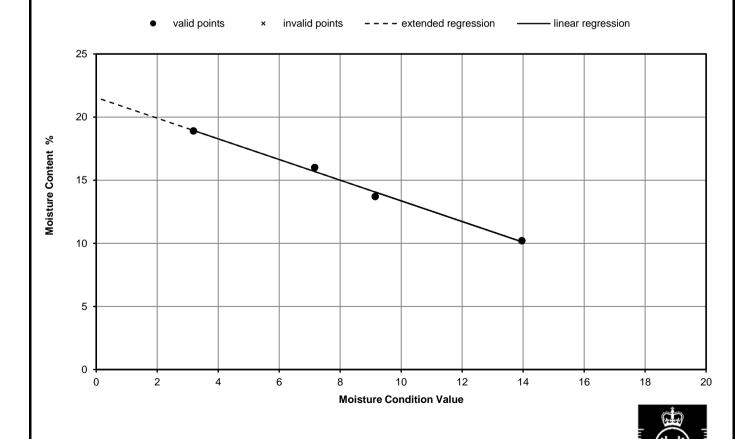
## General remarks

## Table of results

MCV Test Number
Moisture Content, %
Moisture Condition Value
MCV report
Effective / Valid data point

Specimen remarks

1	2	3	4	
19	16	10	14	
3.2	7.2	14.0	9.1	
3.2	7.2	14	9.1	
YES	YES	YES	YES	



Approved

Stephen.Watson

LAB 11R - Version 6



## LABORATORY REPORT



4043

**Contract Number: PSL22/2279** 

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 R Berriman S Royle

(Director) (Quality Manager) (Laboratory Manager)

8/

L Knight S Eyre T Watkins
(Assistant Laboratory Manager) (Senior Technician) (Senior Technician)

Page 1 of

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

# **SUMMARY OF LABORATORY SOIL DESCRIPTIONS**

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP19	3	В	1.00		Brown gravelly sandy CLAY.
TP25	3	В	1.00		Grey sandy slightly clayey GRAVEL.



North Irish Sea Array

Contract No:
PSL22/2279
Client Ref:
21-1619

# **SUMMARY OF THERMAL PROPERTY TESTS**

In accordance with ASTM-D5334

Hole	Sample	Sample	Тор	Base	Moisture Content	Bulk Density	Dry Density	Thermal Conductivity	Thermal Resistivity	Remarks
Number	Number	Type	Depth	Depth	%	Mg/m <sup>3</sup>	Mg/m <sup>3</sup>	W/m K	C.cm/W	10
TP19	3	В	m 1.00	m	15	2.18	1.90	2.098	47.7	
TP25	3	В	1.00		8.4	2.33	2.15	1.506	66.4	
1123	3	Б	1.00		0.4	2.33	2.13	1.300	00.4	
		_				_				
	•			•						

		Contract No:
	North Irish Sea Array	PSL22/2279
Bustonesia Salita Laborata	North Irish Sea Array	Client Ref:
Professional Soils Laboratory		21-1619



Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-11183-1

Initial Date of Issue: 31-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** 21-1618 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: 31-Mar-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

## Results - Soil

#### Project: 21-1618 North Irish Sea Array

Client: Causeway Geotech Ltd	Chemtest Job No.:			22-11183	22-11183	22-11183	
Quotation No.:	(	Chemte	st Sam	ple ID.:	1398048	1398049	1398050
Order No.:		Clie	nt Samp	le Ref.:	4	4	4
		Sa	ample Lo	ocation:	TP19	TP24	TP25
			Sampl	е Туре:	SOIL	SOIL	SOIL
			Top De	oth (m):	2.0	2.0	2.0
			Date Sa	ampled:	23-Mar-2022	23-Mar-2022	23-Mar-2022
Determinand	Accred.	SOP	Units	LOD			
Moisture	N	2030	%	0.020	12	13	10
рН	U	2010		4.0	8.8	8.8	8.8
Sulphate (2:1 Water Soluble) as SO4	U 2120 g/l 0.010			0.16	0.013	0.16	
Sulphate (Total)	U 2430 % 0.010			0.60	0.055	0.94	
Sulphate (Acid Soluble)	U	2430	%	0.010	0.036	< 0.010	0.022

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	рН	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 **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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



#### LABORATORY RESTRICTION REPORT

Project Reference	21-1619	То	Colm Hurley					
Project Name	North Irish Sea Array	Position	Project Manager					
1 Toject Name	North man oca Array	From	Stephen Watson					
TR reference	21-1619 / 3	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								

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		Sample		Test		
Number	Number	Depth (m)	Туре		Reason for Restriction	Required Action
TP24	3	(m) 1	В	Thermal Resistivity	Insufficient material	CANCEL

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

Laboratory Signature	Project Manager Signature
Stephen Watson	Colm Hurley
Date 16 April 2022	Date



#### 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

28 April 2022

Registered in Ireland. Company Number: 633786

www.causewaygeotech.com

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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.

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	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 (UKAS 4043)	Thermal Resistivity		6



### **Summary of Classification Test Results**

North Irish Sea Array

Project No.

Project Name

21-1619

21 Total														
		Sar	nple			Dens	ity	W	Passing	LL	PL	PI	Particle	0
Hole No.	Ref	Тор	Base	Туре	Soil Description	bulk	dry		425µm				density	Casagrande Classification
	IXCI	ТОР	Dasc	Турс		Mg/m	3	%	%	%	%	%	Mg/m3	
BH03	2	0.80	1.00	В	Brown sandy slightly gravelly silty CLAY.			23.0	83	42	21	21		CI
BH03	3	1.80	2.00	В	Brown sandy slightly gravelly silty CLAY.			14.0						
BH03	4	2.80	3.00	В	Brown sandy slightly gravelly silty CLAY.			13.0						
BH03	5	3.80	4.00	В	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		В	Greyish brown sandy slightly gravelly silty CLAY.			17.0	92	45	22	23		CI
TP02	3	1.00		В	Greyish brown sandy slightly gravelly silty CLAY.			14.0	67	30	19	11		CL
TP07	4	1.00		В	Greyish brown sandy slightly gravelly silty CLAY.			16.0	65	30	19	11		CL
TP07	6	2.00		В	Greyish brown sandy slightly gravelly silty CLAY.			14.0	67	40	16	24		CI
TP09	4	1.20		В	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 Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 04/11/2022 00:00 wd - water displacement cas - Casagrande method gj - gas jar 10122 wi - immersion in water 1pt - single point test Stephen.Watson



## **Summary of Classification Test Results**

Project No. Project Name

21-1619

North Irish Sea Array

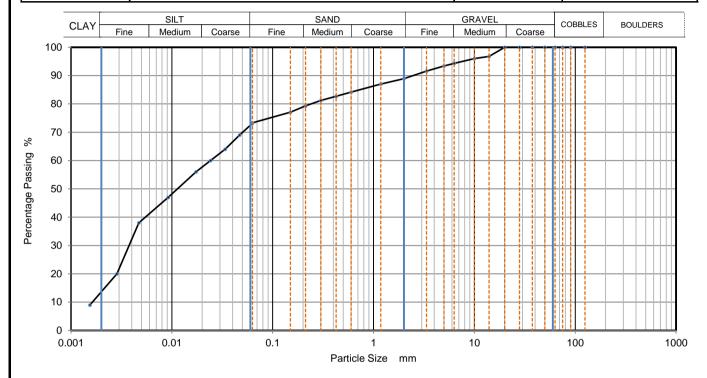
21-1	019	North first Sea Array												
Hole No.			nple	1	Soil Description	Dens bulk	ity dry	W	Passing 425µm	LL	PL	PI	Particle density	Casagrande
1.0.0 . 10.	Ref	Тор	Base	Туре	Con Decempnen	Mg/m		%	%	%	%	%	Mg/m3	Classification
TP20	3	1.00		В	Greyish brown sandy slightly gravelly silty CLAY.			32.0	89	53	26	27		СН
TP20	4	1.20		В	Greyish brown clayey fine to coarse SAND.			37.0	93	40	22	18		CI
TP21	3	1.00		В	Greyish brown sandy slightly gravelly clayey SILT with occasional shell fragments.			58.0	96	53	35	18		МН
														_

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

LAB 01R Version 5

Key Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 04/11/2022 00:00 wd - water displacement cas - Casagrande method gj - gas jar 10122 wi - immersion in water 1pt - single point test Stephen.Watson

CAUSEWAY	DADTI	CLE SIZE DIST	FDIRLITION	Job Ref	21-1619	
—— GEOTECH	PANII	Borehole/Pit No.	вноз			
Site Name	North Irish Sea Array				Sample No.	2
Soil Description	Brown sandy slightly grav	elly silty CLAY.			Depth, m	0.80
Specimen Reference	6	Specimen Depth	Sample Type	В		
Test Method	BS1377:Part 2:1990, clau	ses 9.2 and 9.5		KeyLAB ID	Caus2022032121	



Sievi	ng	Sedimo	entation
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)
0.425	83	2.65	Mg/m3
0.3	81		
0.212	79		
0.15	77	1	
0.063	73	1	

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

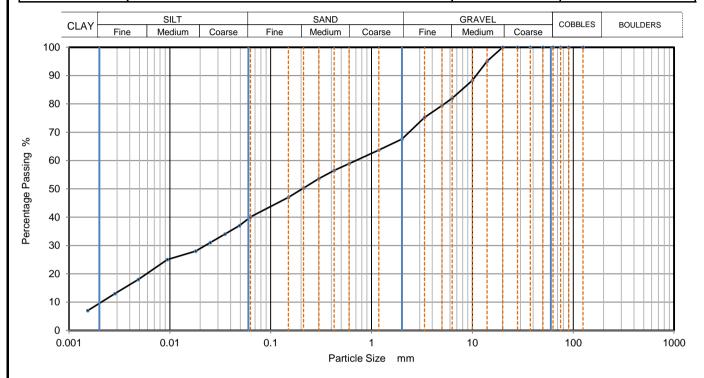
Grading Analysis		
D100	mm	
D60	mm	0.0242
D30	mm	0.00378
D10	mm	0.00164
Uniformity Coefficient		15
Curvature Coefficient		0.36

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -		Job Ref	21-1619		
GEOTECH GEOTECH			Borehole/Pit No.	вноз		
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	5
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	3.80	
Specimen Reference	6 Specimen 3.8 m		Sample Type	В		
Test Method	Method BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022032125	



Sieving		Sedimo	entation
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)
0.425	57	2.65	Mg/m3
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

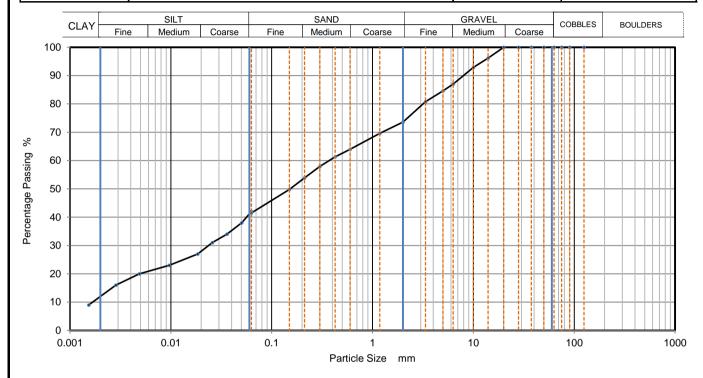
Grading Analysis		
D100	mm	
D60	mm	0.702
D30	mm	0.022
D10	mm	0.002
Uniformity Coefficient		350
Curvature Coefficient		0.34

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619	
GEOTECH GEOTECH	PAN	PARTICLE SIZE DISTRIBUTION		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 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)	
0.425	61	2.65	Mg/m3	
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

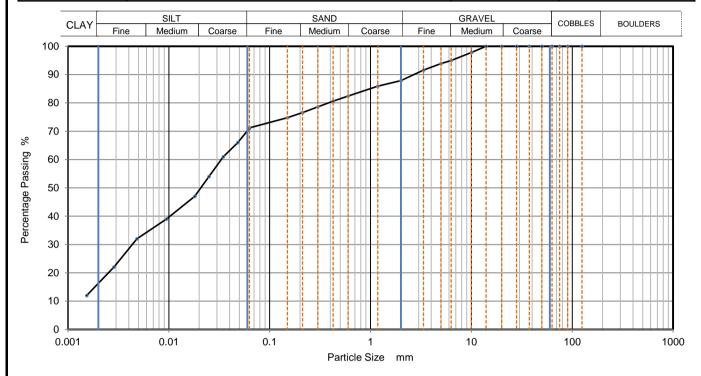
Grading Analysis		
D100	mm	
D60	mm	0.372
D30	mm	0.0242
D10	mm	0.00167
Uniformity Coefficient		220
Curvature Coefficient		0.95

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
GEOTECH	PAN	TICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP01	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	3
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	1.00	
Specimen Reference	7 Specimen 1 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	nuses 9.2 and 9.5			KeyLAB ID	Caus2022032129



Sievi	ng	Sedimo	entation
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)
0.425	81	2.65	Mg/m3
0.3	79		
0.212	77		
0.15	75	1	
0.063	71	1	

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		

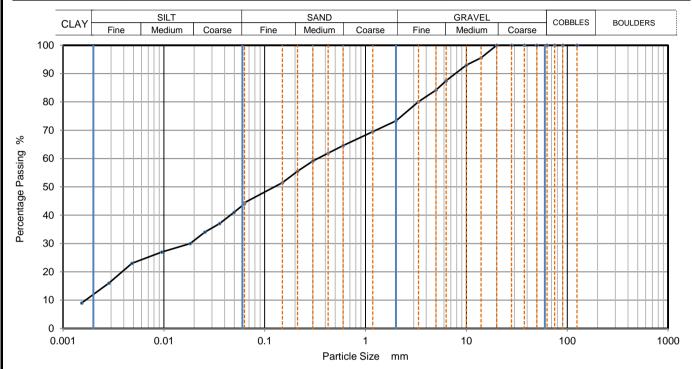
Grading Analysis		
D100	mm	
D60	mm	0.0326
D30	mm	0.00435
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
—— GEOTECH	PANII	TICLE SIZE DISTRIBUTION		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 1 m			Sample Type	В	
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)	
0.425	62	2.65	Mg/m3	
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

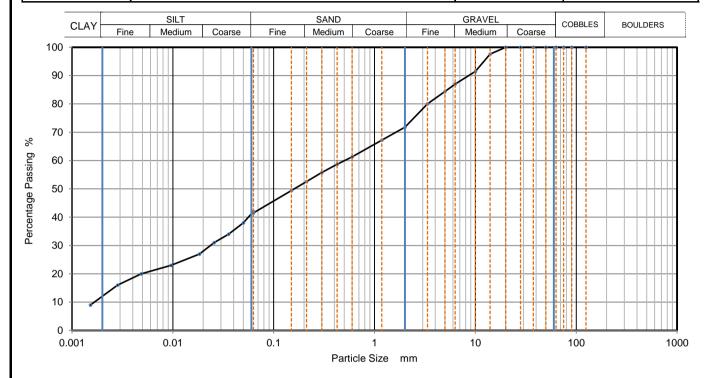
Preparation and testing in accordance with BS1377-2:1990 unless noted below





LAB 05R - Version 5

CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
—— GEOTECH	PANI	TICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP07	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	4
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	1.00	
Specimen Reference	7 Specimen 1 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	uses 9.2 and 9.5			KeyLAB ID	Caus2022032133



Siev	Sieving		entation
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)
0.425	59	2.65	Mg/m3
0.3	56		
0.212	53	1	
0.15	49	1	
0.063	42		

Dry Mass of sample, g	508	
unla Duamantiana	0/ descende	

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

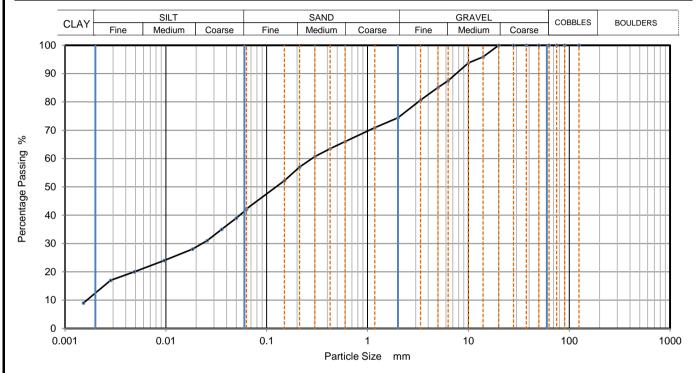
Grading Analysis		
D100	mm	
D60	mm	0.504
D30	mm	0.0241
D10	mm	0.00166
Uniformity Coefficient		300
Curvature Coefficient		0.7

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





<b>30</b> / 2			Job Ref	21-1619		
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			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 2 m Depth			Sample Type	В	
Test Method	S1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus2022032135



Sievi	ng	Sedimo	entation
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)
0.425	64	2.65	Mg/m3
0.3	61		
0.212	57		
0.15	52	1	
0.063	42	1	

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		

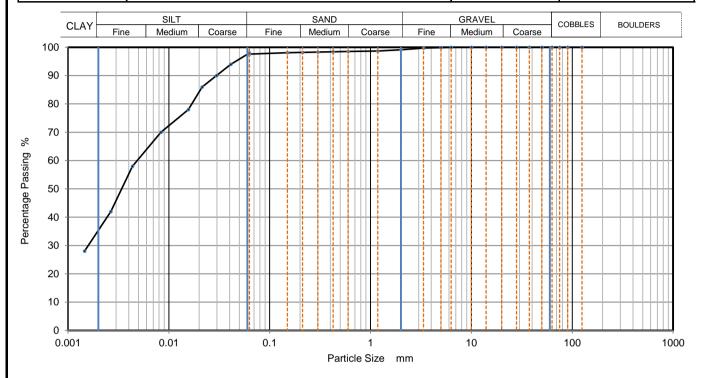
Grading Analysis		
D100	mm	
D60	mm	0.281
D30	mm	0.023
D10	mm	0.00163
Uniformity Coefficient		170
Curvature Coefficient		1.2

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
GEOTECH GEOTECH	PARTICLE SIZE DISTRIBUTION			Borehole/Pit No.	TP09	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	4
Soil Description	Greyish brown silty CLAY.			Depth, m	1.20	
Specimen Reference	7 Specimen 1.2 m		Sample Type	В		
Test Method	SS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022032137	



Sievi	ng	Sedimo	entation
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)
0.425	98	2.65	Mg/m3
0.3	98		
0.212	98	1	
0.15	98	1	
0.063	98	1	

Dry Mass of sample, g	508	
ample Proportions	% dry mass	

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		

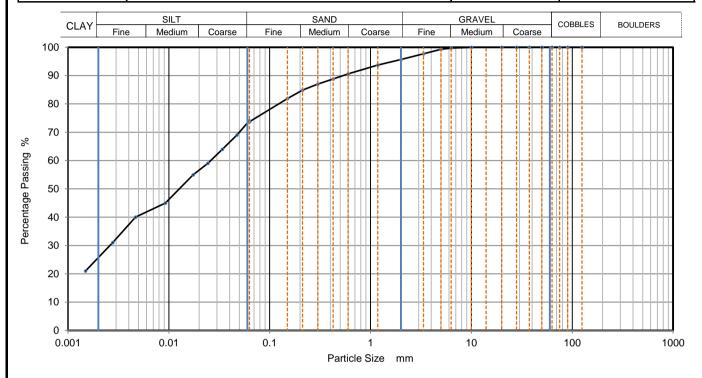
Preparation and testing in accordance with BS1377-2:1990 unless noted below





LAB 05R - Version 5

CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
— БЕОТЕСН	PANI	PARTICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP20	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	3
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	1.00	
Specimen Reference	6 Specimen 1 m			Sample Type	В	
Test Method BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022032138		



Sievi	ing	Sedimo	entation
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)
0.425	89	2.65	Mg/m3
0.3	87		
0.212	85		
0.15	82		
0.063	74	1	

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		

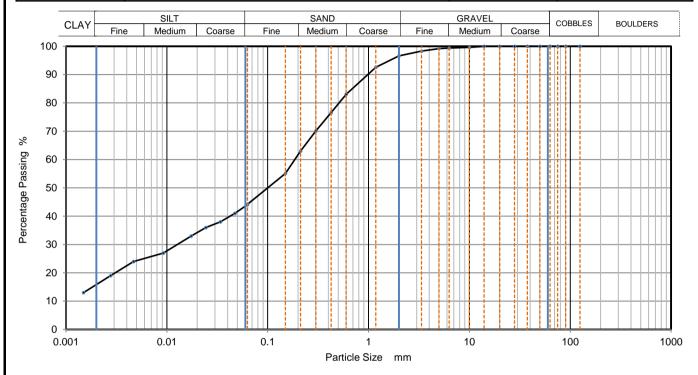
Preparation and testing in accordance with BS1377-2:1990 unless noted below





LAB 05R - Version 5

CAUSEWAY	PARTICLE SIZE DISTRIBUTION		Job Ref	21-1619		
—— GEOTECH	PANII	PARTICLE SIZE DISTRIBUTION		Borehole/Pit No.	TP20	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	4
Soil Description	Greyish brown clayey fine to coarse SAND.			Depth, m	1.20	
Specimen Reference	6 Specimen 1.2 m			Sample Type	В	
Test Method	Test Method BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus2022032139



Siev	ving	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)	
0.425	77	2.65	Mg/m3	
0.3	70			
0.212	63	1		
0.15	55	1		
0.063	44	1		

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		

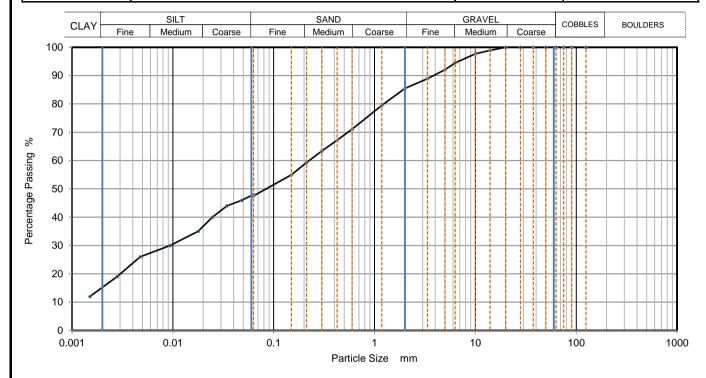
Preparation and testing in accordance with BS1377-2:1990 unless noted below





LAB 05R - Version 5

CAUSEWAY	DART	ICI E SIZE DISI	FDIDLITION	Job Ref	21-1619	
—— GEOTECH	PANI	PARTICLE SIZE DISTRIBUTION				TP21
Site Name	North Irish Sea Array			Sample No.	3	
Soil Description	Greyish brown sandy sli fragments.	ghtly gravelly clayey	SILT with occasional sh	Depth, m	1.00	
Specimen Reference	7	Specimen Depth	1	m	Sample Type	В
Test Method	BS1377:Part 2:1990, cla	uses 9.2 and 9.5		KeyLAB ID	Caus2022032140	



Sie	ving	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)			
0.425	67	2.65	Mg/m3			
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		

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







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

Project No.

