

Contract : Global Centre of Rail Excellence							Trial Pit No.	
Client : Global Centre of Rail Excellence							TP36	
Dates : 12/1/22 - 12/1/22			Job Number : Q0652		Ground Level : 239.90 m A.O.D. <i>Level to Ordnance Datum</i>			
Location : Around washery area			Engineer : ARUP		Coordinates: 285090.03 E 210482.14 N <i>Co-ordinates to National Grid</i>			

m B.G.L.	Samples		Tests		Strata				WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	
1						MADE GROUND - Grass/vegetation over loose black to dark grey slightly sandy silty GRAVEL with high cobble and boulder content. Gravel is fine to coarse angular to sub-angular Mudstone. Cobbles and boulders are sub-angular to angular Sandstone with coal, ash, metal, timber, brick, plastic and rubber			
2					4.00	...At 2.00mbgl old rubber conveyor belt encountered			
3									
4					4.00	Terminated at 4.00mbgl		235.90	

PLAN 		Groundwater: Slight ground water seepage at 0.30mbgl Stability: Sides unstable and collapsing below 2.00mbgl Shoring: N/A	Remarks: TP set out by QGL in liaison with ARUP. Services checked and area CAT scanned
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Equipment Used: 9 tonne tracked 360 excavator

	Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk	Operator: J Lewis	Logged By: S Picton	Sheet No. 1 Of 3	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Trial Pit No.

TP36

Dates : 12/1/22 - 12/1/22

Job Number : Q0652

Ground Level : 239.90 m A.O.D.
Level to Ordnance Datum

Location : Around washery area

Engineer : ARUP

Coordinates: 285090.03 E
210482.14 N
Co-ordinates to National Grid



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email: enquiries@quantumgeotechnic.co.uk

Operator:
J Lewis

Logged By:
S Picton

Sheet No.
2 Of 3

m Per
Page

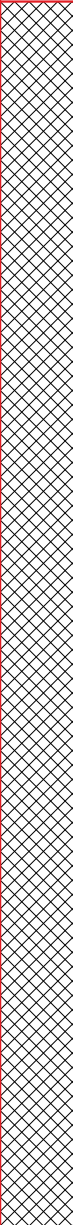
All measurements in
metres unless
otherwise stated

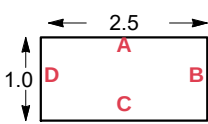


Contract : Global Centre of Rail Excellence		Trial Pit No.	
Client : Global Centre of Rail Excellence		TP36	
Dates : 12/1/22 - 12/1/22	Job Number : Q0652	Ground Level :	239.90 m A.O.D. <i>Level to Ordnance Datum</i>
Location : Around washery area	Engineer : ARUP	Coordinates:	285090.03 E 210482.14 N <i>Co-ordinates to National Grid</i>



Contract : Global Centre of Rail Excellence							Trial Pit No.	
Client : Global Centre of Rail Excellence							TP37	
Dates : 11/1/22 - 11/1/22			Job Number : Q0652			Ground Level : 239.19 m A.O.D. <i>Level to Ordnance Datum</i>		
Location :			Engineer : ARUP			Coordinates: 284931.98 E 210605.04 N <i>Co-ordinates to National Grid</i>		

m B.G.L.	Samples		Tests		Strata				WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	
1						MADE GROUND - Loose dark grey slightly clayey slightly silty slightly sandy Gravel with high cobble content and rare wood / timber fragments. Gravel is fine to coarse angular mudstone. Cobbles are angular mudstone.			
2									
3									
4									
					4.50	Terminated at 4.5mbgl		234.69	

PLAN 	Groundwater: Rapid groundwater inflow below 3.0mbgl Stability: Significant instability throughout Shoring: N/A	Remarks: TP set out by QGL in liaison with ARUP. Services checked, area CAT scanned
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Equipment Used: 13 tonne tracked excavator

	Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk	Operator: QGL	Logged By: P Darby	Sheet No. 1 Of 3	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Trial Pit No.

TP37

Dates : 11/1/22 - 11/1/22

Job Number : Q0652

Ground Level : 239.19 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 284931.98 E
210605.04 N
Co-ordinates to National Grid



Plas Newydd
Swansea
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Operator:
QGL

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P Darby

Sheet No.
2 Of 3

m Per Page

All measurements in metres unless otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Trial Pit No.

TP37

Dates : 11/1/22 - 11/1/22

Job Number : Q0652

Ground Level : 239.19 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 284931.98 E
210605.04 N
Co-ordinates to National Grid



Plas Newydd
Swansea
Tel: 01554744880
email: enquiries@quantumgeotechnic.co.uk

Operator:
QGL

Logged By:
P Darby

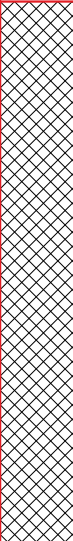
Sheet No.
3 Of 3

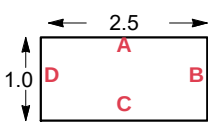
**m Per
Page**

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence							Trial Pit No.	
Client : Global Centre of Rail Excellence							TP37A	
Dates : 17/1/22 - 17/1/22			Job Number : Q0652		Ground Level : 243.46 m A.O.D. <i>Level to Ordnance Datum</i>			
Location : Around washery area			Engineer : ARUP		Coordinates: 284953.00 E 210658.00 N <i>Co-ordinates to National Grid</i>			

m B.G.L.	Samples		Tests		Strata				WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	
1					2.00	MADE GROUND - Grass/vegetation over loose black to dark grey slightly sandy silty GRAVEL with medium to high cobble and boulder content. Gravel is fine to coarse angular to sub-angular Mudstone. Cobbles and boulders are sub-angular to sub-rounded Mudstone with coal, ash, roots, rootlets and railway sleepers			
2					2.00	...Yellow tape encountered at 2.00mbgl Terminated at 2.00mbgl, yellow tape encountered at 2.00mbgl possible service		241.46	

PLAN 		Groundwater: No ground water encountered Stability: Unstable and collapsing below 1.50mbgl Shoring: N/A	Remarks: TP set out by QGL in liaison with ARUP. Services checked and area CAT scanned
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Equipment Used: 9 tonne tracked 360 excavator

	Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk	Operator: G Jones	Logged By: S Picton	Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Trial Pit No.

TP37A

Dates : 17/1/22 - 17/1/22

Job Number : Q0652

Ground Level : 243.46 m A.O.D.
Level to Ordnance Datum

Location : Around washery area

Engineer : ARUP

Coordinates: 284953.00 E
210658.00 N
Co-ordinates to National Grid



Contract : Global Centre of Rail Excellence Client : Global Centre of Rail Excellence							Trial Pit No. TP38	
Dates : 12/1/22 - 12/1/22 Location :			Job Number : Q0652 Engineer : ARUP			Ground Level : 238.95 m A.O.D. <i>Level to Ordnance Datum</i> Coordinates: 284921.93 E 210557.02 N <i>Co-ordinates to National Grid</i>		

m B.G.L.	Samples		Tests		Strata				WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	
1						MADE GROUND - Dense black very silty sandy GRAVEL with high cobble content. Gravel is fine to coarse sub-angular coal. Cobbles sub-angular coal. below 0.3mbgl gravel and cobbles are Mudstone			
2					3.50	 armored cable at 2.2mbgl below 2.5mbgl many timber fragments			
3					3.50	Firm light brown slightly gravelly silty CLAY with pockets of fibrous peat. Gravel is fine to coarse angular mudstone.			235.45
4					0.50				
					4.00	Terminated at 4.0mbgl			234.95

PLAN 		Groundwater: Moderate groundwater inflow at 3.45mbgl Stability: Stable Shoring: N/A	Remarks: TP set out by QGL in liaison with ARUP. Services checked, area CAT scanned
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Equipment Used: 13 tonne tracked excavator

	Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk	Operator: QGL	Logged By: P Darby	Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Global Centre of Rail Excellence		Trial Pit No.
Client : Global Centre of Rail Excellence		TP38
Dates : 12/1/22 - 12/1/22	Job Number : Q0652	Ground Level : 238.95 m A.O.D. <i>Level to Ordnance Datum</i>
Location :	Engineer : ARUP	Coordinates: 284921.93 E 210557.02 N <i>Co-ordinates to National Grid</i>



	Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk	Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated	
		QGL	P Darby	2 Of 2			

KEY TO BOREHOLE AND TRIAL PIT LOGS

MATERIAL LEGENDS

	Made Ground		Topsoil		Clay
	Gravel		Sand		Silt
	Peat		Boulders		Cobbles
	Chalk		Conglomerate		Volcaniclastic
	Asphalt		Void		Mudstone
	Siltstone		Sandstone		Limestone
	Ironstone		Mudstone / Siltstone		Breccia
	Coal		Coral		Bedrock
	Shale		Gypsum		Igneous (Coarse Grained)
	Igneous (Fine Grained)		Igneous (Medium Grained)		Metamorphic (Coarse Grained)
	Metamorphic (Fine Grained)		Metamorphic (Medium Grained)		

INSTALLATION / BACKFILL DETAILS

	Arisings		Concrete		Bentonite cement grout
	Bentonite seal		Filter		Pea Gravel
	Plain pipe		Slotted pipe		Piezometer / Standpipe tip

NOTE:
Legend symbols in accordance with BS 5930 (2015)

KEY TO BOREHOLE AND TRIAL PIT LOGS

m.A.O.D. metres Above Ordnance Datum.

SAMPLE AND TEST TYPES

U	Undisturbed driven tube sample - 102mm diameter, 450mm long.
P	Undisturbed pushed piston sample - 102mm diameter, 1000mm long.
TW	Undisturbed thin walled push in sample - 100mm diameter, 750mm long.
B	Bulk disturbed sample.
BLK	Block Sample
CBR	Heavy duty undisturbed sample - 154 mm diameter (CBR mould).
D	Small disturbed sample.
LB	Large Bulk disturbed sample (for earthworks testing)
C	Core sample
W	Water sample
G	Gas sample
ES	Environmental sample (soil)
j	Jar sample
t	Tub sample
p	Pot sample
s	Small sample
v	Vial sample
S	Standard Penetration Test using split spoon sampler. (See Note).
C	Standard Penetration Test using a solid 60 degree cone. (See Note).

NOTE: Where a single value is quoted this is the N value for 300 mm penetration following a seating drive of 150 mm. Where this full penetration is not achieved the number of blows is quoted for the penetration below the seating drive eg. 63/160 mm.
Where total penetration is less than the seating drive this is indicated by a + and the number of blows for total penetration is quoted eg. +50/75 mm.

HV	Hand Vane Test. Vane undrained shear strength, c_u , quoted in kPa.
V	Borehole Vane Test. Vane undrained shear strength, c_u , quoted in kPa.
FHT/RHT	Falling / Rising Head Permeability Test.

CORE RUN DETAILS

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
FI	Fracture Index. NI - Non intact where > 25 No. per metre length.

WATER COLUMN SYMBOLS

	First water strike, second water strike etc.
	Standing water level after first strike, second strike etc.
	Seepage.

NOTE:
Legend symbols in accordance with BS 5930 (2015)

APPENDIX IV – SOAKAWAY TEST RECORDS

Client : Welsh Government

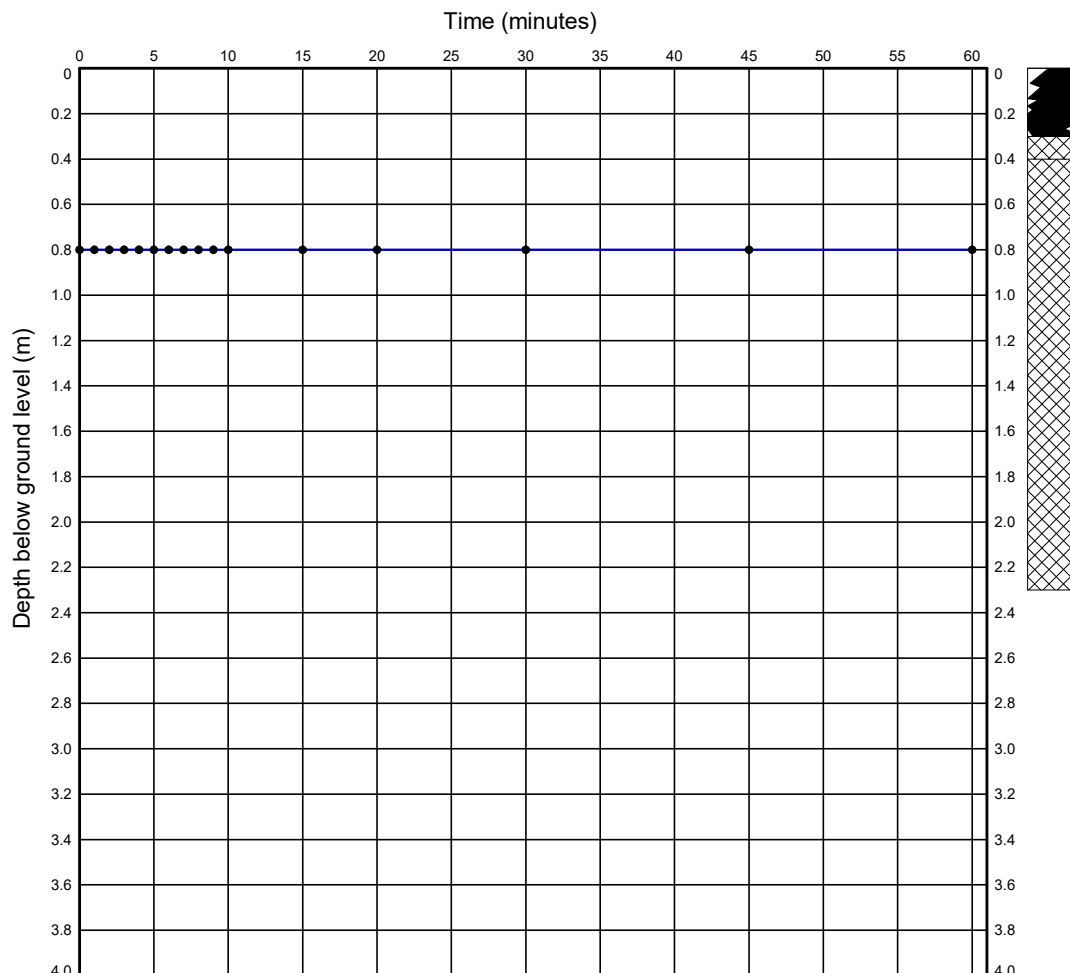
Point Plotted
TP02,1

Job Number : Q0652

Engineer : ARUP

SOAKAWAY TEST CALCULATION SHEET

Field Observations from soakaway trial pit

[illegible]

Remarks: Failed to soakaway

Soakaway test for soil infiltration rate design method based on BRE Digest 365

Permeability Test on Strata

Trial Pit Depth	2.300 m	$V_{p75-25} =$	m^3
Trial Pit Length	2.800 m	$a_{p50} =$	m^2
Trial Pit Width	0.500 m	$t_{p75-25} =$	minutes
Effective Depth	m		
Outflow Time	mins from 75% to 25% full		

f = m/sec



Plas Newydd, Llanedi
SA4 0FQ
Tel: 01554 744880
Tel:
email: enquiries@quantumgeotech.co.uk

Date of Test: 07/01/2022

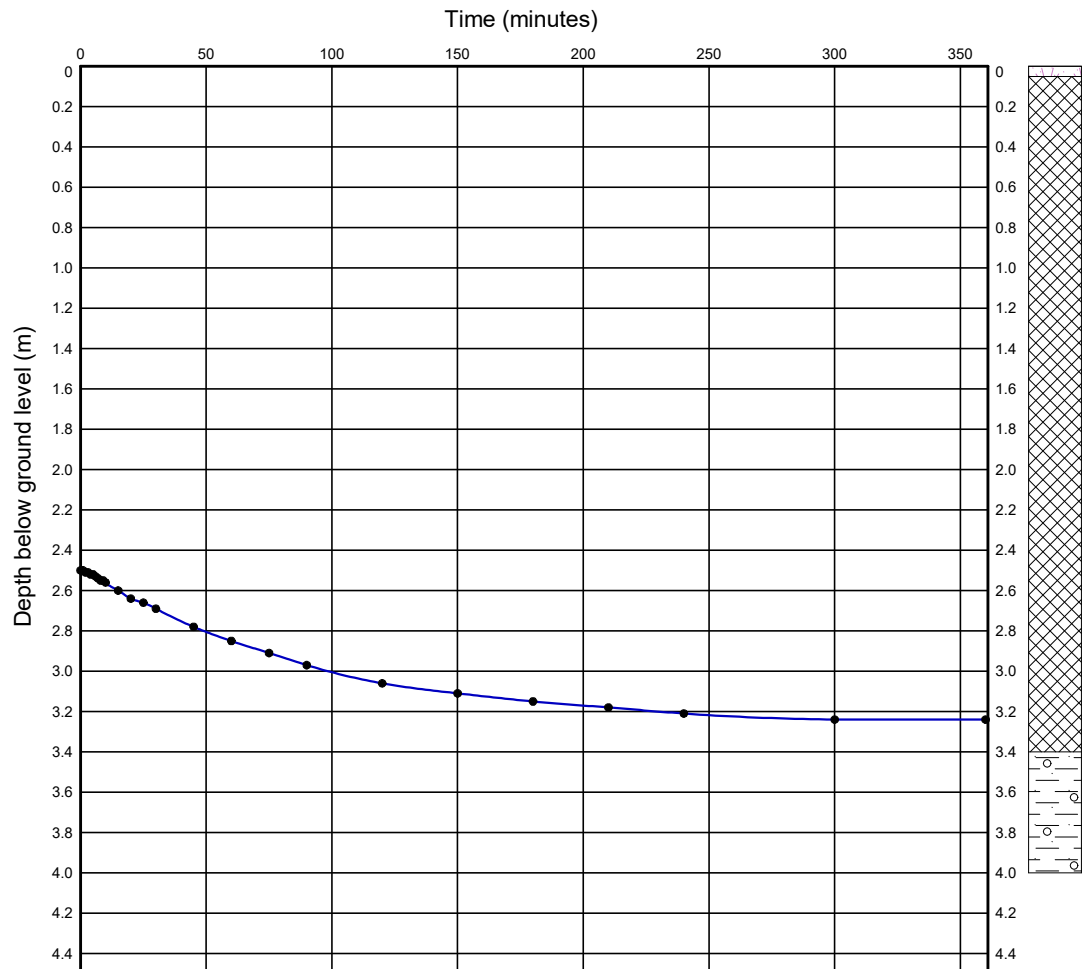
Project File: Q0652 - SP 26.01.22.GPJ

All measurements in metres unless otherwise stated

Figure No.
2

SOAKAWAY TEST CALCULATION SHEET

Field Observations from soakaway trial pit

[illegible]

Remarks: Insufficient outflow to calculate permeability

Soakaway test for soil infiltration rate design method based on BRE Digest 365

Permeability Test on Strata

Trial Pit Depth	4.000 m	$V_{p75-25} =$	2.160 m ³
Trial Pit Length	4.800 m	$a_{p50} =$	10.980 m ²
Trial Pit Width	0.600 m	$t_{p75-25} =$	minutes
Effective Depth	1.500 m		
Outflow Time	mins from 75% to 25% full		

f = m/sec

Contract : Global Centre of Rail Excellence

Point Plotted
TP18,1

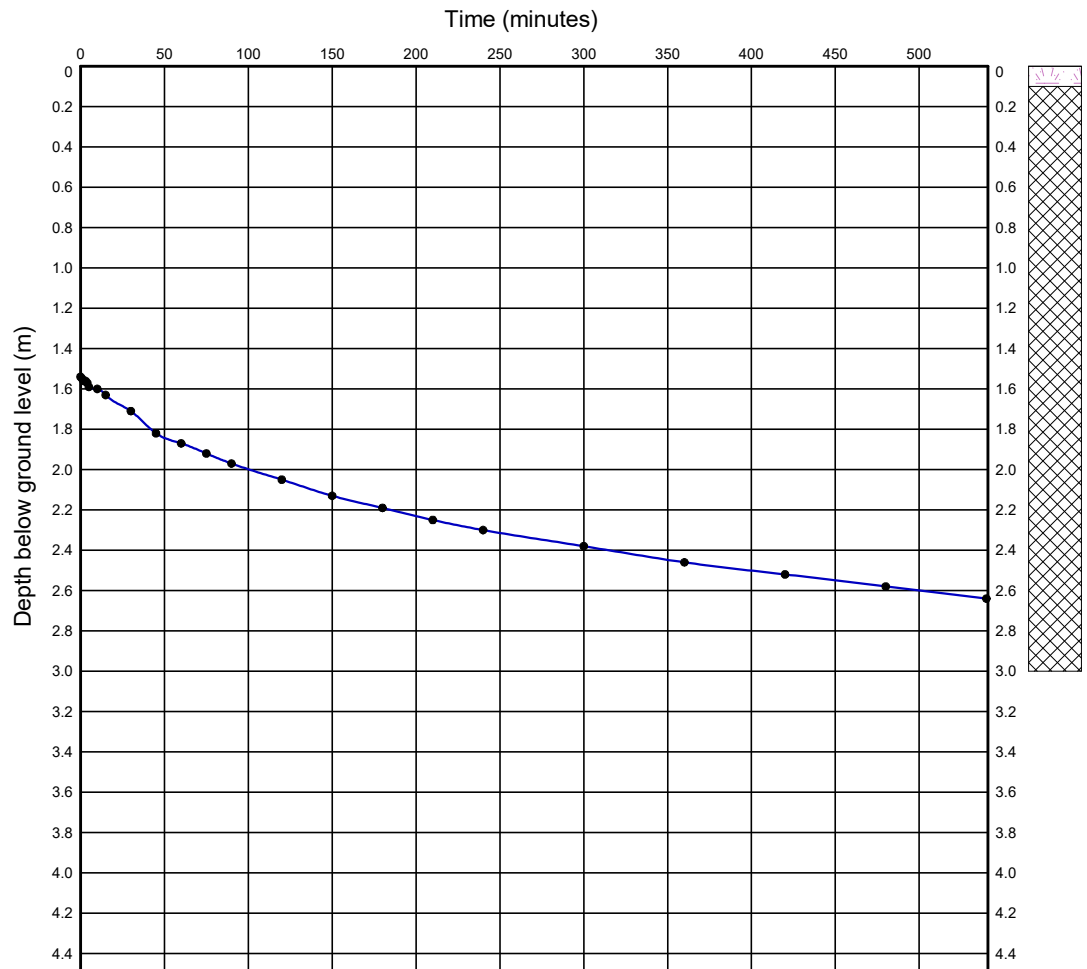
Client : Welsh Government

Job Number : Q0652

Engineer : ARUP

SOAKAWAY TEST CALCULATION SHEET**Field Observations from soakaway trial pit**

Time (Minutes)	Depth of water from ground level (m)
0.0	1.54
1.0	1.55
2.0	1.56
3.0	1.56
4.0	1.57
5.0	1.59
10.0	1.6
15.0	1.63
30.0	1.71
45.0	1.82
60.0	1.87
75.0	1.92
90.0	1.97
120.0	2.05
150.0	2.13
180.0	2.19
210.0	2.25
240.0	2.3
300.0	2.38
360.0	2.46
420.0	2.52
480.0	2.58
540.0	2.64



Remarks:

Soakaway test for soil infiltration rate
design method based on BRE Digest 365

Permeability Test on Strata

Trial Pit Depth	3.000 m	$V_{p75-25} =$	1.073 m ³
Trial Pit Length	2.500 m	$a_{p50} =$	5.933 m ²
Trial Pit Width	0.600 m	$t_{p75-25} =$	160.000 minutes
Effective Depth	1.430 m		
Outflow Time	160 mins from 75% to 25% full		

f = 1.8830E-5 m/sec

Plas Newydd
Swansea
Tel: 01554744880
Tel:
email: enquiries@quantumgeotechnic.co.uk

Date of Test:

Project File: Q0652 - PD.GPJ

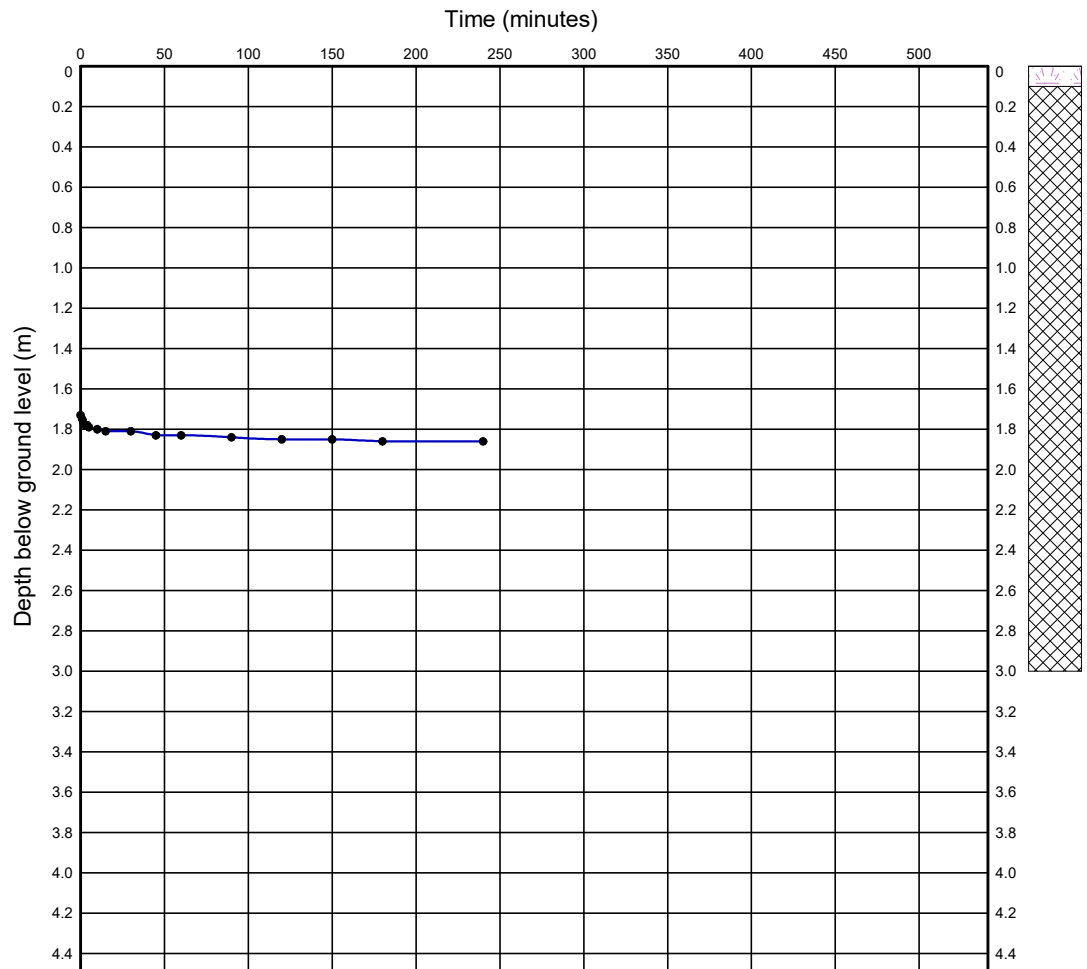
All measurements in
metres unless
otherwise stated

Figure No.

1

SOAKAWAY TEST CALCULATION SHEET

Field Observations from soakaway trial pit

[illegible]

Remarks: Insufficient outflow to calculate permeability

Soakaway test for soil infiltration rate design method based on BRE Digest 365

Permeability Test on Strata

Trial Pit Depth	3.000 m	$V_{p75-25} =$	0.953 m ³
Trial Pit Length	2.500 m	$a_{p50} =$	5.437 m ²
Trial Pit Width	0.600 m	$t_{p75-25} =$	minutes
Effective Depth	1.270 m		
Outflow Time	mins from 75% to 25% full		

f = m/sec

APPENDIX V – GRATICULE RESULTS

FIELD DESCRIPTION OF GRADING USING GRATICULE			
Hole ID	Depth Range (m)	Proportion of material with any length from 125mm -300mm (%)	Proportion of material with any length greater than 300mm (%)
TP22	0.7-4.3	15	10
TP24	0.5-4.5	10	5
TP25	0.3-4.5	15	5
TP26	0.1-0.4	5	0
TP26	0.4-3.8	10	10
TP27	1.25-4.5	10	5
TP29	0.5-4.5	20	10
TP30	0.9-4.5	10	0
TP31	0.05-4.5	15	15
TP32	0.1-4.5	15	10
TP33	0.45-1.15	5	0
TP33	1.15-2.4	2	0
TP34	0.95-4.5	10	0

APPENDIX VI – ARCHEOLOGIST REPORT



**WATCHING BRIEF REPORT
WBR/779/21**

**ONLLWYN WASHERY
NEATH
SOUTH WALES**

Ordnance Survey NGR: SN 83704 10894



**Watford Cottage
Watford Road
Caerphilly
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Report Information

Report Type:	Archaeological Watching Brief
Report Date:	12th February 2022
Authors:	Jim Stewart-Turner <i>PIfA</i> Jane Stewart-Turner BA MA <i>AIfA</i>
Illustrations:	Jim Stewart-Turner <i>PIfA</i>
Site Address	Onllwyn Washery Neath SA10 9HN
OS NGR	SN 83704 10894
Client	Quantum Geotech Ltd. Plas Newydd Farm Llanedi Swansea SA4 0FQ
Report Number	WBR/779/21
Site Code	OWN21
Project Number	260/21

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Report Author	Jim Stewart-Turner CPIfA
Position	Project Officer
Date	12th February 2022
Signature	
Report Checked By	Jane Stewart-Turner ACIfA
Position	Project Manager
Date	12th February 2022
Signature	

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The results of the project will be made publicly available in both digital and hard copy formats, as appropriate, in a range of journals and publications.

1. Summary

Quantum Geotech Limited commissioned Cardiff Archaeology to provide a programme of archaeological work to comply with the requirements of both the Glamorgan Gwent and Clwyd Powys Archaeological Trusts to protect the archaeological resource of the site during ground investigation works at Onllwyn Washery, Neath, SA10 9HN, South Wales.

Watching Brief Report (WBR/779/21) details the archaeological background of the site and methodology employed for the project. The results of site monitoring and recording during the works and post fieldwork analysis are set within archaeological and historical contexts and a conclusion reached. Details of the publication and dissemination of the report and the deposition of the archive are also included.

Analysis of the results of site monitoring and recording concluded that no significant archaeological artefacts, features or contexts were discovered by Cardiff Archaeology during ground investigation works at Onllwyn Washery, Neath, SA10 9HN, South Wales.

1. Crynodeb

Comisiynodd Quantum Geotech Limited Cardiff Archaeology i ddarparu rhaglen o waith archeolegol i gydymffurfio â gofynion Ymddiriedolaethau Archeolegol Morgannwg Gwent a Chlwyd Powys i ddiogelu adnodd archeolegol y safle yn ystod gwaith archwilio tir yng Nolgchfa Onllwyn, Castell-nedd, SA10 9HN, De Cymru.

Mae'r Adroddiad Gwyllo (WBR/779/21) yn manylu ar gefndir archeolegol y safle a'r fethodoleg a ddefnyddiwyd ar gyfer y prosiect. Gosodir canlyniadau monitro a chofnodi safle yn ystod y gwaith a'r dadansoddiad ar ôl gwaith maes o fewn cyd-destunau archeolegol a hanesyddol a daethpwyd i gasgliad. Cynhwysir hefyd fanylion cyhoeddi a dosbarthu'r adroddiad a dyddodiad yr archif.

Daeth dadansoddiad o ganlyniadau monitro a chofnodi safle i'r casgliad na ddarganfuwyd unrhyw arteffactau, nodweddion neu gyd-destunau archeolegol arwyddocaol gan Archeoleg Caerdydd yn ystod gwaith archwilio tir yng Nolgchfa Onllwyn, Castell-nedd, SA10 9HN, De Cymru.

2. Introduction

2.1 Cardiff Archaeology was commissioned by Quantum Geotech Limited¹ to undertake an archaeological watching brief as part of a programme of archaeological work during ground investigation works at Onllwyn Washery, Neath.

2.2 In order to mitigate the effects of proposed groundwork activities on the archaeological resource of the Onllwyn Washery site an archaeological Watching Brief, as part of the programme of archaeological work, was a requirement of both the Clwyd Powys² and Glamorgan Gwent³ Archaeological Trusts.

A Written Scheme of Investigation (WSI/776/21) was produced by Cardiff Archaeology prior to undertaking the watching brief at the site and was approved by both the Clwyd Powys and Glamorgan Gwent Archaeological Trusts. It details the methodology and mitigation strategy for the project in order to protect the archaeological resource and is included as Appendix 4 of this report. It also covers health and safety policy, insurance documentation and risk assessment relating to the project.

2.3 The archaeological watching brief, undertaken by Cardiff Archaeology between November 2021 and January 2022, observed ground investigation works at Onllwyn Washery, Neath.

2.4 This watching brief report (WBR/779/21) details the results of site monitoring and recording during the ground investigation works and sets post fieldwork analysis of the results within a historical/archaeological context.

2.5 The project follows the Code of Conduct, Code of Approved Practice for the regulation of contractual arrangements in archaeology and other relevant by-laws of the Chartered Institute for Archaeologists, and as specified in Standard & Guidance for an Archaeological Watching Brief (2014).

An archaeological watching brief is defined by the Chartered Institute of Archaeologists as *'a programme of observation, investigation and recording conducted during any operation carried out for non-archaeological reasons within a specified area or site, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme of work will result in the preparation of a report and ordered archive'*.

Acknowledgements

Cardiff Archaeology would like to thank Mr Phil Darby and his team at Quantum Geotech Limited for their kind assistance on site with this project.

¹ **Quantum Geotech Limited:** Plas Newydd Farm, Llanedi, Swansea SA4 0FQ Tel: 01554 744880

² **Clwyd Powys Archaeological Trust:** Y Swyddfeydd, Coed y Dinas, Welshpool, SY21 8RP Tel: 01938 552035 Email: trust@cpat.org.uk

³ **Glamorgan Gwent Archaeological Trust:** Sa12 Business Centre, Seaway Parade Industrial Estate, Baglan, Port Talbot SA12 7BR Tel: 01792 655208 Email: enquiries@ggat.org.uk

3. The Site

3.1 Location

The site is located at Onllwyn Washery, Neath, South Wales. It lies within a triangular piece of common land between the A4221, A4109 and Onllwyn Road at the head of the Dulais valley. Onllwyn is a small village in Neath Port Talbot near to the village of Seven Sisters with over 200 years of mining history (7. Archaeological Background) including five coal pits of which the washery is now the only remaining working site. Along the route of the former Neath & Brecon Railway there is a freight only line to the washery from the South Wales Main Line at Neath. The city of Swansea lies approximately 24km to the south west.