Project Name

21-1619

North Irish Sea Array

21-	1619				North Irish Sea Array						
Hole No.		Sar	mple	1	Soil Description	Retained on 20mm sieve		Moisture Condition Value	Method of Interpretation	Remarks	
110.0 110.	Ref	Тор	Base	Type % %				romano			
TP01	3	1.00		В	Greyish brown sandy slightly gravelly silty CLAY.	0	20	13.0	Best fit line		
TP02	3	1.00		В	Greyish brown sandy slightly gravelly silty CLAY.	12	96	8.8	Best fit line		
TP07	4	1.00		В	Greyish brown sandy slightly gravelly silty CLAY.	14	16	8.7	Best fit line		
TP09	4	1.20		В	Greyish brown sandy slightly gravelly silty CLAY.	0	23	13.9	Best fit line		
TP21	3	1.00		В	Greyish brown slightly sandy silty CLAY with occasional shell fragments.	4	69	7.8	Best fit line		
			1	I	l				LA	B 10R - Version 6	

Key

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

annotated otherwise

Date Printed

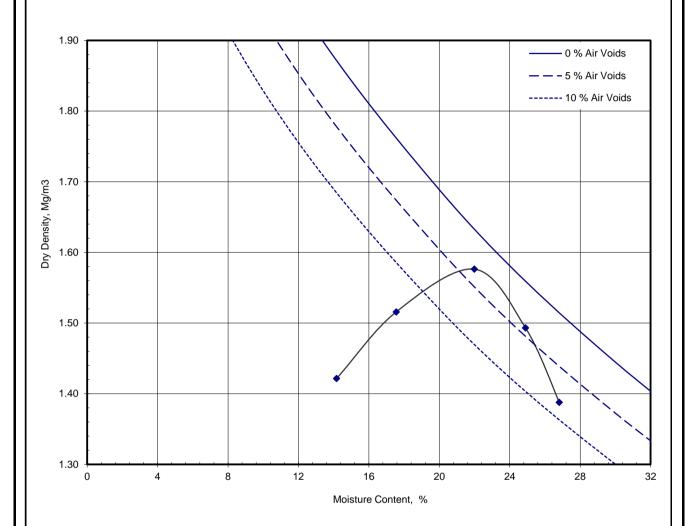
04/11/2022 00:00

Approved By

Stephen.Watson



CALISEWAY	Dry Dens	sity / Moisture Conte	ent Relationship	Job Ref	21-1619	9
CAUSEWAY GEOTECH		Light Compact	on	Borehole / Pit No	TP09	
Site Name		North Irish Sea Ar	Sample No	mple No 3		
Soil Description		Greyish brown silty C	LAY.	Depth	1.00	m
Specimen Ref.	2	Specimen Depth	m	Sample Type	В	
Test Method	BS13	77:Part 4:1990, clause 3.3	, 2.5kg rammer	Keylab ID	Caus202203	32136



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/m³	2.55

Maximum Dry Density	Mg/m³	1.58	
Optimum Moisture Content	%	22	

Approved

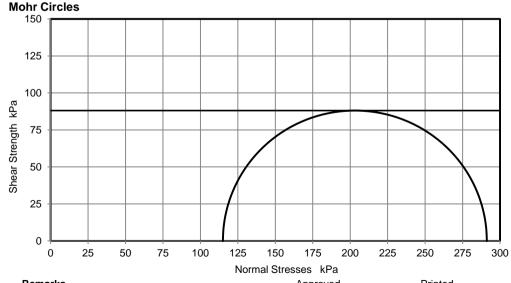
Stephen.Watson

Remarks



**	Unconsolidat					Job Re	ef			21-161	9
CAUSEWA	H	Compression Test without measurement of pore pressure - single specimen  Borehole/Pit No.								BH03	
Site Name		North Irish Sea Array Sample No.									
Soil Description	Brown sandy slightl	Brown sandy slightly gravelly silty CLAY. Depth								2.00	
Specimen Reference	2 Specimen 2.05 m Sample Type									U	
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY. KeyLAB ID								Ca	aus20220	
Test Method	BS1377 : Part 7 : 1	990, clause 8, sir	ngle specime	en		Date o	f test			30/03/20	)22
	Test Number Length Diameter Bulk Density Moisture Content Dry Density					,	1 210.1 104.3 2.21 12 1.97		mm mm Mg/m3 % Mg/m3		
	Rate of Strain								%/min kPa % kPa kPa kPa ½( σ1 - σ3 )f		
viator Stress v	Axial Strain										
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200				•		•					
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50											
0 2	4 6 8	10 12		16 18 Strain %	2	20 2	2 2	4	26	28	30 3
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125										change ane effec	
75									interpre by BS1: This is p		not covere
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0 1 25  Remarks	50 75 100	125 150 Normal Stre	Approved	200 225 Watson		Printed	75 36 2022 16:	00	1		₩ <b>X</b>
			Stepnen	.vvatson							TESTING
						LAB 15R	? - Versio	on 5			10122

	Unconsolidate	ed Undraine	d Triaxial		Job Ref			21-1619		
CAUSEWAY ——GEOTECH		Compression Test without measurement of pore pressure - single specimen  Borehole/Pit N						BH03		
Site Name	North Irish Sea Array		specimen		Sample N	0		14		
Soil Description	Brown sandy slightly		A.V.					5.00		
Specimen		Specimen			Depth					
Reference Specimen	4	Depth	5.05	m	Sample T	ype		U		
Description	Stiff brown sandy sli				KeyLAB II			2022032126		
est Method	BS1377 : Part 7 : 19	90, clause 8, sinç	gle specimen		Date of te	st	30	0/03/2022		
	Test Number Length Diameter Bulk Density Moisture Content Dry Density				1 210 105 2.2 11 2.0	.0	mm mm Mg/m3 % Mg/m3			
oton Strong and	Rate of Strain Cell Pressure At failure					4.0 115 19.9 176 88		%/min kPa % kPa kPa ½(σ1 - σ3 )f		
otor Stress v /	- Train									
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50 - Representation 100 - 100										
0										
	4 6 8	10 12	14 16 Axial Strai		20 22	24	26 2	8 30		



This is provided for information only.



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

Approved Stephen.Watson Printed

11/04/2022 16:04

LAB 15R - Version 5





## 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 R Berriman

(Director) (Quality Manager) (Laboratory Manager)

8/

Page 1 of

S Royle

L Knight S Eyre T Watkins
(Assistant Laboratory Manager) (Senior Technician) (Senior Technician)

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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

## **SUMMARY OF LABORATORY SOIL DESCRIPTIONS**

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP01	4	В	1.20		Dark brown slightly gravelly sandy CLAY.
TP02	4	В	1.20		Brown gravelly sandy CLAY.
TP07	5	В	1.20		Brown gravelly sandy CLAY.
TP09	4	В	1.20		Dark brown slightly sandy CLAY.
TP20	3	В	1.00		Brown slightly gravelly slightly sandy CLAY.
TP21	3	В	1.00		Dark brown sandy CLAY with some organic material.



North Irish Sea Array

Contract No:
PSL22/2280
Client Ref:
21-1619

## **SUMMARY OF THERMAL PROPERTY TESTS**

In accordance with ASTM-D5334

					Moisture	Bulk	Dry	Thermal	Thermal	
Hole	Sample	Sample	Top	Base	Content	Density	Density	Conductivity	Resistivity	Remarks
Number	Number	Type	Depth	Depth	%	$Mg/m^3$	$Mg/m^3$			Kemarks
			m	m				W/m K	C.cm/W	
TP01	4	В	1.20		19	2.01	1.68	1.893	52.8	
TP02	4	В	1.20		14	2.18	1.91	2.171	46.1	
<b>TP07</b>	5	В	1.20		16	2.14	1.84	2.095	47.7	
TP09	4	В	1.20		21	1.99	1.65	1.662	60.2	
TP20	3	В	1.00		31	1.86	1.42	1.657	60.4	
TP21	3	В	1.00		55	1.60	1.03	1.153	86.8	
									1	

		Contract No:
	North Irish Sea Array	PSL22/2280
Burtanianal Called about an	North Irish Sea Array	Client Ref:
Professional Soils Laboratory		21-1619



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> 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

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

20 April 2022

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

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	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.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
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

									<u> </u>					
		Sar	mple	_		Dens		W	Passing	LL	PL	PΙ	Particle	Casagrande
Hole No.	Ref	Тор	Base	Туре	Soil Description	bulk	dry		425µm				density	Classification
	1761	ТОР	Dase	Гуре		Mg/m	13	%	%	%	%	%	Mg/m3	o lacomoano.
ВН09	3	0.30	0.50	В	Brown sandy slightly gravelly silty CLAY.			22.0	81	30	18	12		CL
BH09	5	1.80	2.00	В	Brown sandy slightly gravelly silty CLAY.			14.0	77	25	15	10		CL
ВН09	10	3.00		D	Brown sandy slightly gravelly silty CLAY.			8.0						
BH09	6	3.80	4.00	В	Brown sandy gravelly silty CLAY.			11.0	58	25	14	11		CL
ВН09	7	4.80	5.00	В	Brown sandy slightly gravelly silty CLAY.			12.0						
BH09	8	5.80	6.00	В	Brown sandy clayey subangular fine to coarse GRAVEL.			6.2	53	24	13	11		CL
BH15	4	0.80	1.00	В	Brown sandy slightly gravelly silty CLAY.			16.0	69	33	18	15		CL
BH15	5	1.80	2.00	В	Greyish brown sandy slightly gravelly silty CLAY.			14.0						
BH15	6	2.80	3.00	В	Greyish brown sandy slightly gravelly silty CLAY.			14.0	70	28	16	12		CL
BH15	7	3.80	4.00	В	Greyish brown sandy slightly gravelly silty CLAY.			16.0						
BH15	8	4.80	5.00	В	Greyish brown sandy slightly gravelly silty CLAY.			15.0	70	27	14	13		CL
BH15	9	5.80	6.00	В	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 Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 20/04/2022 wd - water displacement cas - Casagrande method gj - gas jar 10122 wi - immersion in water 1pt - single point test Stephen.Watson



## **Summary of Classification Test Results**

Project No. Project Name

21-1619

North Irish Sea Array

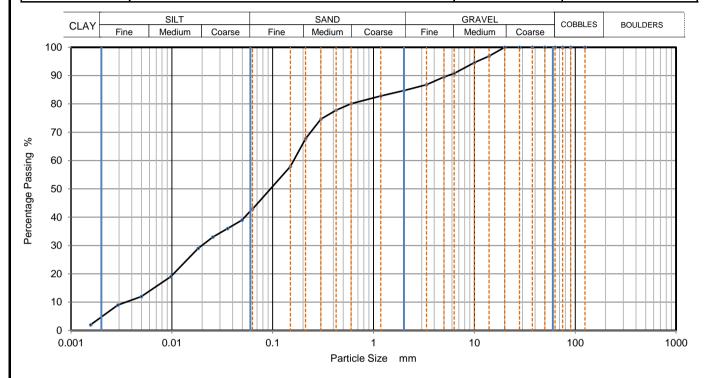
21-1		North Irish Sea Array												
Hole No.		Sar	nple		Soil Description	Dens bulk	ity dry	W	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
TIOIE NO.	Ref	Тор	Base	Туре	Soil Description	Mg/m		%	%	%	%	%	Mg/m3	Classification
BH15	18	6.00	6.45	U	Greyish brown sandy slightly gravelly silty CLAY.			14.0	65	28	14	14		CL
BH15	16	8.00		D	Greyish brown sandy slightly gravelly silty CLAY.			15.0						
	· · ·				I.									

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

LAB 01R Version 5

Key Date Printed Approved By Density test Liquid Limit Particle density Linear measurement unless : 4pt cone unless : sp - small pyknometer 20/04/2022 wd - water displacement cas - Casagrande method gj - gas jar 10122 wi - immersion in water 1pt - single point test Stephen.Watson

CAUSEWAY	DADTI	Job Ref	21-1619			
— GEOTECH	PANII	CLE SIZE DIST	INIBOTION	Borehole/Pit No.	вн09	
Site Name	North Irish Sea Array			Sample No.	3	
Soil Description	Brown sandy slightly grav	elly silty CLAY.	Depth, m	0.30		
Specimen Reference	6	Specimen Depth	0.3	m	Sample Type	В
Test Method	BS1377:Part 2:1990, clau	ses 9.2 and 9.5		KeyLAB ID	Caus2022032920	



Siev	/ing	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)				
0.425	78	2.65	Mg/m3				
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				

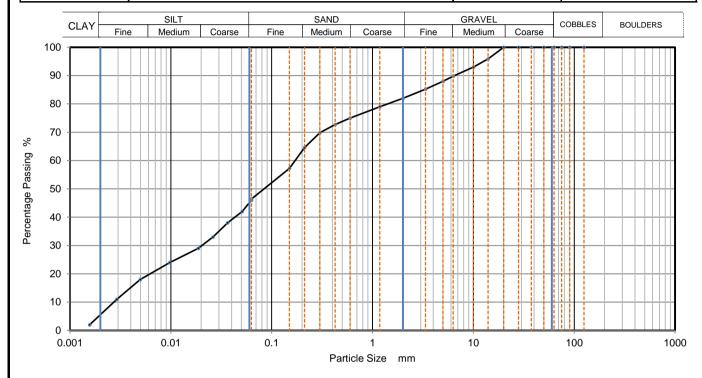
Grading Analysis		
D100	mm	
D60	mm	0.161
D30	mm	0.0199
D10	mm	0.00365
Uniformity Coefficient		44
Curvature Coefficient		0.67

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -		Job Ref	21-1619		
GEOTECH	PANI	ICLE SIZE DISTRIBUTION -		Borehole/Pit No.	вно9	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	5
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth, m	1.80	
Specimen Reference	6 Specimen 1.8 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	uses 9.2 and 9.5			KeyLAB ID	Caus2022032922



Sievi	ng	Sedimo	entation
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)
0.425	73	2.65	Mg/m3
0.3	70		
0.212	65	1	
0.15	57	1	
0.063	46	1	

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		

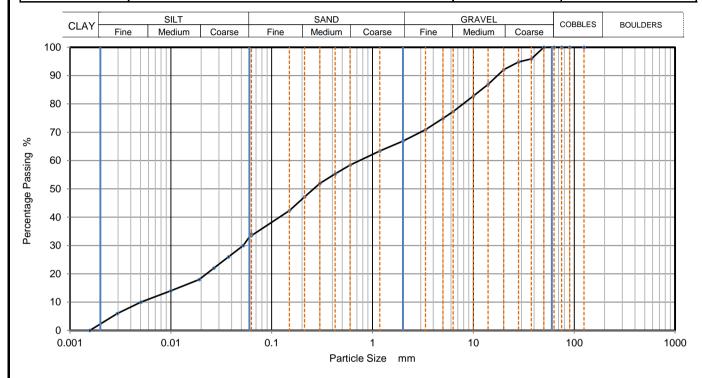
Grading Analysis		
D100	mm	
D60	mm	0.171
D30	mm	0.0206
D10	mm	0.0027
Uniformity Coefficient		63
Curvature Coefficient		0.92

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





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -		Job Ref	21-1619		
GEOTECH GEOTECH	PANI	ICLE SIZE DISTRIBUTION		Borehole/Pit No.	вн09	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.	6
Soil Description	Brown sandy gravelly silty CLAY.			Depth, m	3.80	
Specimen Reference	6 Specimen 3.8 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, cla	uses 9.2 and 9.5			KeyLAB ID	Caus2022032925



Siev	/ing	Sedimo	entation
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)
0.425	55	2.65	Mg/m3
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		

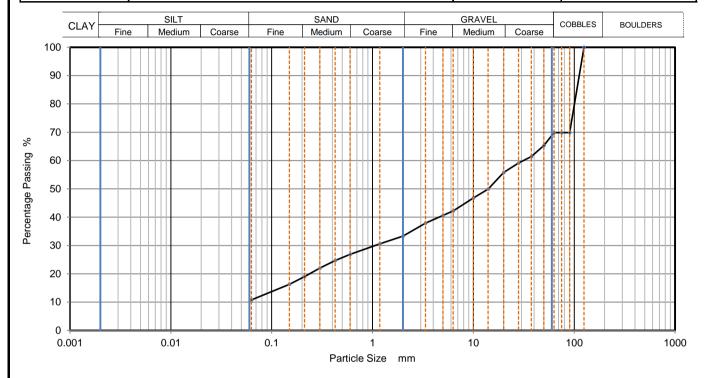
Grading Analysis		
D100	mm	
D60	mm	0.747
D30	mm	0.0533
D10	mm	0.00517
Uniformity Coefficient		140
Curvature Coefficient		0.74

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





CAUSEWAY	WAY PARTICLE SIZE DISTRIBUTION -		Job Ref	21-1619		
—— GEOTECH	PANII	CLE SIZE DISTRIBUTION -		Borehole/Pit No.	вн09	
Site Name	North Irish Sea Array	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 5.8 m			Sample Type	В	
Test Method	BS1377:Part 2:1990, clau	se 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

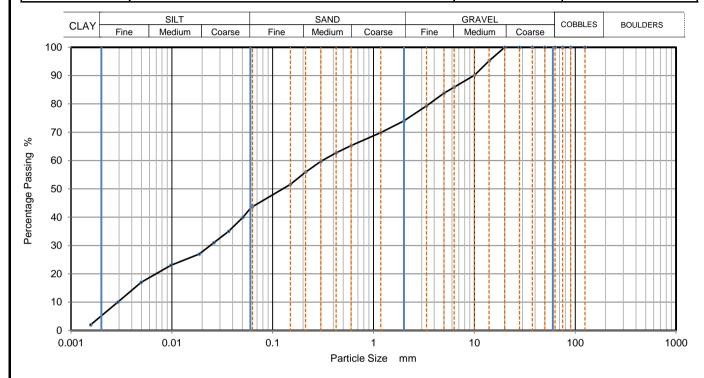
Grading Analysis		
D100	mm	125
D60	mm	31.3
D30	mm	1.05
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

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





CAUSEWAY	DADTI	CLE SIZE DIST	FDIRLITION		Job Ref	21-1619
—— GEOTECH	PANII	CLE SIZE DIST	IKIBUTIUN		Borehole/Pit No.	BH15
Site Name	North Irish Sea Array				Sample No.	4
Soil Description	Brown sandy slightly grav	relly silty CLAY.			Depth, m	0.80
Specimen Reference	6	Specimen Depth	0.8	m	Sample Type	В
Test Method	3S1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022032928	



Siev	/ing	Sedimo	entation
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)
0.425	63	2.65	Mg/m3
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

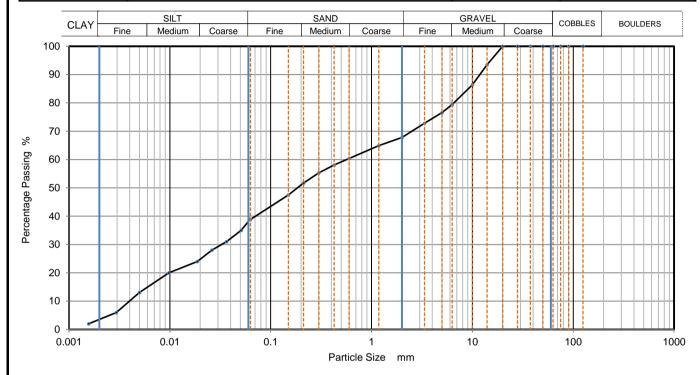
Preparation and testing in accordance with BS1377-2:1990 unless noted below





LAB 05R - Version 5

CAUSEWAY	DARTI	CLE SIZE DIST	FDIRLITION		Job Ref	21-1619
—— GEOTECH	PANII	CLE SIZE DIST	INIBOTION		Borehole/Pit No.	BH15
Site Name	North Irish Sea Array				Sample No.	18
Soil Description	Greyish brown sandy slig	htly gravelly silty CL	AY.		Depth, m	6.00
Specimen Reference	7	Specimen Depth	6	m	Sample Type	U
Test Method	BS1377:Part 2:1990, clau	ses 9.2 and 9.5			KeyLAB ID	Caus2022032935



Sievi	ing	Sedimo	entation
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)
0.425	58	2.65	Mg/m3
0.3	55		
0.212	52	1	
0.15	48	1	
0.063	39	1	