3.2 Ordnance Survey National Grid Reference

NGR: SN 83704 10894.

What3Words: eagles.migrants.countries.

3.3 Geology

The geology of the site consists of South Wales Lower Coal Measures Formation - mudstone, siltstone and sandstone; sedimentary bedrock formed 318-319 million years ago during the Carboniferous Period.

3.4 Topography & Ordnance Datum

Situated 259m (850 ft) OD above sea level on the southern edge of the Brecon Beacons mountain range, ground investigations are taking place on open grassland in close proximity to Onllwyn Washery. The washery is situated at the top of the Dulais Valley which runs north from the town of Neath and further south the town of Port Talbot on the South Wales coast.

3.5 Description of Works (Fig.8.3)

Investigation of the substrate across the site will inform the design plan for future development. Two looped sections of land, drainage infrastructure and natural habitats are to be constructed over the next 5 years. This will create flexible and adaptable land for various uses such as farming, conservation, tourism and leisure, to be determined at a later date. Celtic Energy and Welsh Government are keen to position The Global Centre of Rail Excellence at the site; a train, infrastructure and technology testing facility.

An archaeological watching brief was required during excavation of:

- Machine excavated trial pits. TP10, TP11, TP16, TP19, TP20, 21, TP27, TP32, TP33
- Hand dug starter pits for machine boring. BH01-BH14 & BH17-BH18

Machine excavation of pits took place using a toothless bucket, where appropriate, to allow controlled reduction of soils and maximum opportunity to record features in both plan and profile. The starter pits for machine coring were excavated by hand.

Where possible a representative section of the pits were to be cleaned and recorded adhering to Health & Safety guidelines. Trial pits suffered from section collapse in the majority of cases and deemed dangerous to enter. Further details are contained in the Written Scheme of Investigation WSI/776/21, Appendix 3.

4. Methodology

4.1 A detailed methodology for an archaeological watching brief (Written Scheme of Investigation WSI/776/21, Appendix 4) was produced by Cardiff Archaeology prior to undertaking site monitoring and recording during the groundworks which was approved by both the Clwyd Powys and Glamorgan Gwent Archaeological Trusts.

4.2 Excavations for the groundworks were undertaken by hand and with an excavator fitted with a toothless bucket where ground conditions allowed.

4.3 Site monitoring and recording of groundworks by Cardiff Archaeology taking the form of a watching brief comprised the compilation of a digital photographic record, drawn plan, section and contextual site notes.

4.4 A limited number of trial pits and boreholes were monitored due to ongoing coal processing activity on the site or their position on known deep deposits of colliery waste/open cast backfill. Further groundworks may be undertaken at a future date on the remaining boreholes and trial pits. Only trial pits TP10, TP11, TP16, TP19, TP20, 21, TP27, TP32, TP33 and boreholes BH01-BH14 & BH17-BH18 were monitored for this project.

4.5 A programme of post fieldwork analysis and research was carried out and the results placed within a historical and archaeological context. A copy of this final report detailing the results (WBR/779/21) will be forwarded to the client/agent for submission to both the Clwyd Powys and Glamorgan Gwent Archaeological Trusts for approval.

4.6 A copy of the Final Report and Archive Index will also be deposited by Cardiff Archaeology with the regional Historic Environment Records held by both the Glamorgan-Gwent and Clwyd Powys Archaeological Trusts following Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs) 2018 (<http://www.ggat.org.uk/her/her.html>).

4.7 The archaeological archive for the work will be prepared to the specifications laid out in the Chartered Institute for Archaeologists, Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives (2013).

4.8 The project archive, where appropriate, consists of site plans and sections, photographic records, context information, indices, research notes, recovered artefacts and reports stored by Cardiff Archaeology as drafting film, paper and digital records. will be deposited with the National Monuments Record Wales, Aberystwyth⁴, or if artefacts are recovered the National Museum of Wales, Cardiff⁵. The archive will be deposited following National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017 (<http://www.welshmuseumsfederation.org/en/news-archive/resources-landing/Collections/national-standard-and-guidance-for-collecting-and-depositing-archaeological-archives-in-wales-2017.html>)

⁴ **National Monuments Record Wales**, Ffordd Penglais, Aberystwyth SY23 3BU (01970) 621200

⁵ **National Museum of Wales**, Cathays Park, Cardiff, South Glamorgan CF10 3NP. ☎: (029) 2039 7951

5. Reporting & Archive Deposition

5.1 The project archive consisting of planning information, research notes, context information, site plans, photographic record, project design and final report stored by Cardiff Archaeology as paper and digital (CD) records will be deposited with the National Monuments Record, Aberystwyth⁶ as stated in the project Methodology above.

5.2 No significant artefacts were recovered during the watching brief and therefore no arrangements were required for the deposition of a finds archive with a suitable museum.

5.3 Copies of the Written Scheme of Investigation, Final Report and Archive Index will be deposited with the regional Historic Environment Records held by both the Glamorgan-Gwent and Clwyd Powys Archaeological Trusts as stated in the project Methodology above.

6 Publication

6.1 Publication of the project results will be made available in a range of publications as appropriate.

⁶ **Royal Commission**

The Royal Commission on the Ancient and Historical Monuments of Wales,
Library and Enquiries Service, National Monuments Record of Wales, Plas Crug, Aberystwyth, SY23 1NJ
☎: +44(0)1970 621200 ✉ nmr.wales@rcahmw.gov.uk
www.rcahmw.gov.uk/coflein.

7. Archaeological Background

The development site at Onllwyn Washery is situated mainly in the unitary authority of Powys and partially in Neath Port Talbot, therefore Historic Environment Record information has been sought from both the Clwyd Powys and Glamorgan Gwent Archaeological Trusts (CPAT enquiry ref. E6696 & GGAT enquiry ref. 6694) and also from Historic Wales (RCAHMW). A number of other sources of historic information have also been consulted and are included in the bibliography.

The village of Onllwyn is located in Neath Port Talbot at the head of the Dulais Valley within an area with over 200 years of mining history. The Dulais Valley lies within the modern unitary authority of Neath Port Talbot and formed part of the ancient parish of Cadokten-juxta-Neath.

Prior to the industrialisation of south Wales from the middle of the 18th century the area was mainly rural in nature with evidence of six rural buildings remaining at Onllwyn;

- Blaenant Melyn Farm
- Blaenantcellwen Farm
- Rhos-y-gelynen Cottage
- Rhyd-y-Pwlla Farm
- Tir-Lan Cottage
- Yr Hen Waun Farm

The Brecon Beacons National Park is located immediately to the north of Onllwyn and was established in 1957 as the UK's tenth National Park. It is one of three in Wales, including the Snowdonia and Pembrokeshire Coast National Parks, having special protection and management by the National Park Authority.

Information from the Historic Environment Record provides evidence of early human settlement and activity in the area from the Prehistoric Period.

Mynydd-y-Drum is located close to the site with evidence of prehistoric settlement (prn 12495, SN82851080) recorded. A series of clearance features of indeterminate age of a possible hut site are associated with two burial cairns and excavation produced two flint tools, now in the care of Brecon Museum.

Clwyd Powys Archaeological Trust carried out an assessment of Round Huts in Brecknock, published 2008 (prn 115451, SO 0512725679). The study includes analysis of a desk top assessment and brief overviews of fieldwork with limited attempt at classification of authentic round huts or hut circles visited. A full gazetteer of authentic and possible hut sites in the county is also included.

At Nant Helen a series of Bronze Age clearance cairns (.prn 6174 & 6177-6182, SN82811110) are recorded as well as evidence of post medieval clearance cairns prn 12496, SN82901085).

Evidence of Roman activity in the area includes Sarn Helen a Roman road linking Neath (Nidum) in south Wales to Caernarfon (Segontium) 150 miles to the north. Running along a high ridge between the Neath and Dulais Valleys a 1.3 km long section of the road lies to the north east of Coelbren Fort is a Scheduled Ancient Monument (ID BR074). Coelbren Roman Fort is a medium sized auxilliary fort (ID GM146) built circa AD 75 (ID GM146), south east of the fort lies a Roman Marching Camp (ID GM343) constructed circa AD 74-78 during the Roman conquest of Britain.

The remains of an Early Christian Monument; a stone shaft fragment of a Medieval Cross were discovered on Cefn Hirfynydd nearby (prn 00934w, SN8410) and are now in the collections of Swansea Museum.

Two Post Medieval enclosures have also been excavated at Nant Helen (prn 5947, SN82921116 & prn 6183, SN82851080).

Prior to the Industrial Revolution Wales was still largely rural in character but by 1851 it had become the world's second industrial nation after England. The availability of raw materials such as limestone and coal, manufacture of iron and copper together with engineering and transport developments and its geographical location meant that Wales' economy developed significantly during this time. By 1800 all the main valleys in the South Wales coalfields were linked to sea ports by canals and the early railway age also provided a real boost to the Welsh economy. The population expanded significantly during this time with the majority of immigrant workers coming from rural Wales initially. Alongside the development of industry came a rapid expansion of housing, schools, places of worship and community support for the influx of workers.

Industrial development was significant in the Llanelli-Swansea-Neath area of which the Dulais Valley is part and many features from the industrial period have been recorded including Mynydd-y-Drum Railway Cutting (prn 1001895, SN83021050) and Mynydd-y-Drum Coal Patch (prn1001892, SN83781057). The Drum Colliery (prns 1001888, 1001891, 1001890) has coal mining features of shafts and levels recorded at SN83931077, SN83921067 & SN83971066 respectively.

A tramroad at Ystradgynlais (SAM ID GM399) was built 1832-37 as a 6.4 km link to the Brecon Forest Tramroad (prn1001889, SN83961066) bringing limestone to Ynyscedwyn Ironworks, a well preserved and impressive monument with masonry engine house and cable tunnel runs still visible (SN80130942).

Buildings associated with a significant population expansion in the area due to industrialisation are also recorded, such as Price's Row at Coelbren and Dickson's Row (prn 1001887, SN84481135) which are Post Medieval workers cottages.

At Onllwyn a railway station on the Neath & Brecon Railway is recorded (prn 02818.6w, SN84081050).

Onllwyn Iron Works (prn 05957w) was built in the 1840s and had a brief existence but at the height of production during the 1860s included two furnaces, lime kilns, a smithy, shop, post office and two rows of workers houses now all extant; removed by open cast coal mining activities in the 1970s and later landscaping in 1985.

Three anglican churches are located within the Dulais Valley; St Margarets', Crynant, St Mary's, Seven Sisters (1910) and St David's, Banwen (1925) but during the mid 19th century chapels were already becoming more common places of worship and centres of community activity as industrial communities turned to Non-conformity. Four chapels are known in Seven Sisters alone; Salem (1899), Soar (1878), Seion (1890) and Bethany.

Two public houses are known in the Onllwyn area; the Halfway Inn an old farmhouse granted a licence to sell alcohol in 1863 and rebuilt in 1912 serving miners from Onllwyn Colliery. It closed in 1973 and now no longer exists.

The Travellers's Rest located on Onllwyn No.3 Colliery served travellers between Swansea and the Rhondda Valley and dates to at least 1853, it was later renamed The Greyhound due to dog training taking place there. In 1911 the tenants moved out and the building was converted into stables for the colliery.

Onllwyn School replaced 'Y Tae', a makeshift schoolhouse in 1892 responding to both growing pupil numbers in the area and new government legislation. Extended in 1907 pupils numbers began to decline after the 2nd World War and it finally closed in 1964. Crynant National School was established in 1857 with Crynant Infants School added in 1907 due to increasing pupil numbers.

A Miners Welfare Hall at Onllwyn (prn 414833, SN8439610289) opened in 1955 and is still in use as a social club today.

The development site is located at Onllwyn Coal Washery (prn 306037, SN84571053) built for local drift mines in 1932 then substantially altered and re-equipped in 1950. It services two open cast sites; Nant Helen & Derlwyn with coal delivered by road and exported through Swansea, Neath Abbey & Briton Ferry, and by rail to France and Norway. In 1998 Celtic Energy built a new 'state of the art' plant at the site and in 2005 a Froth Flotation Plant was added to process slurry supplied from Nant Helen, Selar and Margam. Many associated coal shafts are recorded in the area including Onllwyn Colliery Shaft Bft 3 (prn 80162, SN84261042) and Onllwyn Colliery Shaft Bft. 2 (prn 80169, SN84261021). Onllwyn Colliery Western Incline (prn 1001893, SN 83611053).

8. Location Maps & Plans

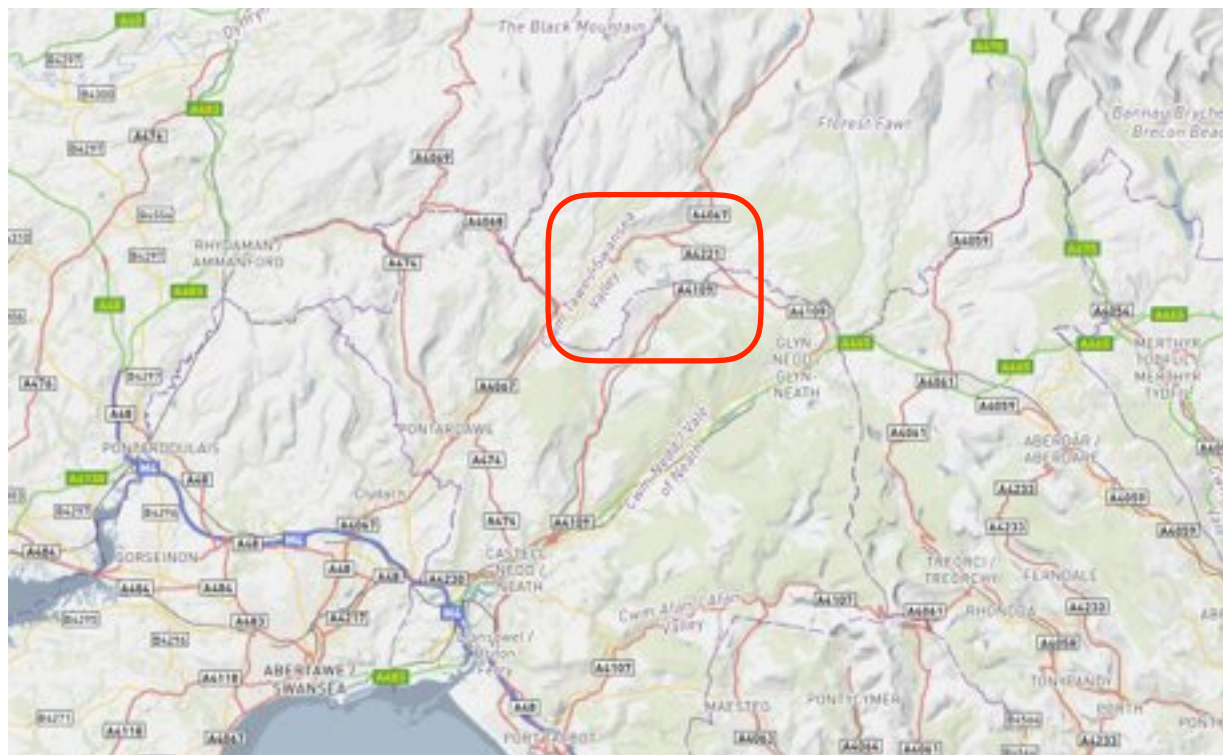


Figure 8.1 Site Location: Dulais Valley, South Wales

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 OS Licence number 100042803

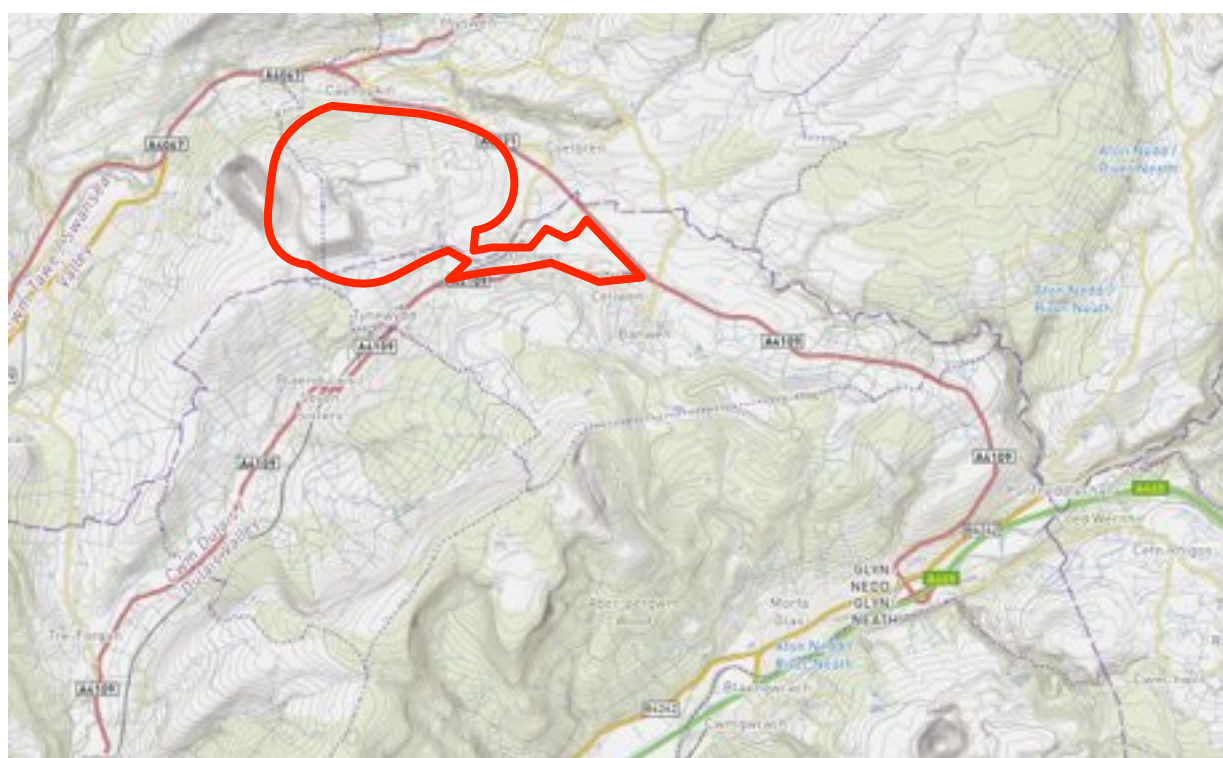


Figure 8.2 Site Location: Onllwyn Washery, Neath

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Figure 8.3 Locations of Monitored Trial Pits

and Boreholes

Original Scale 1:12000

© Quantumgeotechnique

9. Results

9.1 Borehole Records: BH01-BH14 & BH17-BH18

Borehole starter pits were excavated by hand , terminating at approximately 1.50 metres unless solid geology was encountered. These pits averaged 0.30 metre in diameter. Most of the pits encountered colliery spoil although pits 5-8 and 11 and 18 encountered natural clays that had not been buried under the dumping of waste from the coal washery and open cast mine in previous years.

No evidence of earlier structures or features were recorded within the excavated area.

Finds

No artefacts or pottery were recovered from boreholes 1-14 & 17-18 or excavated spoil.

Sampling

No environmental or technological samples were taken during the excavations.

Borehole core samples

Core samples were taken by Quantum Geotech Limited only when bedrock was encountered. These rock samples were not recorded archaeologically. See Appendix 2.

9.2 Trial Pit Records: TP10, TP11, TP16, TP19, TP20, 21, TP27, TP32, TP33

Trial Pits were excavated by machine, averaging 0.50 metres wide, 3.00 metre in length and terminating at approximately 3.00 metres depth unless solid geology was encountered. Most of the pits encountered colliery spoil although pits TP19, TP21, TP27 and TP33 encountered natural clays and topsoils that had been buried under the dumping of waste from the coal washery and open cast mine in previous years.

No evidence of earlier structures or features were recorded within the excavated area.

NB The location of TP 16 has not been recorded on Plan 8.3.

Finds

No artefacts or pottery were recovered from the Trial Pits or excavated spoil.

Sampling

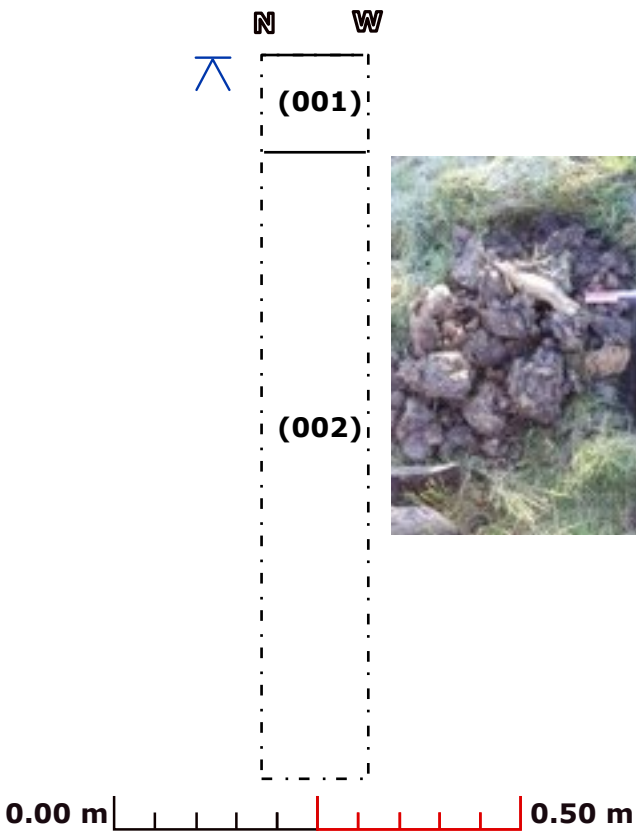
No environmental or technological samples were taken during the excavations of the Trial Pits.

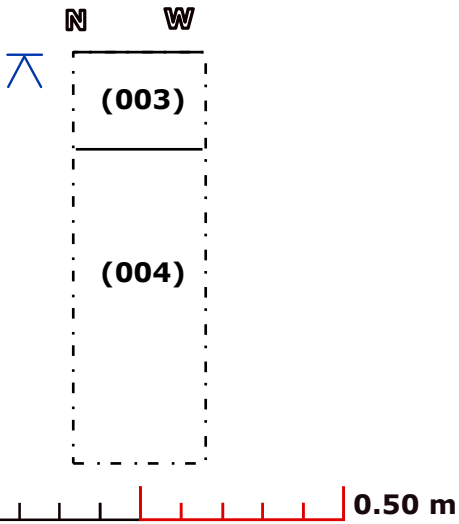
9.3 Context Record

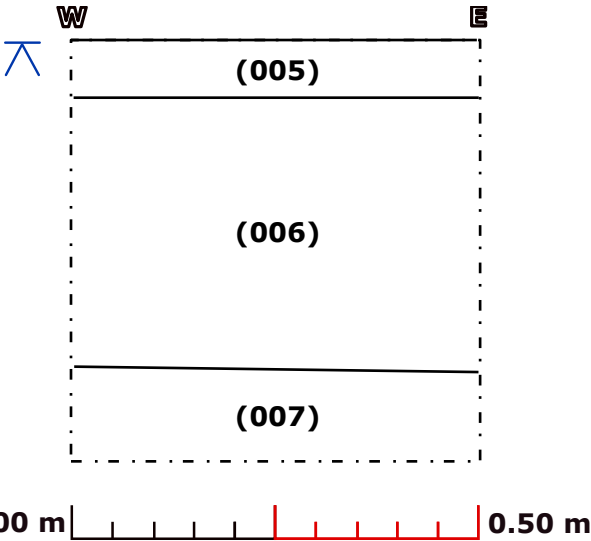
CONTEXT NUMBER	TYPE	Description	Plates	Period
001	Layer	Turf & Topsoil 12cm thick	2192-2193	Natural
002	Layer	Mixed yellow/grey clay, redeposited natural to depth	2192-2193	Natural
003	Layer	Turf & Topsoil 12cm thick	2189-2191	Natural
004	Layer	Black silt & small angular stone, colliery spoil to depth	2189-2191	19th/20th century
005	Layer	Turf & Topsoil 10cm	2172-2174	Natural
006	Layer	Dark grey silt & small angular stone, colliery spoil 30cm thick	2172-2174	19th/20th century
007	Layer	Black silt & small angular stone, colliery spoil to depth	2172-2174	19th/20th century
008	Layer	Turf & Topsoil 10cm	2175-2178	Natural
009	Layer	Dark grey silt & angular stone, colliery waste to 1.05 metres onto bedrock	2175-2178	19th/20th century
010	Layer	Turf & Topsoil 30cm thick	2194-2197	Natural
011	Layer	Grey silty clay to depth	2194-2197	Natural
012	Layer	Turf & Topsoil 20cm thick	2183-2186	Natural
013	Layer	Yellow grey mottled clay with occasional small rounded pebble <13cm	2183-2186	Natural
014	Layer	Turf & Topsoil 10 cm thick	2179-2182	Natural
015	Layer	Fractured bedrock shale	2179-2182	Natural
016	Layer	Turf & Topsoil 10 cm thick	2208-2210	Natural
017	Layer	Mudstone shale 30cm thick onto bedrock	2208-2210	Natural
018	Layer	Turf & Topsoil 10cm thick	2211-2215	Natural
019	Layer	Black colliery waste	2211-2215	19th/20th century
020	Layer	Turf & Topsoil 10cm thick	2216-2220	Natural
021	Layer	Black colliery spoil onto bedrock	2216-2220	19th/20th century
022	Layer	Turf & Topsoil 20cm thick	2204-2207	Natural
023	Layer	Mudstone onto bedrock	2204-2207	Natural
024	Layer	Turf & Topsoil 10cm thick	2219	Natural
025	Layer	Black colliery waste to depth	2220	19th/20th century
026	Layer	Turf & Topsoil 10cm thick	2221-2223	Natural

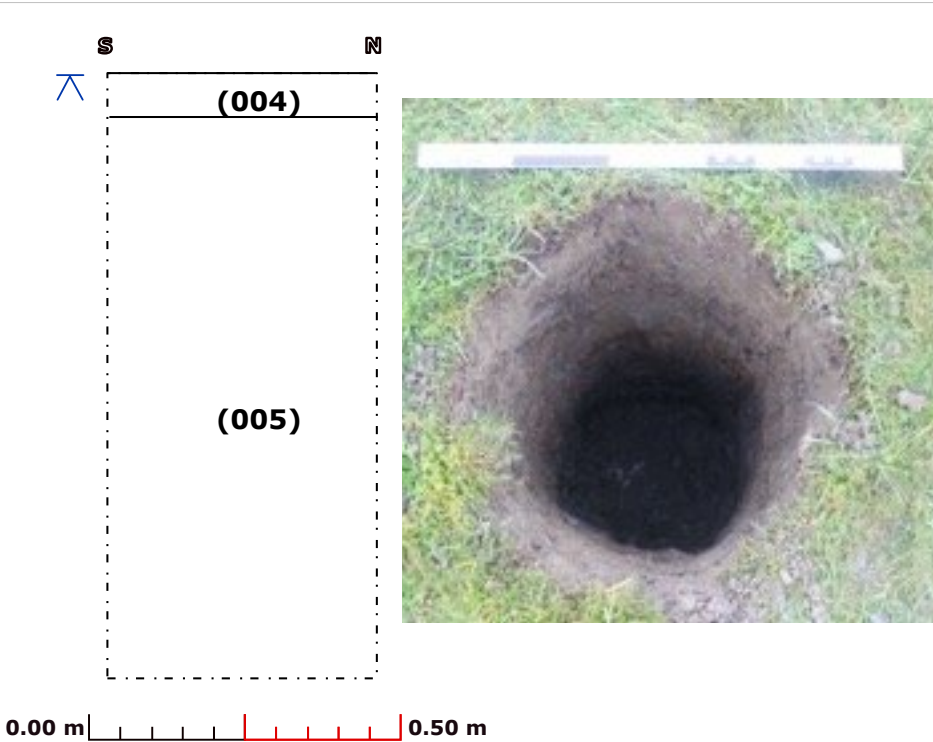
027	Layer	Black colliery spoil 80cm thick onto mudstone bedrock	2221-2223	19th/20th century
028	Layer	Turf & Topsoil 10cm thick	2224-2226	Natural
029	Layer	Black colliery spoil to depth	2224-2226	19th/20th century
030	Layer	Turf & Topsoil 10cm thick	2198-2203	Natural
031	Layer	Black colliery spoil to depth	2198-2203	19th/20th Century
032	Layer	Turf & Topsoil 10cm thick	2187-2188	Natural
033	Layer	Dark grey/brown silty clay	2187-2188	Natural
034	Layer	Dark grey silty clay to depth	2187-2188	Natural
035	Layer	Turf & Topsoil 10cm	2239-2241	Natural
036	Layer	Grey colliery spoil, small angular stone	2239-2241	19th/20th century
037	Layer	Dark grey/black colliery spoil. Large boulders to depth	2239-2241	19th/20th century
038	Layer	Turf & Topsoil 10cm	2273-2278	Natural
039	Layer	Colliery waste & large boulders, possible open cast backfill, rare mixed yellow grey redeposited clay to depth	2273-2278	19th/20th century
040	Layer	Turf & Topsoil 10cm	2227-2231	Natural
041	Layer	Black/grey colliery spoil and mudstone	2227-2231	19th/20th century
042	Layer	Marsh 20cm thick	2242-2246	Natural
043	Layer	Yellow/grey mixed clay, some small angular stone 90cm thick	2242-2246	Natural
044	Layer	Blue/Grey clay with occasional angular stone	2242-2246	Natural
045	Layer	Turf & Topsoil 10cm thick	2247-2252	Natural
046	Layer	Colliery spoil to 3.70 metres onto dark brown silty clay	2247-2252	19th/20th century
047	Layer	Marsh 20cm thick	2259-2266	Natural
048	Layer	Grey silts, mudstone spoil	2259-2266	19th/ 20th century
049	Layer	Red Grey clay large sub rounded boulders and stones	2259-2266	19th/ 20th century
050	Layer	Colliery spoil	2259-2266	19th/ 20th century
051	Layer	Buried dark brown hummic topsoil	2259-2266	Natural
052	Layer	Yellow grey clay	2259-2266	Natural
053	Layer	Turf & Topsoil 10cm thick	2232-2236	Natural
054	Layer	Mixed yellow/ grey clay, redeposited natural	2232-2236	Natural (redeposited)

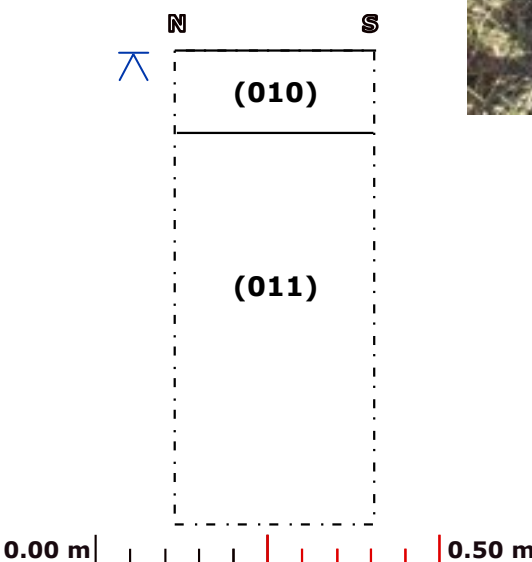
055	Layer	Possible buried topsoil	2232-2236	Natural
056	Layer	blue/ grey mixed clay	2232-2236	Natural
057	Layer	degradedMudstone	2232-2236	Natural
058	Layer	Turf & Topsoil 10cm	2253-2258	Natural
059	Layer	Colliery spoil	2253-2258	19th/20th century
060	Layer	Turf & Topsoil 20cm thick	2267-2272	Natural
061	Layer	Yellow subsoil, sub rounded stones	2267-2272	Natural
062	Layer	Colliery spoil	2267-2272	19th/20th century
063	Layer	Grey/yellow clay	2267-2272	Natural
064	Layer	Buried topsoil	2267-2272	Natural
065	Layer	Grey/yellow clay	2267-2272	Natural

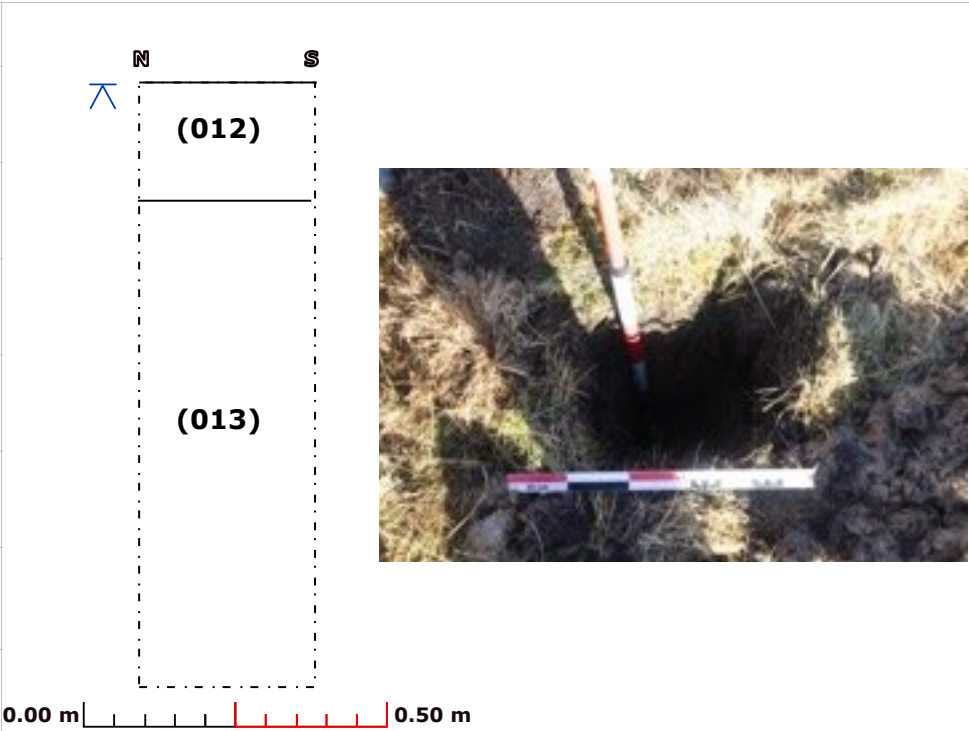
Number	BH01			
Date	25.11.21			
Length (Metres)				
Diameter (Metres)	0.30			
Width (Metres)				
Depth (Metres)	0.90			
Photographic Number	2193			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	001			
Camera Facing	SE			
Section	NW			
CONTEXT NUMBER	TYPE	Description	Plates	Period
001	Layer	Turf & Topsoil 12cm thick	2192-2193	Natural
002	Layer	Mixed yellow/grey clay, redeposited natural to depth	2192-2193	Natural

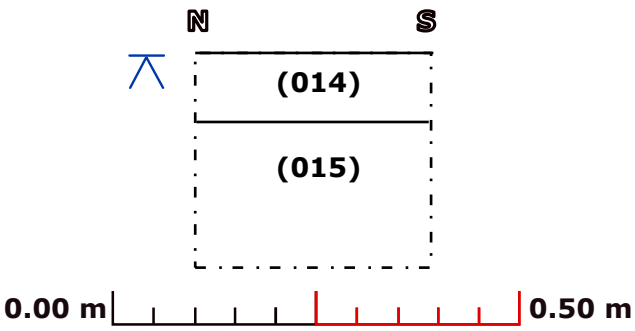
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Date	25.11.21	 		
Length (Metres)				
Diameter (Metres)	0.30			
Width (Metres)				
Depth (Metres)	0.50			
Photographic Number	2191			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	002			
Camera Facing	SE			
Section	NW			
CONTEXT NUMBER	TYPE	Description	Plates	Period
003	Layer	Turf & Topsoil 12cm thick	2189-2191	Natural
004	Layer	Black silt & small angular stone, colliery spoil to depth	2189-2191	19th/20th century

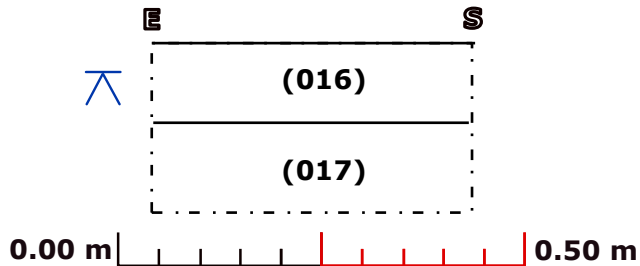
Number	BH03			
Date	18.11.21	 		
Length (Metres)				
Diameter (Metres)	0.50			
Width (Metres)				
Depth (Metres)	0.60			
Photographic Number	2172			
Photographic Scales (metres)	1.00 & 0.50			
Plan Numbers	Fig. 8.3			
Section Number	003			
Camera Facing	E			
Section	W			
Context Number	Type	Description	Plates	Period
005	Layer	Turf & Topsoil 10cm	2172-2174	Natural
006	Layer	Dark grey silt & small angular stone, colliery spoil 30cm thick	2172-2174	19th/20th century
007	Layer	Black silt & small angular stone, colliery spoil to depth	2172-2174	19th/20th century

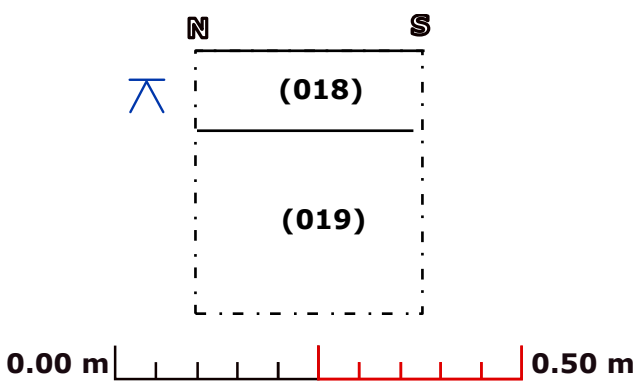
Number	BH04			
Date	18.11.21			
Length (Metres)				
Diameter (Metres)	0.40			
Width (Metres)				
Depth (Metres)	1.05			
Photographic Number	2172			
Photographic Scales (metres)	1.00 & 0.50			
Plan Numbers	Fig. 8.3			
Section Number	004			
Camera Facing	N			
Section	W			
CONTEXT NUMBER	TYPE	Description	Plates	Period
008	Layer	Turf & Topsoil 10cm	2175-2178	Natural
009	Layer	Dark grey silt & angular stone, colliery waste to 1.05 metres onto bedrock	2175-2178	19th/20th century

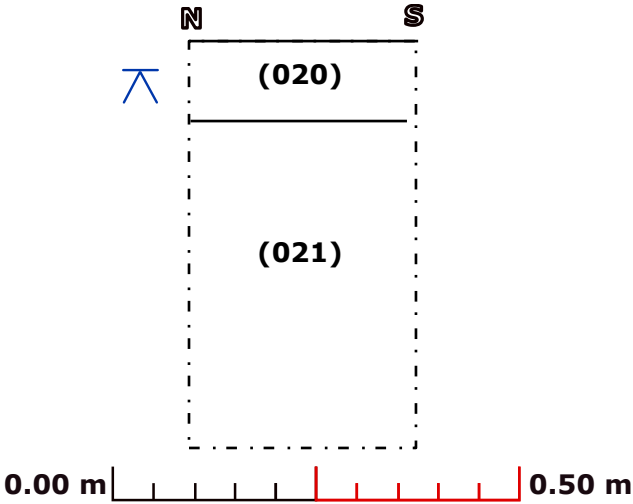
Number	BH05			
Date	25.11.21	  Core samples of bedrock recorded from BH05		
Length (Metres)				
Diameter (Metres)	0.30			
Width (Metres)				
Depth (Metres)	0.70			
Photographic Number	2196 & 2237			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	005			
Camera Facing	E			
Section	E			
CONTEXT NUMBER	TYPE	Description	Plates	Period
010	Layer	Turf & Topsoil 30cm thick	2194-2197	Natural
011	Layer	Grey silty clay to depth	2194-2197	Natural

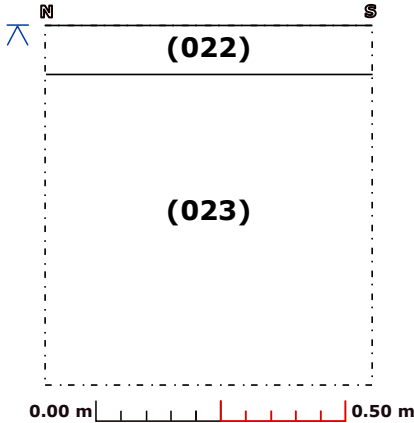
Number	BH06			
Date	22.11.21			
Length (Metres)				
Diameter (Metres)	0.30			
Width (Metres)				
Depth (Metres)	1.00			
Photographic Number	2184			
Photographic Scales (metres)	1.00 & 0.50			
Plan Numbers	Fig. 8.3			
Section Number	006			
Camera Facing	N			
Section	E			
CONTEXT NUMBER	TYPE	Description	Plates	Period
012	Layer	Turf & Topsoil 20cm thick	2183-2186	Natural
013	Layer	Yellow grey mottled clay with occasional small rounded pebble <13cm	2183-2186	Natural

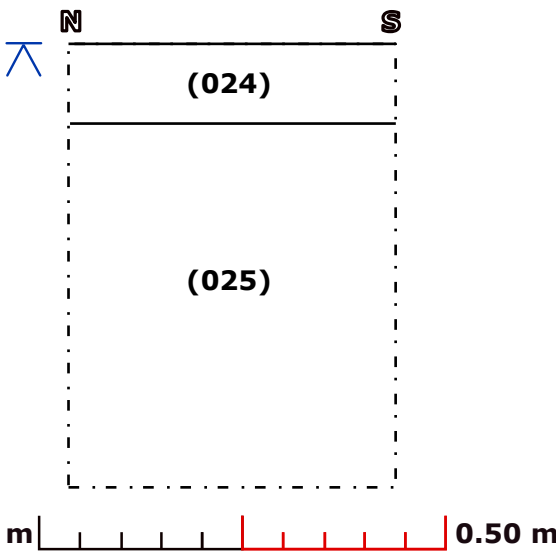
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Date	22.11.21			
Length (Metres)	0.30			
Diameter (Metres)				
Width (Metres)	0.30			
Depth (Metres)	0.25			
Photographic Number	2181			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	007			
Camera Facing	E			
Section	E			
CONTEXT NUMBER	TYPE	Description	Plates	Period
014	Layer	Turf & Topsoil 10 cm thick	2179-2182	Natural
015	Layer	Fractured bedrock shale	2179-2182	Natural

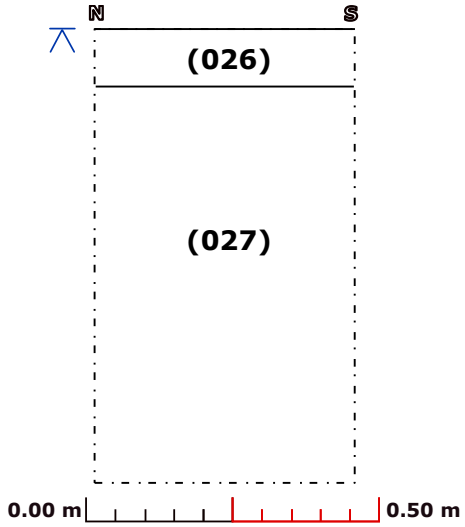
Number	BH08			
Date	29.11.21			
Length (Metres)				
Diameter (Metres)	0.40			
Width (Metres)				
Depth (Metres)	0.20			
Photographic Number	2208			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	008			
Camera Facing	NW			
Section	SE			
CONTEXT NUMBER	TYPE	Description	Plates	Period
016	Layer	Turf & Topsoil 10 cm thick	2208-2210	Natural
017	Layer	Mudstone shale 30cm thick onto bedrock	2208-2210	Natural

Number	BH09			
Date	29.11.21			
Length (Metres)				
Diameter (Metres)	0.30			
Width (Metres)				
Depth (Metres)	0.30			
Photographic Number	2212			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	009			
Camera Facing	E			
Section	E			
CONTEXT NUMBER	TYPE	Description	Plates	Period
018	Layer	Turf & Topsoil 10cm thick	2211-2215	Natural
019	Layer	Black colliery waste	2211-2215	19th/20th century

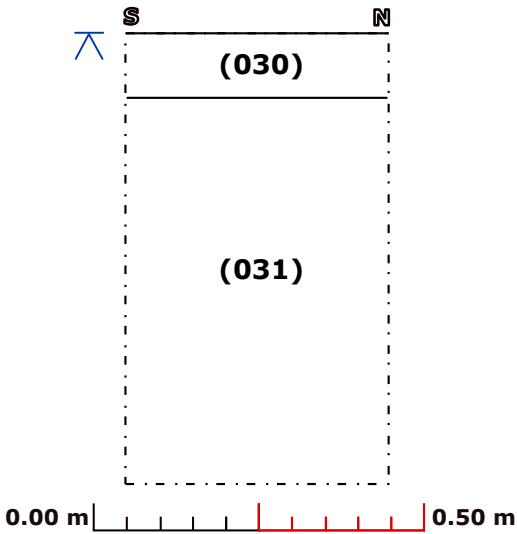
Number	BH10			
Date	29.11.21			
Length (Metres)				
Diameter (Metres)				
Width (Metres)	0.30			
Depth (Metres)	0.49			
Photographic Number	2217			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	010			
Camera Facing	N			
Section	E			
				
CONTEXT NUMBER	TYPE	Description	Plates	Period
020	Layer	Turf & Topsoil 10cm thick	2216-2220	Natural
021	Layer	Black colliery spoil onto bedrock	2216-2220	19th/20th century

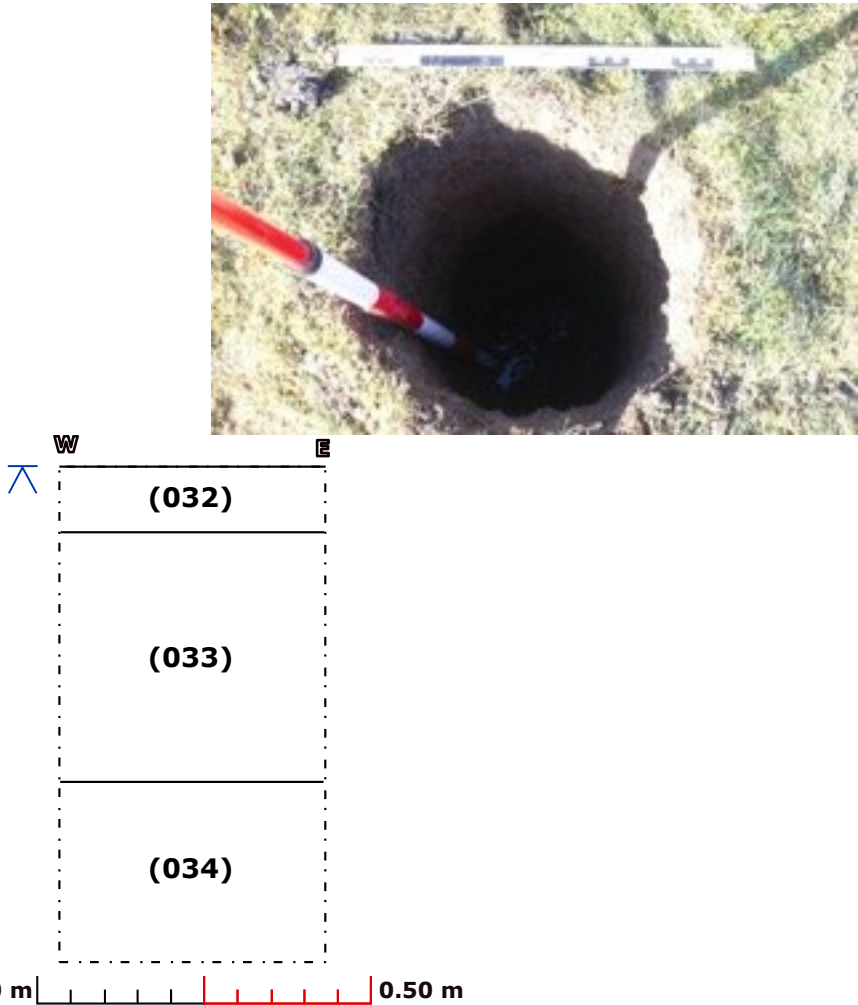
Number	BH11			
Date	29.11.21			
Length (Metres)				
Diameter (Metres)	0.55			
Width (Metres)				
Depth (Metres)	0.70			
Photographic Number	2207			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	011			
Camera Facing	W			
Section	E			
				
CONTEXT NUMBER	TYPE	Description	Plates	Period
022	Layer	Turf & Topsoil 20cm thick	2204-2207	Natural
023	Layer	Mudstone onto bedrock	2204-2207	Natural

Number	BH12			
Date	29.11.21	 		
Length (Metres)				
Diameter (Metres)	0.40			
Width (Metres)				
Depth (Metres)	0.55			
Photographic Number	2220			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	012			
Camera Facing	E			
Section	E			
CONTEXT NUMBER	TYPE	Description	Plates	Period
024	Layer	Turf & Topsoil 10cm thick	2219	Natural
025	Layer	Black colliery waste to depth	2220	19th/20th century

Number	BH13			
Date	29.11.21			
Length (Metres)				
Diameter (Metres)	0.46			
Width (Metres)				
Depth (Metres)	0.80			
Photographic Number	2222			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	013			
Camera Facing	S			
Section	E			
				
CONTEXT NUMBER	TYPE	Description	Plates	Period
026	Layer	Turf & Topsoil 10cm thick	2221-2223	Natural
027	Layer	Black colliery spoil 80cm thick onto mudstone bedrock	2221-2223	19th/20th century

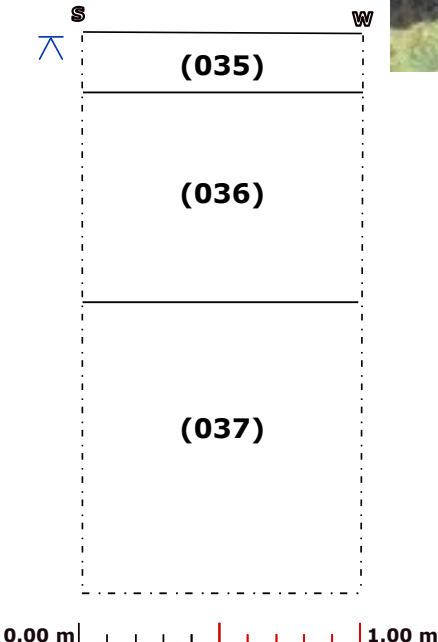
Number	BH14			
Date	29.11.21	 The photograph shows a circular pit in the ground, approximately 0.50m in diameter and 0.60m deep. A scale bar is visible in the background. Below the photograph is a plan diagram showing a rectangular area divided into two sections: (028) at the top and (029) below it. A scale bar at the bottom indicates 0.00 m to 0.50 m. A north arrow points towards the top left.		
Length (Metres)				
Diameter (Metres)	0.50			
Width (Metres)				
Depth (Metres)	0.60			
Photographic Number	2225			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	014			
Camera Facing	E			
Section	E			
CONTEXT NUMBER	TYPE	Description	Plates	Period
028	Layer	Turf & Topsoil 10cm thick	2224-2226	Natural
029	Layer	Black colliery spoil to depth	2224-2226	19th/20th century

Number	BH17			
Date	25.11.21			
Length (Metres)				
Diameter (Metres)	0.40			
Width (Metres)				
Depth (Metres)	0.70			
Photographic Number	2204			
Photographic Scales (metres)	0.50			
Plan Numbers	Fig. 8.3			
Section Number	015			
Camera Facing	W			
Section	W			
				
CONTEXT NUMBER	TYPE	Description	Plates	Period
030	Layer	Turf & Topsoil 10cm thick	2198-2203	Natural
031	Layer	Black colliery spoil to depth	2198-2203	19th/20th Century

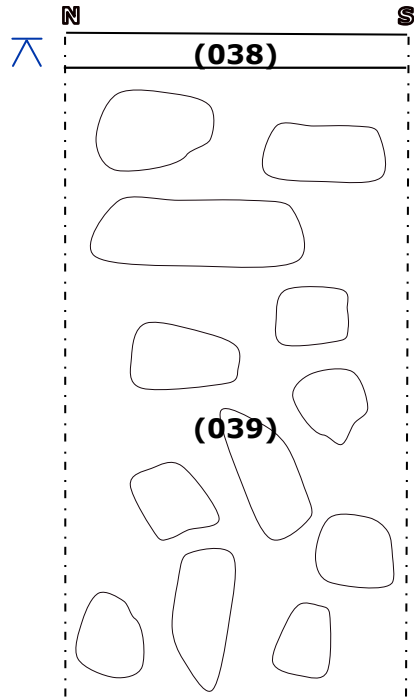
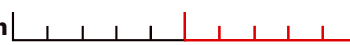
Number	BH18			
Date	22.11.21			
Length (Metres)				
Diameter (Metres)	0.44			
Width (Metres)				
Depth (Metres)	0.75			
Photographic Number	2187			
Photographic Scales (metres)	1.00 & 0.50			
Plan Numbers	Fig. 8.3			
Section Number	016			
Camera Facing	N			
Section	N			
CONTEXT NUMBER	TYPE	Description	Plates	Period
032	Layer	Turf & Topsoil 10cm thick	2187-2188	Natural
033	Layer	Dark grey/brown silty clay	2187-2188	Natural
034	Layer	Dark grey silty clay to depth	2187-2188	Natural

9.3 Trial Pit Records

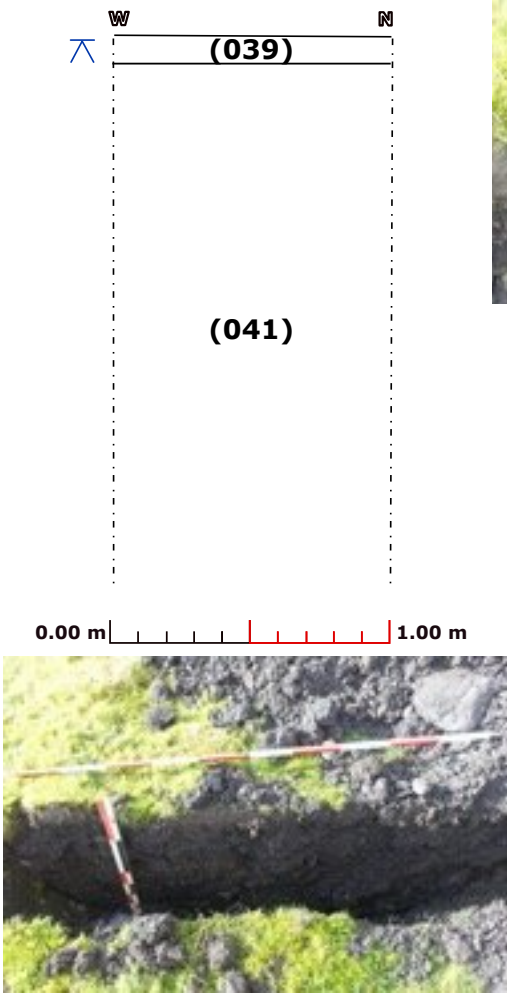
Trial Pits 10, 11, 16, 19, 20, 21, 27, 32, 33

Number	TP10			
Date	25.11.21			
Length (Metres)	5.2			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	2.00			
Photographic Number	2240 2241			
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	017			
Camera Facing	SW			
Section	SW			
		 Excavation @ 1.20 metres		
CONTEXT NUMBER	TYPE	Description	Plates	Period
035	Layer	Turf & Topsoil 10cm	2239-2241	Natural
036	Layer	Grey colliery spoil, small angular stone	2239-2241	19th/20th century
037	Layer	Dark grey/black colliery spoil. Large boulders to depth	2239-2241	19th/20th century

Dangerous and collapsing sections

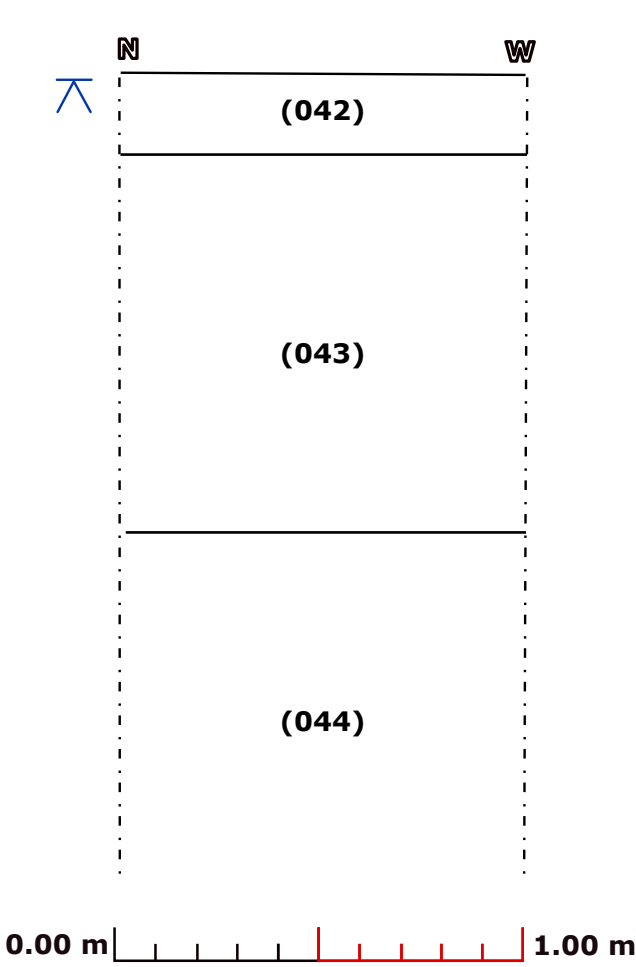
Number	TP11			
Date	10.1.22			
Length (Metres)	3.50			
Diameter (Metres)				
Width (Metres)	1.30			
Depth (Metres)	2.60			
Photographic Number	2274 2275			
Photographic Scales (metres)				
Plan Numbers	Fig. 8.3			
Section Number	018			
Camera Facing	E			
Section	E			
		0.00 m		1.00 m
				
				
		Excavation @ 1.20 metres		
CONTEXT NUMBER	TYPE	Description	Plates	Period
038	Layer	Turf & Topsoil 10cm	2273-2278	Natural
039	Layer	Colliery waste & large boulders, possible open cast backfill, rare mixed yellow grey redeposited clay to depth	2273-2278	19th/20th century

Dangerous and collapsing sections

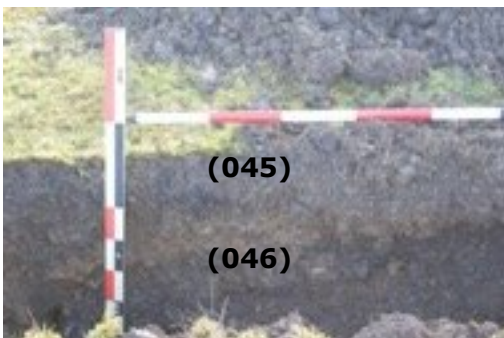
Number	TP16			
Date	6.12.21			
Length (Metres)	3.5			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	3.00			
Photographic Number	2228 2229 2230	 Section 019 @ 1.20 metres 		
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	019			
Camera Facing	NW			
Section	NW			
CONTEXT NUMBER	TYPE	Description	Plates	Period
040	Layer	Turf & Topsoil 10cm	2227-2231	Natural
041	Layer	Black/grey colliery spoil and mudstone	2227-2231	19th/20th century

Dangerous and collapsing sections

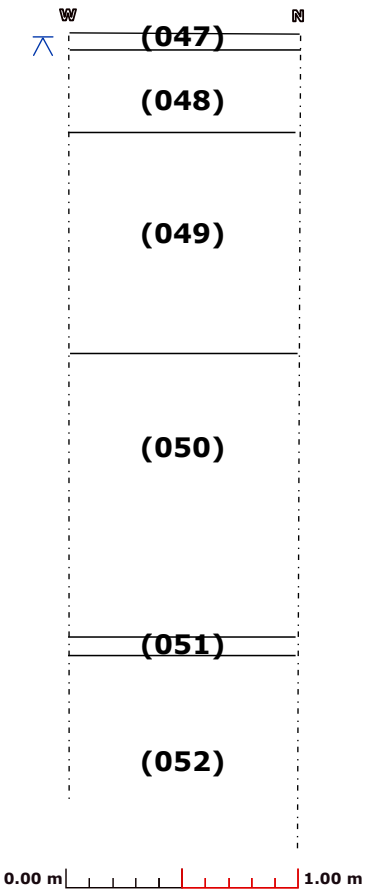
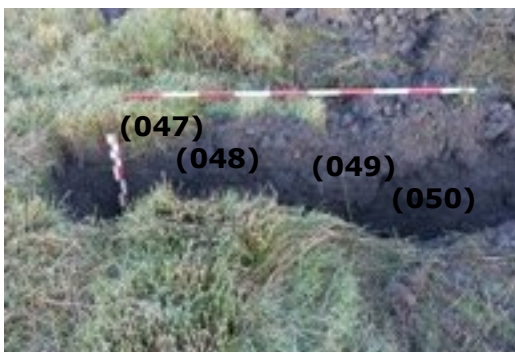
This Trial Pit location has not been recorded on location maps or plans.

Number	TP19			
Date	8.12.21			
Length (Metres)	3.00			
Diameter (Metres)				
Width (Metres)	0.70			
Depth (Metres)	3.2			
Photographic Number	2243 2245			
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	020			
Camera Facing	NW & NE			
Section	NW			
CONTEXT NUMBER	TYPE	Description	Plates	Period
042	Layer	Marsh 20cm thick	2242-2246	Natural
043	Layer	Yellow/grey mixed clay, some small angular stone 90cm thick	2242-2246	Natural
044	Layer	Blue/Grey clay with occasional angular stone	2242-2246	Natural

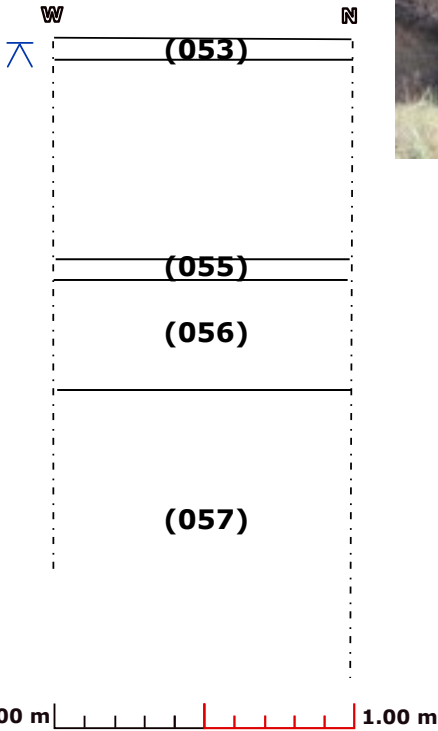
Dangerous and collapsing sections

Number	TP20			
Date	8.12.21	  		
Length (Metres)	3.00			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	4.00			
Photographic Number	2249 2250			
Photographic Scales (metres)	2.00 & 1.00			
Plan Numbers	Fig. 8.3			
Section Number	021			
Camera Facing	NW & NE			
Section	NW			
CONTEXT NUMBER	TYPE	Description	Plates	Period
045	Layer	Turf & Topsoil 10cm thick	2247-2252	Natural
046	Layer	Colliery spoil to 3.70 metres onto dark brown silty clay natural	2247-2252	19th/20th century

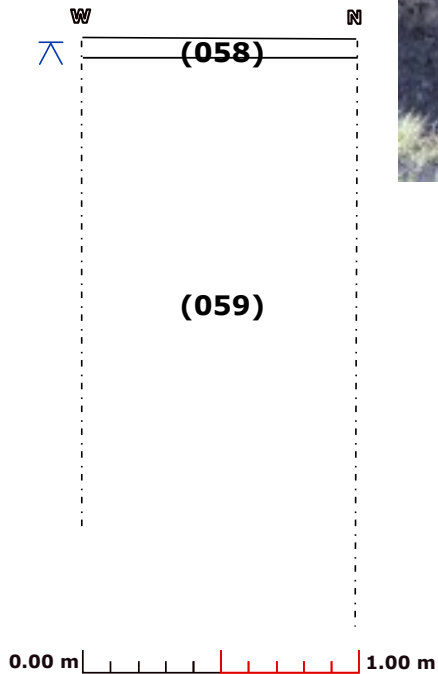
Dangerous and collapsing sections

Number	TP21			
Date	9.12.21			
Length (Metres)	3.00			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	4.00			
Photographic Number	2263 2264			
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	022			
Camera Facing	NW & NE			
Section	NW			
		 		
CONTEXT NUMBER	TYPE	Description	Plates	Period
047	Layer	Marsh 20cm thick	2259-2266	Natural
048	Layer	Grey silts, mudstone spoil	2259-2266	19th/ 20th century
049	Layer	Red Grey clay large sub rounded boulders and stones	2259-2266	19th/ 20th century
050	Layer	Colliery spoil	2259-2266	19th/ 20th century
051	Layer	Buried dark brown hummic topsoil	2259-2266	Natural
052	Layer	Yellow grey clay	2259-2266	Natural

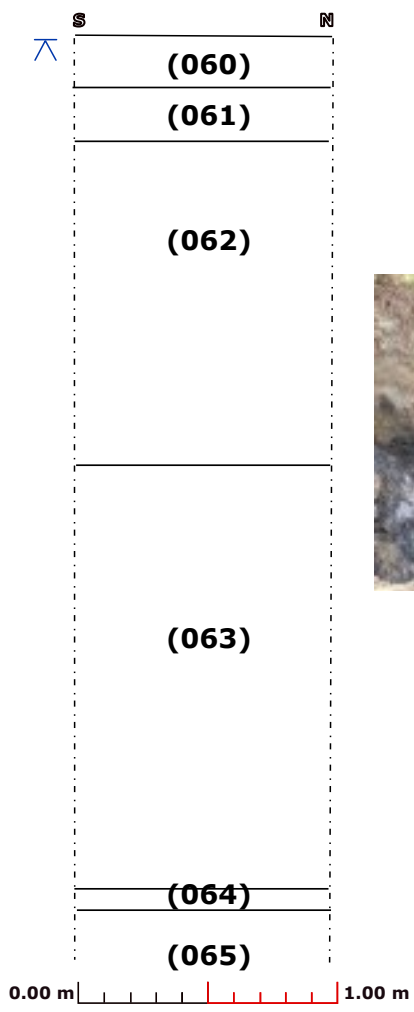
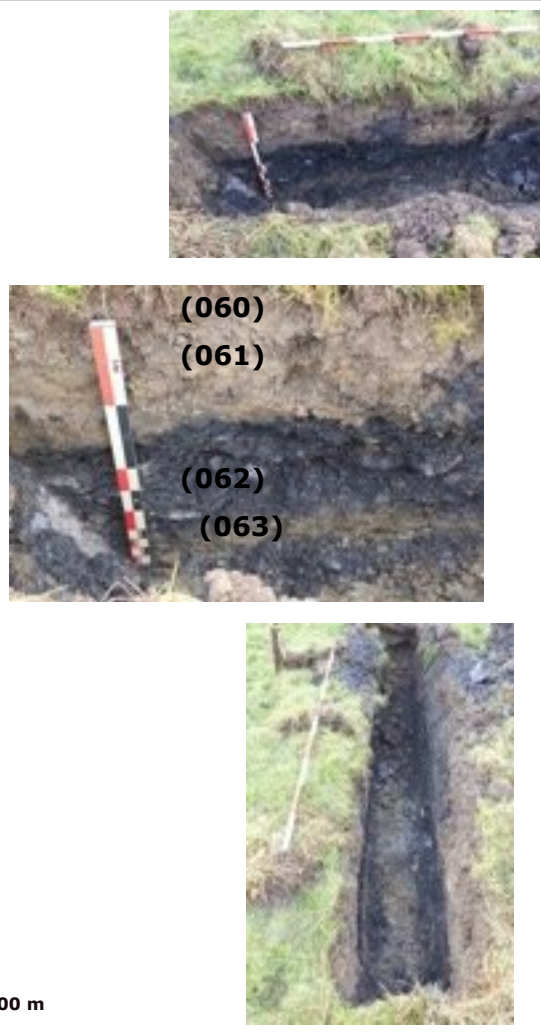
Collapsing Trench. Dangerous to enter

Number	TP27			
Date	7.12.21			
Length (Metres)	3.00			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	4.50			
Photographic Number	2234 2235			
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	023			
Camera Facing	NW NE			
Section	NW			
				
				
CONTEXT NUMBER	TYPE	Description	Plates	Period
053	Layer	Turf & Topsoil 10cm thick	2232-2236	Natural
054	Layer	Mixed yellow/ grey clay, redeposited natural	2232-2236	Natural (redeposited)
055	Layer	Buried topsoil, peaty layer with grass in evidence	2232-2236	Natural
056	Layer	Blue/ grey mixed clay	2232-2236	Natural
057	Layer	degraded Mudstone	2232-2236	Natural

Dangerous and collapsing sections

Number	TP32			
Date	8.12.21			
Length (Metres)	3.00			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	4.00			
Photographic Number	2254 2256			
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	024			
Camera Facing	NE SE			
Section	NE			
CONTEXT NUMBER	TYPE	Description	Plates	Period
058	Layer	Turf & Topsoil 10cm	2253-2258	Natural
059	Layer	Colliery spoil	2253-2258	19th/20th century

Dangerous and collapsing sections

Number	TP33			
Date	9.12.21			
Length (Metres)	4.00			
Diameter (Metres)				
Width (Metres)	0.50			
Depth (Metres)	4.00			
Photographic Number	2268 2269 2270			
Photographic Scales (metres)	1.00 & 2.00			
Plan Numbers	Fig. 8.3			
Section Number	025			
Camera Facing	NE			
Section	NW			
				
CONTEXT NUMBER	TYPE	Description	Plates	Period
060	Layer	Turf & Topsoil 20cm thick	2267-2272	Natural
061	Layer	Yellow subsoil, sub rounded stones	2267-2272	Natural
062	Layer	Colliery spoil	2267-2272	19th/20th century
063	Layer	Grey/yellow clay	2267-2272	Natural
064	Layer	Buried topsoil	2267-2272	Natural
065	Layer	Grey/yellow clay	2267-2272	Natural

Dangerous and collapsing sections

10. Results Analysis

10.1 The archaeological background of Onllwyn Washery and its setting, including a Historic Environment Record search, are detailed in Section 7 of this report and the following results reviewed in context of this information. Located at the head of the Dulais Valley in South Wales, in an area of known industrial activity spanning over 200 years, Onllwyn was used for activities associated with drift mining from 1932 with many coal shafts also recorded in the local vicinity but more recently it has serviced two local open cast mine sites.