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

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





LAB 05R - Version 5

10122

	Unconsolidat	od Hadre	inad "	Trie:	al al					1		<del></del>	
CAUSEWAY GEOTECH		Unconsolidated Undrained Triaxial Compression Test without measurement						Ref			21-1619		
——— GEOTECH	of pore pressure - single specimen						Borehole/Pit No.				BH09		
Site Name	North Irish Sea Arra	у					Sample No.			14			
Soil Description	Brown sandy slightly	Brown sandy slightly gravelly silty CLAY.					Depth	า		2.00			
Specimen Reference	2	Specimen Depth		2.0	)5	m	Samp	ole Type		U			
Specimen Description	Firm to stiff brown s	andy slightly g	gravelly	silty CL	AY.		KeyLAB ID			Caus2022032923		2923	
Test Method	BS1377 : Part 7 : 19	990, clause 8,	single s	specime	n		Date	of test			13/04/202	22	
	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							3.0 50		%/min kPa			
	At failure	Axial Strain	/.	-1 -2)	ر.			13.6 145		% kPa			
	Deviator Stress, ( $\sigma$ 1 - $\sigma$ 3 )f Undrained Shear Strength, cu Mode of Failure						72 kPa ½(σ1-σ3)f				ıf		
Davida a Otaca a a a	hadal Orașia	Mode of Fail	lure			ļ		Brittle		1			
Deviator Stress v A	Axiai Strain				<u> </u>	1	T	T					
050													
ප <u>250</u>													
9 200 ·						+							
ed Deviator Stress kPa													
Deviat			•	•—	•	-				•			
7 100 • 100													
Correct 20 20 Page 20 20 Page													
0													
0 1	2 3 4	5 6	7		8 Strain 9		10	11	12	13	14 1	5 16	
Mohr Circles				Axiai	olialii .	76			_				
125										Deviator for area of membrar	change ar	nd	
100										Mohr circ	eles and ti	heir	
											ation is no	ot covered	
th 75					<del>-</del>					This is prinformation	ovided fo	r	
Shear Strength kPa										momat	on only.		
25													
0 25	50 75 100	125 15 Normal S			200	225 2	250	275	300		( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( (		
Remarks		. 13.11141 0	App	proved			Printed			1			
			S	Stephen.	Watso	n	20/04	1/2022 0	8:35	]	U	KAS ESTING	
								R - Vers	ion 5		10	0122	

	Unconsolidat	ed Undraine	d Triaxial		Job Ref			21-1	619	
CAUSEWAY ——GEOTECH	Compression of pore press			ient	Borehole/Pit l	No.	BH15			
Site Name	North Irish Sea Arra		<u></u>		Sample No.		18			
Soil Description	Greyish brown sand	dy slightly gravelly	silty CLAY.		Depth			6.0	00	
Specimen Reference	8	Specimen Depth	6.05	m	Sample Type			ι	J	
Specimen Description	Stiff greyish brown s		elly silty CLAY.		KeyLAB ID		С	aus202	2032935	;
Test Method	BS1377 : Part 7 : 19	990, clause 8, sing	gle specimen		Date of test			13/04/	/2022	_
	Test Number Length Diameter Bulk Density Moisture Content Dry Density				209.4 103.9 2.37 10 2.14		mm mm Mg/m3 % Mg/m3	3		
	Rate of Strain Cell Pressure At failure Axial Strain Deviator Stress, ( σ1 - σ3 )f Undrained Shear Strength, cu Mode of Failure			140 20.0 150		%/min kPa % kPa kPa ½( σ1 - σ3 )f				
ator Stress v	Axial Strain						-			
50										
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50		-								_
00										
50										
50	4 6 8	10 12	14 16		20 22	24	26	28	30	
50		10 12	14 16 Axial Strain		20 22	24	26	28	30	_

Shear Strength kPa 75 50 25 0 25 50 75 200 0 100 125 150 175 225 250 275 300 Normal Stresses kPa

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

LAB 15R - Version 5



10122



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**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



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# Results - Soil

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

Client: Causeway Geotech Ltd		Che	mtest Jo	22-12437	22-12437	
Quotation No.:	(	Chemte	st Sam	ple ID.:	1403832	1403833
Order No.:		Clie	nt Samp	le Ref.:	6	17
		Sa	ample Lo	ocation:	BH09	BH15
			Sampl	е Туре:	SOIL	SOIL
			Top Dep	oth (m):	3.8	1.2
			Date Sa	ampled:	31-Mar-2022	31-Mar-2022
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	13	15
рН	U 2010 4.0				8.8	8.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.089	0.023	
Sulphate (Total)	U	2430	%	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	рН	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 **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Τ 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



HEAD OFFICE Causeway Geotech Ltd

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> Registered in Northern Ireland. Company Number: NI610766

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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

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

16 September 2022

<b>Project Name:</b>	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 24/08/2022 and 16/09/2022.

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 12 - INTERIM

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	13
SOIL	Liquid and Plastic Limits of soil-4 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	13
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	13
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	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 (UKAS 4043)	Thermal Resistivity		0 (7 x ongoing)



## **Summary of Classification Test Results**

Project No.

Project Name

21-1619

North Irish Sea Array

		Sar	nple			Densit		W	Passing	LL	PL	PI	Particle	0
Hole No.	Ref	Тор	Base	Туре	Specimen Description	bulk Mg/m3	dry 3	%	425µm %	%	%	%	density Mg/m3	Casagrande Classification
ST02	4	1.00		В	Brownish grey sandy gravelly silty CLAY.			12.0	65	33	19	14	, c	CL
ST03	3	0.50		В	Brown slightly sandy slightly clayey subangular fine to coarse GRAVEL with cobbles.			9.5	35	36	22	14		CI
ST03	5	1.30		В	Brown sandy slightly gravelly silty CLAY.			17.0	79	36	19	17		CI
ST06	4	1.00		В	Brown sandy gravelly silty CLAY.			11.0	66	33	17	16		CL
ST23	3	0.50		В	Grey slightly sandy slightly silty subangular fine to coarse GRAVEL.			8.0	37	25	16	9		CL
ST23	4	1.00		В	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			8.9	50	36	22	14		CI
ST24	3	0.50		В	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			6.2	41	27	17	10		CL
ST24	4	1.00		В	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			10.0	37	32	22	10		CL
ST27	5	1.00			Brownish grey sandy slightly gravelly silty CLAY.			12.0	64	35	18	17		CL/CI
ST29	3	0.50		В	Grey gravelly clayey fine to coarse SAND.			7.1	33	27	19	8		CL
ST29	5	1.20		В	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			7.5	44	26	19	7		CL
ST31	3	0.50		В	Grey gravelly slightly silty fine to coarse SAND.			4.0	31	33	21	12		CL

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

LAB 01R Version 6

Date Printed Approved By Key Density test Liquid Limit Particle density Linear measurement unless: 4pt cone unless: sp - small pyknometer 16/09/2022

wd - water displacement cas - Casagrande method gj - gas jar

wi - immersion in water 1pt - single point test

Stephen.Watson



10122



## **Summary of Classification Test Results**

Project No. Project Name

21-1619

North Irish Sea Array

21-1	013			Notiti ilisti Sea Aliay										
Hole No.			nple	I	Specimen Description	Dens bulk	ity dry	W	Passing 425µm	LL	PL	PI	Particle density	Casagrande
	Ref	Тор	Base	Type	opeeimen 2 eeempilen	Mg/m		%	%	%	%	%	Mg/m3	Classification
ST31	5	1.20		В	Brown sandy gravelly silty CLAY.			11.0	76	26	14	12		CL
All tests perfor	ests performed in accordance with BS1377:1990 unless specified otherwise  LAB 01R Version 6							3 01R Version 6						

Key

Density test Liquid Limit Particle density

Linear measurement unless: 4pt cone unless: sp - small pyknometer

wd - water displacement

wi - immersion in water

cas - Casagrande method

1pt - single point test

gj - gas jar

Date Printed

Approved By

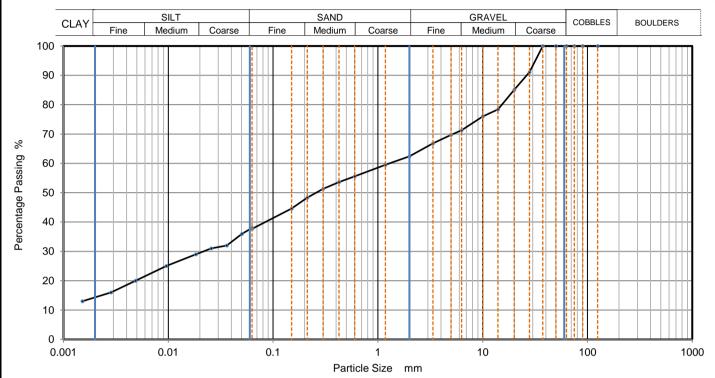
Stephen.Watson

16/09/2022



10122

CAUSEWAY PARTICLE SIZE DISTRIBUTION						21-1619	
CAUSEWAY ——GEOTECH	PARII	RIBUTION	Borehole/F	Pit No.	STO2		
Site Name	North Irish Sea Array			Sample No.		4	
Specimen Description	Brownish grey sandy grav	olly silty CLAV		Sample	Тор	1.00	
Specimen bescription	brownish grey sandy grav	elly silty CLAT.		Depth (m)	Base		
Specimen Reference	6	Specimen Depth	1 m	Sample Ty	oe	В	
Test Method	BS1377:Part 2:1990, claus	ses 9.2 and 9.5		KeyLAB ID		Caus202208240	



Siev	ing	Sedimentation				
Particle Size mm	% Passing	Particle Size mm	% Passing			
125	100	0.06300	38			
90	100	0.05053	36			
75	100	0.03618	32			
63	100	0.02574	31			
50	100	0.01831	29			
37.5	100	0.00957	25			
28	91	0.00487	20			
20	85	0.00284	16			
14	78	0.00151	13			
10	76					
6.3	71					
5	70					
3.35	67					
2	62					
1.18	60					
0.6	56	Particle density	(assumed)			
0.425	54	2.65	Mg/m3			
0.3	51					
0.212	48	1				
0.15	45	1				
0.063	38	1				

3176	
	3176

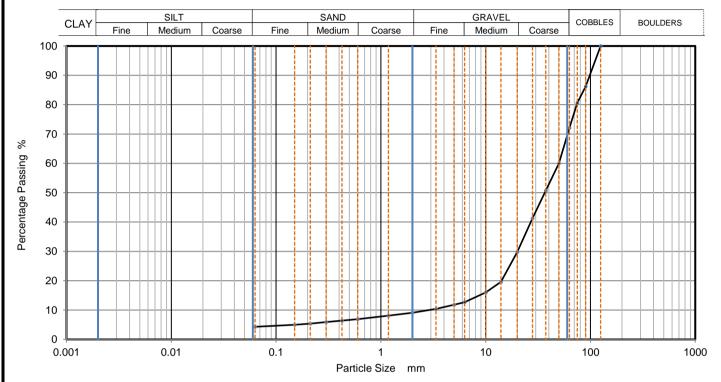
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	37.6
Sand	24.7
Silt	23.5
Clay	14.2

Grading Analysis		
D100	mm	
D60	mm	1.3
D30	mm	0.0233
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	DARTICI E CIZE DISTRIBUTIONI			Job Ref		21-1619
—— GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -			it No.	STO3
Site Name	North Irish Sea Array			Sample No.		3
Specimen Description	Brown slightly sandy slightly clayey subangular fine to coarse GRAVEL with			Sample	Тор	0.50
Specimen Beschption	cobbles.				Base	
Specimen Reference	6 Specimen 0.5 m			Sample Type		В
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID		Caus202208241



Siev	/ing	Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	86		
75	81		
63	72		
50	60		
37.5	51		
28	41		
20	30		
14	20		
10	16		
6.3	13		
5	12		
3.35	10		
2	9		
1.18	8		
0.6	7		
0.425	6		
0.3	6		_
0.212	5		
0.15	5		
0.063	4		

12701

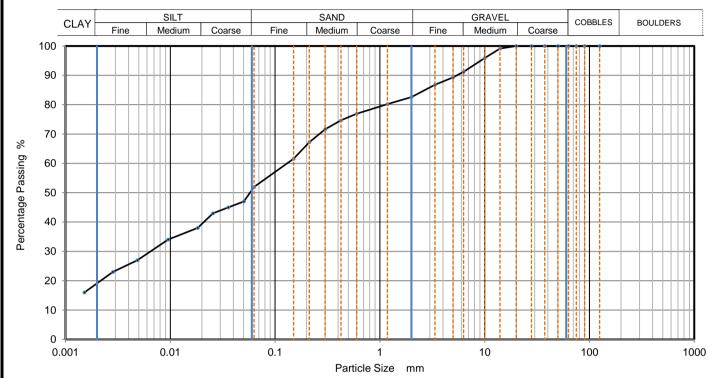
Sample Proportions	% dry mass
Cobbles	27.9
Gravel	63.0
Sand	4.8
Fines < 0.063 mm	4.0

Grading Analysis		
D100	mm	125
D60	mm	50
D30	mm	20.1
D10	mm	2.85
Uniformity Coefficient		18
Curvature Coefficient		2.8





CAUSEWAY	DARTICLE CIZE DISTRIBUTION			Job Ref		21-1619	
—— GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -			Borehole/Pit No.		ST03
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.		5
Specimen Description	pecimen Description Brown sandy slightly gravelly silty CLAY.			Sample	Тор	1.30	
Specimen bescription	brown sandy slightly grav	ndy slightly gravelly slity CLAY.		Depth (m)	Base		
Specimen Reference	6 Specimen 1.3 m			Sample Type		В	
Test Method	BS1377:Part 2:1990, claus	S1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus202208242



Siev	ring	Sedimo	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	52
90	100	0.05033	47
75	100	0.03582	45
63	100	0.02549	43
50	100	0.01824	38
37.5	100	0.00953	34
28	100	0.00485	27
20	100	0.00283	23
14	99	0.00152	16
10	96		
6.3	91		
5	89		
3.35	87		
2	83		
1.18	80		
0.6	77	Particle density	(assumed)
0.425	75	2.65	Mg/m3
0.3	72		
0.212	67	1	
0.15	62	1	
0.063	52	1	

Dry Mass of sample, g	545
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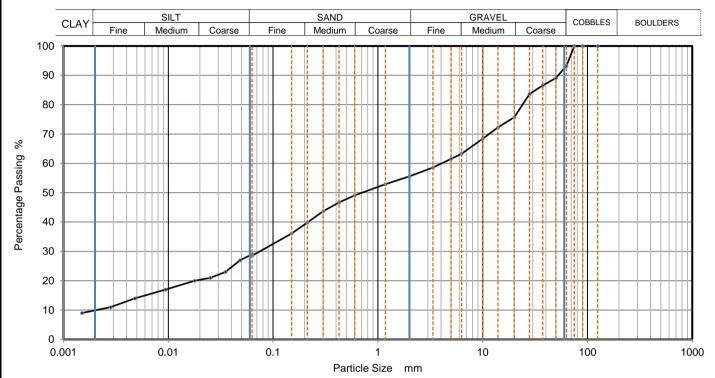
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.4
Sand	30.6
Silt	33.2
Clay	18.8

Grading Analysis		
D100	mm	
D60	mm	0.129
D30	mm	0.00646
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	DARTICI E CIZE DISTRIBUTIONI			Job Ref		21-1619
CAUSEWAY ——GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -			it No.	ST06
Site Name	North Irish Sea Array	North Irish Sea Array				4
Specimen Description	Specimen Description Brown sandy gravelly silty CLAY.			Sample Depth (m)	Тор	1.00
Specimen bescription	Brown sandy gravelly slity CLAY.		Base			
Specimen Reference	6 Specimen 1 m			Sample Type		В
Test Method	BS1377:Part 2:1990, claus	S1377:Part 2:1990, clauses 9.2 and 9.5				Caus202208243



	_	II	_
Siev	/ing	Sedime	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	29
90	100	0.04837	27
75	100	0.03513	23
63	93	0.02517	21
50	89	0.01791	20
37.5	87	0.00942	17
28	84	0.00480	14
20	76	0.00282	11
14	72	0.00150	9
10	68		
6.3	63		
5	62		
3.35	59		
2	56		
1.18	53		
0.6	49	Particle density	(assumed)
0.425	47	2.65	Mg/m3
0.3	44		
0.212	40		
0.15	36		
0.063	29		

Dry Mass of sample, g	9342
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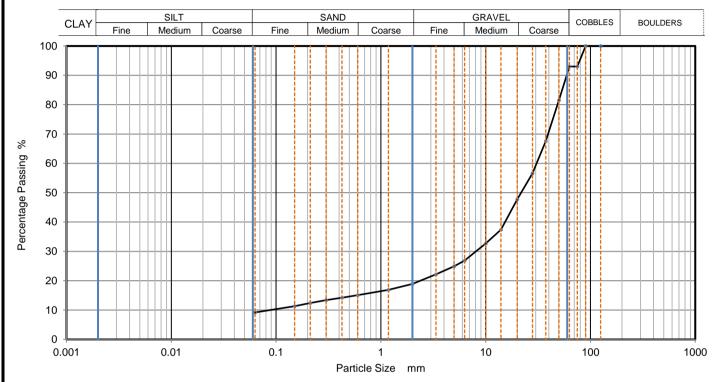
Sample Proportions	% dry mass
Cobbles	6.7
Gravel	37.7
Sand	27.1
Silt	18.8
Clay	9.7

Grading Analysis		
D100	mm	
D60	mm	4.04
D30	mm	0.0749
D10	mm	0.00217
Uniformity Coefficient		1900
Curvature Coefficient		0.64





CAUSEWAY	DARTICI E CIZE DISTRIBUTIONI		Job Ref		21-1619		
—— GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -		Borehole/Pit No.		ST23	
Site Name	North Irish Sea Array		Sample No.		3		
Specimen Description	Grey slightly sandy slightly silty subangular fine to coarse GRAVEL.		Sample	Тор	0.50		
Specificit Description			Depth (m)	Base			
Specimen Reference	6 Specimen 0.5 m			Sample Typ	e	В	
Test Method	3S1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus202208244



Sieving		Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	93		
63	93		
50	82		
37.5	68		
28	57		
20	48		
14	37		
10	33		
6.3	27		
5	25		
3.35	22		
2	19		
1.18	17		
0.6	15		
0.425	14		
0.3	13		
0.212	12	1	
0.15	11	]	
0.063	9		

Dry Mass of sample, g 12033	Dry Mass of sample, g	12033
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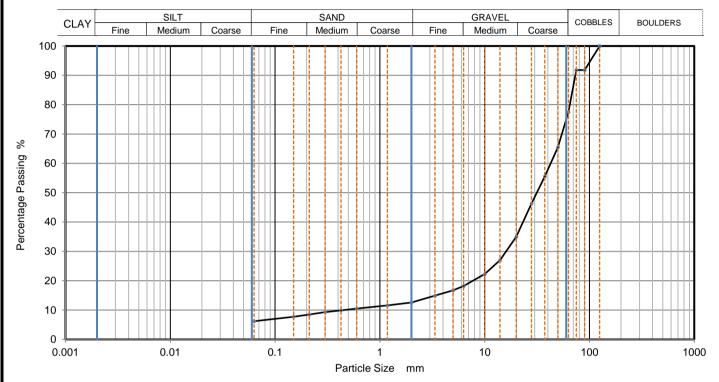
Sample Proportions	% dry mass
Cobbles	7.0
Gravel	74.1
Sand	9.7
Fines < 0.063mm	9.0

Grading Analysis		
D100	mm	
D60	mm	30.6
D30	mm	8.05
D10	mm	0.0877
Uniformity Coefficient		350
Curvature Coefficient		24





CAUSEWAY	DARTICI E CIZE DISTRIBUTIONI		Job Ref		21-1619		
—— GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -		Borehole/Pit No.		ST23	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.		4
Specimen Description	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			Sample	Тор	1.00	
Specificit Description	Grey Slightly Surfay Slightl	orey slightly samuy slightly clayey subaligular fille to coarse GRAVEL.		Depth (m)	Base		
Specimen Reference	6 Specimen 1 m			m	Sample Typ	e	В
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus202208245



		π	
Sieving		Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	92		
75	92		
63	78		
50	66		
37.5	56		
28	46		
20	35		
14	27		
10	22		
6.3	18		
5	17		
3.35	15		
2	13		
1.18	12		
0.6	11		
0.425	10		
0.3	9		
0.212	9	1	
0.15	8		
0.063	6	1	

Dry Mass of sample, g	14563
Dry Mass of sample, g	14563

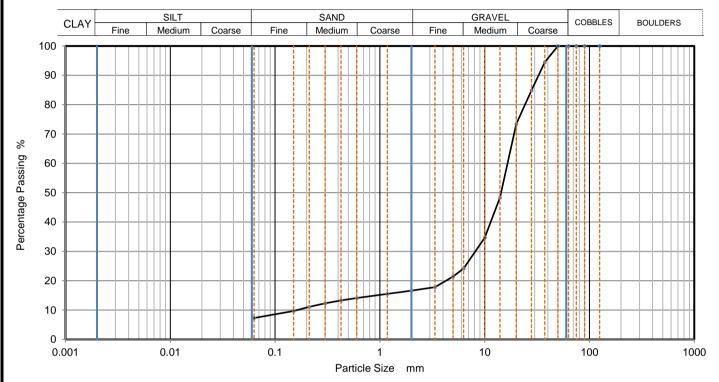
Sample Proportions	% dry mass
Cobbles	22.5
Gravel	64.9
Sand	6.4
Fines < 0.063mm	6.0

Grading Analysis		
D100	mm	125
D60	mm	42.7
D30	mm	16
D10	mm	0.44
Uniformity Coefficient		97
Curvature Coefficient		14





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -			Job Ref		21-1619	
CAUSEWAY ——GEOTECH				Borehole/Pit No.		ST24	
Site Name	North Irish Sea Array			Sample No.		3	
Specimen Description	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			Sample	Тор	0.50	
Specificit Description				Depth (m)	Base		
Specimen Reference	6 Specimen 0.5 m				Sample Type		В
Test Method	S1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus202208246