10.2 Site monitoring and recording in the form of an archaeological watching brief ensured that mitigating measures were in place in order to protect the archaeological resource of the site during recent ground investigation works, namely a series of trial pits and boreholes. A detailed data record of each borehole and trial pit including photographic record can be found in 9. Results (pp 16-40) with an associated Context Record (pp 13-15).

10.3 The results of monitoring the ground investigation works at the site show that the area had previously been used for activities associated with mining, likely to date from the 19th/20th century or later but with no archaeological evidence of any earlier activity at the site. No significant archaeological features or contexts were discovered and no archaeological artefacts were recovered from either the Borehole or Trial Pit excavations, or from the associated excavated spoil.

11. Conclusion

11.1 It can be concluded from analysis of the results of the watching brief that no evidence of earlier archaeological activity was discovered during site monitoring at the site and that recorded industrial contexts are likely to date from the 19th/20th century onwards. No significant archaeological artefacts, features or contexts were recorded during the watching brief.

12. References & Bibliography

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3. Chartered Institute for Archaeologists 2009, *Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives*. University of Reading.
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10. Historic Environment Record Search (enquiry ref E6696, November 2021) Clwyd Powys Archaeological Trust, Welshpool.
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12. McGill G 1995, *Building on the Past, A guide to the archaeology and development process*. College of Estate Management, Reading, UK. Spon Press.
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 Chartered Institute for Archaeologists: www.archaeologists.net
 Historic Wales: historicwales.gov.uk
 Museum Federation of Wales: www.welshmuseumsfederation.org.uk
 Portable Antiquities Scheme: www.finds.org.uk

Appendix 1

Photographic Index

Site Name	Site Code	Sheet Number
Onllwyn Washery	OWN21	1

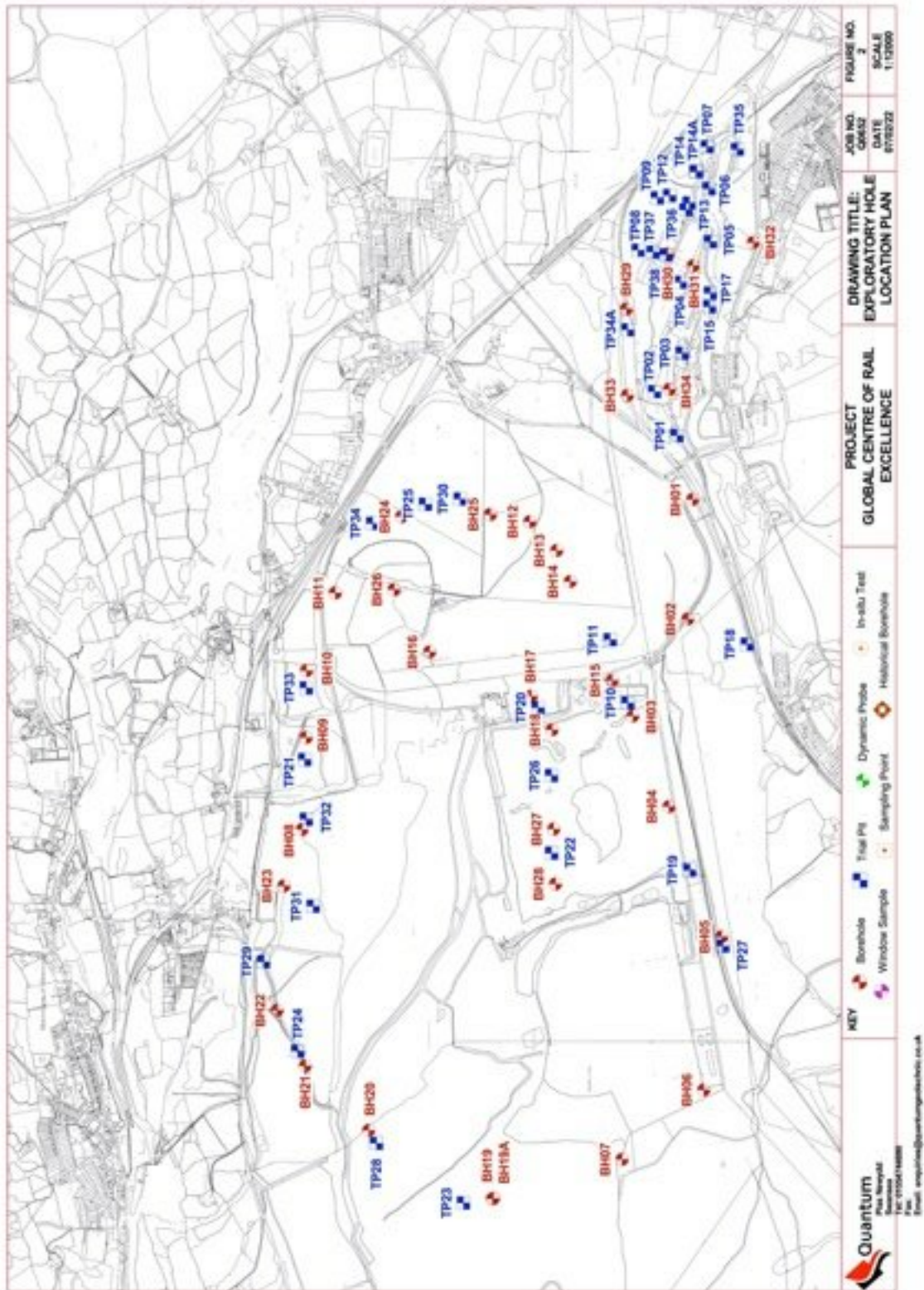
Frame Number		Description	Scale Metres	Camera Facing	Date
2169	1	General view of site BH03		SE	18.11.21
2170	2	General view of site BH03		E	
2171	3	General view of site BH03		SE	
2172	4	BH03	1 & 0.5	E	
2173	5	BH03	1 & 0.5	E	
2174	6	BH03	1	S	
2175	7	BH04 Spoil			18.11.21
2176	8	BH04 Setting up			
2177	9	BH04	0.5	W	
2178	10	BH04	0.5	W	
2179	11	BH07 Setting up		E	22.11.21
2180	12	BH07 General shot		E	
2181	13	BH07	0.5	E	
2182	14	BH07	0.5	E	
2183	15	BH06 General shot		N	22.11.21
2184	16	BH06	2 & 0.5	N	
2185	17	BH06	2 & 0.5	NE	
2186	18	BH06	2 & 0.5	E	
2187	19	BH18	2 & 0.5	N	22.11.21
2188	20	BH18	2 & 0.5	N	
2189	21	BH02 Setting up		SE	25.11.21
2190	22	BH02	0.5	SE	
2191	23	BH02	0.5	SE	
2192	24	BH01 Setting up		SE	25.11.21
2193	25	BH01	0.5	SE	
2194	26	BH05 General Shot		E	25.11.21
2195	27	BH05 General Shot		E	
2196	28	BH05	0.5	E	
2197	29	BH05	0.5	E	
2198	30	BH17 Setting up		W	25.11.21
2199	31	Panorama BH17			
2200	32	Panorama BH17			

2201	33	BH17	0.5	W	
2202	34	BH17	0.5	W	
2203	35	BH17 Spoil	0.5	W	
2204	36	BH11 Setting up			29.11.21
2205	37	BH11	0.5	W	
2206	38	BH11	0.5	W	
2207	39	BH11	0.5	W	
2208	40	BH08	0.5	NW	
2209	41	BH08 Panorama		NW	
2210	42	BH08 Panorama		NW	
2211	43	BH09 Setting up		E	29.11.21
2212	44	BH09	0.5	E	
2213	45	BH09	0.5	E	
2214	46	BH09	0.5	E	
2215	47	BH09	0.5	E	
2216	48	BH10 Setting up		N	29.11.21
2217	49	BH10	0.5	N	
2218	50	BH10	0.5	N	
2219	51	BH12 Setting up		E	29.11.21
2220	52	BH12	0.5	E	
2221	53	BH13 Setting up		S	29.11.21
2222	54	BH13	0.5	S	
2223	55	BH13	0.5	S	
2224	56	BH14	0.5	E	29.11.21
2225	57	BH14	0.5	E	
2226	58	BH14	0.5	E	
2227	59	TP16 Setting up		NW	6.12.21
2228	60	TP16	1 & 2	NW	
2229	61	TP16	1 & 2	NE	
2230	62	TP16 Section	1	NW	
2231	63	TP16 Full depth		NE	
2232	64	TP27 Setting up			7.12.21
2234	65	TP27	1	NW	
2235	66	TP27	1	NW	
2236	67	TP27	1 & 2	NW	
2237	68	Core Sample			
2238	69	Core Sample			
2239	70	TP10 Setting up			7.12.21
2240	71	TP10	1 & 2	S	
2241	72	TP10	1 & 2	W	

2242	73	TP19 Setting up			8.12.21
2243	74	TP19 Section	1 & 2	NW	
2244	75	TP19		NE	
2245	76	TP19		NE	
2246	77	TP19		NE	
2247	78	TP20 Setting up			8.12.21
2248	79	TP20	1 & 2	SE	
2249	80	TP20 Section @ 1.20m	1 & 2	SE	
2250	81	TP20	1	NE	
2251	82	TP20		NE	
2252	83	TP20 Full depth		NE	
2253	84	TP32 Setting up			8.12.21
2254	85	TP32 Section @ 1.20m	1	NE	
2255	86	TP32		NE	
2256	87	TP32	2	NW	
2257	88	TP32	2	NW	
2258	89	TP32		NW	
2259	90	TP21 Setting up			9.12.21
2260	91	TP21 Panorama			
2261	92	TP21 Panorama			
2262	93	TP21	1 & 2	NW	
2263	94	TP21 Section @ 1.20m	1 & 2	NW	
2264	95	TP21	2	NE	
2265	96	TP21 Spoil			
2266	97	TP 21 Spoil			
2267	98	TP33 Setting up			9.12.21
2268	99	TP33	1 & 2	E	
2269	100	TP33 Section @ 1.20m	1	E	
2270	101	TP33	1	N	
2271	102	TP33		N	
2272	103	TP33 Full depth		N	
2273	104	TP11 Under excavation			10.1 22
2274	105	TP11 Section	1 & 2	E	
2275	106	TP11 @ 1.20m	1 & 2	N	
2276	107	TP11 Section	1	E	
2277	108	TP11 Collapse		S	
2278	109	TP11 Collapse		S	

Appendix 2

Borehole Log Sheets



Contract - Order System of Rail Excellence

Order - Major Equipment

Order Number - 00000000000000000000

Order Date - 01/01/2010

Order Status - Open

Order Type - New

Order Description - Major Equipment

Order Details

Item	Part Number	Description	Quantity	Unit Price	Total Price	Order Type	Order Status	Order Date	Order Status	Order Type	Order Status
1	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
2	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
3	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
4	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
5	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
6	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
7	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
8	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
9	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
10	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
11	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
12	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
13	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
14	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
15	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
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17	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
18	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
19	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
20	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
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23	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
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30	00000000000000000000	Major Equipment	1	0.00	0.00	New	Open	01/01/2010	Open	New	Open
31	00000000000000000000	Major Equipment	1	0.00	0.00						

WBS - Work Breakdown Structure

Project Name: WBS
Project Manager: WBS
Project Number: WBS

Task Name	Task ID	Task Type	Task Status	Task Start Date	Task End Date	Task Duration	Task Effort	Task Cost	Task Risk	Task Notes
Task 1	1	Task 1	Not Started	1/1/2023	1/1/2023	1	1	1	1	Task 1
Task 2	2	Task 2	In Progress	1/1/2023	1/1/2023	1	1	1	1	Task 2
Task 3	3	Task 3	Completed	1/1/2023	1/1/2023	1	1	1	1	Task 3
Task 4	4	Task 4	Not Started	1/1/2023	1/1/2023	1	1	1	1	Task 4
Task 5	5	Task 5	In Progress	1/1/2023	1/1/2023	1	1	1	1	Task 5
Task 6	6	Task 6	Completed	1/1/2023	1/1/2023	1	1	1	1	Task 6
Task 7	7	Task 7	Not Started	1/1/2023	1/1/2023	1	1	1	1	Task 7
Task 8	8	Task 8	In Progress	1/1/2023	1/1/2023	1	1	1	1	Task 8
Task 9	9	Task 9	Completed	1/1/2023	1/1/2023	1	1	1	1	Task 9
Task 10	10	Task 10	Not Started	1/1/2023	1/1/2023	1	1	1	1	Task 10

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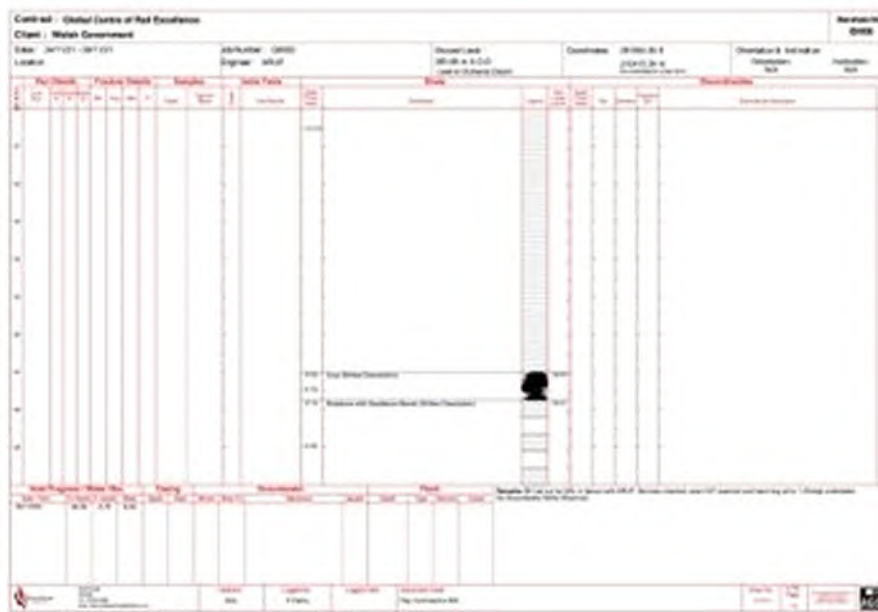
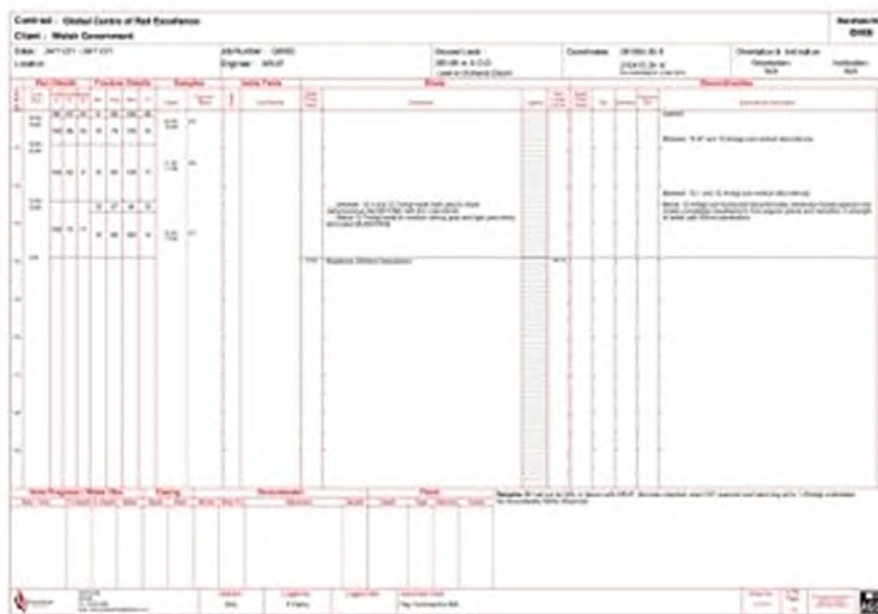


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Contract : Global Centre of Rail Excellence										Store No. BH04																									
Client : Welsh Government																																			
Date : 23/11/21 - 23/11/21		Job Number : Q052		Project Lead : 37 95 4 A C D		Coordinates : 20581 75 2		Groundwork : 20581 75 2		Institution : N/A																									
Location :		Engineer : ANUP		Notes : 20581 75 2		Distribution : N/A		Institution : N/A																											
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Job No.	Job Name	Job Number	Job Date	Job Status	Job Type	Job Location	Job Notes	Job Status	Job Type	Job Location	Job Notes																								
1	20581 75 2	Q052	23/11/21	Completed	Groundwork	20581 75 2	20581 75 2	Completed	Groundwork	20581 75 2	20581 75 2																								
<table border="1"> <thead> <tr> <th>Job No.</th> <th>Job Name</th> <th>Job Number</th> <th>Job Date</th> <th>Job Status</th> <th>Job Type</th> <th>Job Location</th> <th>Job Notes</th> <th>Job Status</th> <th>Job Type</th> <th>Job Location</th> <th>Job Notes</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20581 75 2</td> <td>Q052</td> <td>23/11/21</td> <td>Completed</td> <td>Groundwork</td> <td>20581 75 2</td> <td>20581 75 2</td> <td>Completed</td> <td>Groundwork</td> <td>20581 75 2</td> <td>20581 75 2</td> </tr> </tbody> </table>												Job No.	Job Name	Job Number	Job Date	Job Status	Job Type	Job Location	Job Notes	Job Status	Job Type	Job Location	Job Notes	1	20581 75 2	Q052	23/11/21	Completed	Groundwork	20581 75 2	20581 75 2	Completed	Groundwork	20581 75 2	20581 75 2
Job No.	Job Name	Job Number	Job Date	Job Status	Job Type	Job Location	Job Notes	Job Status	Job Type	Job Location	Job Notes																								
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Contract : Global Centre of Rail Excellence										Store No. BH04																									
Client : Welsh Government																																			
Date : 23/11/21 - 23/11/21		Job Number : Q052		Project Lead :		Coordinates :																													
Location :		Engineer : ANUP		Notes :		Distribution :		Institution :																											
																																			
																																			
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Contract : Global Centre of Rail Excellence										Store No. BH04																									
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Location :		Engineer : ANUP		Notes :		Distribution :		Institution :																											
																																			
																																			
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Job No.	Job Name	Job Number	Job Date	Job Status	Job Type	Job Location	Job Notes	Job Status	Job Type	Job Location	Job Notes																								
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Contract : Global Centre of Rail Excellence		Borehole No. BH06	
Client : Welsh Government			
Date : 24/11/21 - 25/11/21	Job Number : Q0002	Ground Level :	
Location :	Engineer : JWS/P	Cont'd level :	

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Contract : Global Centre of Rail Excellence		Barcode No 89407	
Client : Welsh Government			
Date : 29/1/21 - 30/1/21	Job Number : Q0552	Drawn/Laid :	
Location :	Engineer : JRGF	Contractor :	

JOB NAME: BUCKLE JOB NUMBER: Q0552 RENEWABLE NUMBER: 2017 RIG NUMBER: 20 FROM JOY: 2017 TO JOY: 2017	
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JOB NAME: BUCKLE JOB NUMBER: Q0552 RENEWABLE NUMBER: 2017 RIG NUMBER: 20 FROM JOY: 2017 TO JOY: 2017	
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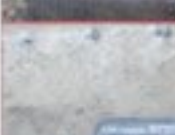
Contract : Global Centre of Rail Excellence				Barcode No 88407	
Client : Welsh Government					
Date : 20/1/21 - 26/1/21		Job Number : 00552		Drawn/Level	
Location :		Engineer : JWP		Coordinate	
		Version: 001 P-001		Sheet No: 1 of 1 Page: 1	
Project: Title: Date: Job Number: Job Name:		Version: P-001		Sheet No: 1 of 1 Page: 1	
		Version: 001 P-001		Sheet No: 1 of 1 Page: 1	

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Contract : Global Centre of Rail Excellence		Document No GCR11	
Client : Welsh Government			
Date : 18/12/11 - 18/12/11	Job Number : Q2862	General Unit	
Location : Ground workshop area	Engineer : JF/UP	Coordinates	



Contract : Global Centre of Rail Excellence		Reference No : GR11	
Client : Welsh Government			
Date : 16/12/11 - 17/12/11	Alt Number : D0832	Start Date :	
Location : Airport railway area	Engineer : AFUP	Complete :	

	Date Issued : By : For :	Version : To :	Logbook : To :	Draw No : To :	Date : To :	Project Name : To :
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[illegible][illegible]

Contract : Global Centre of Rail Excellence		Borehole No.
Client : Welsh Government		BH12
Date: 14/12/21 - 15/12/21	Job Number : Q0052	Ground Level :
Location :	Engineer : ARUP	Coordinates :



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Contract : Global Centre of Rail Excellence		Borehole No.
Client : Welsh Government		BH12
Date: 14/12/21 - 15/12/21	Job Number : Q0052	Ground Level :
Location :	Engineer : ARUP	Coordinates :



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Contract : Global Centre of Rail Excellence			Barcode No
Client : Welsh Government			BH13
Date : -	Job Number : 0000	Ground Level	
Location :	Engine : WUP	Coordinates	

Contract : Global Centre of Rail Excellence			Barcode No
Client : Welsh Government			BH13
Date : -	Job Number : 0000	Ground Level	
Location :	Engine : WUP	Coordinates	

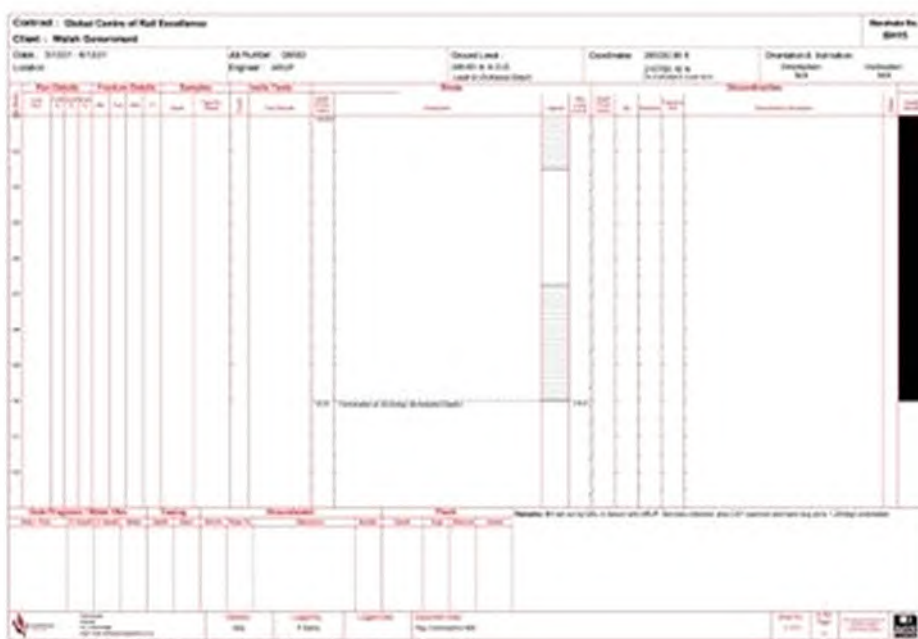
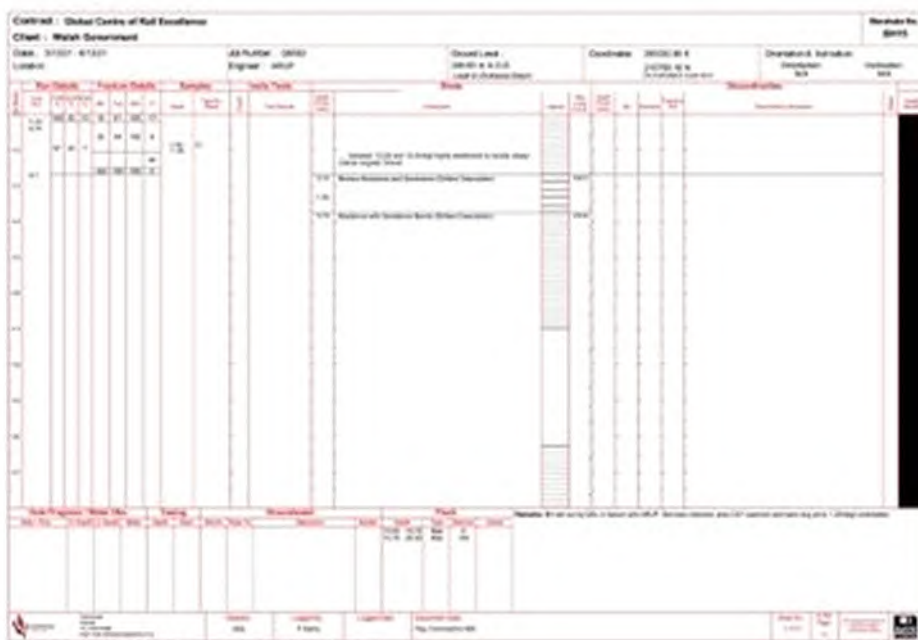
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Client : Welsh Government			BH13
Date : -	Job Number : 0000	Ground Level	
Location :	Engine : WUP	Coordinates	

Contract : Global Centre of Rail Excellence			Barcode No
Client : Welsh Government			BH13
Date : -	Job Number : 0000	Ground Level	
Location :	Engine : WUP	Coordinates	

Continued - Global Centre of Best Practices															Revision 0004	
Project: Western Government					Institution: Global		Document: 0001		Document: 0002		Document: 0003		Document: 0004			
Location: Western Government					Engineer: M&E		Contractor: M&E		Contractor: M&E		Contractor: M&E		Contractor: M&E			
Particulars					Quantity		Unit		Rate		Amount		Total			
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79.00					79.00		79.00		79.00		79.00		79.00			
80.00					80.00		80.00		80.00		80.00		80.00			
81.00					81.00		81.00		81.00		81.00		81.00			
82.00					82.00		82.00		82.00		82.00		82.00			
83.00					83.00		83.00		83.00		83.00		83.00			
84.00					84.00		84.00		84.00		84.00		84.00			
85.00					85.00		85.00		85.00		85.00		85.00			
86.00					86.00		86.00		86.00		86.00		86.00			
87.00					87.00		87.00		87.00		87.00		87.00			
88.00					88.00		88.00		88.00		88.00		88.00			
89.00					89.00		89.00		89.00		89.00		89.00			
90.00					90.00		90.00		90.00		90.00		90.00			
91.00					91.00		91.00		91.00		91.00		91.00			
92.00					92.00		92.00		92.00		92.00		92.00			
93.00					93.00		93.00		93.00		93.00		93.00			
94.00					94.00		94.00		94.00		94.00		94.00			
95.00					95.00		95.00		95.00		95.00		95.00			
96.00					96.00		96.00		96.00		96.00		96.00			
97.00					97.00		97.00		97.00		97.00		97.00			
98.00					98.00		98.00		98.00		98.00		98.00			
99.00					99.00		99.00		99.00		99.00		99.00			
100.00					100.00		100.00		100.00		100.00		100.00			

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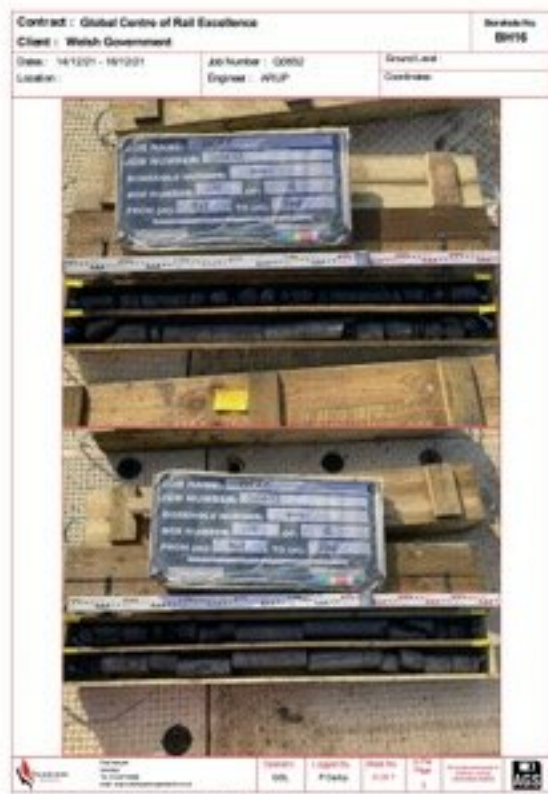




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Contract : Global Centre of Rail Excellence		Drawn by: BH17	
Client : Welsh Government			
Date : 25/1/21 - 25/1/21	Job Number : 02050	Ground Level	
Location :	Engine : WPUF	Coordinate :	

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Contract : Global Centre of Rail Excellence		Drawn By BHV18
Client : Welsh Government		
Draw : 23/1/2011 - 25/1/2011	Job Number : 00052	Drawn And Checked :
Location :	Engineer : WJUP	Continued :

	Drawn By BHV18 Checked By WJUP Date 23/1/2011	Drawn By BHV18 Checked By WJUP Date 23/1/2011	Drawn By BHV18 Checked By WJUP Date 23/1/2011
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Appendix 3

Trial Pit Log Sheets

Contract : Global Centre of Rail Excellence Client : Welsh Government				Trial Pit No. TP10	
Dates : 7/12/21 - 7/12/21		Job Number : Q0652		Ground Level : 257.77 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 283248.02 E 210699.94 N Co-ordinates to National Grid	

Samples		Tests		Strata		Legend	Red Level A.O.D.	WATER
Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description			
0.10 -	D1			0.15	TOPSOIL: Brown very gravelly CLAY with many rootlets.		257.82	
0.30 -	D2			0.15	MADE GROUND: Brown clayey slightly sandy GRAVEL. Gravel is angular to sub angular fine to coarse siltstone.			
0.50 - 0.50	LB3			0.45				
1.00 - 1.50	B4			0.60	MADE GROUND: Dark grey slightly clayey slightly sandy GRAVEL with low cobble content of siltstone. Gravel is angular to sub angular fine to coarse siltstone.		257.17	
2.00 - 2.50	LB5			2.00				
2.60 -	D6			2.60	Trial Pit terminated at 2.6mbgl, sides collapsing, pit unstable.		255.17	

PLAN

Groundwater: No groundwater encountered

Stability: Sides collapsing from surface

Shoring: None

Equipment Used: Stonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

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Operator: JL
Logged By: A Jones
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All measurements in metres unless otherwise stated

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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Phil Darby, Library File: C:\USERS\PHIL.DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence Client : GCRE Limited				Trial Pit No. TP10	
Dates : 7/12/21 - 7/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates:	




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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Arwel Jones, Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNIC LTD\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence Client : Welsh Government				Trial Pit No. TP11	
Dates : 10/1/22 - 10/1/22		Job Number : Q0652		Ground Level : 251.09 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 263484.77 E 210766.09 N Co-ordinates to National Grid	

Samples		Tests		Strata		Legend	Red Level A.O.D.	WATER
Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description			
0.01 -	D1			0.10	TOPSOIL: Brown clayey slightly sandy GRAVEL with many rootlets. Gravel is angular to sub angular fine to coarse siltstone.		250.99	
0.30 -	D2			0.10	MADE GROUND: Dark grey slightly silty slightly sandy GRAVEL with medium cobble content and low boulder content of siltstone. Gravel is angular to sub angular fine to coarse siltstone, rare fine to medium coal and sub angular to sub rounded fine to coarse sandstone with plastic and timber.			
0.50 - 1.00	LB3							
1.50 - 2.00	LB4			2.60				
				2.70	Trial pit terminated at 2.7mbgl, sides collapsing due to fast groundwater ingress.		248.39	

PLAN

Groundwater: Fast ground water ingress at 2.2mbgl

Stability: Sides collapsing from 1.5mbgl

Shoring: None

Equipment Used: 15Tonne tracked 360

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Phil Darby, Library File: C:\USERS\PHIL.DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence Client : GCRE Limited				Trial Pit No. TP11	
Dates : 10/1/22 - 10/1/22		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates:	




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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Arwel Jones, Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNIC LTD\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP19	
Client : Welsh Government					
Dates : 8/12/21 - 8/12/21		Job Number : Q0652		Ground Level : 247.39 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 282624.08 E 210468.10 N Co-ordinates to National Grid	

m B.G.L.	Samples		Tests		Strata		Legend	Red. Level A.O.D.	WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description			
0.00 - 0.10	D1				0.10	TOPSOIL: Black slightly silty slightly sandy organic CLAY.		247.19	
0.30 -	D2	0.3	Vare. P-36 - R-164Nm2 Vare. P-40 - R-204Nm2 Vare. P-32 - R-164Nm2		0.30	Soft to firm yellowish brown grey sandy gravelly CLAY with low cobble content of sandstone. Gravel is sub angular to sub rounded fine to coarse sandstone.			
0.50 - 1.00	LB3				0.85				
1.50 -	B4				1.05	Firm dark grey slightly sandy gravelly CLAY with low cobble content of sandstone. Gravel is angular to sub rounded fine to coarse sandstone, angular to sub angular fine to coarse siltstone.		246.34	
2.50 - 3.00	LB5				2.95	with low boulder content of siltstone from 2.4mbgl			
3.20 -	D6								
3.50 - 4.00	B7								
4.00					4.00	Trial Pit terminated at scheduled depth of 4.0mbgl		243.39	

PLAN

Groundwater: No groundwater encountered

Stability: Stable

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Phil Darby, Library File: C:\USERS\PHIL.DARBY\ONE DRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP19	
Client : GCRE Limited					
Dates : 8/12/21 - 8/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates:	




PLAN

Groundwater: No groundwater encountered

Stability: Stable

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

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m Per Page

All measurements in metres unless otherwise stated

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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Arwel Jones, Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNIC LTD\QUANTUM GEOTECHNICAL - COMPANY\GINT\QUANTUM LIBRARY

Contract : Global Centre of Rail Excellence				Trial Pit No. TP20	
Client : Welsh Government					
Dates : 8/12/21 - 8/12/21		Job Number : Q0652		Ground Level : 275.01 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 283231.19 E 211035.80 N Co-ordinates to National Grid	

m B.G.L.	Samples		Tests		Strata		Legend	Red. Level A.O.D.	WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description			
0.00 - 0.05	D1				0.05	TOPSOIL: Brown clayey GRAVEL with many rootlets. Gravel is angular fine to coarse siltstone.		274.98	
0.30 -	D2				0.05	MADE GROUND: Dark grey clayey slightly sandy GRAVEL with low cobble content and low boulder content of siltstone. Gravel is angular to sub angular fine to coarse siltstone and sandstone.			
0.50 - 1.00	B3								
1.50 - 2.00	LB4				3.35				
2.50 - 3.00	B5								
3.50 - 4.00	B6				3.40	Firm brown sandy gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse sandstone.		271.61	
4.00 -	D7				0.60				
4.00					4.00	Trial Pit terminated at scheduled depth of 4.0mbgl		271.01	

PLAN

Groundwater: No groundwater encountered

Stability: Stable

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

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All measurements in metres unless otherwise stated

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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Phil Darby, Library File: C:\USERS\PHIL.DARBY\ONE DRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP20	
Client : GCRE Limited					
Dates : 8/12/21 - 8/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates:	




PLAN

Groundwater: No groundwater encountered

Stability: Stable

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

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Form Name: TP LOG, Version 2.11.100, 27/11/20 Output By: Arwel Jones, Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNIC LTD\QUANTUM GEOTECHNICAL - COMPANY\GINT\QUANTUM LIBRARY

Contract : Global Centre of Rail Excellence				Trial Pit No. TP21	
Client : Welsh Government					
Dates : 9/12/21 - 9/12/21		Job Number : Q0652		Ground Level : 230.34 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 283037.70 E 211907.98 N Co-ordinates to National Grid	

J G L E	Samples		Tests		Strata		Legend	Red. Level A.O.D.	WATER
	Depth	Type No.	Depth	Test Results	Depth (Thick-ness)	Description			
-1	0.10 - 0.30	D1			0.15	TOPSOIL: Brown slightly sandy gravelly CLAY with many rootlets. Gravel is angular to sub angular fine to coarse siltstone.		230.19	
	0.30 - 0.50	D2			0.15	MADE GROUND: Brownish grey clayey slightly sandy GRAVEL with low cobble content of siltstone. Gravel is angular to sub angular fine to coarse siltstone and sandstone.		228.74	
	0.50 - 1.00	D3			1.45			227.74	
-2	1.00 - 1.50	LB4			1.60	MADE GROUND: Brownish grey slightly clayey slightly sandy GRAVEL with low cobble content of siltstone. Gravel is angular to sub angular fine to coarse siltstone, sandstone and fine to medium coal.		227.74	
	1.50 - 2.00	LB5			1.00			227.74	
-3	2.00 - 2.50	D6			2.60	Soft grey slightly sandy organic CLAY with rootlets		227.74	
	2.50 - 2.70	D6			2.70	Firm orange brown with grey mottling sandy slightly gravelly CLAY with low cobble content of sandstone.		227.74	
-4	2.70 - 3.00	D7			1.30			226.34	
	3.00 - 3.50	D7			1.30			226.34	
-4	3.50 - 4.00	D8			4.00	Trial Pit terminated at scheduled depth of 4.0mbgl		226.34	
	4.00 -	D8			4.00			226.34	

PLAN

Groundwater: No groundwater encountered

Stability: Sides collapsing 0-2.6mbgl

Shoring: None

Equipment Used: 90tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 90tonne tracked 360 excavator

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Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Phil Darby. Library File: C:\USERS\PHIL.DARBY\ONE-DRIVE - QUANTUM GEOTECHNICAL\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP21	
Client : GCRE Limited					
Dates : 9/12/21 - 9/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates :	




PLAN

Groundwater: No groundwater encountered

Stability: Sides collapsing 0-2.6mbgl

Shoring: None

Equipment Used: 90tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 90tonne tracked 360 excavator

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Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Aneel Jones. Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNICAL\QUANTUM GEOTECHNICAL - COMPANY\GINT\QUANTUM\BIR

Contract : Global Centre of Rail Excellence				Trial Pit No. TP27	
Client : Welsh Government					
Dates : 7/12/21 - 7/12/21		Job Number : Q0652		Ground Level : 239.62 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 282341.17 E 210344.22 N Co-ordinates to National Grid	

J G L E	Samples		Tests		Strata		Legend	Red. Level A.O.D.	WATER
	Depth	Type No.	Depth	Test Results	Depth (Thick-ness)	Description			
-1	0.10 - 0.20	D1			0.15	TOPSOIL: Brown slightly sandy gravelly CLAY with many rootlets.		239.47	
	0.20 - 0.50	D2			0.15	MADE GROUND: Brown gravelly sandy slightly organic CLAY		238.97	
	0.50 - 0.60	D3			0.60			238.72	
-2	0.60 - 0.80	D4			0.75	Dark brown very fibrous PEAT.		238.37	
	0.80 - 0.90	D5			0.15	Very soft yellow brown slightly silty slightly sandy slightly gravelly CLAY.		238.37	
	0.90 - 1.00	D6			0.30			238.37	
-3	1.00 - 1.20	D7	1.2	Vane: P=12- R=4Nm2 Vane: P=10- R=2Nm2 Vane: P=14- R=4Nm2	1.25	Firm dark grey slightly sandy gravelly CLAY with low cobble and low boulder content of siltstone. Gravel is angular to sub angular fine to coarse siltstone and sandstone.		238.37	
	1.20 - 1.50	D7			1.25			238.37	
	1.50 - 2.00	D8			1.25			238.37	
-4	2.00 - 2.50	LB10			3.25			238.12	
	2.50 - 3.00	LB10			3.25			238.12	
-4	3.00 - 3.50	B11			4.50	Trial Pit terminated at scheduled depth of 4.5mbgl		238.12	
	3.50 - 4.00	B11			4.50			238.12	
-4	4.00 - 4.50	D9			4.50			238.12	
	4.50 -	D9			4.50			238.12	

PLAN

Groundwater: No groundwater encountered

Stability: Stable

Shoring: None

Equipment Used: 90tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 90tonne tracked 360 excavator

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Operator: JL
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Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Phil Darby. Library File: C:\USERS\PHIL.DARBY\ONE-DRIVE - QUANTUM GEOTECHNICAL\QUANTUM 4 GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP27	
Client : GCRE Limited					
Dates : 7/12/21 - 7/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates :	




PLAN

Groundwater: No groundwater encountered

Stability: Stable

Shoring: None

Equipment Used: 90tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by QGL prior to starting work. Soakaway test carried out within pit. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 90tonne tracked 360 excavator

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Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Aneel Jones. Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNICAL\QUANTUM GEOTECHNICAL - COMPANY\GINT\QUANTUM\BIR

Contract : Global Centre of Rail Excellence				Trial Pit No. TP32	
Client : Welsh Government					
Dates : 8/12/21 - 8/12/21		Job Number : Q0652		Ground Level : 235.63 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 282814.33 E 211902.59 N Co-ordinates to National Grid	

m B.G.L.	Samples		Tests		Strata		Legend	Red. Level A.O.D.	WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description			
0.00 - 0.10	D1				0.10	TOPSOIL: Brown clayey GRAVEL with many rootlets. Gravel is angular to sub angular fine to coarse siltstone.		235.63	
0.50 - 1.00	B2					MADE GROUND: Dark grey clayey slightly sandy GRAVEL with low cobble content and low boulder content of siltstone. Gravel is angular to sub angular fine to coarse siltstone, sandstone and brick.			
						with steel wire at 1.0-1.1mbgl			
						from 2.0mbgl with fine to coarse coal.			
2.00 - 2.50	B4				4.40				
2.80 -	D5								
3.00 - 3.50	B6								
4.00 - 4.50	LB7								
					4.50	Trial Pit terminated at scheduled depth of 4.5mbgl		231.13	

PLAN

Groundwater: No groundwater encountered

Stability: Slight collapse of sides.

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by GGL prior to starting work. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 9tonne tracked 360 excavator

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Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Phil Darby, Library File: C:\USERS\PHIL.DARBY\ONEDRIVE - QUANTUM GEOTECHNICAL\TOQUANTUM 4.GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP32	
Client : GCRE Limited					
Dates : 8/12/21 - 8/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates :	




PLAN

Groundwater: No groundwater encountered

Stability: Slight collapse of sides.

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by GGL prior to starting work. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 9tonne tracked 360 excavator

Quantum Geotechnical
Pia Newydd, Llandudno, Penarth & Swansea
Surveys
Tel: 01554 744880
email: enquiries@quantumgeotech.co.uk

Operator: JL
Logged By: A Jones
Sheet No. 2 Of 2
m Per Page 5
All measurements in metres unless otherwise stated

AGS

Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Arwel Jones, Library File: C:\USERS\ARWEL.JONES\QUANTUM GEOTECHNICAL\TOQUANTUM GEOTECHNICAL - COMPANY\GINTY\QUANTUM\LIBRARY

Contract : Global Centre of Rail Excellence				Trial Pit No. TP33	
Client : Welsh Government					
Dates : 9/12/21 - 9/12/21		Job Number : Q0652		Ground Level : 236.29 m A.O.D. Level to Ordnance Datum	
Location :		Engineer : ARUP		Coordinates : 283304.69 E 211902.41 N Co-ordinates to National Grid	

m B.G.L.	Samples		Tests		Strata		Legend	Red. Level A.O.D.	WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description			
0.10 -	D1				0.45	TOPSOIL: Brown slightly sandy gravelly CLAY with many rootlets. Gravel is angular to sub angular fine to coarse siltstone.		236.84	
0.50 - 1.00	LB2				0.70	MADE GROUND: Black slightly silty slightly clayey slightly sandy GRAVEL with low cobble content of siltstone and brick. Gravel is angular to sub angular fine to coarse siltstone.			
					1.15	MADE GROUND: Brown and grey slightly sandy gravelly CLAY with low cobble content of siltstone and sandstone. Gravel is angular to sub angular fine to coarse siltstone, sandstone and fine to medium coal.		236.14	
1.50 - 2.00	LB3				1.25				
2.30 -	D4				2.40	Soft to firm lack slightly sandy organic CLAY with rootlets.		233.89	
2.50 -	D5				2.65	Firm pale brownish grey sandy slightly gravelly CLAY.		233.64	
2.80 - 3.20	B6				0.95				
3.50 -	D7				3.60	Grey clayey slightly sandy GRAVEL with low cobble content of sandstone. Gravel is sub angular to sub rounded fine to coarse sandstone.		232.89	
3.80 - 4.20	B8				0.90				
					4.50	Trial Pit terminated at scheduled depth of 4.5mbgl		231.79	

PLAN

Groundwater: Seepage at 3.4mbgl

Stability: Stable

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by GGL prior to starting work. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 9tonne tracked 360 excavator

Quantum Geotechnical
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email: enquiries@quantumgeotech.co.uk

Operator: GJ
Logged By: A Jones
Sheet No. 1 Of 2
m Per Page 5
All measurements in metres unless otherwise stated

AGS

Form Name: TP LOG Version 2.11.100, 27/11/20 Output By: Phil Darby, Library File: C:\USERS\PHIL.DARBY\ONEDRIVE - QUANTUM GEOTECHNICAL\TOQUANTUM 4.GLB

Contract : Global Centre of Rail Excellence				Trial Pit No. TP33	
Client : GCRE Limited					
Dates : 9/12/21 - 9/12/21		Job Number : Q0652		Ground Level :	
Location :		Engineer : Ove Arup and Partners Ltd		Coordinates :	




PLAN

Groundwater: Seepage at 3.4mbgl

Stability: Stable

Shoring: None

Equipment Used: 9tonne tracked 360 excavator

Remarks: Position marked out using co-ordinates supplied by the engineer. Area CAT and GENNY scanned with permit to excavate issued by GGL prior to starting work. On completion hole backfilled with arisings, compacted in layers in reverse order of excavation.

Equipment Used: 9tonne tracked 360 excavator

Quantum Geotechnical
Pia Newydd, Llandudno, Penarth & Swansea
Surveys
Tel: 01554 744880
email: enquiries@quantumgeotech.co.uk

Operator: GJ
Logged By: A Jones
Sheet No. 2 Of 2
m Per Page 5
All measurements in metres unless otherwise stated

AGS

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APPENDIX 4



**Written Scheme of Historic
Environment Mitigation:
WSI/778/21**

**ONLLWYN WASHERY
NEATH
SA10 9HN**

OS NGR: SN 83704 10894



**Watford Cottage
Watford Road
Caerphilly
CF83 1NE**

**02920 888 794
07974 857 799**

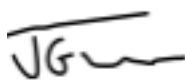
**admin@cardiffarchaeology.co.uk
www.cardiffarchaeology.co.uk**

Report Information

Type	Written Scheme of Historic Environment Mitigation for a Watching Brief
Date	30th November 2021
Authors	J G Stewart-Turner <i>PCIfA</i> J Stewart-Turner <i>BA (Hons) MA ACIfA</i>
Site Address	Onllwyn Washery Neath SA10 9HN
OS NGR	SN 83704 10894
Client	Quantum Geotech Ltd. Plas Newydd Farm Llanedi Swansea SA4 0FQ
Report Number	WSI/778/21
Site Code	OWN21
Project Number	260/21

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Professional Standard & Quality Control			
Report Checked By	Jane Stewart-Turner <i>BA (Hons) MA ACIfA</i>	Report Author	Jim Stewart-Turner
Position	Partner	Position	Partner
Date	30/11/2021	Date	28/11/2021
Signature		Signature	

1. Summary

Quantum Geotech Limited have commissioned Cardiff Archaeology to provide a programme of archaeological work for the excavation of trial pits and boreholes during ground investigation works at Onllwyn Washery, Neath, SA10 9HN, South Wales.

As part of the programme of works a Written Scheme of Historic Environment Mitigation for a watching brief is a requirement of both the Glamorgan Gwent and Clwyd Powys Archaeological Trusts prior to ground investigations taking place.

A methodology and mitigation strategy for the watching brief is proposed by Cardiff Archaeology in the contexts of site location and nature of groundworks, together with information about the archaeological contractor. The archaeological background of the site and potential impact of groundwork activities on the archaeological resource are described with procedures for analysis of results, reporting, publication and archive deposition information also included.

This Written Scheme of Historic Environment Mitigation (WSI/778/21) has been produced by Cardiff Archaeology to be submitted for approval from both the Glamorgan Gwent Archaeological Trust and The Clwyd Powys Archaeological Trust prior to undertaking the proposed watching brief.

1. Crynodeb

Mae Quantum Geotech Limited wedi comisiynu Archeoleg Caerdydd i ddarparu rhaglen o waith archeolegol ar gyfer cloddio pyllau prawf a thyllau turio yn ystod gwaith ymchwilio i'r ddaear yn Onllwyn Washery, Castell-nedd, SA10 9HN, De Cymru.

Fel rhan o'r rhaglen waith mae Cynllun Ysgrifenedig o Liniaru'r Amgylchedd Hanesyddol ar gyfer briff gwylio yn ofyniad gan Ymddiriedolaethau Archeolegol Morgannwg Gwent a Clwyd Powys cyn cynnal ymchwiliadau daear.

Mae Archeoleg Caerdydd yn cynnig strategaeth fethodoleg a lliniaru ar gyfer y briff gwylio yng nghyd-destun lleoliad y safle a natur y gwaith daear, ynghyd â gwybodaeth am y contractwr archeolegol. Disgrifir cefndir archeolegol y safle ac effaith bosibl gweithgareddau gwaith daear ar yr adnodd archeolegol gyda gweithdrefnau ar gyfer dadansoddi canlyniadau, adroddiadau, cyhoeddi a gwybodaeth dyddodi archif hefyd wedi'u cynnwys.

Cynhyrchwyd y Cynllun Ysgrifenedig hwn o Liniaru'r Amgylchedd Hanesyddol (WSI / 778/21) gan Archeoleg Caerdydd i'w gyflwyno i'w gymeradwyo gan Ymddiriedolaeth Archeolegol Morgannwg Gwent ac Ymddiriedolaeth Archeolegol Clwyd Powys cyn ymgymryd â'r briff gwylio arfaethedig.

2. Introduction

2.1 In order to mitigate the effects of ground investigation activities on the archaeological resource of the site at Onllwyn Washery a Written Scheme of Historic Environment Mitigation for a Watching Brief, as part of a programme of archaeological work, is a requirement of both the Clwyd Powys⁷ and Glamorgan Gwent⁸ Archaeological Trusts.

2.2 Quantum Geotech Limited⁹ have commissioned Cardiff Archaeology to produce a Written Scheme of Historic Environment Mitigation for a Watching Brief (Cardiff Archaeology Ref: WSI/778/21) as part of a programme of archaeological work in order to fully comply with the trusts requirements. This will be submitted to both archaeological trusts for approval prior to undertaking ground investigation works at the site.

2.3 Ground investigation works are to be carried out prior to development of the site. An archaeological watching brief will therefore be required during machine excavation of 16 trial pits, and also during excavation of an additional 16 hand dug borehole starter pits, across the site to investigate the substrata and inform a design plan for the development (Figs 5.3). Any associated works will also be monitored. Further details in Description of Works 4.5, p.7.

2.4 Written Scheme of Historic Environment Mitigation WSI/778/21 details a Watching Brief strategy for the site investigations. It contains site location and groundwork information, an archaeological and historical background of the site, and analysis of the potential impact of groundwork activities on the archaeological resource. Mitigation measures to protect the archaeological resource of the site include a methodology for archaeological recording during the ground works, results analysis, reporting and publication, and archiving processes. A site specific Risk Assessment is also included.

2.5 The proposed programme of archaeological work will comply with the requirements of the archaeological trusts and will ensure that archaeological operations are undertaken to an acceptable professional standard as specified by the Chartered Institute for Archaeologists (CIfA)¹⁰.

An archaeological Watching Brief is defined by the CIfA as *'a programme of observation, investigation and recording conducted during any operation carried out for non-archaeological reasons within a specified area or site, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme of work will result in the preparation of a report and ordered archive'* (IfA 1994, updated 2013).

2.6 The proposed programme of archaeological work will also fulfil the conditions of Welsh Government's *Planning Policy Wales 2018 (Edition 10) Chapter 6 Conserving The Historic Environment and Technical Advice Note 24 (TAN 24) The Historic Environment*.

⁷ **Clwyd Powys Archaeological Trust:** Y Swyddfeydd, Coed y Dinas, Welshpool, SY21 8RP Tel: 01938 552035 Email: trust@cpat.org.uk

⁸ **Glamorgan Gwent Archaeological Trust:** Sa12 Business Centre, Seaway Parade Industrial Estate, Baglan, Port Talbot SA12 7BR Tel: 01792 655208 Email: enquiries@ggat.org.uk

⁹ **Quantum Geotech Limited:** Plas Newydd Farm, Llanedi, Swansea SA4 0FQ Tel: 01554 744880

¹⁰ **CIfA:** Power Steele Building, Wessex Hall, Whiteknights Road, Early, Reading RG6 6DE Tel: 0118 966 2841 Email: admin@archaeologists.net

3. Project Aims

3.1 To provide the client with a professional written scheme of historic environment mitigation for a watching brief during ground works, to submit for approval and comply with the requirements of both the Clwyd Powys and Glamorgan Gwent Archaeological Trusts.

3.2 To undertake an archaeological Watching Brief during ground works at the site to meet CIfA guidelines and current professional archaeological standards.

3.3 To fulfil the requirements of the Clwyd Powys and Glamorgan Gwent Archeological Trusts to carry out an archaeological watching brief during ground works and provide a report and archive index for submission to both the trust's Historic Environment Records.

3.4 To produce a stable, ordered and accessible archive as specified in CIfA Standards and Guidance for the creation, compilation, transfer and deposition of archaeological archives (October 2009).

3.5 To ensure that the project archive is deposited with an accredited museum such as National Museum Wales¹¹, and in the case of a documentary archive only, with the National Monument Record of Wales, Aberystwyth¹².

3.6 To publish the results of the Watching Brief in regional and national archaeological journals and publications, as appropriate.

¹¹ **National Museum of Wales**

National Museum Cardiff, Cathays Park, Cardiff, CF10 3NP.
☎: (029) 2039 7951

¹² **The Royal Commission on the Ancient and Historical Monuments of Wales**

Library and Enquiries Service, National Monuments Record of Wales, Plas Crug, Aberystwyth, SY23 1NJ
☎: +44(0)1970 621200 ✉ nmr.wales@rcahmw.gov.uk
www.rcahmw.gov.uk/coflein

4. The Site

4.1 Location

The site is located at Onllwyn Washery, Neath, South Wales. It lies within a triangular piece of common land between the A4221, A4109 and Onllwyn Road at the head of the Dulais valley. Onllwyn is a small village in Neath Port Talbot near to the village of Seven Sisters with over 200 years of mining history (Archaeological Background, p.9) including five coal pits of which the washery is now the only remaining working site. Along the route of the former Neath & Brecon Railway there is a freight only line to the washery from the South Wales Main Line at Neath. The city of Swansea lies approximately 24km to the south west.

4.2 Ordnance Survey National Grid Reference

NGR: SN 83704 10894.

What3Words: eagles.migrants.countries.

4.3 Geology

The geology of the site consists of South Wales Lower Coal Measures Formation - mudstone, siltstone and sandstone; sedimentary bedrock formed 318-319 million years ago during the Carboniferous Period.

4.4 Topography & Ordnance Datum

Situated 259m (850 ft) OD above sea level on the southern edge of the Brecon Beacons mountain range, ground investigations are taking place on open grassland in close proximity to Onllwyn Washery. The washery is situated at the top of the Dulais Valley which runs north from the town of Neath and further south the town of Port Talbot on the South Wales coast.

4.5 Description of Works (Fig.5.3)

Investigation of the substrate across the site will inform the design plan for future development. Two looped sections of land, drainage infrastructure and natural habitats are to be constructed over the next 5 years. This will create flexible and adaptable land for various uses such as farming, conservation, tourism and leisure, to be determined at a later date. Celtic Energy and Welsh Government are keen to position The Global Centre of Rail Excellence at the site; a train, infrastructure and technology testing facility.

An archaeological watching brief is required during excavation of:

- Machine excavated trial pits.
- Hand dug starter pits for machine boring.

Machine excavation of pits will take place using a toothless bucket to allow controlled reduction of soils and maximum opportunity to record features in both plan and profile. The starter pits for machine coring will be excavated by hand and if possible a representative section of the pits will be cleaned and recorded adhering to Health & Safety guidelines. Further details in 10. Recording, p.14.

5. Location Maps & Plans

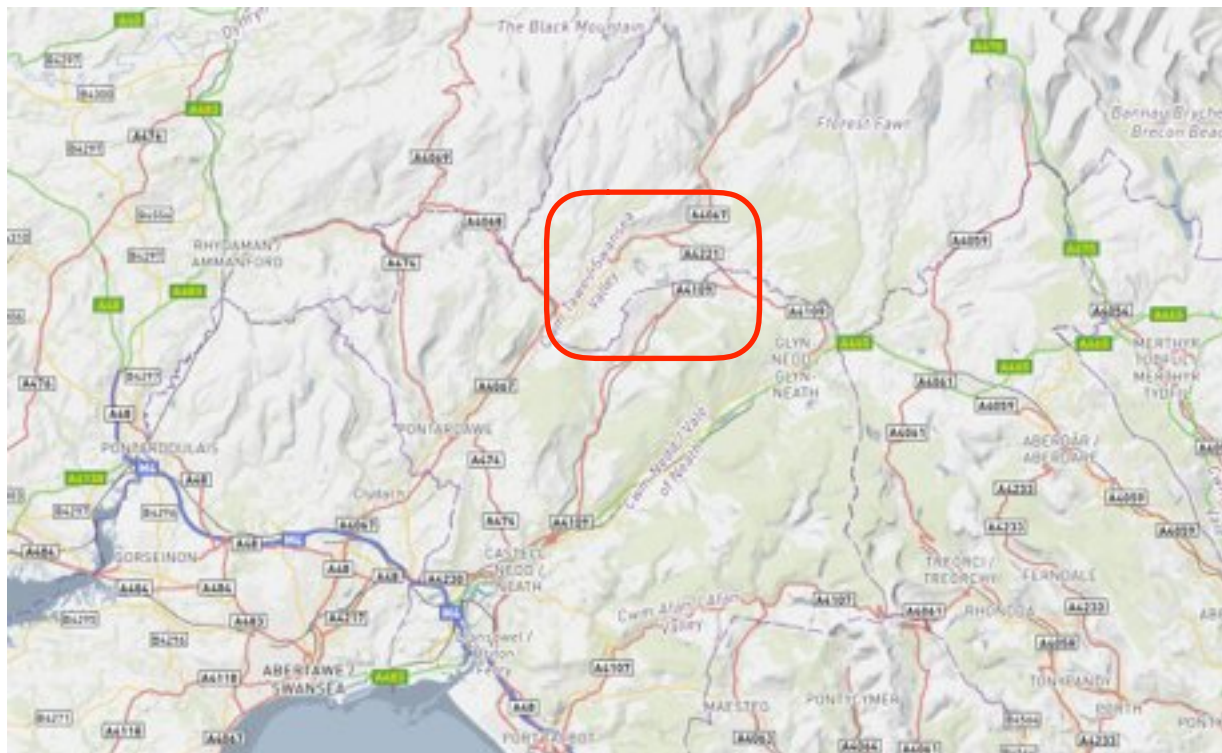


Figure 5.1 Site Location: Dulais Valley, South Wales (red)

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OS Licence number 100042803

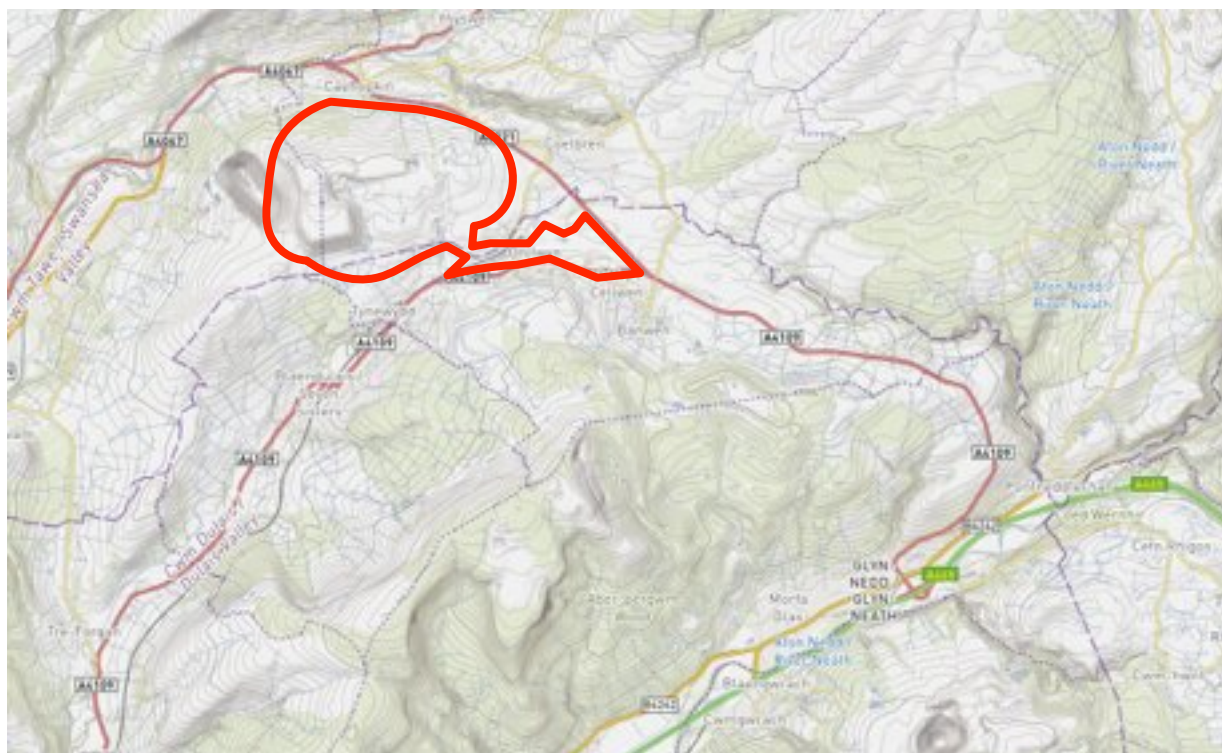


Figure 5.2 Site Location: Onllwyn Washery (red)

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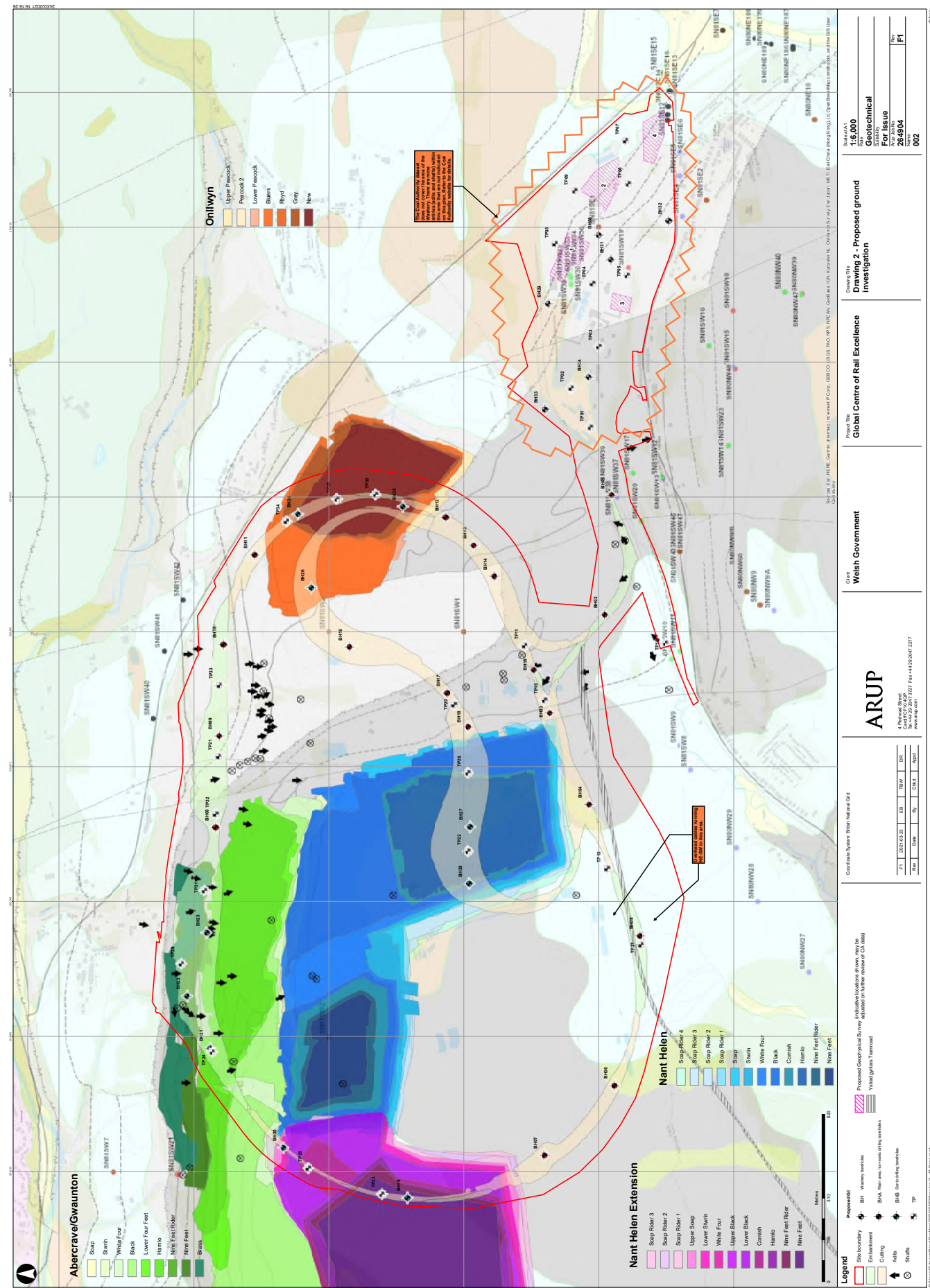


Figure 5.3: Proposed Ground Investigations

6. Archaeological Background

The development site at Onllwyn Washery is situated mainly in the unitary authority of Powys and partially in Neath Port Talbot, therefore Historic Environment Record information has been sought from both the Clwyd Powys and Glamorgan Gwent Archaeological Trusts (CPAT enquiry ref. E6696 & GGAT enquiry ref. 6694) and also from Historic Wales (RCAHMW). A number of other sources of historic information have also been consulted and are included in the bibliography.

The village of Onllwyn is located in Neath Port Talbot at the head of the Dulais Valley within an area with over 200 years of mining history. The Dulais Valley lies within the modern unitary authority of Neath Port Talbot and formed part of the ancient parish of Cadoxten-juxta-Neath.