Sievi	Sieving		tation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	85		
20	73		
14	48		
10	35		
6.3	24		
5	21		
3.35	18		
2	17		
1.18	16		
0.6	14		
0.425	13	1	
0.3	12		
0.212	11	1	
0.15	10		
0.063	7	]	

Dry Mass of Sample, g	Dry Mass of sample, g	11052
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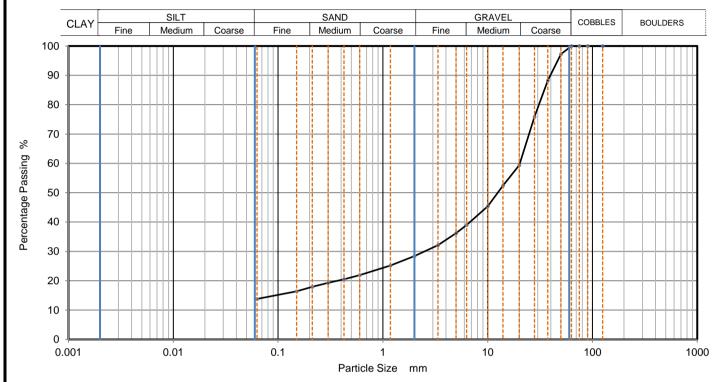
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	83.4
Sand	9.3
Fines < 0.063mm	7.0

Grading Analysis		
D100	mm	
D60	mm	16.5
D30	mm	8.13
D10	mm	0.16
Uniformity Coefficient		100
Curvature Coefficient		25





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -			Job Ref		21-1619	
—— GEOTECH				Borehole/Pit No.		ST24	
Site Name	North Irish Sea Array			Sample No.		4	
Specimen Description	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			Sample	Тор	1.00	
Specimen Description				Depth (m)	Base		
Specimen Reference	6 Specimen 1 m				Sample Type		В
Test Method	3S1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus202208247



		П	
Siev	/ing	Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	97		
37.5	88		
28	76		
20	59		
14	52		
10	45		
6.3	39		
5	36		
3.35	32		
2	28		
1.18	25		
0.6	22		
0.425	21		
0.3	19		
0.212	18		
0.15	16		
0.063	14		

Dry Mass of sample, g	9399
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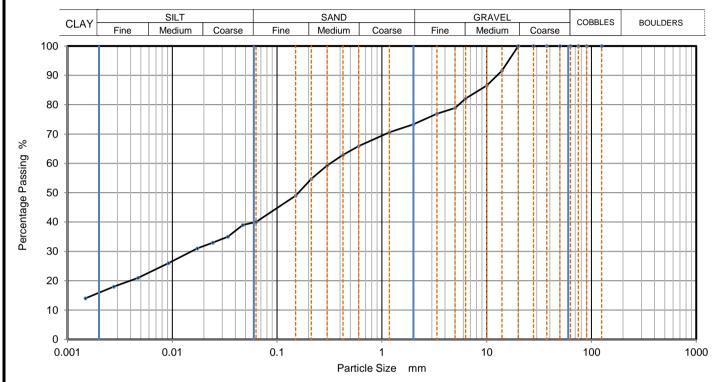
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	71.6
Sand	14.6
Fines < 0.063mm	14.0

Grading Analysis		
D100	mm	
D60	mm	20.3
D30	mm	2.49
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	PARTICLE SIZE DISTRIBUTION -			Job Ref		21-1619
CAUSEWAY ——GEOTECH				Borehole/Pit No.		ST27
Site Name	North Irish Sea Array			Sample No.		5
Specimen Description	Drawnish groves and estimately grovelly sitty CLAV			Sample	Тор	1.00
Specimen bescription	Brownish grey sandy sligh	Brownish grey sandy slightly gravelly silty CLAY.			Base	
Specimen Reference	6	1 m	Sample Type		В	
Test Method	BS1377:Part 2:1990, claus	S1377:Part 2:1990, clauses 9.2 and 9.5				Caus2022082412



Siev	ing	Sedimo	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06276	40
90	100	0.04701	39
75	100	0.03397	35
63	100	0.02435	33
50	100	0.01734	31
37.5	100	0.00919	26
28	100	0.00471	21
20	100	0.00277	18
14	92	0.00148	14
10	87		
6.3	82		
5	79		
3.35	77		
2	73		
1.18	71		
0.6	66	Particle density	(assumed)
0.425	63	2.65	Mg/m3
0.3	59		
0.212	55		
0.15	49		
0.063	40		

525	
	525

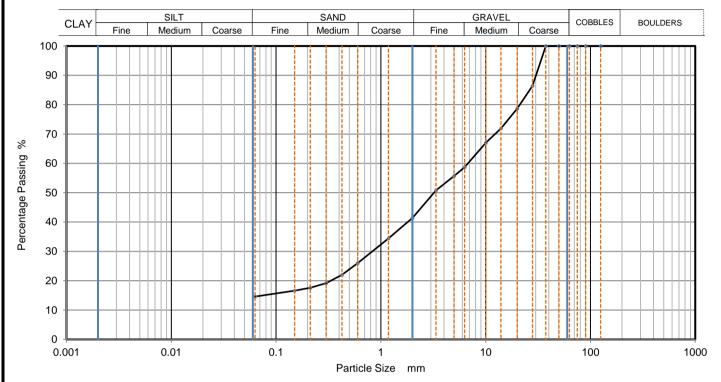
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.7
Sand	33.2
Silt	24.6
Clay	15.5

Grading Analysis		
D100	mm	
D60	mm	0.321
D30	mm	0.0148
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	DARTICI E CIZE DICTRIBUTIONI		Job Ref		21-1619		
—— GEOTECH	PARTICLE SIZE DISTRIBUTION			Borehole/Pit No.		ST29	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.		3
Specimen Description	Grey gravelly clayey fine to coarse SAND.			Sample	Тор	0.50	
Specimen bescription				Depth (m)	Base		
Specimen Reference	6 Specimen 0.5 m			Sample Typ	oe	В	
Test Method	2S1377:Part 2:1990, clause 9.2			KeyLAB ID		Caus202208248	



Siev	/ing	Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	86		
20	79		
14	72		
10	67		
6.3	59		
5	56		
3.35	51		
2	41		
1.18	34		
0.6	26		
0.425	22		
0.3	19		
0.212	18		
0.15	17		
0.063	15		

3359	
	3359

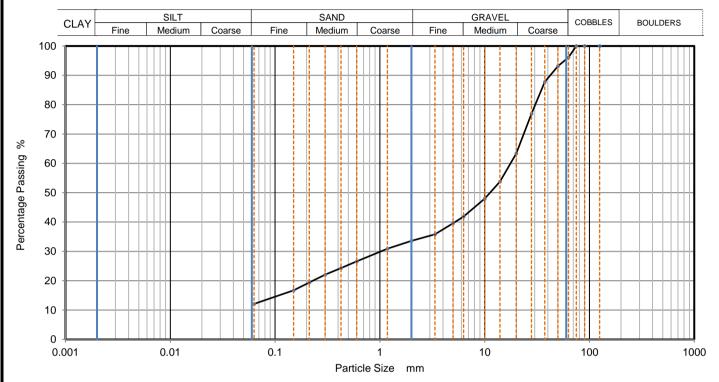
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	58.6
Sand	26.8
Fines < 0.063mm	15.0

Grading Analysis		
D100	mm	
D60	mm	6.76
D30	mm	0.83
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1619	
—— GEOTECH				Borehole/Pit No.		ST29	
Site Name	North Irish Sea Array	North Irish Sea Array			Sample No.		5
Specimen Description	Crouglighthy conducting the player subangular fine to page CDAVEL			Sample	Тор	1.20	
Specimen bescription	Grey slightly sandy slightl	Grey slightly sandy slightly clayey subangular fine to coarse GRAVEL.			Depth (m)	Base	
Specimen Reference	6 Specimen 1.2 m			Sample Typ	oe	В	
Test Method	S1377:Part 2:1990, clause 9.2			KeyLAB ID		Caus202208249	



Sievi	ing	Sedimen	itation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	96		
50	93		
37.5	88		
28	77		
20	63		
14	54		
10	48		
6.3	42		
5	40		
3.35	36		
2	34		
1.18	31		
0.6	27		
0.425	24	1	
0.3	22		
0.212	19	1	
0.15	17	1	
0.063	12	]	

Dry Mass of sample, g	17445
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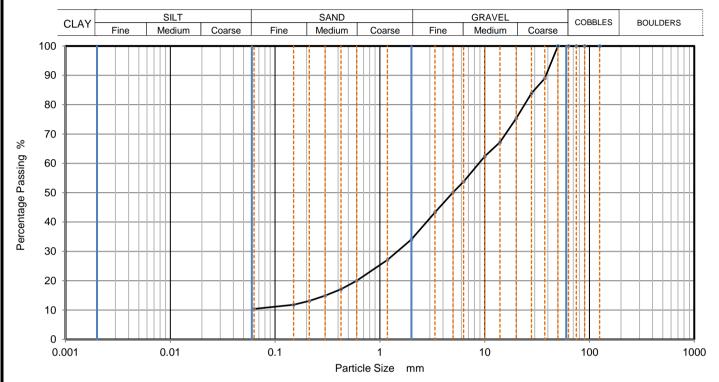
Sample Proportions	% dry mass
Cobbles	3.9
Gravel	62.5
Sand	21.5
Fines < 0.063mm	12.0

Grading Analysis		
D100	mm	
D60	mm	17.6
D30	mm	1.02
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	DARTICLE CIZE DISTRIBUTION		Job Ref		21-1619		
CAUSEWAY ——GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -		Borehole/Pit No.		ST31	
Site Name	North Irish Sea Array				Sample No.		3
Specimen Description	Grey gravelly slightly silty fine to coarse SAND.			Sample Depth (m)	Тор	0.50	
Specificit Description					Base		
Specimen Reference	6 Specimen 0.5 m			m	Sample Typ	oe	В
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus2022082410



		п	
Siev	/ing	Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	89		
28	84		
20	75		
14	67		
10	62		
6.3	54		
5	50		
3.35	43		
2	34		
1.18	27		
0.6	20		
0.425	17		
0.3	15		
0.212	13	1	
0.15	12		
0.063	10	1	

Dry Mass of sample, g	13271	
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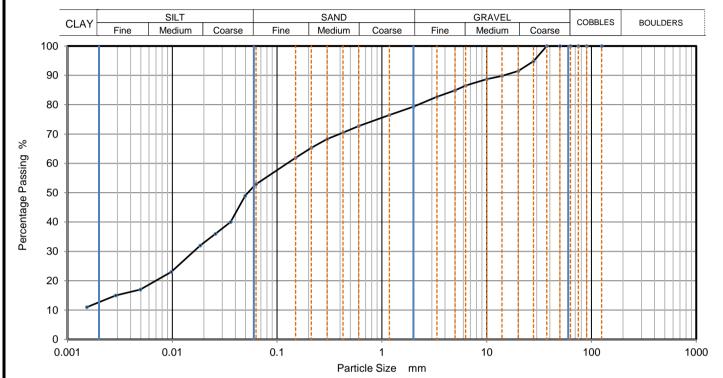
Sample Proportions	% dry mass
Cobbles	0.0
Gravel	65.9
Sand	23.7
Fines < 0.063mm	10.0

Grading Analysis		
D100	mm	
D60	mm	8.78
D30	mm	1.47
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		





CAUSEWAY	DARTICI E CIZE DICTRIBUTIONI		Job Ref		21-1619		
—— GEOTECH	PARII	PARTICLE SIZE DISTRIBUTION -			Borehole/Pit No.		ST31
Site Name	North Irish Sea Array			Sample No	•	5	
Specimen Description	Brown sandy gravelly silty CLAY.				Sample Depth (m)	Тор	1.20
Specificit Description						Base	
Specimen Reference	6 Specimen 1.2 m			Sample Typ	e	В	
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID		Caus2022082411



Sieving		Sedime	entation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	53
90	100	0.04969	49
75	100	0.03604	40
63	100	0.02580	36
50	100	0.01846	32
37.5	100	0.00976	23
28	95	0.00496	17
20	92	0.00288	15
14	90	0.00153	11
10	89		
6.3	87		
5	85		
3.35	83		
2	79		
1.18	77		
0.6	73	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	68		
0.212	65		
0.15	62		
0.063	53		

Dry Mass of sample, g	3312
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Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.7
Sand	26.4
Silt	40.5
Clay	12.4

Grading Analysis		
D100	mm	
D60	mm	0.125
D30	mm	0.0162
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		







# LABORATORY REPORT



4043

Contract Number: PSL22/5887

Report Date: 26 September 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: 9/9/2022 Date Commenced: 9/9/2022 Date Completed: 26/9/2022

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 R Berriman S Royle

(Director) (Quality Manager) (Laboratory Manager)

EK#

L Knight S Eyre T Watkins (Assistant Laboratory Manager) (Senior Technician) (Senior Technician)

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# **SUMMARY OF LABORATORY SOIL DESCRIPTIONS**

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
ST03	5	В	1.20		Brown slightly gravelly sandy CLAY.
ST06	5	В	1.20		Brown slightly gravelly very sandy CLAY.
ST23	5	В	1.20		Brown gravelly very sandy CLAY.
ST24	5	В	1.20		Brown slightly gravelly very sandy CLAY.
ST29	5	В	1.20		Brown slightly gravelly very sandy CLAY.
ST31	5	В	1.20		Brown slightly gravelly very sandy CLAY.
ST27		В	1.20		Brown slightly gravelly very sandy CLAY.



North Irish Sea Array

Contract No:
PSL22/5887
Client Ref:
21-1619

# **SUMMARY OF THERMAL PROPERTY TESTS**

In accordance with ASTM-D5334

					Moisture	Bulk	Dry	Thermal	Thermal	
Hole	Sample	Sample	Top	Base	Content	Density	Density	Conductivity	Resistivity	Remarks
Number	Number	Type	Depth	Depth	%	$Mg/m^3$	Mg/m <sup>3</sup>			
			m	m				W/m K	C.cm/W	
ST03	5	В	1.20		17	2.08	1.78	2.145	46.6	
ST06	5	В	1.20		13	2.11	1.87	2.675	37.4	
ST23	5	В	1.20		15	2.11	1.84	2.506	39.9	
ST24	5	В	1.20		11	2.19	1.99	1.890	52.9	
ST29	5	В	1.20		10	2.20	2.00	3.739	26.7	
ST31	5	В	1.20		12	2.19	1.96	2.402	41.6	
ST27		В	1.20		12	2.02	1.81	2.745	36.4	
									<u> </u>	

		Contract No:
	Nouth Inigh Con Annay	PSL22/5887
	North Irish Sea Array	Client Ref:
Professional Soils Laboratory		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

# SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

26 September 2022

Project Name:	North Irish Sea Array
Project No.:	21-1619
Client:	Statkraft
Engineer:	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 08/09/2022 and 26/09/2022.

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 13

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	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	2
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	1

### **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 (UKAS 4043)	Thermal Resistivity		1



## **Summary of Classification Test Results**

Project No.

Project Name

21-1619

North Irish Sea Array

	_										_			
Hole No.	Ref		nple Base	Type	Specimen Description	Densi bulk	ty dry	W	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Kei	тор	Dase	Туре		Mg/m	3	%	%	%	%	%	Mg/m3	Olassinoation
SLT02	1	0.70		В	Brown slightly sandy clayey subangular fine to coarse GRAVEL.			7.5	63	35	18	17		CL/CI
SLT02	3	1.40		В	Brown gravelly sandy CLAY.			10.0	49	25	16	9		CL

Key

Density test Liquid Limit

Particle density

Approved By

Linear measurement unless:

4pt cone unless:

1pt - single point test

sp - small pyknometer

26/09/2022

Date Printed

10122

wd - water displacement

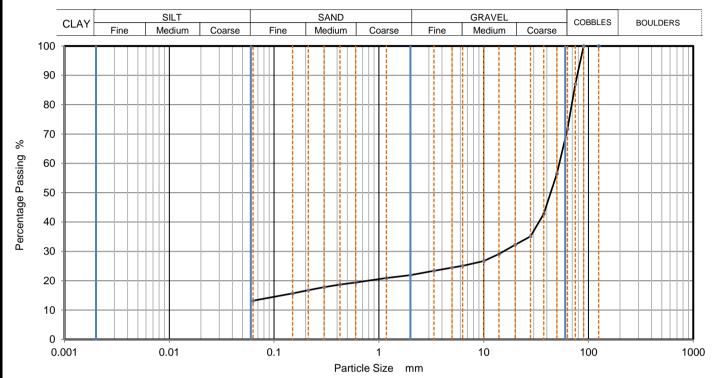
wi - immersion in water

cas - Casagrande method

gj - gas jar

Stephen.Watson

CAUSEWAY	DARTI	FRIRITION	Job Ref		21-1619		
—— GEOTECH	PARII	CLE SIZE DIST	IKIBUTIUN	Borehole/F	it No.	SLT02	
Site Name	North Irish Sea Array				Sample No		1
Specimen Description	Brown slightly sandy clay	o coarse GRAVEI	Sample	Тор	0.70		
Specificit Description	brown slightly sandy clay	ey subangular fille t	o coarse divavel.	Depth (m)	Base		
Specimen Reference	6	0.7	т	Sample Type		В	
Test Method	BS1377:Part 2:1990, clau	se 9.2	KeyLAB ID		Caus20220908171		



Siev	/ing	Sedime	ntation
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	87		
63	72		
50	57		
37.5	43		
28	35		
20	32		
14	29		
10	27		
6.3	25		
5	25		
3.35	23		
2	22		
1.18	21		
0.6	19		
0.425	19		
0.3	18		
0.212	17		
0.15	16		
0.063	13		

Sample Proportions	% dry mass
Cobbles	28.3
Gravel	49.8
Sand	8.8
Fines < 0.063mm	13.0

Grading Analysis		
D100	mm	
D60	mm	52.7
D30	mm	15.5
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

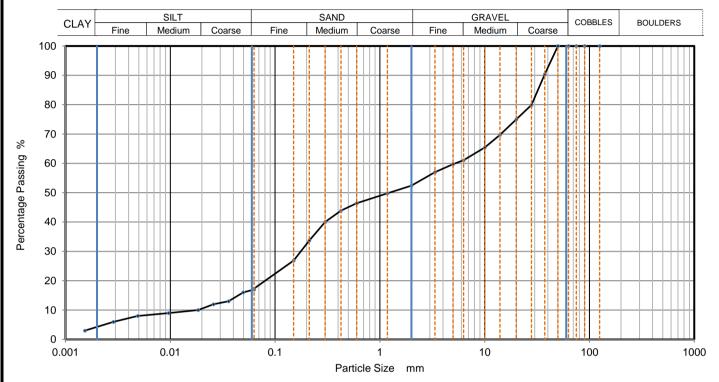
Preparation and testing in accordance with BS1377-2:1990 unless noted below





LAB 05R - Version 6

CAUSEWAY	CAUSEWAY PARTICLE SIZE DISTRIBUTION			Job Ref		21-1619	
——GEOTECH				Borehole/Pit No.		SLT02	
Site Name	North Irish Sea Array			Sample No.		3	
Specimen Description Brown gravelly sandy CLAY.				Sample	Тор	1.40	
Specificit Description	brown graverry sarray CLA	AI.			Depth (m)	Base	
Specimen Reference	6	Specimen Depth	1.4	m	Sample Type		В
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID		Caus20220908172



		II			
Siev	ving	Sedimentation			
Particle Size mm	% Passing	Particle Size mm	% Passing		
125	100	0.06300	17		
90	100	0.04969	16		
75	100	0.03604	13		
63	100	0.02580	12		
50	100	0.01846	10		
37.5	90	0.00965	9		
28	80	0.00488	8		
20	75	0.00286	6		
14	70	0.00153	3		
10	65				
6.3	61				
5	60				
3.35	57				
2	52				
1.18	50				
0.6	46	Particle density	(assumed)		
0.425	44	2.65	Mg/m3		
0.3	40				
0.212	34				
0.15	27				
0.063	17	1			

3122

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	47.6
Sand	35.1
Silt	13.0
Clay	4.3

Grading Analysis		
D100	mm	
D60	mm	5.28
D30	mm	0.176
D10	mm	0.0154
Uniformity Coefficient		340
Curvature Coefficient		0.38







# LABORATORY REPORT



4043

Contract Number: PSL22/5888

Report Date: 26 September 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: 9/9/2022 Date Commenced: 9/9/2022 Date Completed: 26/9/2022

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

£KII

L Knight S Eyre T Watkins
(Assistant Laboratory Manager) (Senior Technician) (Senior Technician)

7 Heythorne Road Heythorne

5 – 7 Hexthorpe Road, Hexthorpe,

Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642

e-mail: rgunson@prosoils.co.uk awatkins@prosoils.co.uk

# **SUMMARY OF LABORATORY SOIL DESCRIPTIONS**

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
SLT02	2	В	1.20		Brown gravelly sandy CLAY.