Prior to the industrialisation of south Wales from the middle of the 18th century the area was mainly rural in nature with evidence of six rural buildings remaining at Onllwyn;

- Blaenant Melyn Farm
- Blaenantcellwen Farm
- Rhos-y-gelynen Cottage
- Rhyd-y-Pwlla Farm
- Tir-Lan Cottage
- Yr Hen Waun Farm

The Brecon Beacons National Park is located immediately to the north of Onllwyn and was established in 1957 as the UK's tenth National Park. It is one of three in Wales, including the Snowdonia and Pembrokeshire Coast National Parks, having special protection and management by the National Park Authority.

Information from the Historic Environment Record provides evidence of early human settlement and activity in the area from the Prehistoric Period.

Mynydd-y-Drum is located close to the site with evidence of prehistoric settlement (prn 12495, SN82851080) recorded. A series of clearance features of indeterminate age of a possible hut site are associated with two burial cairns and excavation produced two flint tools, now in the care of Brecon Museum.

Clwyd Powys Archaeological Trust carried out an assessment of Round Huts in Brecknock, published 2008 (prn 115451, SO 0512725679). The study includes analysis of a desk top assessment and brief overviews of fieldwork with limited attempt at classification of authentic round huts or hut circles visited. A full gazetteer of authentic and possible hut sites in the county is also included.

At Nant Helen a series of Bronze Age clearance cairns (.prn 6174 & 6177-6182, SN82811110) are recorded as well as evidence of post medieval clearance cairns prn 12496, SN82901085).

Evidence of Roman activity in the area includes Sarn Helen a Roman road linking Neath (Nidum) in south Wales to Caernarfon (Segontium) 150 miles to the north. Running along a high ridge between the Neath and Dulais Valleys a 1.3 km long section of the road lies to the north east of Coelbren Fort is a Scheduled Ancient Monument (ID BR074). Coelbren Roman Fort is a medium sized auxilliary fort (ID GM146) built circa AD 75 (ID GM146), south east of the fort lies a Roman Marching Camp (ID GM343) constructed circa AD 74-78 during the Roman conquest of Britain.

The remains of an Early Christian Monument; a stone shaft fragment of a Medieval Cross were discovered on Cefn Hirfynydd nearby (prn 00934w, SN8410) and are now in the collections of Swansea Museum.

Two Post Medieval enclosures have also been excavated at Nant Helen (prn 5947, SN82921116 & prn 6183, SN82851080).

Prior to the Industrial Revolution Wales was still largely rural in character but by 1851 it had become the world's second industrial nation after England. The availability of raw materials such as limestone and coal, manufacture of iron and copper together with engineering and transport developments and its geographical location meant that Wales' economy developed significantly during this time. By 1800 all the main valleys in the South Wales coalfields were linked to sea ports by canals and the early railway age also provided a real boost to the Welsh economy. The population expanded significantly during this time with the majority of immigrant workers coming from rural Wales initially. Alongside the development of industry came a rapid expansion of housing, schools, places of worship and community support for the influx of workers.

Industrial development was significant in the Llanelli-Swansea-Neath area of which the Dulais Valley is part and many features from the industrial period have been recorded including Mynydd-y-Drum Railway Cutting (prn 1001895, SN83021050) and Mynydd-y-Drum Coal Patch (prn1001892, SN83781057). The Drum Colliery (prns 1001888, 1001891, 1001890) has coal mining features of shafts and levels recorded at SN83931077, SN83921067 & SN83971066 respectively.

A tramroad at Ystradgynlais (SAM ID GM399) was built 1832-37 as a 6.4 km link to the Brecon Forest Tramroad (prn1001889, SN83961066) bringing limestone to Ynyscedwyn Ironworks, a well preserved and impressive monument with masonry engine house and cable tunnel runs still visible (SN80130942).

Buildings associated with a significant population expansion in the area due to industrialisation are also recorded, such as Price's Row at Coelbren and Dickson's Row (prn 1001887, SN84481135) which are Post Medieval workers cottages.

At Onllwyn a railway station on the Neath & Brecon Railway is recorded (prn 02818.6w, SN84081050).

Onllwyn Iron Works (prn 05957w) was built in the 1840s and had a brief existence but at the height of production during the 1860s included two furnaces, lime kilns, a smithy, shop, post office and two rows of workers houses now all extant; removed by open cast coal mining activities in the 1970s and later landscaping in 1985.

Three anglican churches are located within the Dulais Valley; St Margarets', Crynant, St Mary's, Seven Sisters (1910) and St David's, Banwen (1925) but during the mid 19th century chapels were already becoming more common places of worship and centres of community activity as industrial communities turned to Non-conformity. Four chapels are known in Seven Sisters alone; Salem (1899), Soar (1878), Seion (1890) and Bethany.

Two public houses are known in the Onllwyn area; the Halfway Inn an old farmhouse granted a licence to sell alcohol in 1863 and rebuilt in 1912 serving miners from Onllwyn Colliery. It closed in 1973 and now no longer exists.

The Travellers's Rest located on Onllwyn No.3 Colliery served travellers between Swansea and the Rhondda Valley and dates to at least 1853, it was later renamed The Greyhound due to dog training taking place there. In 1911 the tenants moved out and the building was converted into stables for the colliery.

Onllwyn School replaced 'Y Tae', a makeshift schoolhouse in 1892 responding to both growing pupil numbers in the area and new government legislation. Extended in 1907 pupils numbers began to decline after the 2nd World War and it finally closed in 1964. Crynant National School was established in 1857 with Crynant Infants School added in 1907 due to increasing pupil numbers.

A Miners Welfare Hall at Onllwyn (prn 414833, SN8439610289) opened in 1955 and is still in use as a social club today.

The development site is located at Onllwyn Coal Washery (prn 306037, SN84571053) built for local drift mines in 1932 then substantially altered and re-equipped in 1950. It services two open cast sites; Nant Helen & Derlwyn with coal delivered by road and exported through Swansea, Neath Abbey & Briton Ferry, and by rail to France and Norway. In 1998 Celtic Energy built a new 'state of the art' plant at the site and in 2005 a Froth Flotation Plant was added to process slurry supplied from Nant Helen, Selar and Margam. Many associated coal shafts are recorded in the area including Onllwyn Colliery Shaft Bft 3 (prn 80162, SN84261042) and Onllwyn Colliery Shaft Bft. 2 (prn 80169, SN84261021). Onllwyn Colliery Western Incline (prn 1001893, SN 83611053).

7. Potential Impact Assessment

7.1 Ground investigation works at the site have been identified as having a potential impact on the archaeological resource and therefore a requirement for an archaeological programme of works for a watching brief has been requested by both the Clwyd Powys and Glamorgan Gwent Archeological Trusts.

7.2 Information regarding the archaeological and historical background of the site and area is provided in 6. above and the following specific development activities have been identified as having a potential impact on the archaeological resource:

- Trial Pit excavation
- Bore Hole excavation
- Associated activities

7.3 An archaeological Watching Brief, meeting current professional standards, will be therefore be undertaken during ground investigations during any activities likely to expose archaeological remains and the results analysed and reported on in order to mitigate any impacts of the investigations on the archaeological resource, further details can be found below.

8. Contractor & Core Staff

Cardiff Archaeology will be responsible for the programme of archaeological work for the development and accredited members of the Chartered Institute for Archaeologists will carry out all activities associated with project. Additional specialist consultants and contractors will be used as appropriate for project requirements.

Cardiff Archaeology was established in 2004 providing a professional archaeological service in the South Wales region. Many projects been successfully completed for a wide range of clients and agents, many of whom return to use our services. Cardiff Archaeology is now a Partnership run by Jim and Jane Stewart-Turner. For further details please visit: www.cardiffarchaeology.co.uk

Jim Stewart-Turner PCIfA

A professional archaeologist with over thirty years experience; Jim was previously employed by National Museum Wales, the Glamorgan Gwent Archaeological Trust, Gloucester County Council Archaeological Service, Cotswold Archaeological Trust and English Heritage before becoming self employed. His main areas of interest are Roman archaeology and the military history and archaeology of WW1.

Jane Stewart-Turner BA (Hons.) MA (Dip) ACIfA

Jane joined Cardiff Archaeology in 2010 with more than twenty-five years experience of working for museums, the national Portable Antiquities Scheme (www.pas.org.uk) and more recently as Community Archaeologist for Cardiff University. Her main areas of interest are Prehistoric archaeology and the vernacular architecture of Wales.

Members of:

The Chartered Institute for Archaeologists (www.archaeologists.net)

The Council for British Archaeology (www.archaeologyuk.org)

The Society for the Protection of Ancient Buildings (www.spab.org.uk)

The Glamorgan History Society (www.glamorganhistory.org)

The Medieval Settlement Research Group (www.medieval-settlement.com)

9. Method & Mitigation Strategy

9.1 The Client/Agent will advise the Local Planning Authority of the appointment of Cardiff Archaeology as the archaeological contractor for the works at least two weeks prior to ground works commencing, if appropriate.

9.2 The strategy is proposed on the basis of the likely extent and form of archaeological interests and the proposed extent and form of development effect.

9.3 The effect of the development on potential archaeological interests will be safeguarded by means of a Watching Brief on any ground disturbance defined in the Potential Impact Assessment (7).

9.4 On site contractors will be notified of the need to allow the site archaeologist conducting the Watching Brief reasonable access to their works to record archaeological remains.

9.5 Groundworks (7.2) will not be undertaken in the area to which this scheme applies without the site archaeologist being present to observe and record any archaeological remains revealed.

9.6 If archaeological remains are discovered the archaeologist undertaking the Watching-Brief, in consultation with the resident engineer or equivalent agent will make a decision as to whether it can be adequately recorded and removed without disruption to adjacent construction activities as part of the Watching Brief programme

9.7 If significant archaeological remains are discovered these areas will be clearly marked and fenced off. No machines or contractors will work in these areas until the recording of the archaeology has been completed.

9.8 A contingency for a maximum of five days, and three extra site archaeologists per area, to work within such areas to record the archaeological remains.

9.9 If archaeological remains are discovered of greater significance than the contingency arrangement (9.8) would be able to cover then a meeting with the Local Planning Authority and other relevant parties will be instigated to formulate and agree an appropriate strategy. Further work (e.g. full excavation, exhumation of human remains etc) may be required by the Local Planning Authority and their advisors and will be part of a separate agreement to the Watching Brief programme.

9.10 Stray finds and minor archaeological deposits are to be recorded by the archaeologist.

9.11 Any human remains encountered will be archaeologically recorded under conditions which comply with all current legislation. As the excavation is to be undertaken on Church ground any human remains will be collected and prepared for reburial within the confines of the graveyard. Any removal of remains from the graveyard will require relevant licences, reporting to relevant authorities and provision for reburial.

9.12 A final report detailing the archaeological work undertaken and the results will be forwarded to the client for submission to the Local Planning Authority for approval and discharge of the archaeological planning condition.

10. Recording

10.1 All archaeological techniques employed are to conform to current best professional practice in line with guidance from the Chartered Institute for Archaeologists, The Glamorgan Gwent Archaeological Trust, Welsh Museums Federation and other professional heritage organisations.

10.2 Archaeological deposits and features will be recorded using a single continuous numbering system.

10.3 Recording forms and a copy of the archaeological contractors' site manual will be available to the regional curatorial archaeologist, in this case The Glamorgan Gwent Archaeological Trust, and the Client/Agent on request.

10.4 Drawings will be at a suitable scale in plan and/or section, where appropriate, and will be located by a site grid and benchmark tied to Ordnance Survey datum.

10.5 Significant contexts will be photographed in digital (18mp images saved in RAW and JPEG formats) and 35mm (colour and monochrome) where appropriate.

10.6 Archaeological finds will be retained, cleaned and catalogued, and final deposition arrangements agreed as required by the *CIfA Standard and Guidance for the collection, documentation and research of archaeological materials* (2001). Large quantities of residual, un-diagnostic or modern materials recovered will be recorded and a discard policy devised.

10.7 Human remains will not be removed from the site until all permissions from relevant organisations have been attained and legal permission in the form of a Coroners Licence from the Ministry of Justice (England & Wales) obtained.

10.8 Environmental recording and sampling should follow Historic England's *Environmental Archaeology: a Guide to the Theory and Practice of Methods*, from Sampling and recovery to Post-excavation (Second Edition, 2011). A specialist in this field should sample deposits with high paleo-environmental potential in bulk or column for later analysis.

11. Reporting and Archive

11.1 A post fieldwork review of the evidence recovered will lead to a programme of analysis and research, to include specialist consultants if required, resulting in a site narrative with supporting data such as drawings and photographs where appropriate. An environmental specialist will also be identified to oversee the sampling programme if required.

11.2 A wide range of archaeological and historical sources will be consulted in order to place fieldwork results in context and information from regional Historic Environment Records held by the Glamorgan Gwent and Clwyd Powys Archaeological Trusts have also been obtained (GGAT enquiry ref. 6694, CPAT enquiry ref. E6696).

11.4 A Final Report detailing the results will be produced and a copy, together with the Archive Index, will be deposited by Cardiff Archaeology with the regional Historic Environment Records of the Glamorgan-Gwent and Clwyd Powys Archaeological Trusts following Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs) 2018.

11.5 The project archive for the work will be prepared to the specifications laid out in the Chartered Institute for Archaeologists, Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives (2013) and deposited as below (11.6).

11.6 The archive consisting of site plans, photographic records, research notes and reports, stored by Cardiff Archaeology as drafting film, paper and digital records. will be deposited with the National Monuments Record Wales, Aberystwyth¹³, or if artefacts are recovered the National Museum of Wales, Cardiff¹⁴. It will be deposited following National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017 (<http://www.welshmuseumsfederation.org/en/news-archive/resources-landing/Collections/national-standard-and-guidance-for-collecting-and-depositing-archaeological-archives-in-wales-2017.html>).

11.7 The contents of the final report will be made available in regional and national archaeological journals and publications, as appropriate.

¹³ **National Monuments Record Wales**, Ffordd Penglais, Aberystwyth SY23 3BU (01970) 621200

¹⁴ **National Museum of Wales**, Cathays Park, Cardiff, South Glamorgan CF10 3NP. ☎: (029) 2039 7951

12. Timescale

12.1 Proposed start of archaeological watching brief: TBA.

12.2 Cardiff Archaeology makes every effort to issue the final report within two months of completion of site work. Please note delays may be caused by factors beyond the control of Cardiff Archaeology e.g. awaiting pottery results, radio carbon dating results, artefact conservation etc. The client will be informed should any substantial delays occur resulting in a delay with issuing the report. An interim report may be produced, should the project require one, after consultation with the client, agent and/or planning advisors.

13. Quality Control

The contractor will carry out all works in accordance with the Chartered Institute for Archaeologists *Code of Conduct*, *Code of approved practice for the regulation of contractual arrangements in field archaeology*, *Standards and Guidance for archaeological watching briefs*, and other related by-laws.

14. Insurance

The contractor is fully insured with Townergate Insurance¹⁵ for the proposed work, details available on request.

15. Health and Safety

15.1 The contractor will follow best practice for Health and Safety as defined by the Standing Conference of Archaeological Unit Managers (SCAUM *Health and Safety in Field Archaeology* 1991). Copies of the contractor's Health and Safety Statement, in accordance with the *Health and Safety at Work Act 1974* and a project specific Risk Assessment, in accordance with the *Management of Health and Safety Regulations 1992*, are provided in Appendices 1 & 2, pages 18 & 19.

16. Publication and Copyright

16.1 The contents of the final report will be accessible to the public through the regional Historic Environment Record (The Glamorgan Gwent Archaeological Trust) and published in regional and national archaeological journals and publications, as appropriate.

16.2 Cardiff Archaeology will retain full copyright of any commissioned reports, tender documents or other project documents under the Copyright, Designs and Patents Act 1988 with all rights reserved. Cardiff Archaeology will grant permission for the client/agent to use the contents of the final report for any purpose relating to the project, for the duration of the development project.

17. Arbitration

Differences arising out of a contract for this work should be referred for decision in accordance with the Rules of the Chartered Institute of Arbitrators *Arbitration Scheme for the Chartered Institute for Archaeologists*.

18. Bibliography & Sources

1. British Geological Survey, 1994 *Geological Map of Wales 1:250 000* 1st Edition SOLID.
2. Brown Duncan H 2007, *Archaeological Archives: A Guide to Best Practice in Creation, Compilation, Transfer and Curation*.

¹⁵ Townergate Insurance

Funtley Court, Funtley Hill, Fareham, Hampshire PO16 7UY
 ☎ 01329 826 260 www.townergateinsurance.co.uk

3. Chartered Institute for Archaeologists 2009, *Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives*. University of Reading.
4. Chartered Institute for Archaeologists 2001 (revised 2008), *Standard and Guidance for the Collection, Documentation and Research of Archaeological Materials*. University of Reading.
5. Chartered Institute for Archaeologists 1994 (revised 2008), *Standards and Guidance for Archaeological Watching Briefs*. University of Reading..
6. English Heritage 2004, *Mitigation of Construction Impact on Archaeological Remains*. English Heritage London.
7. English Heritage 1991, *Management of Archaeological Projects 2*. English Heritage London.
8. Glamorgan County History Trust 1980, *Glamorgan County History Vol. 5 Industrial Glamorgan 1700 to 1970*.
9. Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs) 2018 (<http://www.ggat.org.uk/her/her.html>). Glamorgan Gwent Archaeological Trust, Swansea.
10. Historic Environment Record Search (enquiry ref E6696, November 2021) Clwyd Powys Archaeological Trust, Welshpool.
11. Historic Environment Record Search (enquiry Ref: 6694, November 2021), Glamorgan Gwent Archaeological Trust, Swansea.
12. McGill G 1995, *Building on the Past, A guide to the archaeology and development process*. College of Estate Management, Reading, UK. Spon Press.
13. National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017 (<http://www.welshmuseumsfederation.org/en/news-archive/resources-landing/Collections/national-standard-and-guidance-for-collecting-and-depositing-archaeological-archives-in-wales-2017.html>). Welsh Museums Federation, Cardiff.
14. Planning Policy Wales (Ed. 10) 2018, Welsh Assembly Government, Cardiff.
15. RCAHMW Guidelines for Digital Archives, 2015: www.rcahmw.gov.uk/HI/ENG/Search+Records/Standards/Archive. Royal Commission for Ancient & Historic Monuments Wales, Aberystwyth.

Internet

Archwilio: archwilio.org.uk
 British Geological Survey: www.bgs.ac.uk
 Chartered Institute for Archaeologists: www.archaeologists.net
 Historic Wales: historicwales.gov.uk
 Museum Federation of Wales: www.welshmuseumsfederation.org.uk
 Portable Antiquities Scheme: www.finds.org.uk

Appendix 1**Health and Safety Policy Statement****(Health and Safety at Work Act, 1974)**

Cardiff Archaeology's Statement of General Policy is:

- To provide adequate control of the health and safety risks arising from our work activities.
- To consult with our employees on matters affecting their health and safety at work.
- To provide and maintain safe plant and equipment.
- To ensure safe handling and use of substances.
- To provide information, instruction and supervision for employees.
- To ensure all employees are competent to do their tasks, and to give them adequate training.
- To prevent accidents and cases of work-related ill health.
- To maintain safe and healthy working conditions
- To review this statement and revise this policy as necessary and at regular intervals.

We comply with:

- Health and Safety at Work Act 1974
- Workplace (Health, Safety and Welfare) Regulations 1992
- Management of Health and Safety at Work Regulations 1999
- Fire Safety Orders, Acts and Regulations (dependent on location)

Appendix 2

RISK ASSESSMENT

TASK: Watching Brief during ground investigation works at: **Onllwyn Washery, Neath, South Wales.**

ALL STAFF WILL WEAR APPROPRIATE SAFETY CLOTHING AND SAFETY HEADWEAR ON SITE AT ALL TIMES.

At minimum this will consist of:

- Hi visibility vest or jacket
- Safety helmet
- Safety boots

Additionally safety goggles, gloves and masks will be available on site for all personnel and other PPE if and when required.

Unplanned risks will be immediately reported to all relevant parties.

A HAZARD is the potential to cause harm

0=No Hazard

5=Possible Death

A RISK is the likelihood of a particular event happening

0=Not Likely

5=Very likely

Risk Level

0%-20% **Very Low**

21%-40% **Low**

41%-60% **Medium**

61%-80% **High**

81% 100% **Very high**

Hazards highlighted in grey in the following table are considered no risk for this project.

SITE SPECIFIC IDENTIFIED HAZARDS

No identified site specific hazards (e.g. asbestos, hydrocarbons etc) have been brought to the attention of Cardiff Archaeology by the Client, Principal Designer or Principal Contractor at this point. It is expected that the Client, Principal Designer or Principal Contractor will immediately report any issues to Cardiff Archaeology and appropriate action can be mitigated.

ADDENDUM COVID 19

Due to the recent crisis further risk assessment has had to be undertaken for all sites. Cardiff Archaeology staff will be allowed on site when only absolutely necessary

Social distancing guidance will be strictly adhered to.

All staff will be required to wear appropriate PPE (mask, gloves) and wash hands or use hand sanitiser regularly

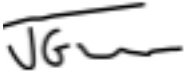
All other contractors will be expected to adhere to social distancing and PPE guidance, failure to do so will result in the cessation of all archaeologically related work and Cardiff Archaeology staff will immediately vacate the site.

Risk Assessment Table 1

HAZARD (A) SEVERITY OF HAZARD 1-5	RISK LEVEL (B) 1-5	HAZARD RISK ANALYSIS (A x B)	REVISED SEVERITY OF HAZARD (C)	REVISED RISK LEVEL (D)	REVISED HAZARD RISK ANALYSIS (C x D)	PLANNED MITIGATING MEASURES
Accident while driving to and from site SEVERITY 5	1	5/25	5	1	5/25	It is the responsibility of the driver to ensure that routine checks such as oil and tyre pressure are carried out and that any defects are reported immediately to the project manager. Drivers are not to drive under the influence of alcohol or any other drug whether medically prescribed or not. Drivers to be aware of the affects of tiredness on driving ability and to arrange to share driving tasks as appropriate.
Objects/debris falling onto personnel SEVERITY 5	2	10/25	5	2	10/25	Safety helmets to be worn properly at all times. Objects likely to fall are to be removed or secured prior to commencement. Personnel must not work below others. Make sure the area is safe to enter.
Moving across uneven or broken ground or wet slippery surfaces or missing or damaged floor surfaces SEVERITY 5	1	5/25	5	1	5/25	Personnel to move with care across surfaces and walk (not run) at all times. Holes and unsafe areas are not to be entered.
Open trenches with unstable sides – may lead to falling into trench, and/or engulfment of personnel within trench SEVERITY 5	1	5/25	5	1	5/25	Personnel must not stand too near edges that look unsafe. Personnel must not go beyond safety fence without supervision.
Excavation of trenches in excess of 1.2m below ground level –possibility of trench collapse and engulfment of personnel SEVERITY 5	1	5/25	5	1	5/25	Excavation sides to be stepped and shored if needed before further work can take place. Access/egress by means of securely fixed ladders. Or if access not possible to record with sketches and photographs only.
Use of mechanical plant to excavate – possibility of injury or death to personnel SEVERITY 5	1	5/25	5	1	5/25	Personnel to wear high-visibility waistcoats, hard hats and protective boots. Personnel to remain in drivers view at all times and alert the driver to their presence. Only one personnel member to guide machine operators.
Spoil storage leading to trench collapse and engulfment of personnel SEVERITY 5	1	5/25	5	1	5/25	Spoil will be temporarily stored at least 1m from the edge of the trench.
Damage to hearing caused by noise from machinery SEVERITY 5	1	2/25	2	1	2/25	Personnel to wear appropriate ear defenders when noisy machinery is in operation.
Live services exposed/ damaged during works SEVERITY 5	1	5/25	5	1	5/25	The location and state of services to be determined before work by Client. Supplies to be disconnected by appropriate authorised personal. Unexpected services found during works should be left exposed and marked until inspected by suitably qualified personnel.
Falling from ladders SEVERITY 5	1	5/25	5	1	5/25	All ladders to be erected carefully, on level ground and according to the instructions of the manufacturer. No work from ladders to be carried out above 3m.
Unauthorised personnel falling into un-fenced trenches SEVERITY 5	1	5/25	5	0	0/25	Open trenches and working easements will be fenced off from the rest of the site in order to prevent unauthorised access to the areas.
Exhaust gases entering and accumulating in confined space SEVERITY 5	1	5/25	5	1	5/25	No engine to be left running in the vicinity of any confined spaces. Site personnel to check for the presence of fumes in confined spaces and ensure that air quality is acceptable before entering that confined space.
Exposure to wet and/or cold weather for extended periods leading to hypothermia SEVERITY 5	1	5/25	5	0	0/25	Staff to wear appropriate warm, waterproof clothing and boots. Staff to ensure colleagues are well.
Unexploded Ordnance SEVERITY 5	1	5/25	5	1	5/25	Site evacuated and bomb disposal Immediately notified.

Risk Assessment Table 1 cont/

HAZARD (A) SEVERITY OF HAZARD 1-5	RISK LEVEL (B) 1-5	HAZARD RISK ANALYSIS (AxB)	REVISED SEVERITY OF HAZARD(C)	REVISED RISK LEVEL (D)	REVISED HAZARD RISK ANALYSIS (Cx D)	PLANNED MITIGATING MEASURES
Anthrax. Exposure to anthrax is unlikely during most fieldwork, but may be more likely when encountering stray articulated burials of pigs, cattle, sheep or horses SEVERITY 5	1	5/25	5	0	0/25	Cover all cuts, ensure that high standards of hygiene are maintained. Wear appropriate PPE: type suit, P3 grade disposable respirator, and latex gloves, disposable or washable footwear. Tools and footwear to be cleaned using excess of disinfectant.
Hazardous toxic substances uncovered during works, Specifically Asbestos, Lead and Zinc (see client's report) SEVERITY 5	5	25/25	5	3	15/25	Client to undertake check before work starts. If encountered such substances are to be identified and removed by suitably qualified personnel (i.e. not CAU archaeologists). No other personnel to enter the area until this has been done and approved clearance has been given. Protective clothing (protective disposable suit, facemask, and gloves) to be worn whilst observing groundworks in contaminated areas). Contaminated deposits are NOT to be excavated by hand. Do not smoke or use naked flames on site. Food is only to be eaten in the designated area. Do not eat food on site without washing hands first.
Injury during manual handling of excavated material SEVERITY 5	2	10/25	5	1	5/25	Personnel to use appropriate containers (buckets and wheelbarrows) for handling excavated material and not to overload the containers. Personnel to wear safety hats and safety footwear with protection for toes, heels and soles at all times.
Injuries to personnel working alone SEVERITY 5	2	10/25	5	1	5/25	No CA personnel to work alone. Work should be organised so that no member of personnel is beyond the vision or audible range of others. Ground workers should be made aware of presence of CA personnel on site.
Collection of groundwater within trenches SEVERITY 5	1	5/25	5	0	0/25	Areas filled/partially filled with water are not to be entered.
Weils Disease SEVERITY 5	1	5/25	5	1	5/25	Always wash hands before eating/drinking. Food is only to be eaten in the designated area. Avoid unnecessary contact with eyes, mouth and nose using dirty hands.
Insect attack SEVERITY 5	1	5/25	5	1	5/25	Personnel to be aware of wasp/bee/hornet nests that may be disturbed during groundwork. Site personnel with insect allergy to inform other personnel at beginning of works.
Sharps (contaminated needles etc) SEVERITY 5	1	5/25	5	1	5/25	Client to undertake check before work starts. If encountered such substances are to be identified and removed by suitably qualified personnel (i.e. not CA archaeologists).
Broken glass & other sharps SEVERITY 5	2	10/25	5	2	10/25	CA personnel to wear appropriate protective gloves in handling broken glass etc. Broken glass & sharps should be avoided whenever possible.
Covid 19 Exposure SEVERITY 5	5	25/25	5	2	10/25	CA personnel to wear appropriate appropriate PPE, Hand washing/Anti bacterial wash

Risk Assessment	
RISK LEVEL	177/600=29.50 % RISK LEVEL LOW
REVISED RISK LEVEL	122/600=20.33 % RISK LEVEL LOW
Checked by:	Jim Stewart-Turner PCIfA
Position	Partner
Date	18th November 2021
Signature	

Appendix 3

Timeline

Palaeolithic

The earliest division of the prehistoric period, from the first evidence of tool making by humans to the final retreat of glacial ice from Britain. It is dated circa 500,000 to circa 10,000 BC.

Mesolithic

A chronological division of the prehistoric period spanning the period from the end of the last ice age to the introduction of farming. It is dated between circa 10,000 and circa 4,000 BC.

Neolithic

A chronological division of the prehistoric period during which agriculture and domestic animals were introduced to Britain. It is dated circa 4,500 to circa 2,300 BC.

Bronze Age

A chronological division of the prehistoric period, which sees the introduction of copper and the eventual widespread adoption of bronze for use in weapons, jewellery etc. In Britain it is dated between circa 2300 and 700 BC.

Iron Age

The period after the Bronze age and before the Roman Occupation circa 500 BC to 55 AD.

Roman

Period when Britain was ruled by Rome circa 45 - 410 AD.

Romano-British

Term used to describe a fusion of indigenous late Iron Age traditions with Roman culture.

Early Medieval

The period between the break down of Roman rule and the Norman invasion (circa 410 to 1070 AD).

Medieval

The period after the Norman invasion nominally finishing at the Battle of Bosworth and the commencement of the reign of Henry VII (1066 to 1485 AD).

Post-Medieval

Period between 1485 and 1900 AD.

Modern

The period since 1900 AD.

Glossary of Terms

Archaeological Contractor

A professionally qualified individual or an organisation containing professionally qualified archaeological staff, able to offer an appropriate and satisfactory treatment of the archaeological resource, retained by the developer to carry out archaeological work either prior to the submission of a planning application or as a requirement of the planning process. A list of appropriate Archaeological Contractors available for work in Wales has been prepared by the Welsh Archaeological Trusts and is available on request from any of the regional archaeological curators.

Archaeological Curator

A person, or organisation, responsible for the conservation and management of archaeological evidence by virtue of official or statutory duties. In Wales the archaeological advisors to the Local Planning Authorities are the Planning Services departments of the Regional Archaeological Trusts, all of whom work to the Welsh Archaeological Trust's Curators' Code of Practice. In south-east Wales the 12 Unitary Councils are served by The Planning Services Division of the Glamorgan-Gwent Archaeological Trust.

Archive

An ordered collection of all documents and artefacts from an archaeological project, which at the conclusion of the work should be deposited at a public repository, such as the local museum or national records office.

Appraisal

An appraisal is a rapid reconnaissance of site and records to identify whether a development proposal has a potential archaeological dimension requiring further clarification.

Assessment

A desk-based assessment is a detailed consideration of the known or potential archaeological resource within a specified area or site (land-based, intertidal or underwater), consisting of a collation of existing written and graphic information in order to identify the likely character, extent, quality and worth of the known or potential archaeological resource in a local, regional or national context as appropriate.

Bailey

A fortified enclosure, particularly the outer court of an earthwork castle, sometimes used for a walled enclosure carrying out the same function in later castles.

Brief

An outline framework of the archaeological situation, which has to be addressed, together with an indication of the scope of the works that will be required.

Cadw: Welsh Ancient Monuments

An executive agency of the Welsh Assembly: Cadw are responsible for the planning issues which affect statutorily protected ancient monuments and buildings. They also grant aid repairs to historic buildings and monuments and manage ancient monuments which are in direct State care.

Cantref

An administrative sub-division of an early medieval Welsh kingdom.

Causewayed Enclosure

Enclosure consisting of one or more concentric circular ditches, interrupted by "causeways". Ditch terminals often contain "ritual" deposits of animal/human remains. Generally interpreted as Early Neolithic ritual meeting places. Example: Windmill Hill

Evaluation

A limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site; and, if present, defines their character and extent, and relative quality. It enables an assessment of their worth in a local, regional, national or international context as appropriate. The programme of work will result in the preparation of a report and ordered archive.

Henge

A large circular/oval enclosure consisting of a bank with an internal ditch often of massive construction. Enclosures usually have one or two entrances. Interpreted as later Neolithic/ early Bronze Age ritual meeting places succeeding causewayed enclosures. Examples: Stonehenge phase 1, Avebury phase 1.

Moated Site

A medieval manor house, parsonage, or grange enclosed by a wide wet moat, usually square or rectangular. Larger moated sites may have been constructed to protect subsidiary areas such as gardens, and orchards

Motte

A flat topped and steep sided mound formerly supporting a palisaded timber tower. Either entirely artificial or formed by scarping and re-shaping natural features. It can have an associated bailey; it constitutes the most common form of Norman castle.

Murage Grant

A local medieval tax to provide money to pay for town defences to be built.

Natural

Archaeological term for undisturbed natural geology on a site.

NGR

National Grid Reference

Reen

Water management ditch to convey or store water

Ring Cairn

A broad class of monuments usually consisting of a circular bank and ditch, often including one or more rings of standing stones and also frequently with a central stone burial cist. Once interpreted as burial cairns, it is now believed that human remains are secondary "ritual" deposits and that these sites had a primarily ritual purpose.

Risk Assessment

A document prepared to meet the requirements of The Management of Health and Safety at Work Regulations 1992 assessing all risks to the health and safety of employees and others arising from a work activity.

Ringwork

A circular or oval fortification enclosed by an earthen rampart. This generic term applies to a range of such earthworks attributable to many periods. Medieval earthwork castles of this type are also referred to as Castle Ringworks.

Sites and Monuments Record (SMR)

A documentary record of known sites in a given area. In south-east Wales the SMR is curated by the Curatorial Division of the Glamorgan-Gwent Archaeological Trust.

Specification

A written schedule of works required for a particular project (by a curator, planning archaeologist or client), set out in sufficient detail to be quantifiable, implemented and monitored. Normally prepared by or agreed with the relevant curator.

Watching Brief

An archaeological watching brief is defined as a programme of observation, investigation and recording conducted during any operation carried out for non-archaeological reasons within a specified area or site, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme of work will result in the preparation of a report and ordered archive.

Welsh Archaeological Trusts

There are 4 Welsh Archaeological Trusts, Clwyd-Powys, Dyfed, Gwynedd and Glamorgan-Gwent. The Trusts were established between 1974 and 1975 in order to carry out rescue archaeological work in Wales. The Trusts are now divided into Contracts and Curatorial Divisions. . They are all charities but are also limited companies.

Appendix 4

Specialist Consultants and Contractors

Conservation X-Radiography & Materials Analysis

Cardiff Conservation Services:

Mr Phil Parkes

Position: Senior Conservator

029 208 75628 parkes@cardiff.ac.uk

Portable Antiquities

Mark Lodwick

Department of History & Archaeology, Amgueddfa Cymru, National Museum Wales, Cathays Park, Cardiff CF10 3NP

0292057 3226 mark.lodwick@museumwales.ac.uk

Geophysics & Metallurgy

Dr Tim Young

GeoArch, Unit 6, Western Industrial Estate, Caerphilly, CF83 1BQ,

029 20881431 Tim.Young@GeoArch.co.uk

Osteoarchaeology

Cardiff School of History, Archaeology and Religion

02920874247 mulvilleja@cardiff.ac.uk

Specialist Archaeological Photography

Adam Stanford

Aerial-Cam limited

Harrowfields, Eckington WR10 3BA

07815007128 adam@aerial-cam.co.uk

Dendrochronology

Professor Nigel Nayling

University of Wales Trinity Saint David, Archaeology and Anthropology Department.

01570424904 n.nayling@tsd.uwtsd.ac.uk

Radiocarbon Dating

RCD Laboratory Queens University Belfast

Archaeology & Palaeoecology Building, Queen's University Belfast, 42 Fitzwilliam Street, Belfast BT9 6AX.

Archaeomagnetic Dating

Geoquest Associates, County Durham

Rockside, Dreemskerry, Maughold, Isle of Man, IM7 1BL.

01624 819364 rockside@manx.ne

Environmental

Environmental samples will be prepared by Cardiff Archaeology analysed by Bournemouth University Environmental Archaeology Service.

Appendix 6 Bore Hole and Trial Pit Logs

APPENDIX VII – GEOTECHNICAL LABORATORY TEST RESULTS



Contract Number: 57248

Client Ref: **Q0652**

Report Date: **27-01-2022**

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Steffan Picton**

Date Received: **20-12-2021**

Date Completed: **27-01-2022**

Test Description	Qty
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	4
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	4
Organic Matter Content-dichromate method Sub-contracted Test	2
LOI Sub-contracted Test	4
One-dimensional Consolidation 75mm or 50mm diameter specimens (5 days) BS 1377:1990 - Part 5 : 3 - * UKAS	4
Samples Received - @ Non Accredited Test	19
As 5.01, 5.03 & 5.04 each extra additional day BS 1377:1990 - Part 5 : 3	8

Notes: ~~Observations and Interpretations are outside the UKAS Accreditation~~
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 57248

Test Description	Qty
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) BS 1377:1990 - Part 7 : 8 - * UKAS	4
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

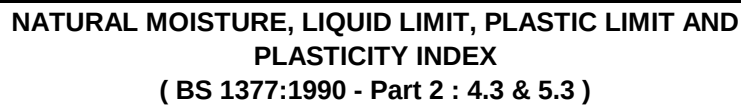
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

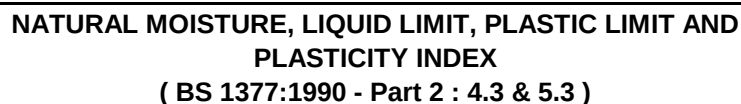
Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

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ONE DIMENSIONAL CONSOLIDATION TEST **BS1377:Part 5:1990, clause 3**

Contract Number

57248

Borehole/Trialpit No.

BH29

Site Name

GCRE

Sample No.

1

Soil Description

Depth Top (m)

3.70

Depth Base (m)

4.20

Lab Temperature

20°C

Sample Location

Top

Remarks

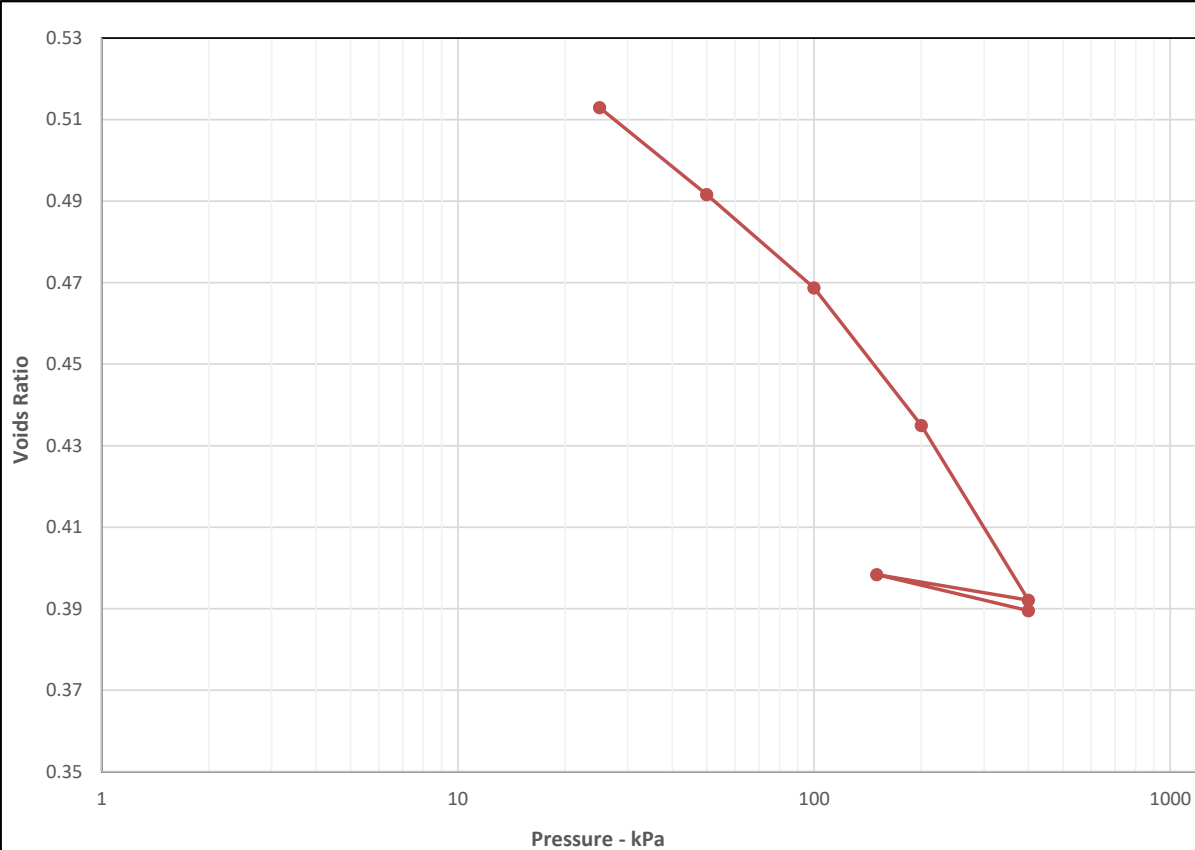
Cv Calculated Using T90
Particle Density Assumed Unless Stated Otherwise

Sample Type

S

Date Tested

04/01/2022



Initial Sample Conditions		Pressure Range			Mv m2/MN	Cv m2/yr	Pressure Range			Mv m2/MN	Cv m2/yr
Moisture Content (%)	24	0	-	25	1.1	2.7		-			
Bulk Density (Mg/m3)	2.12	25	-	50	0.56	1.5		-			
Dry Density (Mg/m3)	1.70	50	-	100	0.31	2.3		-			
Voids Ratio	0.5569	100	-	200	0.23	5.9		-			
Degree of saturation	116.4	200	-	400	0.15	3		-			
Height (mm)	19.73	400	-	150	0.018	8.2		-			
Diameter (mm)	75.1	150	-	400	0.025	14		-			
Particle Density (Mg/m3)	2.65		-					-			

Operators	Checked	26/01/2022	Richard John	
Wayne W	Approved	27/01/2022	Paul Evans	

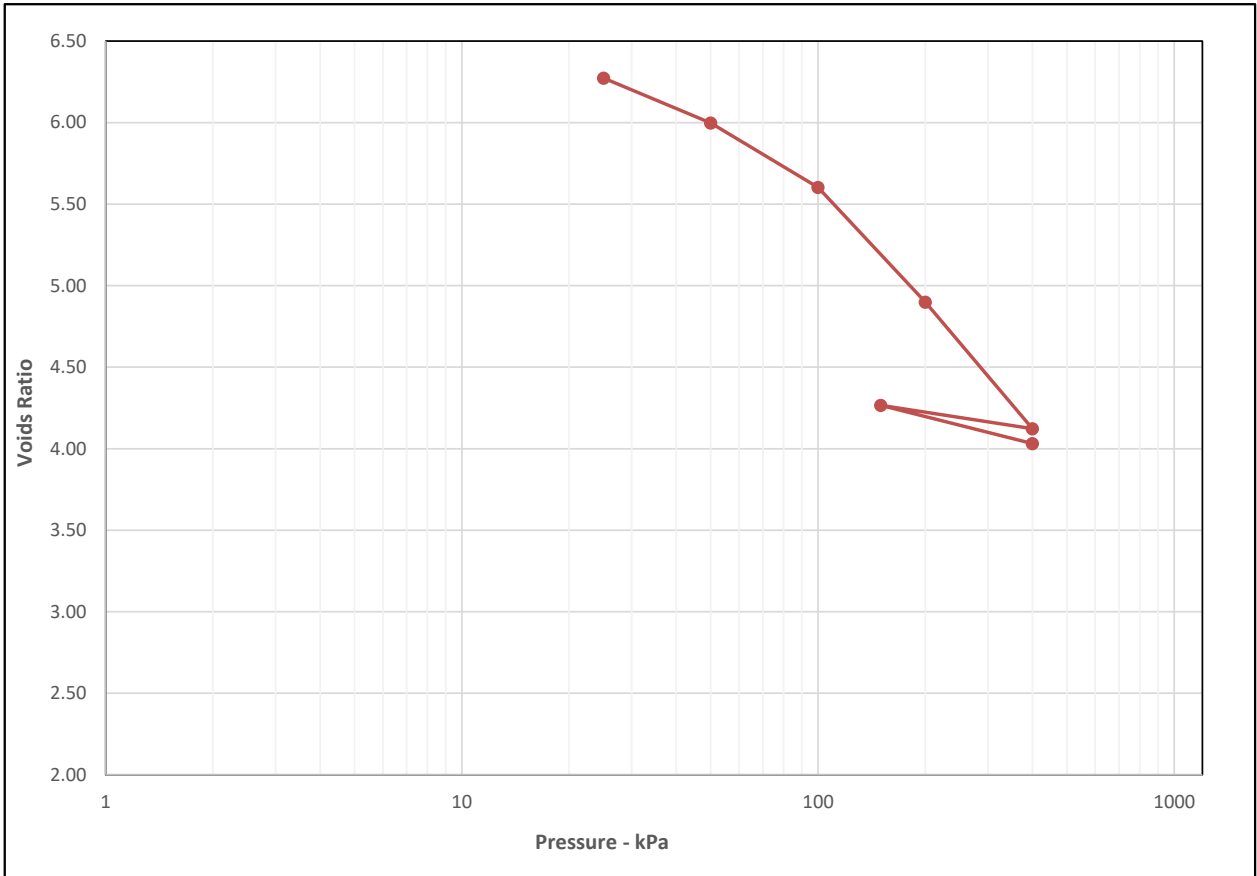


2788



ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3

		Contract Number	57248
		Borehole/Trialpit No.	BH31
Site Name	GCRE	Sample No.	1
Soil Description		Depth Top (m)	6.70
		Depth Base (m)	7.20
Lab Temperature	20°C	Sample Location	Top
Remarks	Cv Calculated Using T90 Particle Density Assumed Unless Stated Otherwise	Sample Type	S
Date Tested	04/01/2022		



Initial Sample Conditions		Pressure Range			Mv m2/MN	Cv m2/yr	Pressure Range			Mv m2/MN	Cv m2/yr
Moisture Content (%)	209	0	-	25	2.4	15		-			
Bulk Density (Mg/m3)	1.06	25	-	50	1.5	8		-			
Dry Density (Mg/m3)	0.34	50	-	100	1.1	16		-			
Voids Ratio	6.7457	100	-	200	1.10	6.1		-			
Degree of saturation	82.1	200	-	400	0.66	3.2		-			
Height (mm)	18.72	400	-	150	0.11	2.8		-			
Diameter (mm)	75.1	150	-	400	0.18	2.8		-			
Particle Density (Mg/m3)	2.65		-					-			

Operators	Checked	26/01/2022	Richard John	
Wayne W	Approved	27/01/2022	Paul Evans	





ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3

Contract Number

57248

Borehole/Trialpit No.

BH33

Site Name

GCRE

Sample No.

1

Soil Description

Depth Top (m)

2.70

Depth Base (m)

3.20

Lab Temperature

20°C

Sample Location

Top

Remarks

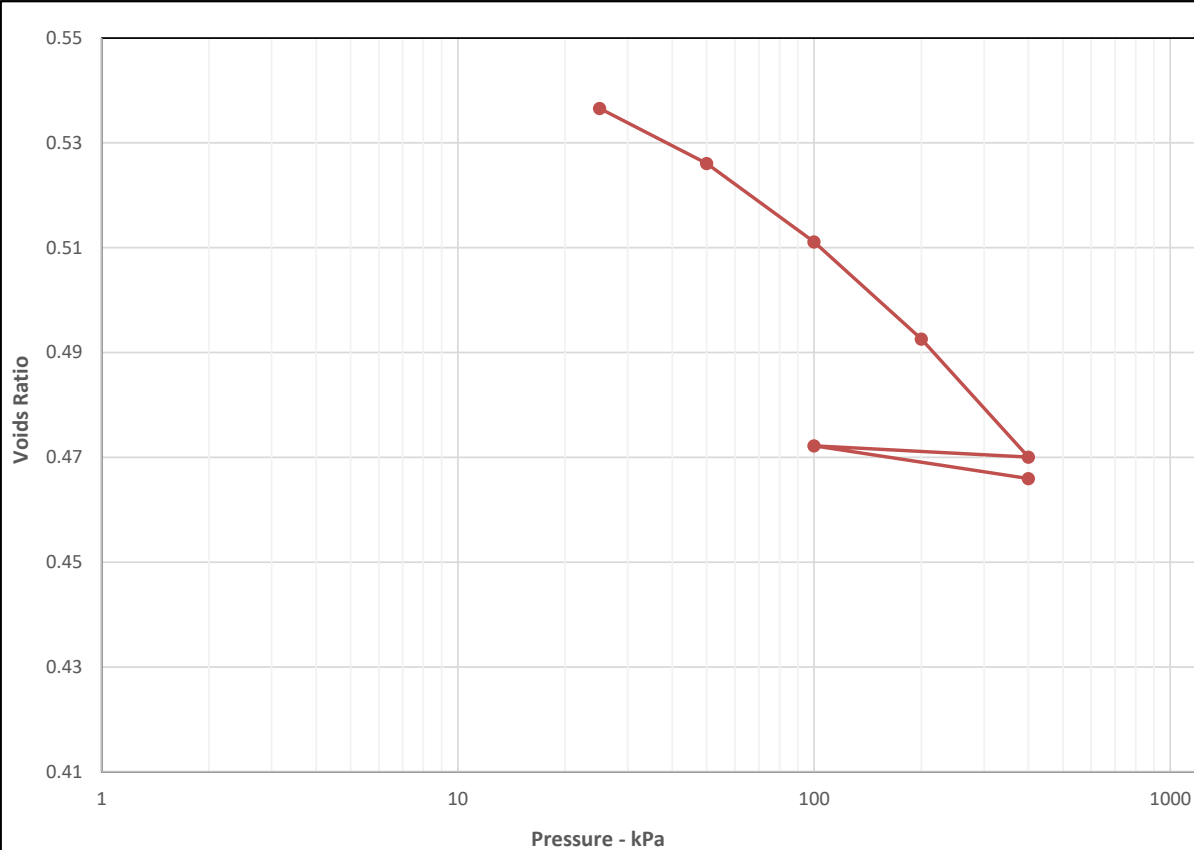
Cv Calculated Using T90
Particle Density Assumed Unless Stated Otherwise

Sample Type

S

Date Tested

04/01/2022



Initial Sample Conditions		Pressure Range			Mv m2/MN	Cv m2/yr	Pressure Range			Mv m2/MN	Cv m2/yr
Moisture Content (%)	24	0	-	25	0.9	3		-			
Bulk Density (Mg/m3)	2.10	25	-	50	0.27	4.2		-			
Dry Density (Mg/m3)	1.69	50	-	100	0.2	4.9		-			
Voids Ratio	0.5705	100	-	200	0.12	8.5		-			
Degree of saturation	113.4	200	-	400	0.075	8.2		-			
Height (mm)	19.1	400	-	100	0.0048	4.3		-			
Diameter (mm)	76.27	100	-	400	0.014	4.4		-			
Particle Density (Mg/m3)	2.65		-					-			

Operators	Checked	26/01/2022	Richard John	
Wayne W	Approved	27/01/2022	Paul Evans	



2788



ONE DIMENSIONAL CONSOLIDATION TEST
BS1377:Part 5:1990, clause 3

Contract Number

57248

Borehole/Trialpit No.

BH34

Site Name

GCRE

Sample No.

1

Soil Description

Depth Top (m)

6.20

Depth Base (m)

6.70

Lab Temperature

20°C

Sample Location

Top

Remarks

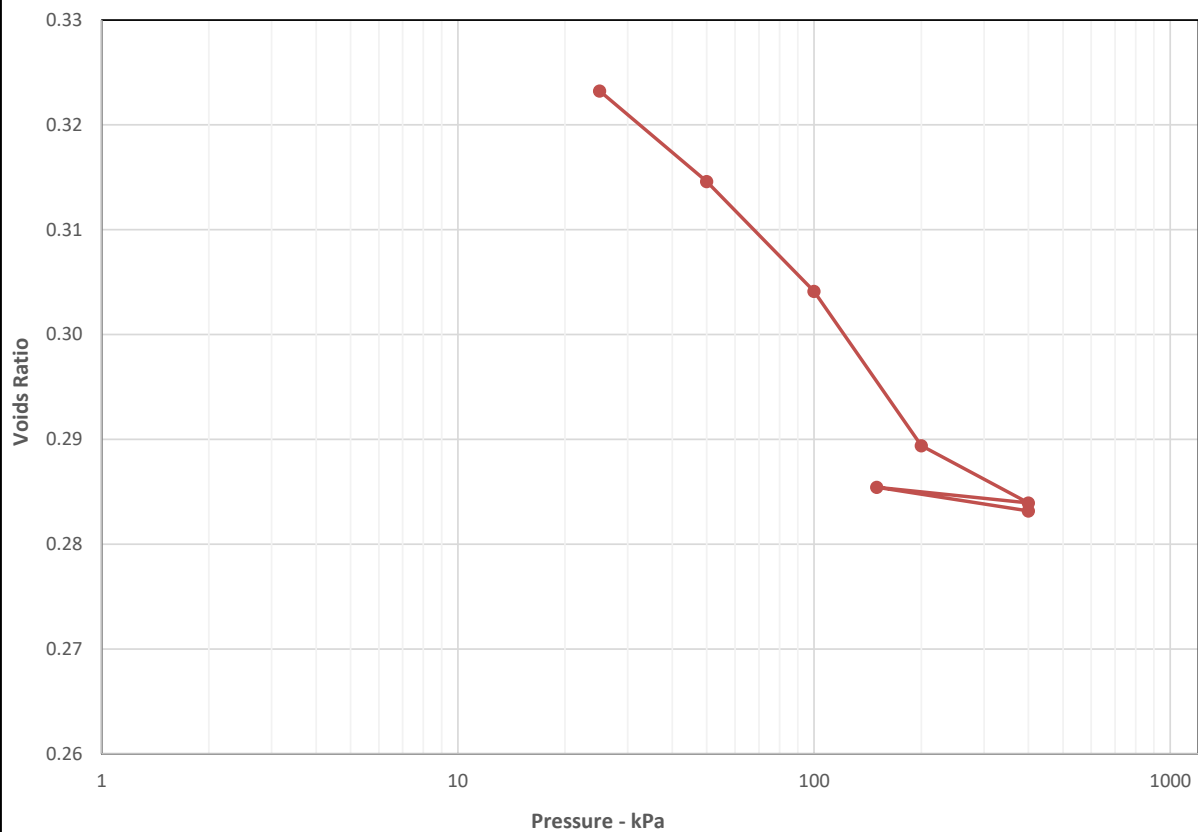
Cv Calculated Using T90
Particle Density Assumed Unless Stated Otherwise

Sample Type

S

Date Tested

04/01/2022



Initial Sample Conditions		Pressure Range			Mv m2/MN	Cv m2/yr	Pressure Range			Mv m2/MN	Cv m2/yr
Moisture Content (%)	15	0	-	25	0.6	6.8		-			
Bulk Density (Mg/m3)	2.27	25	-	50	0.26	4.6		-			
Dry Density (Mg/m3)	1.97	50	-	100	0.16	4.6		-			
Voids Ratio	0.3432	100	-	200	0.11	4.7		-			
Degree of saturation	115.8	200	-	400	0.021	4.7		-			
Height (mm)	19.61	400	-	150	0.0047	4.6		-			
Diameter (mm)	74.92	150	-	400	0.007	4.6		-			
Particle Density (Mg/m3)	2.65		-					-			

Operators	Checked	26/01/2022	Richard John	
Wayne W	Approved	27/01/2022	Paul Evans	





**Single Stage Unconsolidated-Undrained Triaxial
Test
BS 1377 : 1990 Part 7 : 8**

Contract Number 57248

Borehole/Pit No. BH29

Site Name GCRE

Sample No. 1

Soil Description

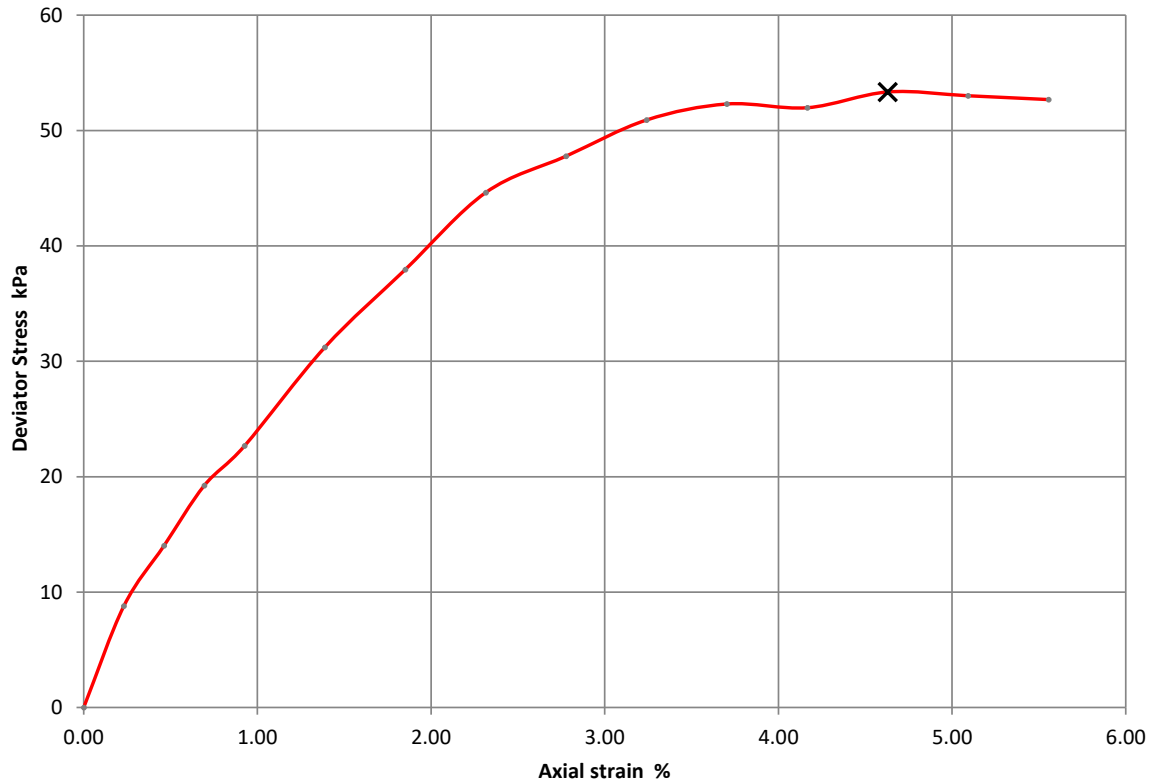
Depth Top (m) 3.70

Depth Base (m) 4.20

Date Tested 26/01/2022

Sample Type U

Technician Daniel B



Moisture Content (%)	19
Bulk Density (Mg/m ³)	1.81
Dry Density (Mg/m ³)	1.52
Specimen Length (mm)	216
Specimen Diameter (mm)	108
Cell Pressure (kPa)	70
Deviator Stress (kPa)	53
Undrained Shear Strength (kPa)	27
Failure Strain (%)	5
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.39

Checked	26/01/2022	Richard John	
Approved	27/01/2022	Paul Evans	





**Single Stage Unconsolidated-Undrained Triaxial
Test
BS 1377 : 1990 Part 7 : 8**

Contract Number 57248

Borehole/Pit No. BH31

Site Name GCRE

Sample No. 1

Soil Description

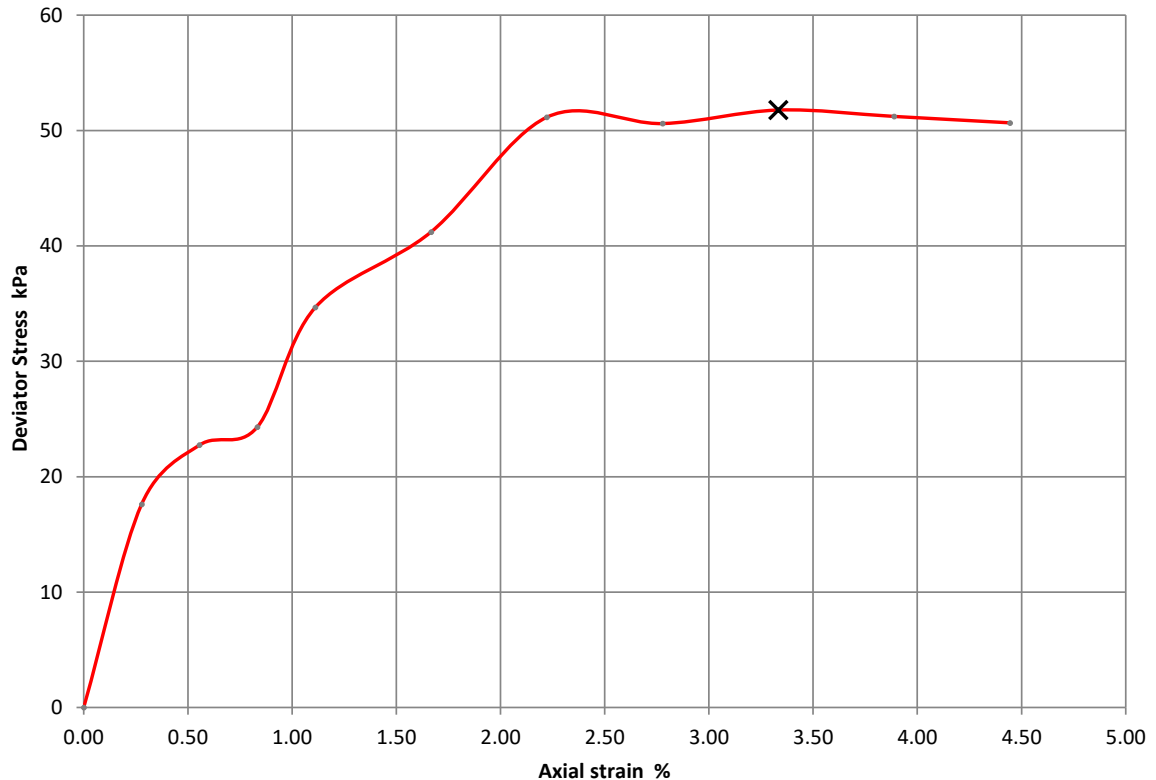
Depth Top (m) 6.70

Depth Base (m) 7.20

Date Tested 26/01/2022

Sample Type U

Technician Daniel B



Moisture Content (%)	56
Bulk Density (Mg/m ³)	1.83
Dry Density (Mg/m ³)	1.17
Specimen Length (mm)	72
Specimen Diameter (mm)	36
Cell Pressure (kPa)	130
Deviator Stress (kPa)	52
Undrained Shear Strength (kPa)	26
Failure Strain (%)	3
Mode Of Failure	Brittle
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	4.17

Checked	26/01/2022	Richard John	
Approved	27/01/2022	Paul Evans	





**Single Stage Unconsolidated-Undrained Triaxial
Test
BS 1377 : 1990 Part 7 : 8**

Contract Number 57248

Borehole/Pit No. BH33

Site Name GCRE

Sample No. 1

Soil Description

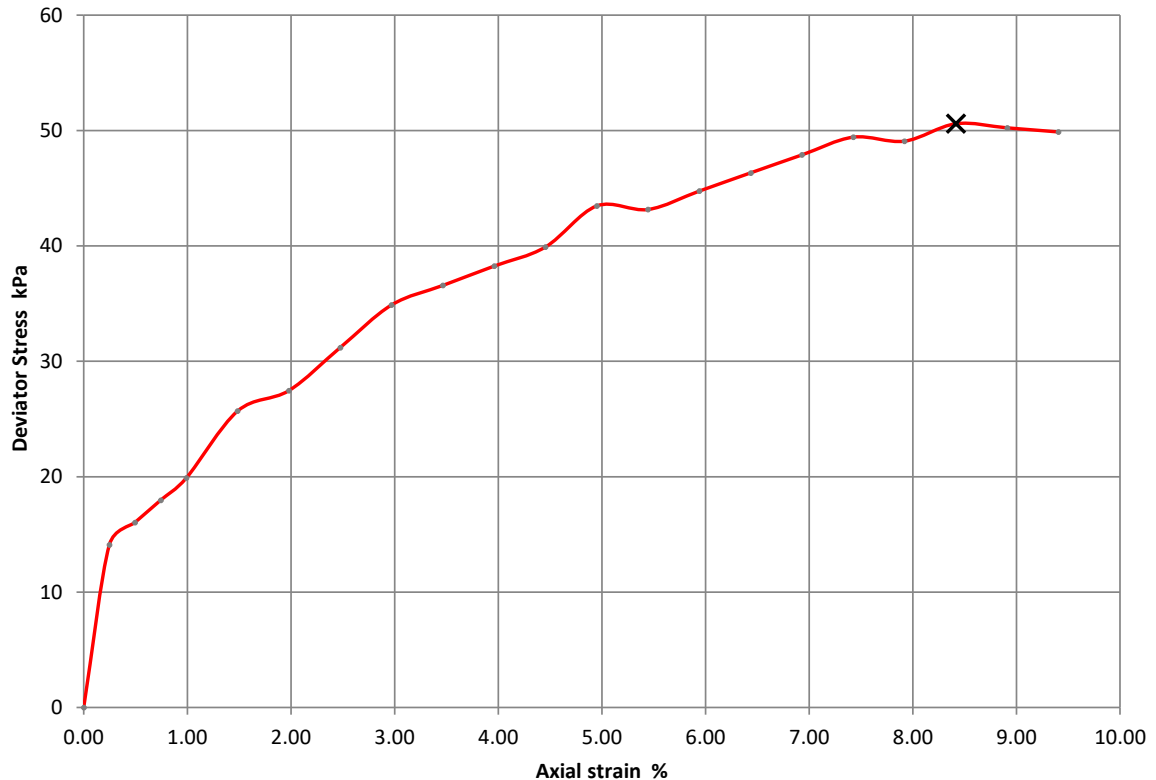
Depth Top (m) 2.70

Depth Base (m) 3.20

Date Tested 26/01/2022

Sample Type U

Technician Daniel B



Moisture Content (%)	21
Bulk Density (Mg/m ³)	2.21
Dry Density (Mg/m ³)	1.82
Specimen Length (mm)	202
Specimen Diameter (mm)	101
Cell Pressure (kPa)	54
Deviator Stress (kPa)	51
Undrained Shear Strength (kPa)	25
Failure Strain (%)	8
Mode Of Failure	Brittle
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.49

Checked 26/01/2022

Richard John

Approved 27/01/2022

Paul Evans





**Single Stage Unconsolidated-Undrained Triaxial
Test
BS 1377 : 1990 Part 7 : 8**

Contract Number 57248

Borehole/Pit No. BH34

Site Name GCRE

Sample No. 1

Soil Description

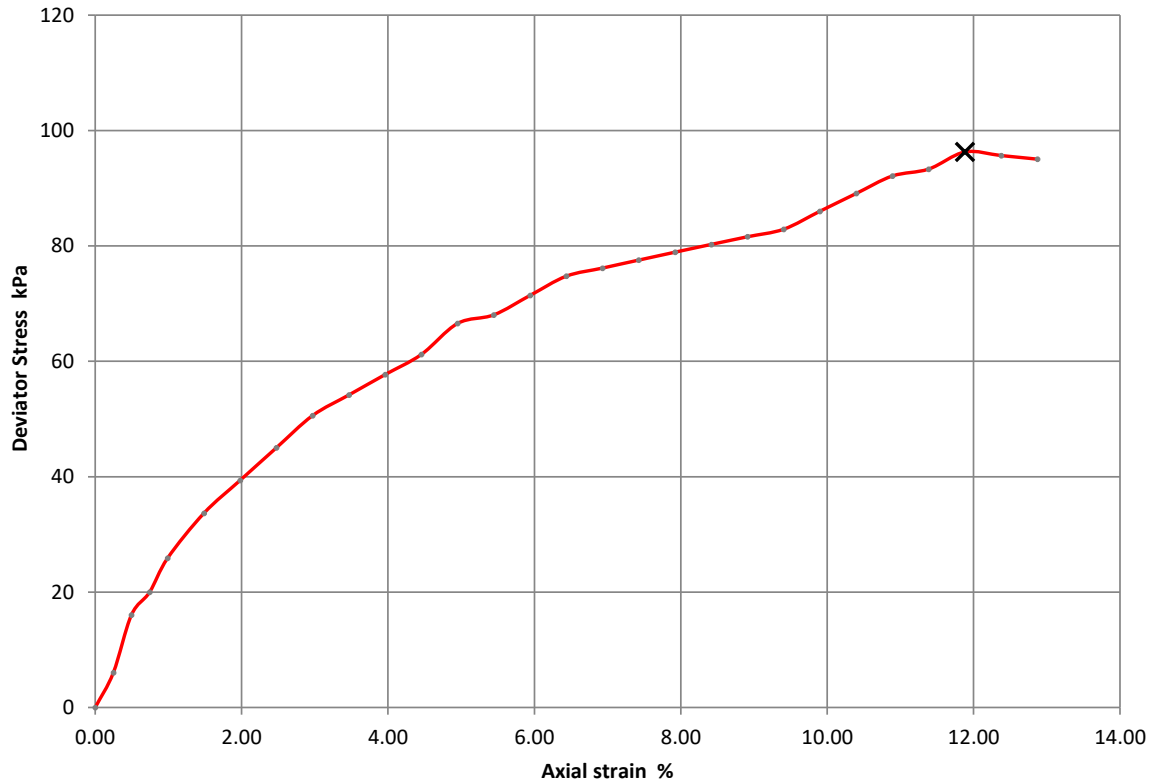
Depth Top (m) 6.20

Depth Base (m) 6.70

Date Tested 26/01/2022

Sample Type U

Technician Daniel B



Moisture Content (%)	13
Bulk Density (Mg/m ³)	2.25
Dry Density (Mg/m ³)	1.98
Specimen Length (mm)	202
Specimen Diameter (mm)	101
Cell Pressure (kPa)	120
Deviator Stress (kPa)	96
Undrained Shear Strength (kPa)	48
Failure Strain (%)	12
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.49

Checked	26/01/2022	Richard John	
Approved	27/01/2022	Paul Evans	





ANALYTICAL TEST REPORT

Contract no: 104493

Contract name: GCRE - Steff Picton

Client reference: Q0652

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 13 January 2022

Analysis started: 13 January 2022

Analysis completed: 20 January 2022

Report issued: 20 January 2022

Key

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

Approved by:

Rachael Burton

Reporting Team Lead

Chemtech Environmental Limited

SOILS

Lab number			104493-1	104493-2	104493-3	104493-4
Sample id			BH29	BH31	BH33	BH34
Depth (m)			3.70-4.20	6.70-7.20	2.70-3.30	6.20-6.70
Sample Type			S1	S1	S1	S1
Date sampled			-	-	-	-
Test	Method	Units				
Total Organic Carbon (TOC)	CE197	% w/w C	-	26.8	2.3	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	46.2	3.9	-
Loss On Ignition at 440°C	CE006 ^U	% w/w	6.4	60.8	3.3	15.1

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE006	Loss On Ignition at 440°C	Based on BS 1377, Gravimetry	Dry	U	0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
104493-1	BH29	3.70-4.20	Y	All (NSD)
104493-2	BH31	6.70-7.20	Y	All (NSD)
104493-3	BH33	2.70-3.30	Y	All (NSD)
104493-4	BH34	6.20-6.70	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

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

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

Methods, procedures and performance data are available on request.