North Irish Sea Array

Contract No:
PSL22/5888
Client Ref:
21-1619

# **SUMMARY OF THERMAL PROPERTY TESTS**

In accordance with ASTM-D5334

Hole Number	Sample Number	Sample Type	Top Depth	Base Depth	Moisture Content %	Bulk Density Mg/m <sup>3</sup>	Dry Density Mg/m <sup>3</sup>	Thermal Conductivity	Thermal Resistivity	Remarks
			m	m		~	~	W/m K	C.cm/W	
SLT02	2	В	1.20		17	2.09	1.79	1.990	50.3	

		Contract No:
	North Irish Sea Array	PSL22/5888
Burtanai and Caile Laboratore	North Irish Sea Array	Client Ref:
Professional Soils Laboratory		21-1619



# APPENDIX I ENVIRONMENTAL LABORATORY TEST RESULTS





Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-09208-1

Initial Date of Issue: 21-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 Franey Stephen Watson Stuart Abraham Thomas McAllister

**Project** 21-1619 North Irish Sea Array (NISA)

Quotation No.: Q21-26199 Date Received: 10-Mar-2022

Order No.: Date Instructed: 11-Mar-2022

No. of Samples: 10

Turnaround (Wkdays): 7 Results Due: 21-Mar-2022

Date Approved: 21-Mar-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

Client: Causeway Geotech Ltd			С	hemtest	: Job No.:	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208
Quotation No.: Q21-26199			Cher	ntest Sa	mple ID.:	1389143	1389144	1389145	1389146	1389147	1389148	1389149	1389150
				Client Sa	ample ID.:	1	2	1	2	1	2	1	2
				Sample	Location:	TP22	TP22	TP23	TP23	TP18	TP18	TP17	TP17
				San	nple Type:	SOIL							
				Top [	Depth (m):	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50
				Date	Sampled:	07-Mar-2022							
Determinand	Accred.	SOP	Туре	Units	LOD								
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	78	65	59	65	72	46	26	33
Chloride	U	1220	10:1	mg/l	1.0	2.3	< 1.0	< 1.0	1.7	3.4	1.6	1.3	1.3
Fluoride	U	1220	10:1	mg/l	0.050	0.49	0.28	0.41	0.36	0.32	0.21	0.48	0.19
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	1.2	2.5	1.5	2.3	2.1	< 1.0	3.6
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0020	< 0.0002	0.0003	< 0.0002	0.0003	< 0.0002	0.0012	0.0004
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	0.010	0.008	0.009	0.014	< 0.005	< 0.005	0.006	< 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	0.0009	< 0.0005	< 0.0005	0.0009	< 0.0005	< 0.0005	0.0010	0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0034	< 0.0005	0.0006	0.0009	0.0005	< 0.0005	0.0025	0.0006
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	0.0019	0.010	0.0045	0.011	0.0041	0.0014	0.0010	0.0004
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0022	< 0.0005	0.0006	0.0016	< 0.0005	< 0.0005	0.0017	0.0006
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0010	< 0.0005	< 0.0005	0.0005	< 0.0005	< 0.0005	0.0013	< 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	0.0009	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	0.025	0.004	0.009	0.041	< 0.003	0.005	0.007	0.004
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	34	14	19	15	31	37	23	38
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

Client: Causeway Geotech Ltd			С	hemtest	Job No.:	22-09208	22-09208
Quotation No.: Q21-26199			Cher	ntest Sa	mple ID.:	1389151	1389152
				Client S	ample ID.:	1	2
				TP16	TP16		
				SOIL	SOIL		
					Depth (m):	0.50	1.50
				Date	Sampled:	07-Mar-2022	07-Mar-2022
Determinand	Accred.	SOP	Туре	Units	LOD		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	46	72
Chloride	U	1220	10:1	mg/l	1.0	1.1	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.41	0.46
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	2.6
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0013	< 0.0002
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	< 0.005	0.011
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0014	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0060	0.0006
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0013	0.0083
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0027	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0009	< 0.0005
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	0.009	0.004
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	31	18
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Client: Causeway Geotech Ltd		Ch	emtest	Job No.:	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208
Quotation No.: Q21-26199		Chem	test Sar	nple ID.:	1389143	1389144	1389145	1389146	1389147	1389148	1389149	1389150	1389151
		С	lient Sa	mple ID.:	1	2	1	2	1	2	1	2	1
		5	Sample	Location:	TP22	TP22	TP23	TP23	TP18	TP18	TP17	TP17	TP16
			Sam	ple Type:	SOIL								
			Top D	epth (m):	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50
			Date S	Sampled:	07-Mar-2022								
			Asbe	stos Lab:	DURHAM								
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	1	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected								
Moisture	N	2030	%	0.020	27	13	16	14	20	30	21	28	20
рН	U	2010		4.0	8.5	8.7	8.6	8.2	8.4	8.5	8.4	8.5	8.8
Arsenic	U	2450	mg/kg	1.0	6.9	14	16	16	15	17	18	22	18
Barium	U	2450	mg/kg	10	68	88	140	160	90	180	130	190	100
Cadmium	U	2450	mg/kg	0.10	0.72	2.1	1.5	1.5	1.0	2.2	1.8	2.5	1.4
Mercury Low Level	U	2450	mg/kg	0.05	0.07	0.07	0.06	0.05	< 0.05	0.05	0.07	< 0.05	0.08
Molybdenum	U	2450	mg/kg	2.0	< 2.0	4.0	3.2	4.1	3.0	2.9	3.7	3.0	2.7
Antimony	N	2450	mg/kg	2.0	< 2.0	2.0	2.1	2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.0
Copper	U	2450	mg/kg	0.50	20	31	30	31	29	33	35	34	40
Nickel	U	2450	mg/kg	0.50	22	41	45	44	37	45	48	50	56
Lead	U	2450	mg/kg	0.50	27	27	25	27	25	25	38	30	21
Selenium	U	2450	mg/kg	0.20	0.64	0.59	< 0.20	0.43	0.50	0.46	0.96	0.84	0.62
Zinc	U	2450	mg/kg	0.50	57	55	61	66	69	93	79	110	62
Chromium (Trivalent)	N	2490	mg/kg	1.0	16	16	22	20	27	33	33	46	30
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	6.5	2.6	2.5	2.6	2.9	3.5	3.8	3.6	3.1
Total Organic Carbon	U	2625	%	0.20	2.4	0.30	0.41	0.33	0.75	0.71	1.1	0.75	0.54
Mineral Oil	N	2670	mg/kg	10	< 10	200	28	< 10	< 10	< 10	< 10	57	< 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	53	< 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	74	< 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	16	< 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	62	28	< 1.0	< 1.0	< 1.0	< 1.0	57	< 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	200	28	< 5.0	< 5.0	< 5.0	< 5.0	57	< 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	3.2	< 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	58	< 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	15	67	< 1.0	< 1.0	< 1.0	< 1.0	73	< 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

Client: Causeway Geotech Ltd		Che	emtest .	Job No.:	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208	22-09208
Quotation No.: Q21-26199		Chemt	est Sar	nple ID.:	1389143	1389144	1389145	1389146	1389147	1389148	1389149	1389150	1389151
		Cl	lient Sa	mple ID.:	1	2	1	2	1	2	1	2	1
		S	Sample I	Location:	TP22	TP22	TP23	TP23	TP18	TP18	TP17	TP17	TP16
			Sam	ole Type:	SOIL								
			Top D	epth (m):	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50
			Date S	Sampled:	07-Mar-2022								
			Asbe	stos Lab:	DURHAM								
Determinand	Accred.	SOP	Units	LOD									
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	76	67	< 5.0	< 5.0	< 5.0	< 5.0	73	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	280	94	< 10	< 10	< 10	< 10	130	< 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		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	< 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	0.67	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	< 0.010	0.55	< 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	0.65	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	< 0.010	0.51	< 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	0.63	< 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	0.48	< 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	0.56	< 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	0.56	< 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	0.33	< 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	0.74	< 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	5.7	< 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	< 0.0010
PCB 52	N		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		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		mg/kg		< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 153	N		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
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		0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Client: Causeway Geotech Ltd				Job No.:						
Quotation No.: Q21-26199				nple ID.:	1389152					
				nple ID.:	2					
		5	Sample L	ocation:	TP16					
				ole Type:	SOIL					
		Top Depth (m):								
		Date Sampled:								
		Asbestos Lab:								
Determinand	Accred.	SOP	Units	LOD						
ACM Type	U	2192		N/A	-					
Asbestos Identification	U	2192		N/A	No Asbestos Detected					
Moisture	N	2030	%	0.020	16					
рН	U	2010		4.0	8.6					
Arsenic	U		mg/kg	1.0	14					
Barium	U		mg/kg	10	88					
Cadmium	Ü		mg/kg	0.10	1.1					
Mercury Low Level	Ü		mg/kg	0.05	0.05					
Molybdenum	Ü	2450	mg/kg	2.0	2.6					
Antimony	N		mg/kg	2.0	< 2.0					
Copper	U		mg/kg	0.50	30					
Nickel	Ü		mg/kg	0.50	42					
Lead	Ü		mg/kg	0.50	18					
Selenium	Ü		mg/kg	0.20	0.41					
Zinc	Ü		mg/kg	0.50	48					
Chromium (Trivalent)	N	2490	mg/kg	1.0	21					
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50					
LOI	U	2610	%	0.10	3.2					
Total Organic Carbon	Ü	2625	%	0.20	0.35					
Mineral Oil	N		mg/kg	10	< 10					
Aliphatic TPH >C5-C6	N		mg/kg	1.0	< 1.0					
Aliphatic TPH >C6-C8	N		mg/kg	1.0	< 1.0					
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0					
Aliphatic TPH >C10-C12	U	2680		1.0	< 1.0					
Aliphatic TPH >C10-C12	U		mg/kg	1.0	< 1.0					
Aliphatic TPH >C12-C16  Aliphatic TPH >C16-C21	U		mg/kg	1.0	< 1.0					
Aliphatic TPH >C16-C21 Aliphatic TPH >C21-C35	U		mg/kg	1.0	4.9					
Aliphatic TPH >C21-C35  Aliphatic TPH >C35-C44	N N		)	1.0	< 1.0					
Total Aliphatic Hydrocarbons	N N		mg/kg	5.0	< 1.0 < 5.0					
Aromatic TPH >C5-C7	N N		mg/kg	1.0						
		2680	mg/kg		< 1.0					
Aromatic TPH > C7-C8	N		mg/kg	1.0	< 1.0					
Aromatic TPH >C8-C10	U		mg/kg	1.0	< 1.0					
Aromatic TPH >C10-C12	U		mg/kg	1.0	< 1.0					
Aromatic TPH >C12-C16	U		mg/kg	1.0	< 1.0					
Aromatic TPH >C16-C21	U		mg/kg	1.0	< 1.0					
Aromatic TPH >C21-C35	U		mg/kg	1.0	60					
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0					

Client: Causeway Geotech Ltd		Ch	emtest .	Job No.:	22-09208			
Quotation No.: Q21-26199		Chem	test San	nple ID.:	1389152			
		С	lient Sar	nple ID.:	2			
		5	Sample I	_ocation:	TP16			
		Sample Type						
			Top De	epth (m):	1.50			
			Date S	Sampled:	07-Mar-2022			
			Asbes	stos Lab:	DURHAM			
Determinand	Accred.	SOP	Units	LOD				
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	60			
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	65			
Benzene	U	2760	mg/kg	0.0010	< 0.0010			
Toluene	U	2760	mg/kg	0.0010	< 0.0010			
Ethylbenzene	U	2760	mg/kg	0.0010	< 0.0010			
m & p-Xylene	Ü	2760	mg/kg	0.0010	< 0.0010			
o-Xylene	U	2760	mg/kg	0.0010	< 0.0010			
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	< 0.0010			
Naphthalene	N	2800	mg/kg	0.010	< 0.010			
Acenaphthylene	N	2800		0.010	< 0.010			
Acenaphthene	N	2800		0.010	< 0.010			
Fluorene	N	2800	mg/kg	0.010	< 0.010			
Phenanthrene	N	2800		0.010	1.0			
Anthracene	N	2800	0	0.010	0.95			
Fluoranthene	N	2800	mg/kg	0.010	2.3			
Pyrene	N	2800		0.010	2.5			
Benzo[a]anthracene	N	2800		0.010	2.3			
Chrysene	N	2800		0.010	2.1			
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	2.2			
Benzo[k]fluoranthene	N	2800		0.010	2.0			
Benzo[a]pyrene	N	2800		0.010	2.4			
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	2.2			
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	1.9			
Benzo[g,h,i]perylene	N	2800		0.010	2.2			
Coronene	N	2800		0.010	< 0.010			
Total Of 17 PAH's	N	2800		0.20	24			
PCB 28	N	2815		0.0010	< 0.0010			
PCB 52	N	2815		0.0010	< 0.0010			
PCB 90+101	N	2815	mg/kg		< 0.0010			
PCB 118	N	2815			< 0.0010			
PCB 153	N	2815		0.0010	< 0.0010			
PCB 138	N	2815			< 0.0010			
PCB 180	N	2815	mg/kg	0.0010	< 0.0010			
Total PCBs (7 congeners)	N	2815		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	determination by inductively coupled plasma
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

# **Test Methods**

SOP	Title	Parameters included	Method summary
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)		ComplianceTest for Leaching of Granular Waste Material and Sludge

#### **Report Information**

#### Key **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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: <u>customerservices@chemtest.com</u>



# eurofins

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL

Chemtest

Tel: 01638 606070 Email: info@chemtest.com

# **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



#### **Chemtest**

Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070

Email: info@chemtest.com

Client: Causeway Geotech Ltd			C	nemtest	Job No.:	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199			Chen	ntest Sa	mple ID.:	1393655	1393656	1393657	1393658	1393659	1393660	1393661	1393662
				Sample	Location:	TP01	TP01	TP02	TP02	TP07	TP07	TP09	TP09
				Sam	ple Type:	SOIL							
					epth (m):	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
		Date Sampled:				15-Mar-2022							
Determinand	Accred.	SOP	Туре	Units	LOD								
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

Olient Conserved Control III	<u>.,</u>		-		Jak Na .	00.40044	00.40044	00.40044	00.40044	00.40044	00.40044	00.40044	00.40044
Client: Causeway Geotech Ltd					Job No.:	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199			Chen		mple ID.:	1393663	1393664	1393665	1393666	1393667	1393668	1393669	1393670
					Location:	TP08	TP08	TP12	TP12	TP05	TP05	TP04	TP04
					ple Type:	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							
Determinand	Accred.	SOP	Туре	Units	LOD								
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

Client: Causeway Geotech Ltd			C	hemtest	Job No.:	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199			Chen	ntest Sa	mple ID.:	1393671	1393672	1393673	1393674
				Sample	Location:	TP11	TP11	TP03	TP03
		Sample Type			nple 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	
Determinand	Accred.	SOP	Type	Units	LOD				
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

Client: Causeway Geotech Ltd		Ch	emtest .	Job No.:	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199				nple ID.:	1393655	1393656	1393657	1393658	1393659	1393660	1393661	1393662	1393663
Quotation No.: Q21 20100				_ocation:	TP01	TP01	TP02	TP02	TP07	TP07	TP09	TP09	TP08
				ole Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				epth (m):	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5
				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
				stos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD	OOVEITHE	COVERTICE	COVERNIA	COVENIA	OOVEIVIIVI	OOVEIVII	COVERTIC	OUVERTICE	COVERTIC
ACM Type	U	2192	- Cinto	N/A	-	-	_	-	-	-	-	_	-
,	_				No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos
Asbestos Identification	U	2192		N/A	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
Moisture	N	2030	%	0.020	18	16	16	11	16	16	27	18	18
pH	U	2010	70	4.0	8.5	8.5	8.5	8.7	8.6	8.7	8.2	8.5	8.5
Arsenic	Ü	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	%	0.10	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		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 >C0-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 >C12-C16	U	2680	mg/kg 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		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 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		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	< 5.0 < 1.0	< 1.0	< 1.0	< 5.0 < 1.0	< 1.0	< 5.0 < 1.0	< 1.0
			mg/kg										_
Aromatic TPH > C7-C8	N U	2680 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			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

Client: Causeway Geotech Ltd		Che	emtest	Job No.:	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199				nple ID.:	1393655	1393656	1393657	1393658	1393659	1393660	1393661	1393662	1393663
				Location:	TP01	TP01	TP02	TP02	TP07	TP07	TP09	TP09	TP08
			Sam	ple Type:	SOIL								
				epth (m):	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5
				Sampled:	15-Mar-2022	14-Mar-2022							
				stos Lab:	COVENTRY								
Determinand	Accred.	SOP	Units	LOD									
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
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		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	< 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

Client: Causeway Geotech Ltd	<u></u>	Ch	emtest .	Job No.:	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199				nple ID.:	1393664	1393665	1393666	1393667	1393668	1393669	1393670	1393671	1393672
Quotation No.: Q21-20199				ocation:	TP08	TP12	TP12	TP05	TP05	TP04	TP04	TP11	TP11
				ole Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				epth (m):	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
				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
				stos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD	COVENTRI	COVENTRI	COVENTRI	COVENTRI	COVENTRI	COVENTRI	COVENTRI	COVENTRI	COVENTRI
ACM Type	U Accrea.	2192	Ullits	N/A									
ACIVI Type	- 0			IN/A	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos	No Asbestos
Asbestos Identification	U	2192		N/A	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected
Moisture	N	2030	%	0.020	14	20	20	17	17	17	9.5	15	16
рН	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	Ū	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	Ū	2450	mg/kg	0.05	0.06	0.06	0.07	< 0.05	0.05	0.09	0.05	0.08	0.05
Molybdenum	Ü	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	Ü	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	Ü	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		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 mg/kg	1.0	< 1.0	< 1.0	< 5.0 < 1.0	< 1.0	< 1.0	< 5.0 < 1.0	< 1.0	< 5.0 < 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
Aromatic TPH >C7-C6  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	< 1.0
	U	2680	mg/kg										
Aromatic TPH > C10-C12	U	2680		1.0	< 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	< 1.0
Aromatic TPH > C16-C21	U	2680	mg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Aromatic TPH > C21-C35			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

Client: Causeway Geotech Ltd		Che	emtest	Job No.:	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214	22-10214
Quotation No.: Q21-26199		Chemt	test Sar	nple ID.:	1393664	1393665	1393666	1393667	1393668	1393669	1393670	1393671	1393672
		S		Location:	TP08	TP12	TP12	TP05	TP05	TP04	TP04	TP11	TP11
			Sam	ple Type:	SOIL								
			Top D	epth (m):	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
			Date S	Sampled:	14-Mar-2022								
			Asbe	stos Lab:	COVENTRY								
Determinand	Accred.	SOP	Units	LOD									
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	< 0.010	< 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	< 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	< 0.20	< 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	< 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		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

Client: Causeway Geotech Ltd				Job No.:	22-10214	22-10214
Quotation No.: Q21-26199				nple ID.:	1393673	1393674
		5	Sample L	_ocation:	TP03	TP03
			Samp	ole Type:	SOIL	SOIL
			Top De	epth (m):	0.5	1.0
			Date S	Sampled:	14-Mar-2022	14-Mar-2022
			Asbes	stos 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
рН	U	2010		4.0	7.6	8.1
Arsenic	U	2450	mg/kg	1.0	12	13
Barium	Ū	2450		10	47	56
Cadmium	Ü	2450	0	0.10	0.81	0.31
Mercury Low Level	Ü	2450	mg/kg	0.05	0.06	< 0.05
Molybdenum	Ü	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	Ū	2450	mg/kg	0.50	32	39
Lead	U	2450	mg/kg	0.50	17	7.0
Selenium	Ü	2450	mg/kg	0.20	0.29	< 0.20
Zinc	Ü	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	Ü	2625	%	0.20	1.4	0.40
Mineral Oil	N	2670		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	Ü	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	Ü	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	Ü	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	Ü	2680		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

Client: Causeway Geotech Ltd		Ch	emtest .	Job No.:	22-10214	22-10214
Quotation No.: Q21-26199				nple ID.:	1393673	1393674
		(		Location:	TP03	TP03
			Samp	ole Type:	SOIL	SOIL
			Top D	epth (m):	0.5	1.0
			Date S	Sampled:	14-Mar-2022	14-Mar-2022
			Asbes	stos 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	determination by inductively coupled plasma
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

# **Test Methods**

SOP	Title	Parameters included	Method summary
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)		ComplianceTest for Leaching of Granular Waste Material and Sludge

#### **Report Information**

Key	
U	UKAS accredited
М	MCERTS and UKAS accredited
Ν	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
Т	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

Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-30572-1

Initial Date of Issue: 25-Aug-2022

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road

Balnamore Ballymoney County Antrim BT53 7QL

Contact(s): 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

Rachel White

Thomas McAllister

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

Quotation No.: Q21-26199 Date Received: 11-Aug-2022

Order No.: Date Instructed: 17-Aug-2022

No. of Samples: 6

Turnaround (Wkdays): 7 Results Due: 25-Aug-2022

Date Approved: 25-Aug-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

Project: 21-1619 North Irish Sea A	iiay_							1		1	
Client: Causeway Geotech Ltd			-		t Job No.:	22-30572	22-30572	22-30572	22-30572	22-30572	22-30572
Quotation No.: Q21-26199			Chen	ntest Sa	ample ID.:	1485686	1485687	1485688	1485689	1485690	1485691
			-	Client S	ample ID.:	1	2	1	2	1	2
				Sample	Location:	ST24	ST24	ST23	ST23	ST06	ST06
				San	nple Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top I	Depth (m):	0.50	1.00	0.50	1.00	0.50	1.00
				Date	Sampled:	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022
Determinand	Accred.	SOP	Type	Units	LOD						
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	47	53	43	62	47	80
Chloride	U	1220	10:1	mg/l	1.0	< 1.0	1.4	2.6	6.1	8.1	12
Fluoride	U	1220	10:1	mg/l	0.050	0.16	0.23	0.17	0.20	0.55	0.70
Sulphate	U	1220	10:1	mg/l	1.0	1.5	1.9	2.2	3.9	8.1	6.4
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0034	0.0030	0.0015	0.0010	0.0014	0.0007
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	< 0.005	< 0.005	< 0.005	0.006	< 0.005	0.008
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	0.00044	< 0.00011	0.00025	< 0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	0.0006	< 0.0005	0.0005	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0023	0.0019	0.0013	0.0014	0.0030	0.0011
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	0.013	0.014	0.0044	0.0047	0.0027	0.0060
Nickel (Dissolved)	U	1455	10:1	mg/l	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
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0028	0.0018	0.0034	0.0011	0.0008	0.0006
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0039	0.0029	0.0027	0.0024	0.0016	0.0011
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	13	13	11	13	19	14
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

Client: Causeway Geotech Ltd				Job No.:	22-30572	22-30572	22-30572	22-30572	22-30572	22-30572
Quotation No.: Q21-26199		Chem	test San	nple ID.:	1485686	1485687	1485688	1485689	1485690	1485691
				nple ID.:	1	2	1	2	1	2
		5	Sample I	_ocation:	ST24	ST24	ST23	ST23	ST06	ST06
			Samp	ole Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top De	epth (m):	0.50	1.00	0.50	1.00	0.50	1.00
			Date S	Sampled:	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-202
			Asbes	stos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD						
ACM Type	U	2192		N/A	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbesto Detected				
Moisture	N	2030	%	0.020	5.8	8.1	6.9	6.7	9.5	10
pH	U	2010		4.0	8.6	8.5	8.6	8.1	7.7	7.8
Arsenic	Ü	2455	mg/kg	0.5	11	11	13	8.1	13	16
Barium	Ü	2455	mg/kg	0	63	32	58	47	65	75
Cadmium	Ü	2455	mg/kg	0.10	0.49	0.26	0.56	0.65	0.84	0.89
Mercury Low Level	Ü	2450	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05
Molybdenum	U	2455	mg/kg	0.5	1.6	1.5	2.1	1.5	2.0	3.2
Antimony	N	2455	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2455	mg/kg	0.50	55	25	89	17	30	33
Nickel	U		mg/kg	0.50	20	26	25	20	32	37
Lead	Ü	2455	mg/kg	0.50	15	14	17	22	15	16
Selenium	Ü	2455	mg/kg	0.25	0.75	0.61	0.86	1.1	1.1	1.6
Zinc	Ü	2455	mg/kg	0.50	46	46	53	67	43	49
Chromium (Trivalent)	N	2490	mg/kg	1.0	12	14	15	11	20	24
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	4.6	4.9	2.2	2.1	2.5	2.6
Total Organic Carbon	Ü	2625	%	0.20	0.41	0.36	0.78	0.90	0.25	0.25
Mineral Oil	N		mg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680		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
Aliphatic TPH >C8-C10	U		mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U		mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N		mg/kg	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
Aromatic TPH >C5-C7	N	2680	J	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
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	Ü	2680	mg/kg	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
Aromatic TPH >C21-C35	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N		mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Client: Causeway Geotech Ltd				Job No.:	22-30572	22-30572	22-30572	22-30572	22-30572	22-30572
Quotation No.: Q21-26199				nple ID.:	1485686	1485687	1485688	1485689	1485690	1485691
				mple ID.:	1	2	1	2	1	2
		5	Sample I	_ocation:	ST24	ST24	ST23	ST23	ST06	ST06
				ole Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				epth (m):	0.50	1.00	0.50	1.00	0.50	1.00
			Date S	Sampled:	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022
			Asbes	stos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD						
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 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
Toluene	U	2760	mg/kg	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
m & p-Xylene	U	2760	mg/kg	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
Methyl Tert-Butyl Ether	U	2760	mg/kg	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
Acenaphthylene	N	2800	mg/kg	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
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	8.0	8.0	15	0.60	1.5	< 0.010
Anthracene	N	2800	mg/kg	0.010	2.5	2.4	5.0	0.30	0.44	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	11	7.7	18	2.6	1.6	< 0.010
Pyrene	N	2800	mg/kg	0.010	8.4	5.9	14	2.6	1.1	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	3.4	2.2	7.2	1.3	< 0.010	< 0.010
Chrysene	N	2800	mg/kg	0.010	2.8	1.6	5.2	1.1	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	4.3	< 0.010	8.3	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	1.4	< 0.010	2.8	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	3.2	< 0.010	6.5	< 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
Dibenz(a,h)Anthracene	N	2800	mg/kg	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
Coronene	N	2800	mg/kg	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	45	28	82	8.5	4.6	< 0.20
PCB 28	N	2815	mg/kg	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
PCB 90+101	N	2815	mg/kg	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
PCB 153	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 138	N	2815		0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 180	N	2815		0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815		0.0010	< 0.0010	< 0.0010	< 0.0010	< 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	determination by inductively coupled plasma	
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	

# **Test Methods**

SOP	Title	Parameters included	Method summary		
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS		
640		, ,	ComplianceTest for Leaching of Granular Waste Material and Sludge		

#### **Report Information**

#### Key **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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

Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-30639-1

Initial Date of Issue: 25-Aug-2022

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road

Balnamore Ballymoney County Antrim BT53 7QL

Contact(s): 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 Army

Quotation No.: Q21-26199 Date Received: 11-Aug-2022

Order No.: Date Instructed: 17-Aug-2022

No. of Samples: 5

Turnaround (Wkdays): 7 Results Due: 25-Aug-2022

Date Approved: 25-Aug-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager

# **Results - Leachate**

Client: Causeway Geotech Ltd			C	hemtest	Job No.:	22-30639	22-30639	22-30639	22-30639	22-30639
Quotation No.: Q21-26199			Chen	ntest Sa	mple ID.:	1485978	1485979	1485980	1485981	1485982
			(	Client S	ample ID.:	1	2	1	2	3
				Sample	Location:	ST02	ST02	ST03	ST03	ST03
				San	nple Type:	SOIL	SOIL	SOIL	SOIL	SOIL
					Depth (m):	0.5	1.0	0.5	1.0	1.3
				08-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-2022		
Determinand	Accred.	SOP	Туре	Units	LOD					
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	65	59	300	490	170
Chloride	U	1220	10:1	mg/l	1.0	4.5	4.6	6.9	8.9	22
Fluoride	U	1220	10:1	mg/l	0.050	0.41	0.38	0.12	0.090	0.62
Sulphate	U	1220	10:1	mg/l	1.0	2.0	1.4	170	390	49
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	< 0.0002	0.0005	< 0.0002	< 0.0002	0.0012
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	< 0.005	< 0.005	0.011	0.036	0.017
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011	< 0.00011	0.00044	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	0.0005	< 0.0005	< 0.0005	0.0018
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0038	0.0064	0.0050	< 0.0002	0.0063
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	0.040	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	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	0.0010	< 0.0005	0.0006
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	0.012	0.046	0.0011
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	< 0.003	< 0.003	< 0.003	0.005	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	14	16	14	4.8	15
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

Client: Causeway Geotech Ltd				Job No.:	22-30639	22-30639	22-30639	22-30639	22-30639
Quotation No.: Q21-26199		Chem	test San	nple ID.:	1485978	1485979	1485980	1485981	1485982
		С	lient Sar	mple ID.:	1	2	1	2	3
		5		_ocation:	ST02	ST02	ST03	ST03	ST03
				ole Type:	SOIL	SOIL	SOIL	SOIL	SOIL
			Top De	epth (m):	0.5	1.0	0.5	1.0	1.3
			Date S	Sampled:	08-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-202
			Asbes	stos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD					
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbesto Detected
Moisture	N	2030	%	0.020	14	9.8	9.8	12	13
pH	U	2010		4.0	7.7	7.6	7.6	5.8	7.4
Arsenic	U	2455	mg/kg	0.5	27	28	35	52	11
Barium	U	2455	mg/kg	0	49	56	53	46	61
Cadmium	U	2455	mg/kg	0.10	0.92	1.2	0.98	0.26	1.1
Mercury Low Level	U	2450	mg/kg	0.05	0.06	0.08	0.08	0.14	< 0.05
Molybdenum	U	2455	mg/kg	0.5	9.9	12	16	43	2.4
Antimony	N	2455	mg/kg	2.0	3.4	4.0	5.0	8.1	< 2.0
Copper	U	2455	mg/kg	0.50	36	42	49	75	22
Nickel	U	2455	mg/kg	0.50	34	41	37	14	30
Lead	U	2455	mg/kg	0.50	31	36	42	73	22
Selenium	U	2455	mg/kg	0.25	3.4	3.9	5.1	1.5	1.1
Zinc	U	2455	mg/kg	0.50	50	61	56	21	69
Chromium (Trivalent)	N	2490	mg/kg	1.0	23	26	25	17	13
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	2.4	2.7	3.0	4.4	4.1
Total Organic Carbon	U	2625	%	0.20	0.42	0.64	0.63	1.5	0.79
Mineral Oil	N	2670	mg/kg	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
Aliphatic TPH >C6-C8	N	2680	mg/kg	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
Aliphatic TPH >C10-C12	U	2680	mg/kg	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
Aliphatic TPH >C16-C21	U	2680	mg/kg	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
Aliphatic TPH >C35-C44	N	2680	mg/kg	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
Aromatic TPH >C5-C7	N	2680	mg/kg	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
Aromatic TPH >C8-C10	U	2680	mg/kg	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
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	60	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	210	< 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

Client: Causeway Geotech Ltd		Ch	emtest .	Job No.:	22-30639	22-30639	22-30639	22-30639	22-30639
Quotation No.: Q21-26199		Chem	test San	nple ID.:	1485978	1485979	1485980	1485981	1485982
		С	lient Sar	mple ID.:	1	2	1	2	3
		5	Sample I	Location:	ST02	ST02	ST03	ST03	ST03
			Samp	ole Type:	SOIL	SOIL	SOIL	SOIL	SOIL
			Top De	epth (m):	0.5	1.0	0.5	1.0	1.3
			Date S	Sampled:	08-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-2022
				stos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD					
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	270	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	270	< 10	< 10	< 10
Benzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	U	2760	mg/kg	0.0010	0.0015	< 0.0010	< 0.0010	0.0037	< 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	0.0062	< 0.0010	0.0027	0.0070	< 0.0010
m & p-Xylene	U	2760	mg/kg	0.0010	0.024	< 0.0010	0.0077	0.019	< 0.0010
o-Xylene	U	2760	mg/kg	0.0010	0.0053	< 0.0010	0.0014	0.0039	< 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	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
Acenaphthylene	N	2800	mg/kg	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
Fluorene	N	2800	mg/kg	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
Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	0.96	0.74	< 0.010	< 0.010	< 0.010
Pyrene	N	2800	mg/kg	0.010	0.78	0.61	< 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
Chrysene	N	2800	mg/kg	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
Benzo[k]fluoranthene	N	2800	mg/kg	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
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	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
Benzo[g,h,i]perylene	N	2800	mg/kg	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
Total Of 17 PAH's	N	2800	mg/kg	0.20	1.7	1.4	< 0.20	< 0.20	< 0.20
PCB 28	N	2815	mg/kg	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
PCB 90+101	N	2815	mg/kg	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
PCB 153	N	2815	mg/kg		< 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
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N		mg/kg		< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

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	determination by inductively coupled plasma				
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS				

SOP	Title	Parameters included	Method summary
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	<b>5</b> . <b>5</b>	ComplianceTest for Leaching of Granular Waste Material and Sludge

### **Report Information**

#### Key **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-30817-1

Initial Date of Issue: 25-Aug-2022

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road

Balnamore Ballymoney County Antrim BT53 7QL

Contact(s): 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.: Q21-26199 Date Received: 12-Aug-2022

Order No.: Date Instructed: 17-Aug-2022

No. of Samples: 4

Turnaround (Wkdays): 7 Results Due: 25-Aug-2022

Date Approved: 25-Aug-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager

# Results - Leachate

Client: Causeway Geotech Ltd			CI	hemtest	t Job No.:	22-30817	22-30817	22-30817	22-30817
Quotation No.: Q21-26199			Chen	ntest Sa	ample ID.:	1486825	1486826	1486827	1486828
				Sample	Location:	ST29	ST29	ST31	ST31
				San	nple Type:	SOIL	SOIL	SOIL	SOIL
				Top [	Depth (m):	1.0	0.5	1.0	0.5
		Date Sampled: 1		10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022		
Determinand	Accred.	SOP	OP Type Units LOD						
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	110	69	61	68
Chloride	U	1220	10:1	mg/l 1.0		26	10	3.2	4.5
Fluoride	U	1220	10:1	1 mg/l 0.050		0.19	0.19	0.14	0.27
Sulphate	U	1220	10:1	mg/l 1.0		7.0	2.9	1.2	2.6
Arsenic (Dissolved)	U	1455	10:1	mg/l 0.0002		0.0010	0.0005	0.033	0.0009
Barium (Dissolved)	U	1455	10:1	mg/l 0.005		0.014	< 0.005	0.007	0.014
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	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0007	< 0.0005	0.0030	< 0.0005
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	0.0066	0.0043	0.0052	0.013
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005	0.032	< 0.0005
Antimony (Dissolved)	U	1455	10:1	:1 mg/l 0.0005		< 0.0005	< 0.0005	0.0014	< 0.0005
Selenium (Dissolved)	U	1455	10:1	10:1 mg/l 0.0005		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Zinc (Dissolved)	U	1455	10:1	10:1 mg/l 0.002		< 0.003	< 0.003	< 0.003	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	13	14	34	37
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	0.088	< 0.030

Client: Causeway Geotech Ltd		Chemtest Job No.:				22-30817	22-30817	22-30817
Quotation No.: Q21-26199				nple ID.:	1486825	1486826	1486827	1486828
		9	Sample I	_ocation:	ST29	ST29	ST31	ST31
			Samp	ole Type:	SOIL	SOIL	SOIL	SOIL
			Top De	epth (m):	1.0	0.5	1.0	0.5
			Date S	Sampled:	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-202
			Asbes	stos Lab:	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A	1	ī	ı	1
Asbestos Identification	U	2192		N/A	No Asbestos	No Asbestos	No Asbestos	No Asbesto
Aspestos identification	U	2192		IN/A	Detected	Detected	Detected	Detected
Moisture	N	2030	%	0.020	6.0	6.3	0.78	9.0
рН	U	2010		4.0	7.8	8.4	8.6	8.7
Arsenic	U		mg/kg	0.5	9.5	17	15	18
Barium	U	2455	mg/kg	0	44	55	48	65
Cadmium	U	2455		0.10	1.4	0.95	0.85	0.89
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05	< 0.05	< 0.05	0.25
Molybdenum	U	2455	mg/kg	0.5	2.6	2.1	1.8	1.8
Antimony	N	2455		2.0	< 2.0	< 2.0	< 2.0	3.0
Copper	U	2455	mg/kg	0.50	21	19	18	38
Nickel	U	2455	mg/kg	0.50	32	29	27	29
Lead	U	2455	mg/kg	0.50	18	27	25	12
Selenium	U	2455		0.25	1.0	0.93	0.83	0.88
Zinc	U	2455	mg/kg	0.50	66	55	51	34
Chromium (Trivalent)	N	2490		1.0	11	13	11	17
Chromium (Hexavalent)	N		mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	1.9	1.8	1.9	1.9
Total Organic Carbon	U	2625	%	0.20	1.2	0.52	0.83	0.57
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	620	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680		1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680		1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680		1.0	< 1.0	< 1.0	13	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	69	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	110	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	420	< 1.0
Aliphatic TPH >C35-C44	N	2680	Ü	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680		5.0	< 5.0	< 5.0	620	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680		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
Aromatic TPH >C10-C12	U		mg/kg	1.0	< 1.0	< 1.0	140	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	480	< 1.0
Aromatic TPH >C16-C21	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	1100	130
Aromatic TPH >C21-C35	Ü	2680	mg/kg	1.0	< 1.0	< 1.0	2300	290
Aromatic TPH >C35-C44	N		mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N		mg/kg	5.0	< 5.0	< 5.0	4000	420

Client: Causeway Geotech Ltd		Ch	emtest .	Job No.:	22-30817	22-30817	22-30817	22-30817
Quotation No.: Q21-26199		Chem	test Sar	nple ID.:	1486825	1486826	1486827	1486828
		5	Sample I	Location:	ST29	ST29	ST31	ST31
			Samp	ole Type:	SOIL	SOIL	SOIL	SOIL
			Top Do	epth (m):	1.0	0.5	1.0	0.5
			Date S	Sampled:	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
			Asbes	stos Lab:	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD				
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	4600	420
Benzene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	0.0064	< 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	0.0043 < 0.001		0.013	< 0.0010
m & p-Xylene	U	2760	mg/kg	0.0010	0.013	< 0.0010	0.045	< 0.0010
o-Xylene	U	2760	mg/kg	0.0010	0.0026	< 0.0010	0.033	< 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Naphthalene	N	2800	mg/kg	0.010	< 0.010	< 0.010	4.3	4.5
Acenaphthylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	0.34	0.37
Acenaphthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	8.4	8.5
Fluorene	N	2800	mg/kg	0.010	< 0.010	< 0.010	10	9.4
Phenanthrene	N	2800	mg/kg	0.010	1.1	< 0.010	47	42
Anthracene	N	2800	mg/kg	0.010	0.22	< 0.010	14	14
Fluoranthene	N	2800	mg/kg	0.010	0.99	< 0.010	38	37
Pyrene	N	2800	mg/kg	0.010	0.89	< 0.010	30	30
Benzo[a]anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	16	16
Chrysene	N	2800	mg/kg	0.010	< 0.010	< 0.010	12	12
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	17	17
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	< 0.010	< 0.010	6.0	6.6
Benzo[a]pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	16	15
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	< 0.010	< 0.010	11	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	< 0.010	< 0.010	1.1	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	< 0.010	< 0.010	6.8	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	3.2	< 0.20	240	210
PCB 28	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 52	N		mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 90+101	N		mg/kg	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
PCB 153	N	2815	mg/kg	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
PCB 180	N		mg/kg	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

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	determination by inductively coupled plasma				
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS				

SOP	Title	Parameters included	Method summary
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	<b>5</b> . <b>5</b>	ComplianceTest for Leaching of Granular Waste Material and Sludge

### **Report Information**

#### Key **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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

Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-31064-1

Initial Date of Issue: 25-Aug-2022

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road

Balnamore Ballymoney County Antrim BT53 7QL

Contact(s): 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.: Q21-26199 Date Received: 15-Aug-2022

Order No.: Date Instructed: 17-Aug-2022

No. of Samples: 2

Turnaround (Wkdays): 7 Results Due: 25-Aug-2022

Date Approved: 25-Aug-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager

# Results - Leachate

Client: Causeway Geotech Ltd			C	hemtest	Job No.:	22-31064	22-31064
Quotation No.: Q21-26199			Chen	ntest Sa	mple ID.:	1487811	1487812
				Client S	ample ID.:	1	2
				Sample	Location:	ST27	ST27
				San	nple Type:	SOIL	SOIL
				Top [	Depth (m):	0.50	1.00
Determinand	Accred.	Accred. SOP Type Units LOD					
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	100	120
Chloride	U	1220	10:1	mg/l	1.0	11	19
Fluoride	U	1220	10:1	mg/l	0.050	0.24	0.42
Sulphate	U	1220	10:1	mg/l	1.0	35	21
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0026	0.0005
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	0.006	0.007
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0053	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	0.0008	0.0013
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0067	0.010
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Selenium (Dissolved)	U	U 1455 10:1 mg/l 0.0005				0.0018	0.0012
Zinc (Dissolved)	U	U 1455 10:1 mg/l 0.002					< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	9.3	15
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Client: Causeway Geotech Ltd		Ch	emtest .	Job No.:	22-31064	22-31064
Quotation No.: Q21-26199		Chem	test San	nple ID.:	1487811	1487812
		С	lient Sar	nple ID.:	1	2
		(	Sample I	ocation:	ST27	ST27
			Samp	ole Type:	SOIL	SOIL
			Top De	epth (m):	0.50	1.00
			Asbes	stos Lab:	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	=	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	6.7	9.3
рН	U	2010		4.0	[A] 8.3	[A] 8.3
Arsenic	U	2455	mg/kg	0.5	11	12
Barium	U	2455		0	87	89
Cadmium	U	2455	mg/kg	0.10	0.91	1.2
Mercury Low Level	U	2450		0.05	0.05	0.06
Molybdenum	U	2455	mg/kg	0.5	2.1	2.7
Antimony	N	2455		2.0	< 2.0	< 2.0
Copper	U	2455	mg/kg	0.50	23	25
Nickel	U		mg/kg	0.50	28	34
Lead	U	2455		0.50	35	35
Selenium	U	2455		0.25	0.80	1.0
Zinc	U	2455		0.50	74	70
Chromium (Trivalent)	N	2490	mg/kg	1.0	12	14
Chromium (Hexavalent)	N	2490		0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	2.8	3.0
Total Organic Carbon	U	2625	%	0.20	[A] 0.83	[A] 0.82
Mineral Oil	N	2670	mg/kg	10	[A] < 10	[A] < 10
Aliphatic TPH >C5-C6	N		mg/kg	1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C6-C8	N	2680		1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C10-C12	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C12-C16	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C16-C21	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C35-C44	N	2680		1.0	[A] < 1.0	[A] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0
Aromatic TPH >C5-C7	N		mg/kg	1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C7-C8	N	2680		1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C10-C12	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C12-C16	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C16-C21	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C21-C35	U	2680		1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C35-C44	N	2680		1.0	[A] < 1.0	[A] < 1.0
Total Aromatic Hydrocarbons	N	2680		5.0	[A] < 5.0	[A] < 5.0

Client: Causeway Geotech Ltd		Chemtest Job No.:			22-31064	22-31064
Quotation No.: Q21-26199				nple ID.:	1487811	1487812
		Client Sample ID.:			1	2
		Sample Location:			ST27	ST27
		Sample Type:			SOIL	SOIL
				epth (m):	0.50	1.00
			Asbes	stos Lab:	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[A] < 10	[A] < 10
Benzene	U	2760	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
Toluene	U	2760	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	[A] 0.0018	[A] 0.0016
m & p-Xylene	U	2760	mg/kg	0.0010	[A] 0.0047	[A] 0.0051
o-Xylene	U	2760	mg/kg	0.0010	[A] 0.0013	[A] 0.0013
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
Naphthalene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Acenaphthylene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Acenaphthene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Fluorene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Phenanthrene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Anthracene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Fluoranthene	N	2800	mg/kg	0.010	[A] 0.61	[A] < 0.010
Pyrene	N	2800	mg/kg	0.010	[A] 0.58	[A] < 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Chrysene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Coronene	N	2800	mg/kg	0.010	[A] < 0.010	[A] < 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	[A] 1.2	[A] < 0.20
PCB 28	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
PCB 52	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
PCB 90+101	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
PCB 118	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
PCB 153	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
PCB 138	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
PCB 180	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 0.0010
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010	[A] < 0.0010	[A] < 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:
1487811		1	ST27		А	Amber Glass 250ml
1487811		1	ST27		А	Amber Glass 60ml
1487811		1	ST27		А	Plastic Tub 500g
1487812		2	ST27		А	Amber Glass 250ml
1487812		2	ST27		А	Amber Glass 60ml
1487812		2	ST27		А	Plastic Tub 500g

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	determination by inductively coupled plasma
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

SOP	Title	Parameters included	Method summary
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	<b>5</b> . <b>5</b>	ComplianceTest for Leaching of Granular Waste Material and Sludge

### **Report Information**

### Key **UKAS** accredited MCERTS and UKAS accredited M Unaccredited Ν This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for S this analysis This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited SN for this analysis Т 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: <u>customerservices@chemtest.com</u>



**&** eurofins

Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# **Final Report**

**Report No.:** 22-36060-1

Initial Date of Issue: 30-Sep-2022

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road

Balnamore Ballymoney County Antrim BT53 7QL

Contact(s): Alistair McQuat

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 Franey
Stephen McCracken
Stephen Watson
Stuart Abraham
Thomas McAlli

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

Quotation No.: Q21-26199 Date Received: 21-Sep-2022

Order No.: Date Instructed: 21-Sep-2022

No. of Samples: 2

Turnaround (Wkdays): 7 Results Due: 29-Sep-2022

Date Approved: 30-Sep-2022

Approved By:

**Details:** Stuart Henderson, Technical

Manager



Eurofins Chemtest Ltd Depot Road Newmarket CB8 0AL

Tel: 01638 606070 Email: info@chemtest.com

# Results - Leachate

Client: Causeway Geotech Ltd			С	Job No.:	22-36060	22-36060	
Quotation No.: Q21-26199			Cher	ntest Sa	mple ID.:	1510217	1510218
				Client S	ample ID.:	0.15	0.7
		Sample Location:					ST02
				San	nple Type:	SOIL	SOIL
					Depth (m):	0.15	0.7
				Date	Sampled:	02-Sep-2022	02-Sep-2022
Determinand	Accred.	SOP	Type	Units	LOD		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	32	35
Chloride	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.11	0.13
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0
Arsenic (Dissolved)	U	1455	10:1	mg/l	0.0002	0.0015	0.0006
Barium (Dissolved)	U	1455	10:1	mg/l	0.005	0.019	< 0.005
Cadmium (Dissolved)	U	1455	10:1	mg/l	0.00011	< 0.00011	< 0.00011
Chromium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Copper (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	0.0005
Mercury (Dissolved)	U	1455	10:1	mg/l	0.00005	< 0.00005	< 0.00005
Molybdenum (Dissolved)	U	1455	10:1	mg/l	0.0002	< 0.0002	0.0013
Nickel (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Lead (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Antimony (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Selenium (Dissolved)	U	1455	10:1	mg/l	0.0005	< 0.0005	< 0.0005
Zinc (Dissolved)	U	1455	10:1	mg/l	0.002	< 0.003	< 0.003
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	18	3.8
Total Phenols	U	1920	10:1	mg/l	0.030	3.1	< 0.030

Client: Causeway Geotech Ltd		Chemtest Job No.:				22-36060
Quotation No.: Q21-26199				nple ID.:	1510217	1510218
		Client Sample ID.:			0.15	0.7
		Sample Location:			ST02	ST02
				ole Type:	SOIL	SOIL
		Top Depth (m):			0.15	0.7
			Date S	Sampled:	02-Sep-2022	02-Sep-2022
			Asbes	stos Lab:	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	0.55	10
pH	U	2010		4.0	8.8	8.7
Arsenic	U	2455	mg/kg	0.5	1.3	22
Barium	U	2455	0	0	4	62
Cadmium	U	2455	mg/kg	0.10	0.11	1.2
Mercury Low Level	Ü	2450		0.05	< 0.05	0.08
Molybdenum	U	2455	mg/kg	0.5	< 0.5	3.0
Antimony	N	2455	mg/kg	2.0	< 2.0	< 2.0
Copper	U	2455		0.50	1.9	39
Nickel	U	2455		0.50	2.9	55
Lead	U	2455	mg/kg	0.50	3.3	23
Selenium	U	2455	mg/kg	0.25	< 0.25	0.94
Zinc	Ü	2455	mg/kg	0.50	7.6	87
Chromium (Trivalent)	N	2490	mg/kg	1.0	2.4	34
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	U	2610	%	0.10	17	2.5
Total Organic Carbon	U	2625	%	0.20	31	< 0.20
Mineral Oil	N	2670	mg/kg	10	[B] 1100	[B] < 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] 52	[B] < 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] 250	[B] < 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] 270	[B] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] 550	[B] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[B] 1100	[B] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C10-C12	Ü	2680	mg/kg	1.0	[B] 620	[B] < 1.0
Aromatic TPH >C12-C16	Ü	2680	mg/kg	1.0	[B] 2200	[B] < 1.0
Aromatic TPH >C16-C21	Ü	2680	mg/kg	1.0	[B] 4200	[B] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] 9400	[B] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] 310	[B] < 1.0

Client: Causeway Geotech Ltd				Job No.:	22-36060	22-36060
Quotation No.: Q21-26199		Chem	test Sar	nple ID.:	1510217	1510218
				mple ID.:	0.15	0.7
		Sample Location:			ST02	ST02
				ole Type:	SOIL	SOIL
		Top Depth (m):			0.15	0.7
		Date Sampled:			02-Sep-2022	02-Sep-2022
		Asbestos Lab:				DURHAM
Determinand	Accred.	SOP	Units	LOD		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[B] 17000	[B] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[B] 18000	[B] < 10
Benzene	U	2760	mg/kg	0.0010	[B] 0.014	[B] < 0.0010
Toluene	U	2760	mg/kg	0.0010	[B] 0.039	[B] < 0.0010
Ethylbenzene	U	2760	mg/kg	0.0010	[B] 0.020	[B] < 0.0010
m & p-Xylene	U	2760	mg/kg		[B] 0.073	[B] < 0.0010
o-Xylene	U	2760	mg/kg	0.0010	[B] 0.046	[B] < 0.0010
Methyl Tert-Butyl Ether	U	2760	mg/kg	0.0010	[B] < 0.0010	[B] < 0.0010
Naphthalene	N	2800	mg/kg	0.010	74	< 0.010
Acenaphthylene	N	2800	mg/kg	0.010	0.60	< 0.010
Acenaphthene	N	2800	mg/kg	0.010	69	< 0.010
Fluorene	N	2800	mg/kg	0.010	59	< 0.010
Phenanthrene	N	2800	mg/kg	0.010	210	< 0.010
Anthracene	N	2800	mg/kg	0.010	70	< 0.010
Fluoranthene	N	2800	mg/kg	0.010	170	< 0.010
Pyrene	N	2800	mg/kg	0.010	120	< 0.010
Benzo[a]anthracene	N	2800	mg/kg	0.010	58	< 0.010
Chrysene	N	2800	mg/kg	0.010	49	< 0.010
Benzo[b]fluoranthene	N	2800	mg/kg	0.010	57	< 0.010
Benzo[k]fluoranthene	N	2800	mg/kg	0.010	22	< 0.010
Benzo[a]pyrene	N	2800	mg/kg	0.010	49	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010	28	< 0.010
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010	6.0	< 0.010
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010	27	< 0.010
Coronene	N	2800	mg/kg	0.010	< 0.010	< 0.010
Total Of 17 PAH's	N	2800	mg/kg	0.20	1100	< 0.20
PCB 28	N	2815	mg/kg		< 0.0010	< 0.0010
PCB 52	N	2815	mg/kg		< 0.0010	< 0.0010
PCB 90+101	N	2815			< 0.0010	< 0.0010
PCB 118	N	2815			< 0.0010	< 0.0010
PCB 153	N	2815	mg/kg		< 0.0010	< 0.0010
PCB 138	N	2815			< 0.0010	< 0.0010
PCB 180	N	2815	mg/kg	0.0010	< 0.0010	< 0.0010
Total PCBs (7 congeners)	N	2815		0.0010	< 0.0010	< 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:
1510217		0.15	ST02	02-Sep-2022	В	Amber Glass 250ml
1510217		0.15	ST02	02-Sep-2022	В	Amber Glass 60ml
1510217		0.15	ST02	02-Sep-2022	В	Plastic Tub 500g
1510218		0.7	ST02	02-Sep-2022	В	Amber Glass 250ml
1510218		0.7	ST02	02-Sep-2022	В	Amber Glass 60ml
1510218		0.7	ST02	02-Sep-2022	В	Plastic Tub 500g

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	determination by inductively coupled plasma
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	рН	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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

SOP	Title	Parameters included	Method summary
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)		ComplianceTest for Leaching of Granular Waste Material and Sludge

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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

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- 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

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All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

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



# APPENDIX J SPT HAMMER ENERGY MEASUREMENT REPORT



# **Hammer Energy Test Report**





**Dynamic Sampling Uk Ltd Unit 8 Victory Park Victory Road** Derby **DE24 8ZF** 

Hammer Ref:

D130 (Asset No. 1411)

Test Date:

25/04/2022

Report Date:

25/04/2022

File Name:

D130.spt

Test Operator:

**B.HUNTER** 

### **Instrumented Rod Data**

Diameter d<sub>r</sub> (mm):

54

Wall Thickness t<sub>r</sub> (mm):

6.5

Assumed Modulus Ea (GPa): 208

Accelerometer No.1:

62901

Accelerometer No.2:

62902

### **Hammer Information**

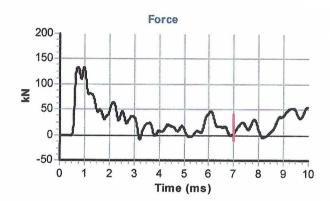
Hammer Mass m (kg): 63.5

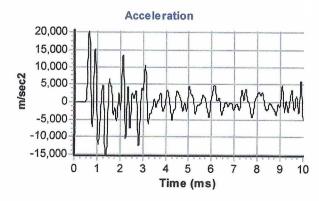
Falling Height h (mm): 760

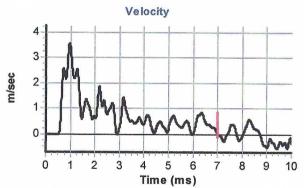
String Length L (m):

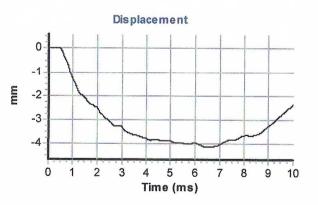
10.0

### **Comments / Location**









### **Calculations**

Area of Rod A (mm2):

970

Theoretical Energy E<sub>theor</sub> (J):

473

Measured Energy E<sub>meas</sub>

318

Energy Ratio  $E_r$  (%):

67

Signed: B.Hunter

Title:

**Operations Manager** 



### **SPT Hammer Energy Test Report**

in accordance with BSEN ISO 22476-3:2005

**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<sub>r</sub> (mm):

54

Wall Thickness  $t_r$  (mm):

6.0

Assumed Modulus Ea (GPa): 200

Accelerometer No.1:

64786

Accelerometer No.2:

64789

### **SPT Hammer Information**

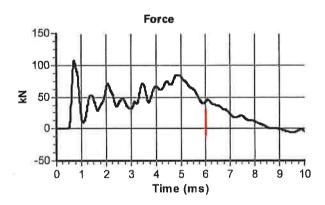
Hammer Mass m (kg):

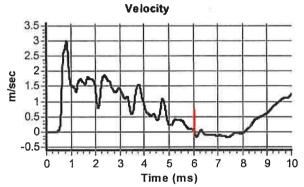
Falling Height h (mm): 760

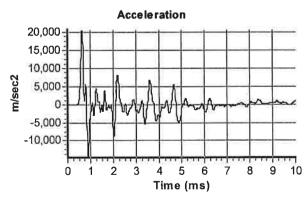
SPT String Length L (m): 12.0

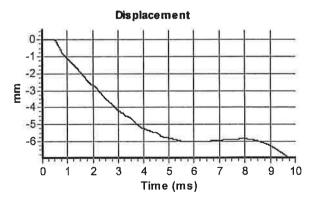
**Comments / Location** 

**CAUSEWAY** 









### **Calculations**

Area of Rod A (mm2):

905

Theoretical Energy  $E_{theor}$  (J):

473

340

Measured Energy E<sub>meas</sub> (J):

Signed: N Burrows

FOC Manager

Title:

Energy Ratio  $E_r$  (%):

**72** 



## **SPT Hammer Energy Test Report**

in accordance with BSEN ISO 22476-3:2005

Southern Testing

Unit 11

**RH19 2HU** 

**Charlwoods Road** East Grinstead West Sussex

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<sub>r</sub> (mm):

54

Wall Thickness  $t_r$  (mm):

6.0

Assumed Modulus Ea (GPa): 200

Accelerometer No.1:

64786

Accelerometer No.2:

64789

### **SPT Hammer Information**

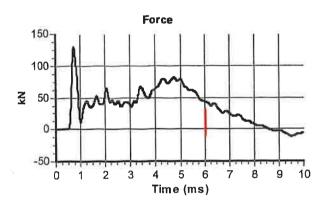
Hammer Mass m (kg):

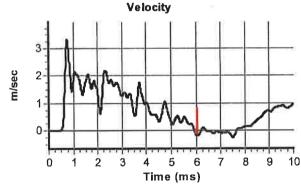
Falling Height h (mm): 760

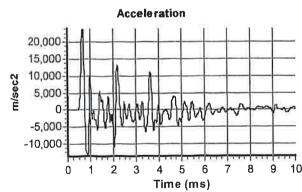
SPT String Length L (m): 12.0

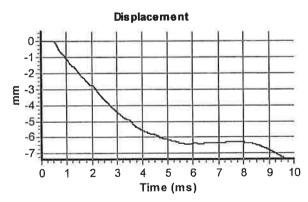
### **Comments / Location**

**CAUSEWAY** 









### **Calculations**

Area of Rod A (mm2):

905

Theoretical Energy  $E_{theor}$  (J):

473

Measured Energy E<sub>meas</sub>

357 (J):

Energy Ratio  $E_r$  (%):

76

Signed: N Burrows

Title:

**FOC Manager** 



in accordance with BSEN ISO 22476-3:2005



D124

Test Date:

20/10/2021

Report Date:

File Name:

D124.spt

Test Operator:

**B HUNTER** 

### **Instrumented Rod Data**

Diameter d<sub>r</sub> (mm):

54

Wall Thickness t<sub>r</sub> (mm):

6.0

Assumed Modulus Ea (GPa): 208

Accelerometer No.1: Accelerometer No.2: 62901

62902

### **Hammer Information**

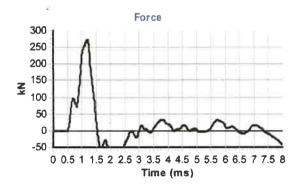
Hammer Mass m (kg): 63.5

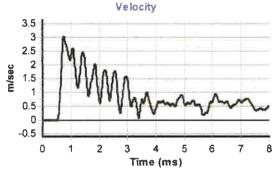
Falling Height h (mm): 760

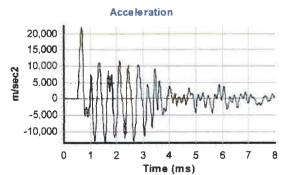
String Length L (m):

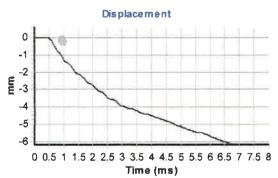
**Comments / Location** 











### **Calculations**

Area of Rod A (mm2):

905

Theoretical Energy  $E_{theor}$  (J):

473

260

Measured Energy E<sub>meas</sub>

Energy Ratio E (%):

55

pestino Marger. Signed: Title:



# APPENDIX K 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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Figure 3.2	Aerial image showing the location of five of the six boreholes, just
Figure 3.3	north of Balbriggan.  Location map showing the location of borehole 9, just North of
Figure 3.4	Swords (highlighted by a red striped circle). Aerial map showing borehole 9's location.
Figure 4	Geophysical Logs
Appendix 1	Geophysical Logs

#### 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  $4^{\text{th}}$  May 2022 and the  $6^{\text{th}}$  May 2022.

The following logs were run:

вн	Logs	From (m)	To (m)
1		0.6	22.2
2	Natural Gamma (GV NGRS) 3-Arm Caliper (GV CAL3)	0.9	28
4	Focused Resistivity (GV DLL3) Sonic Velocity (GV ASNC) Fluid Temperature & Conductivity (GV TCIS)	0.6	17.7
9	Fluid Velocity (GV IFM)	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<sup>40</sup>, though the U<sup>238</sup> series of elements and the Th<sup>232</sup> 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.

## 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 though 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 I/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 (Vp) - 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<sub>s</sub> 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.

EIR Code: O16

## 3.0 SITE DETAILS North Irish Sea Array, Balbriggan

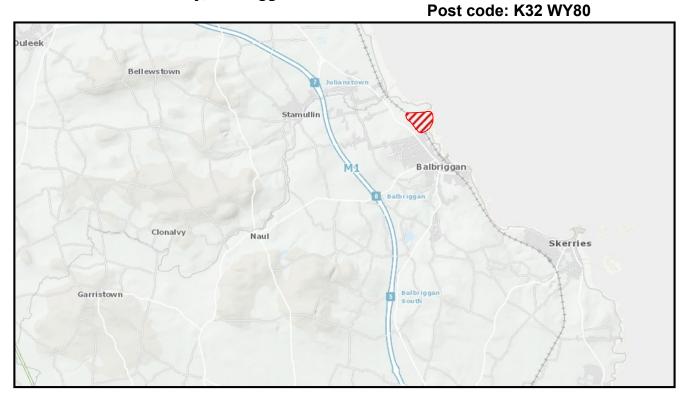


Figure 3.1 Location map showing the main area of investigation highlighted by the red striped area © Ordnance Survey Ireland 2022.

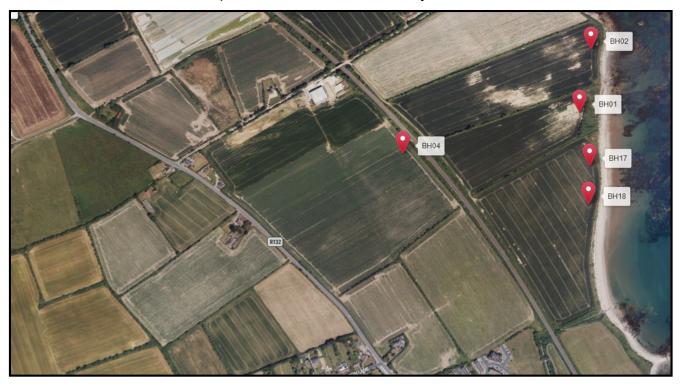


Figure 3.2 Aerial image showing the location of five of the six boreholes, just north of Balbriggan © Applemaps 2022.

### SITE DETAILS 3.0 **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.

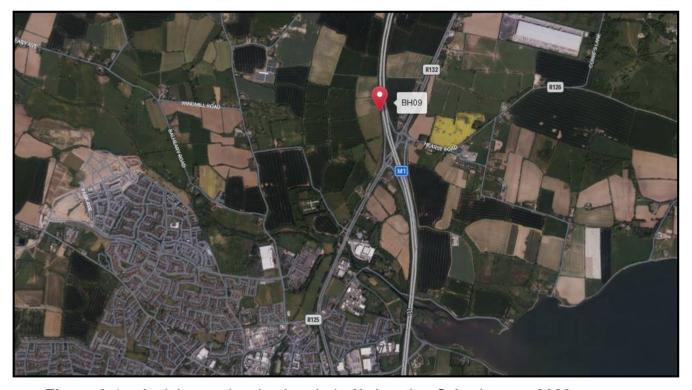


Figure 3.4 Aerial map showing borehole 9's location © Applemaps 2022.

#### 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

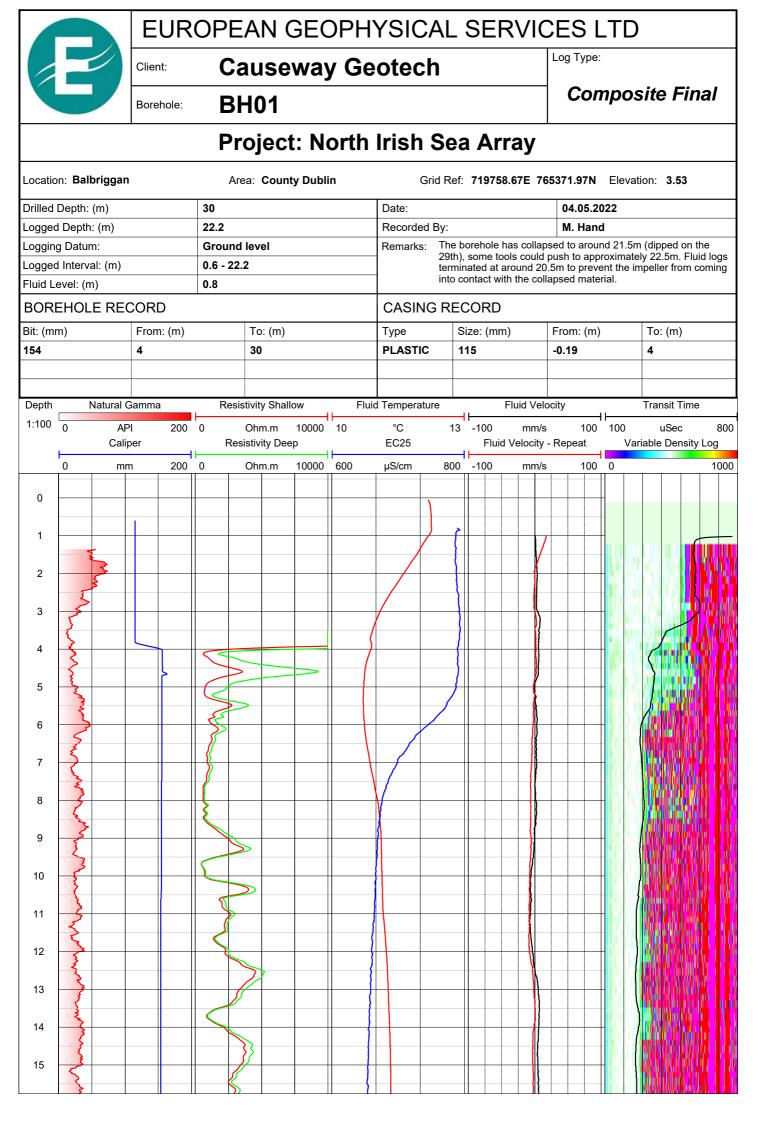
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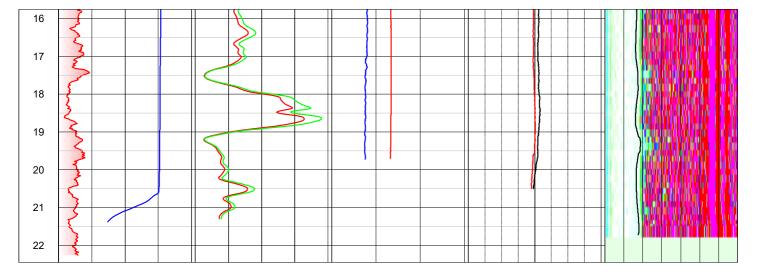
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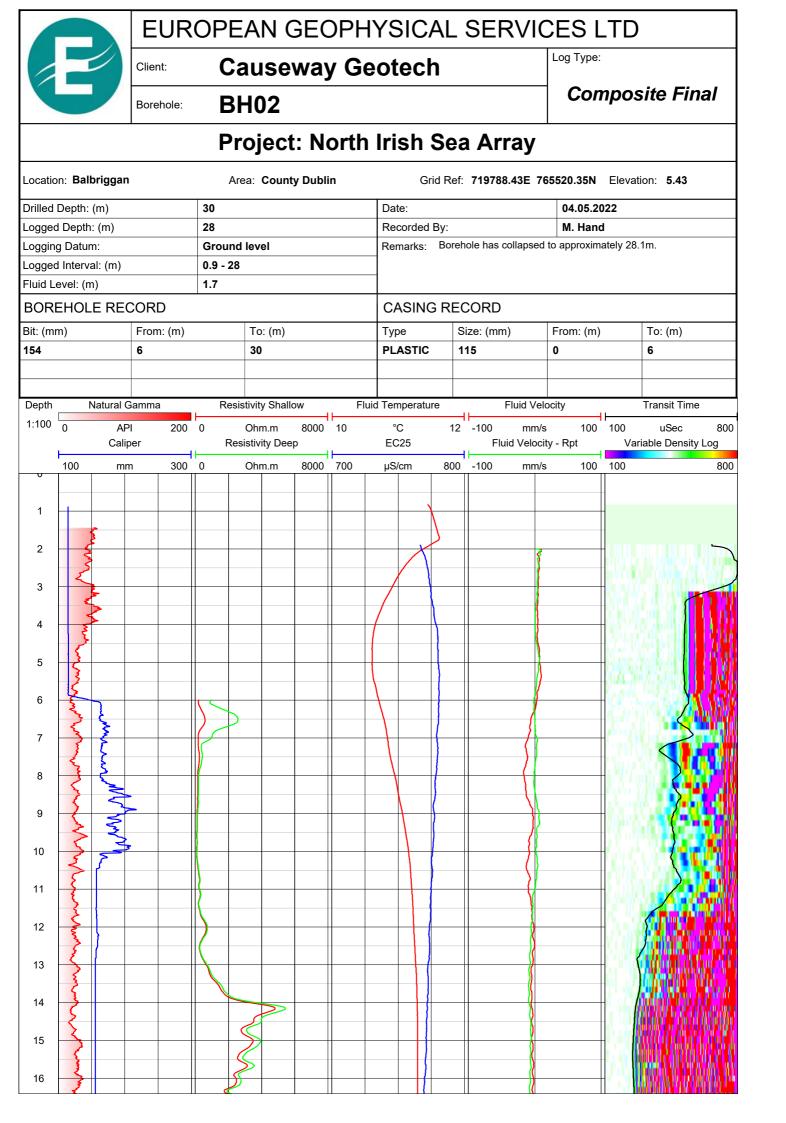
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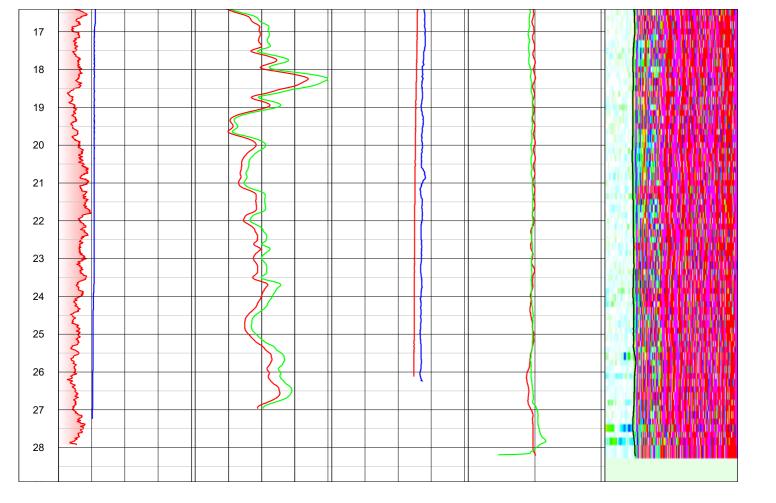
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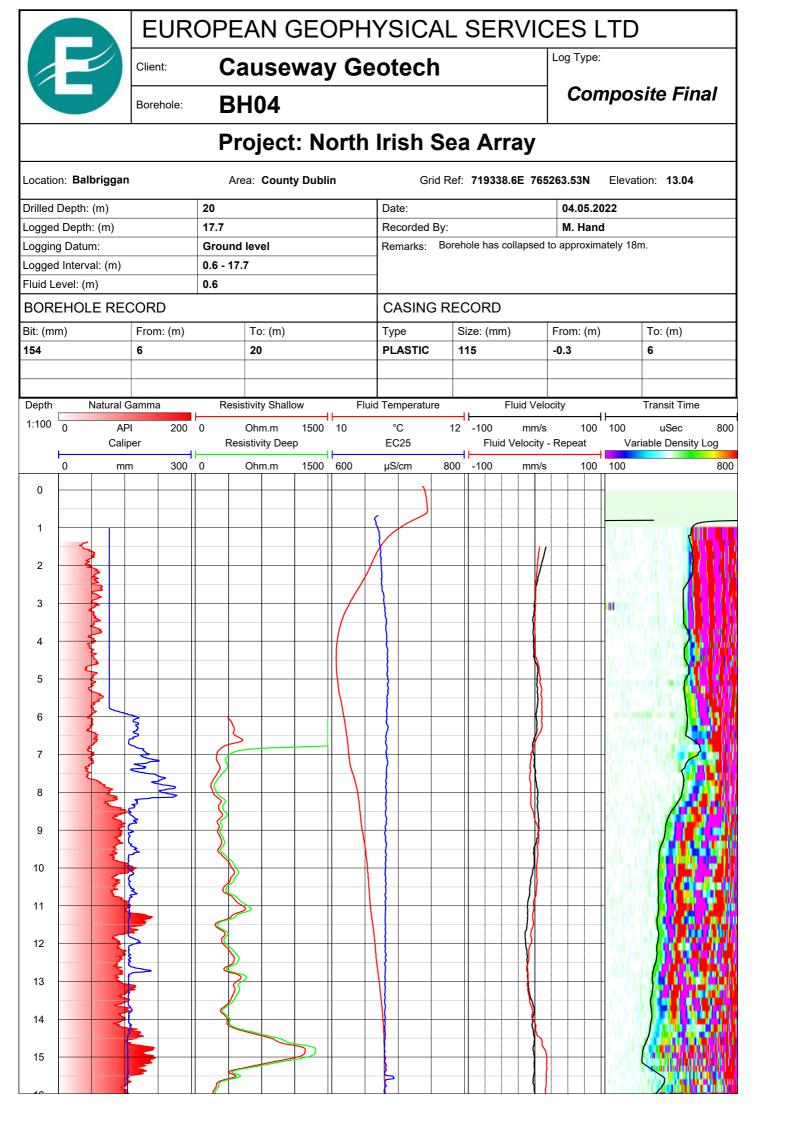
Appendix 1 Geophysical Logs



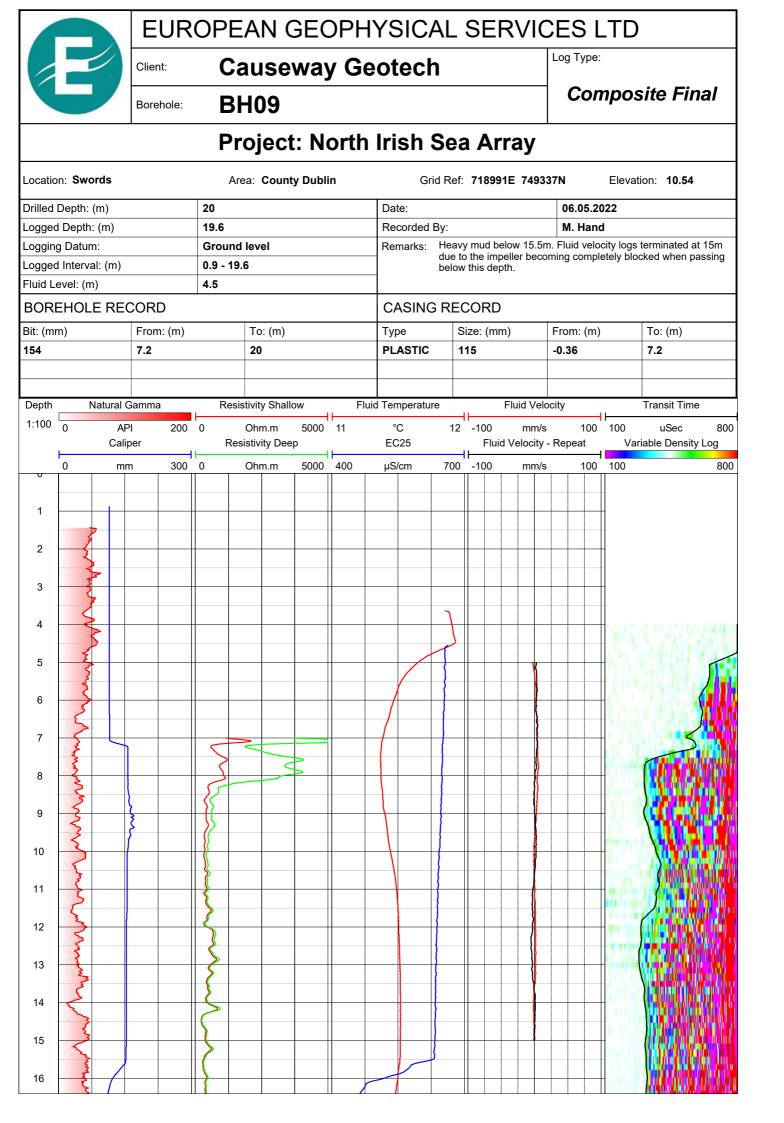




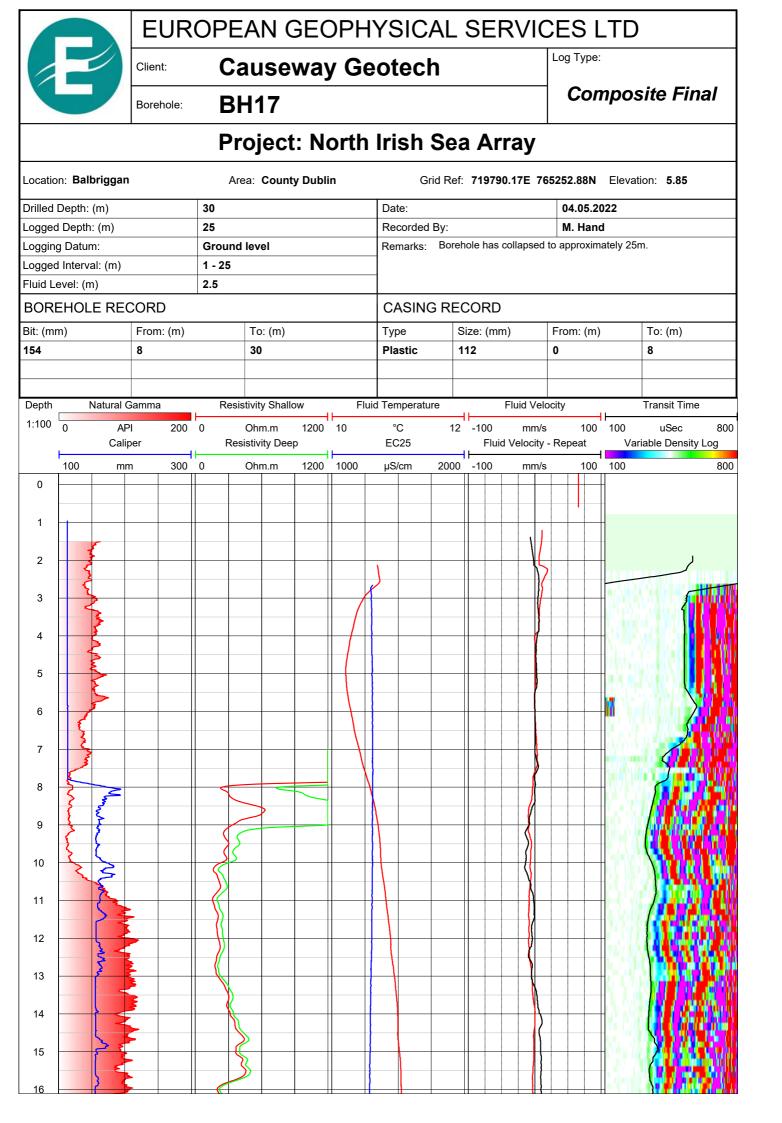


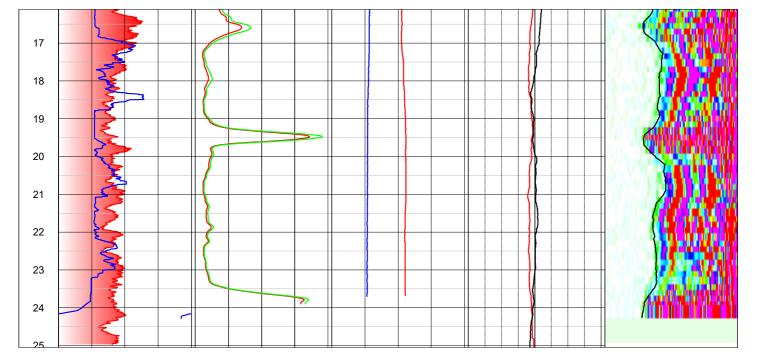


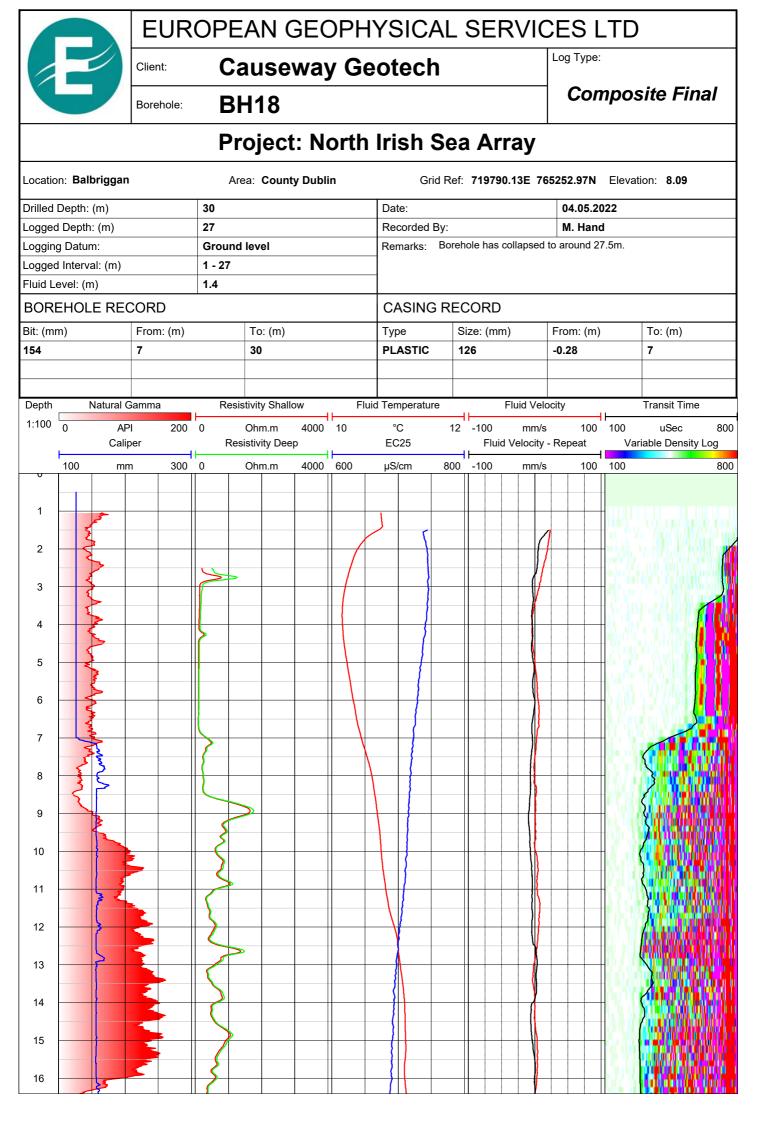
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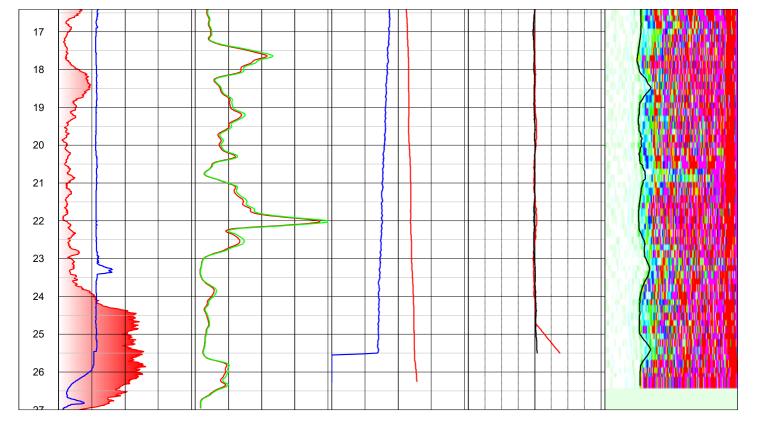


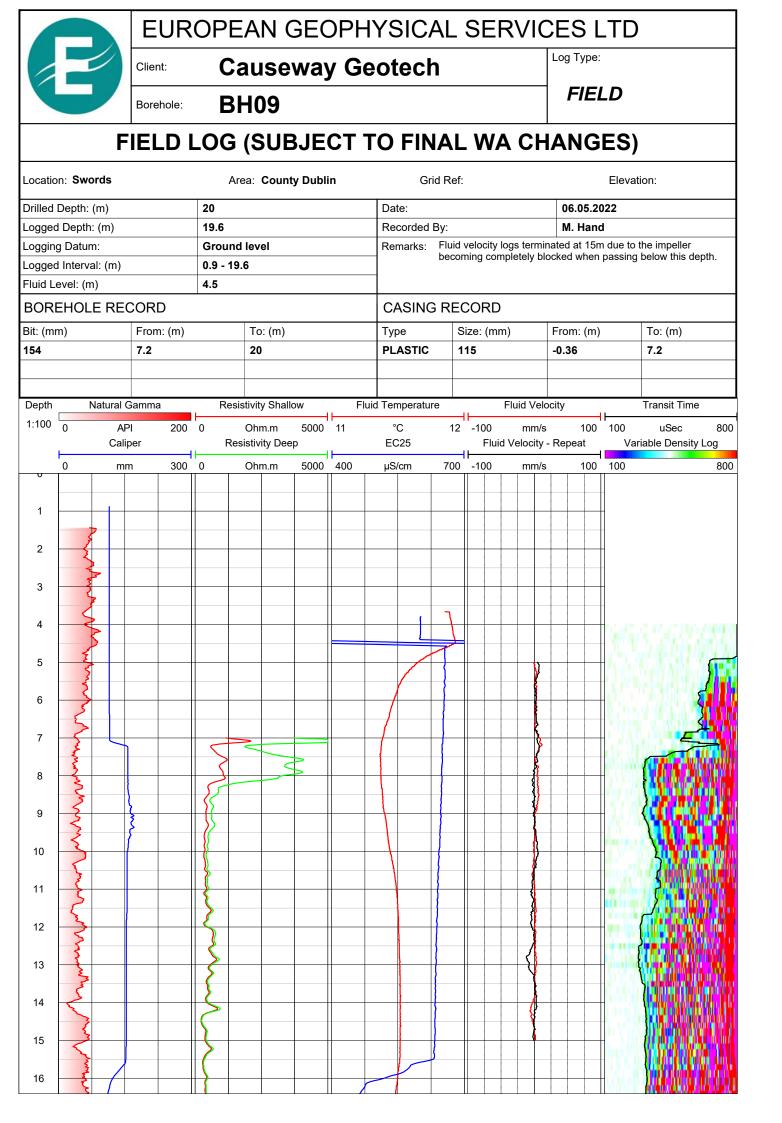
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