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

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

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

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

Analytical results are inclusive of stones, where applicable.



Contract Number: 57361

Client Ref: **Q0652**

Report Date: **24-01-2022**

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Steffan Picton**

Date Received: **20-12-2021**

Date Completed: **24-01-2022**

Test Description	Qty
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	5
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	5
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	14
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	9
Organic Matter Content-dichromate method Sub-contracted Test	3
BRE Reduced Suite includes pH, water & acid soluble sulphate and total sulphur Sub-contracted Test	6

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 57361

Test Description	Qty
BRE Full Suite includes pH, water & acid soluble sulphate, total sulphur, magnesium, chloride and nitrate <i>Sub-contracted Test</i>	6
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

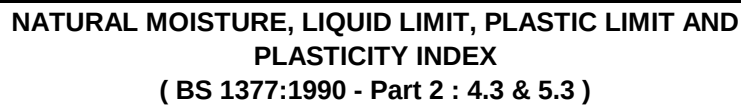
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

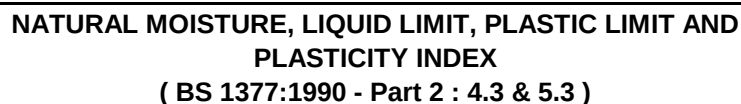
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



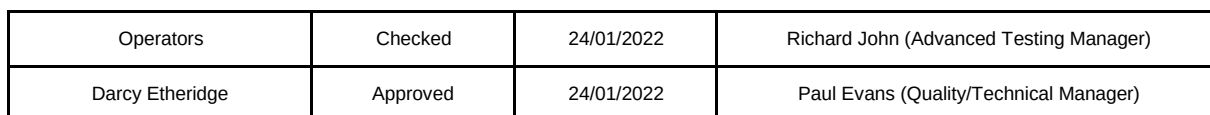
Contract Number	57361	
Site Name	GCRE	
Date Tested	20/01/2022	
	DESCRIPTIONS	

[illegible]

Operators	Checked	24/01/2022	Richard John (Advanced Testing Manager)
Darcy Etheridge	Approved	24/01/2022	Paul Evans (Quality/Technical Manager)

[illegible]

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION BS 5930:1999+A2:2010





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57361

Borehole/Pit No. BH29

Site Name GCRE

Sample No. 5

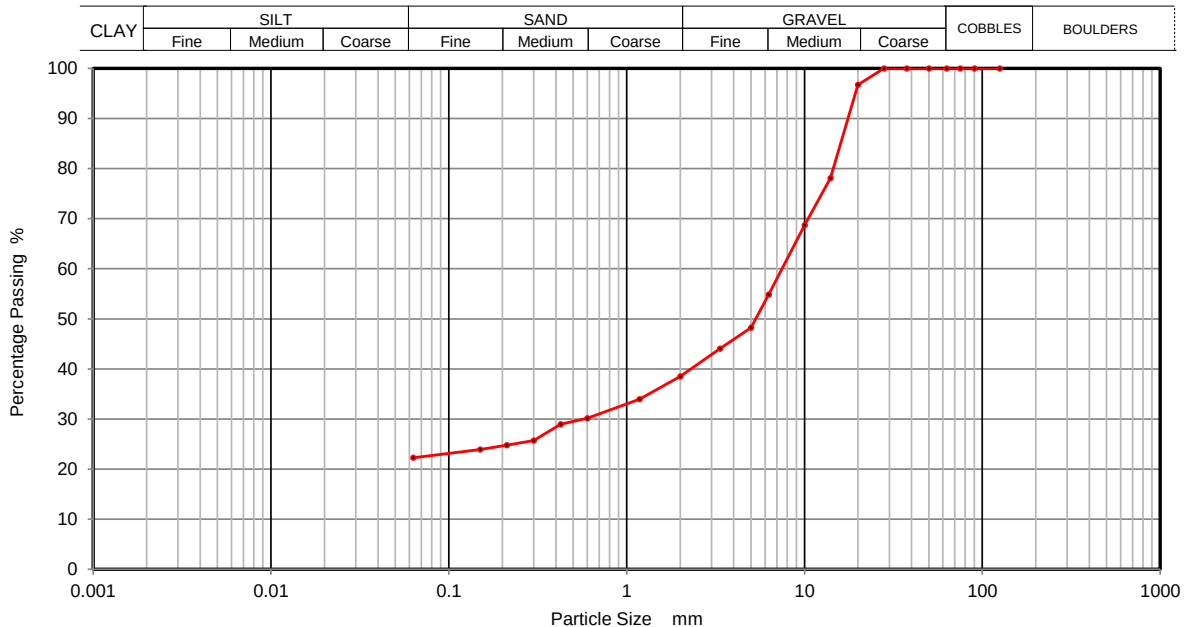
Soil Description Black fine to coarse sandy clayey/silty fine to coarse COAL

Depth Top 1.00

Depth Base 1.50

Date Tested 20/01/2022

Sample Type B



Sieving		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	97		
14	78		
10	69		
6.3	55		
5	48		
3.35	44		
2	39		
1.18	34		
0.6	30		
0.425	29		
0.3	26		
0.212	25		
0.15	24		
0.063	22		

Sample Proportions	% dry mass
Cobbles	0
Gravel	61
Sand	17
Silt and Clay	22

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

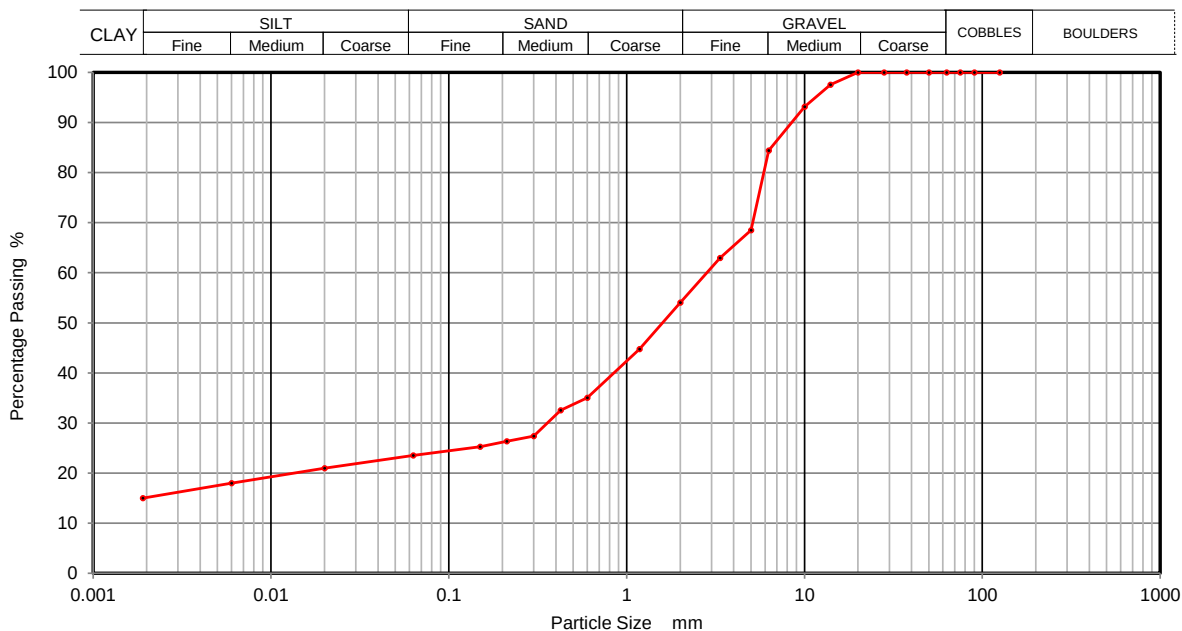




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH29
Sample No.	14
Depth Top	4.00
Depth Base	4.50
Sample Type	B

Site Name	GCRE
Soil Description	Black silty clayey PEAT
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	21
90	100	0.0060	18
75	100	0.0020	15
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	93		
6.3	84		
5	68		
3.35	63		
2	54		
1.18	45		
0.6	35		
0.425	33		
0.3	27		
0.212	26		
0.15	25		
0.063	24		

Sample Proportions	% dry mass
Cobbles	0
Gravel	46
Sand	30
Silt	9
Clay	15

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57361

Borehole/Pit No. BH30

Site Name GCRE

Sample No. 5

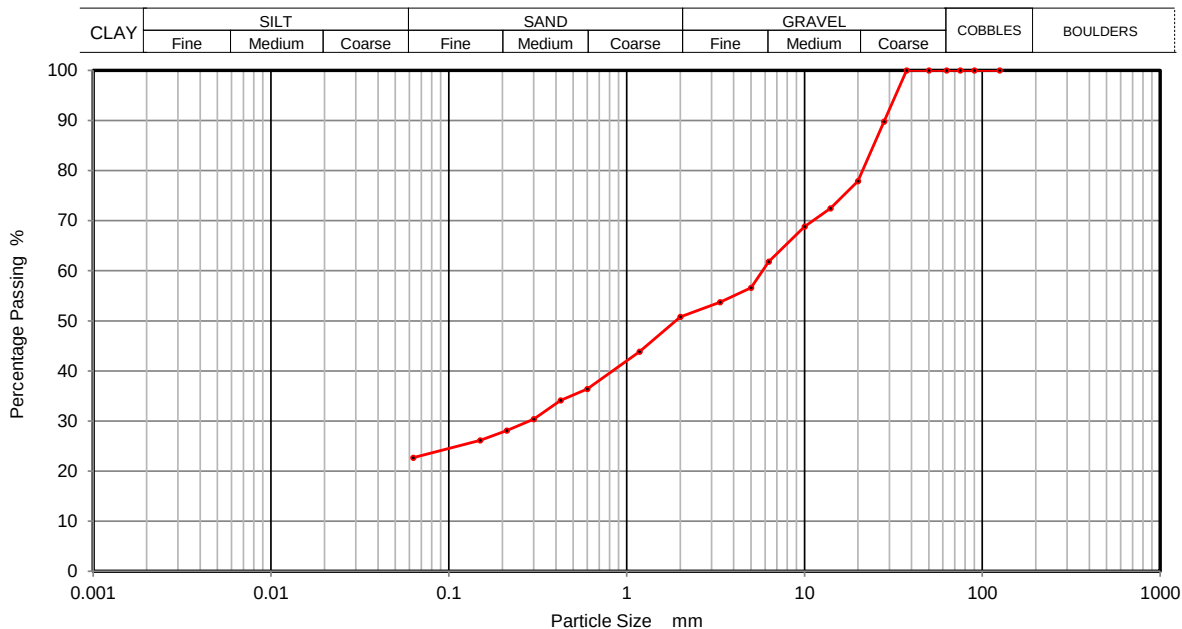
Soil Description Grey clayey/silty fine to coarse sandy fine to coarse GRAVEL

Depth Top 1.20

Depth Base 1.70

Date Tested 20/01/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	90		
20	78		
14	72		
10	69		
6.3	62		
5	57		
3.35	54		
2	51		
1.18	44		
0.6	36		
0.425	34		
0.3	30		
0.212	28		
0.15	26		
0.063	23		

Sample Proportions	% dry mass
Cobbles	0
Gravel	49
Sand	28
Silt and Clay	23

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	



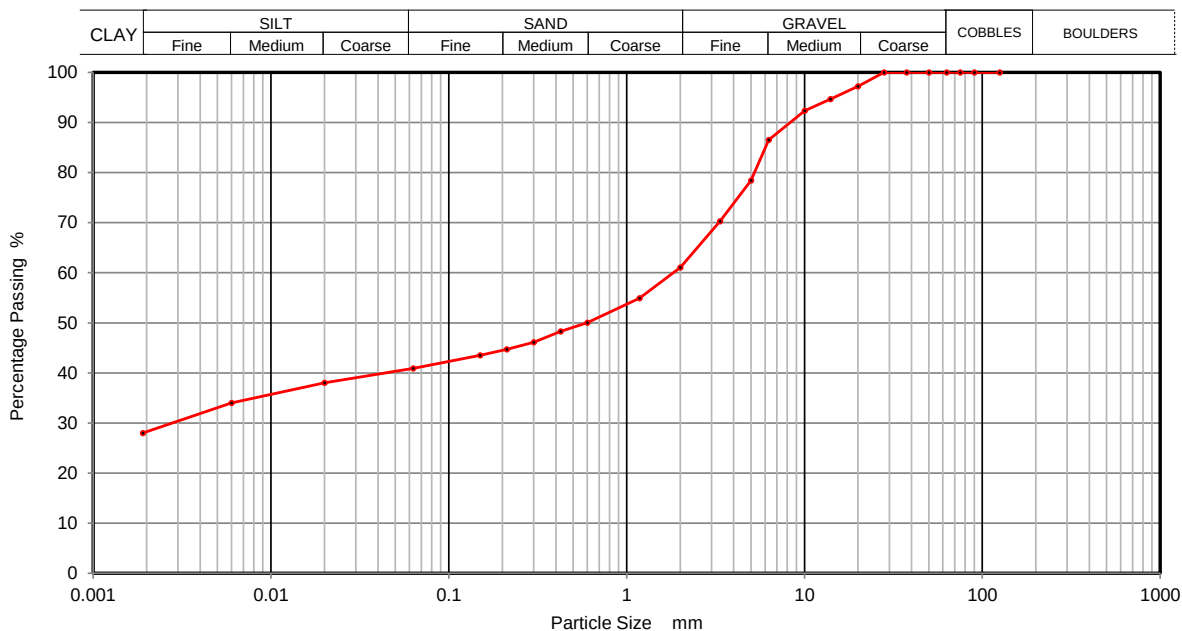
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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH30
Sample No.	17
Depth Top	5.00
Depth Base	5.50
Sample Type	B

Site Name	GCRE
Soil Description	Grey silty fine to coarse sandy clayey fine to coarse GRAVEL
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	38
90	100	0.0060	34
75	100	0.0020	28
63	100		
50	100		
37.5	100		
28	100		
20	97		
14	95		
10	92		
6.3	87		
5	78		
3.35	70		
2	61		
1.18	55		
0.6	50		
0.425	48		
0.3	46		
0.212	45		
0.15	44		
0.063	41		

Sample Proportions	% dry mass
Cobbles	0
Gravel	39
Sand	20
Silt	13
Clay	28

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	





**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 57361

Borehole/Pit No. BH31

Site Name GCRE

Sample No. 8

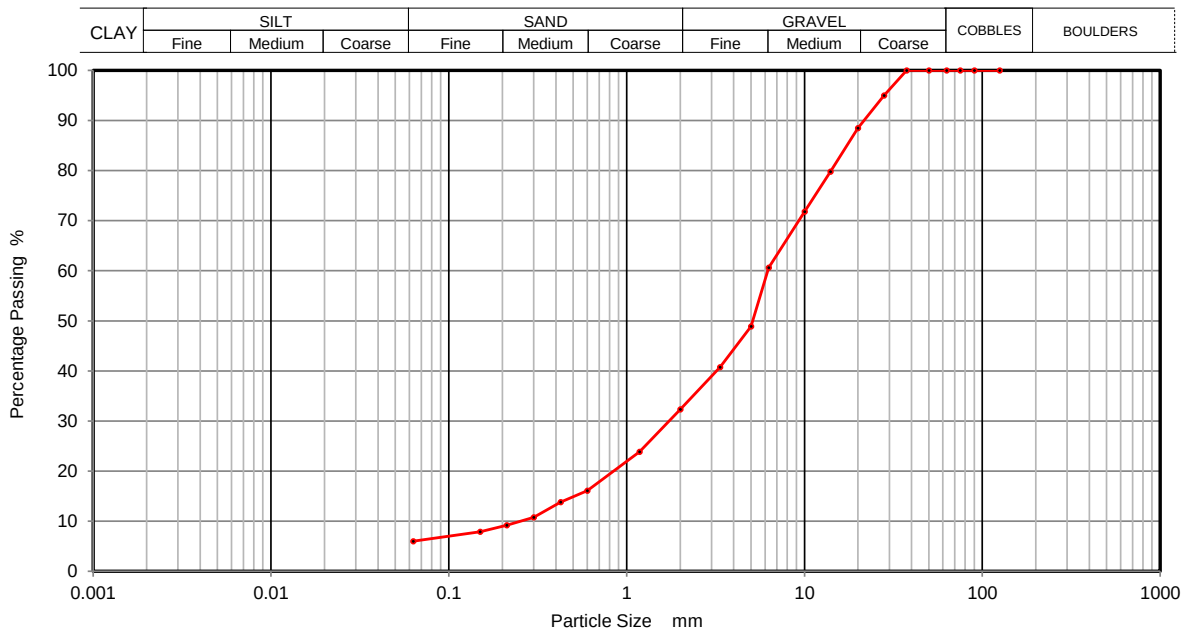
Soil Description Black slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL

Depth Top 2.00

Depth Base 2.50

Date Tested 20/01/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	95		
20	88		
14	80		
10	72		
6.3	61		
5	49		
3.35	41		
2	32		
1.18	24		
0.6	16		
0.425	14		
0.3	11		
0.212	9		
0.15	8		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	26
Silt and Clay	6

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	



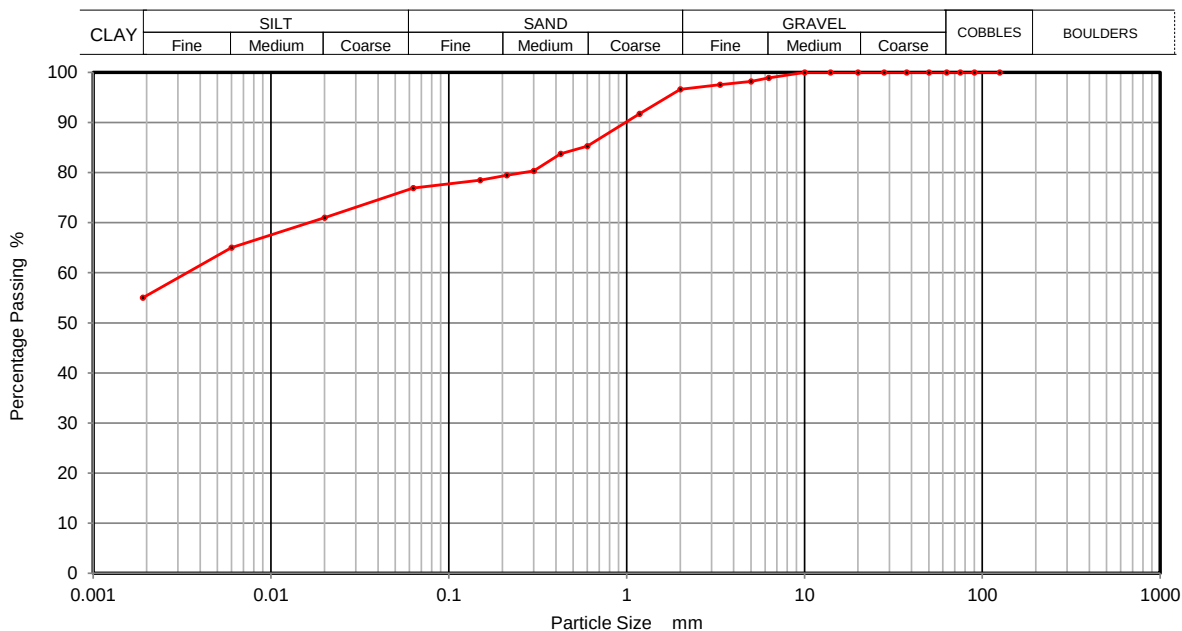
2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH31
Sample No.	22
Depth Top	6.80
Depth Base	7.30
Sample Type	B

Site Name	GCRE
Soil Description	Grey slightly fine to medium gravelly fine to coarse sandy silty CLAY
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	71
90	100	0.0060	65
75	100	0.0020	55
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	98		
3.35	98		
2	97		
1.18	92		
0.6	85		
0.425	84		
0.3	80		
0.212	79		
0.15	78		
0.063	77		

Sample Proportions	% dry mass
Cobbles	0
Gravel	3
Sand	20
Silt	22
Clay	55

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

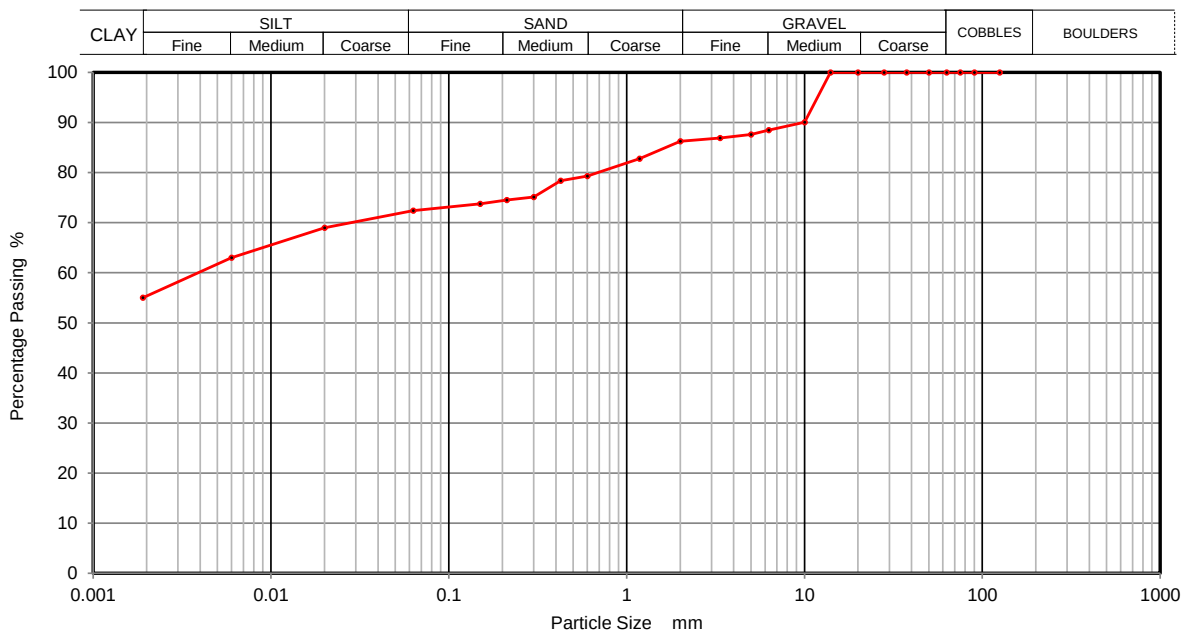




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH31
Sample No.	25
Depth Top	8.00
Depth Base	8.50
Sample Type	B

Site Name	GCRE
Soil Description	Grey fine to medium gravelly fine to coarse sandy silty CLAY
Date Tested	00/01/1900



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	69
90	100	0.0060	63
75	100	0.0020	55
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	90		
6.3	88		
5	88		
3.35	87		
2	86		
1.18	83		
0.6	79		
0.425	78		
0.3	75		
0.212	75		
0.15	74		
0.063	72		

Sample Proportions	% dry mass
Cobbles	0
Gravel	14
Sand	14
Silt	17
Clay	55

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

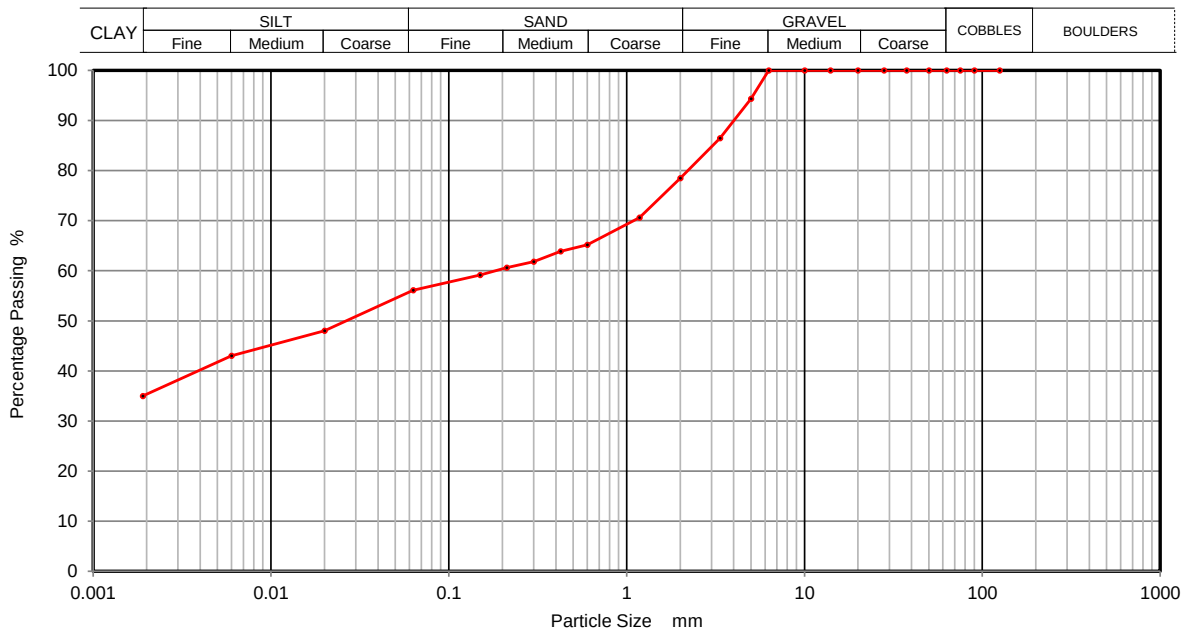




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH32
Sample No.	5
Depth Top	1.20
Depth Base	1.70
Sample Type	B

Site Name	GCRE
Soil Description	Grey silty fine to coarse sandy fine gravelly CLAY
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	48
90	100	0.0060	43
75	100	0.0020	35
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	94		
3.35	86		
2	78		
1.18	71		
0.6	65		
0.425	64		
0.3	62		
0.212	61		
0.15	59		
0.063	56		

Sample Proportions	% dry mass
Cobbles	0
Gravel	22
Sand	22
Silt	21
Clay	35

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57361

Borehole/Pit No. BH33

Site Name GCRE

Sample No. 2

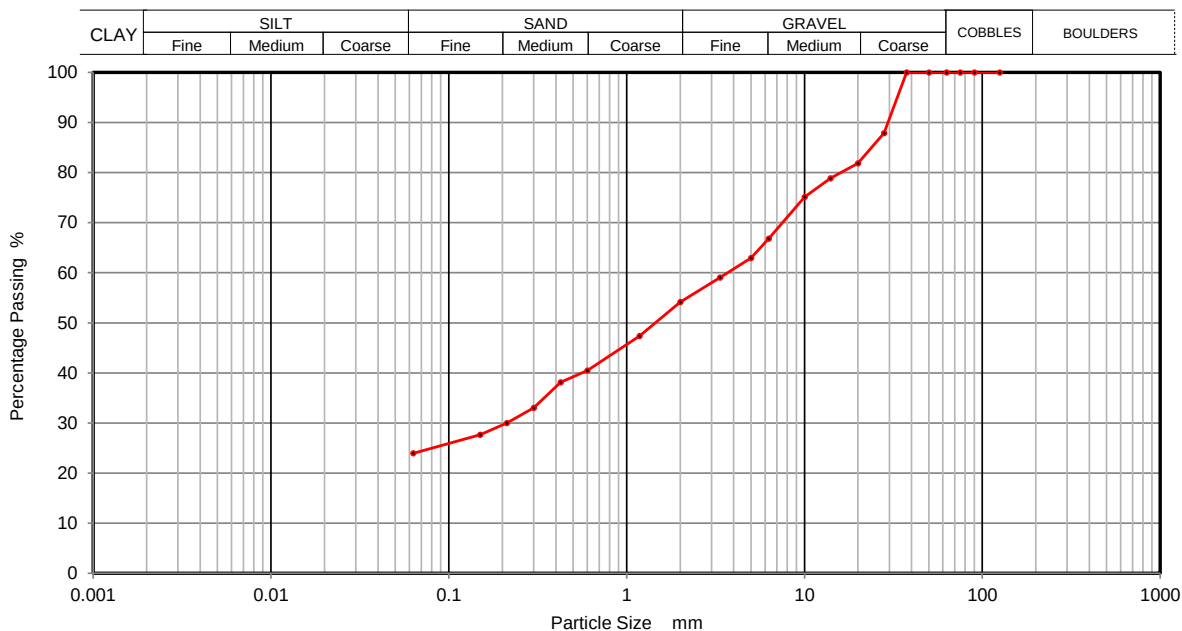
Soil Description Grey clayey/silty fine to coarse sandy fine to coarse GRAVEL

Depth Top 0.50

Depth Base 1.00

Date Tested 00/01/1900

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	88		
20	82		
14	79		
10	75		
6.3	67		
5	63		
3.35	59		
2	54		
1.18	47		
0.6	40		
0.425	38		
0.3	33		
0.212	30		
0.15	28		
0.063	24		

Sample Proportions	% dry mass
Cobbles	0
Gravel	46
Sand	30
Silt and Clay	24

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

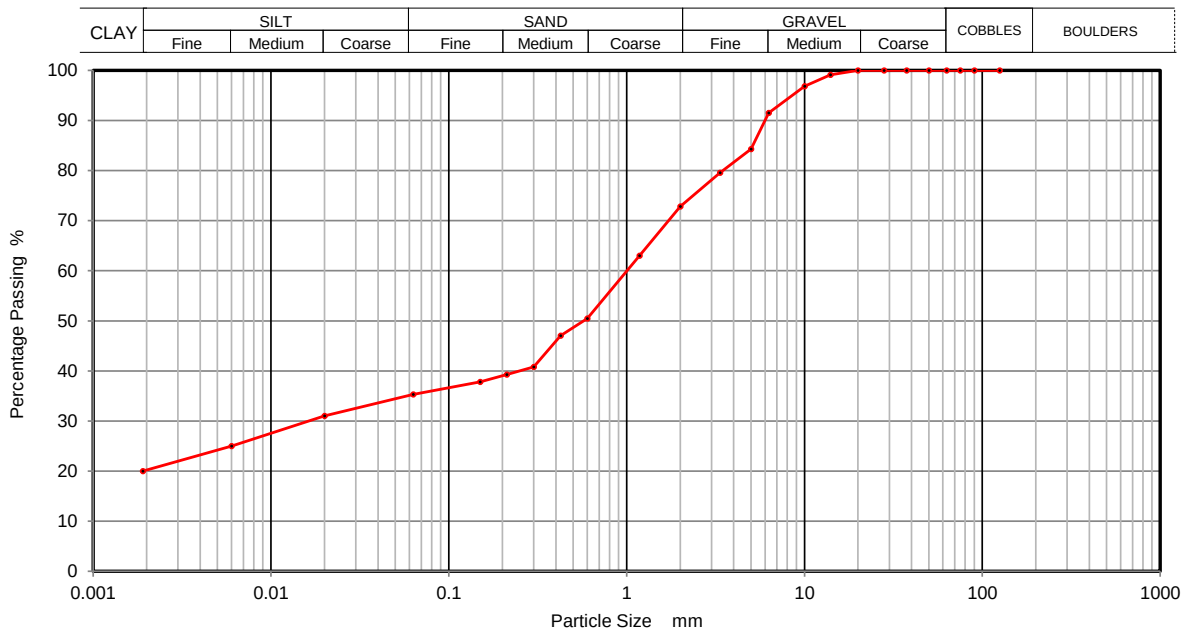




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH33
Sample No.	8
Depth Top	2.00
Depth Base	2.50
Sample Type	B

Site Name	GCRE
Soil Description	Dark grey silty clayey fine to medium gravelly fine to coarse SAND
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	31
90	100	0.0060	25
75	100	0.0020	20
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	97		
6.3	92		
5	84		
3.35	80		
2	73		
1.18	63		
0.6	50		
0.425	47		
0.3	41		
0.212	39		
0.15	38		
0.063	35		

Sample Proportions	% dry mass
Cobbles	0
Gravel	27
Sand	38
Silt	15
Clay	20

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57361

Borehole/Pit No. BH34

Site Name GCRE

Sample No. 5

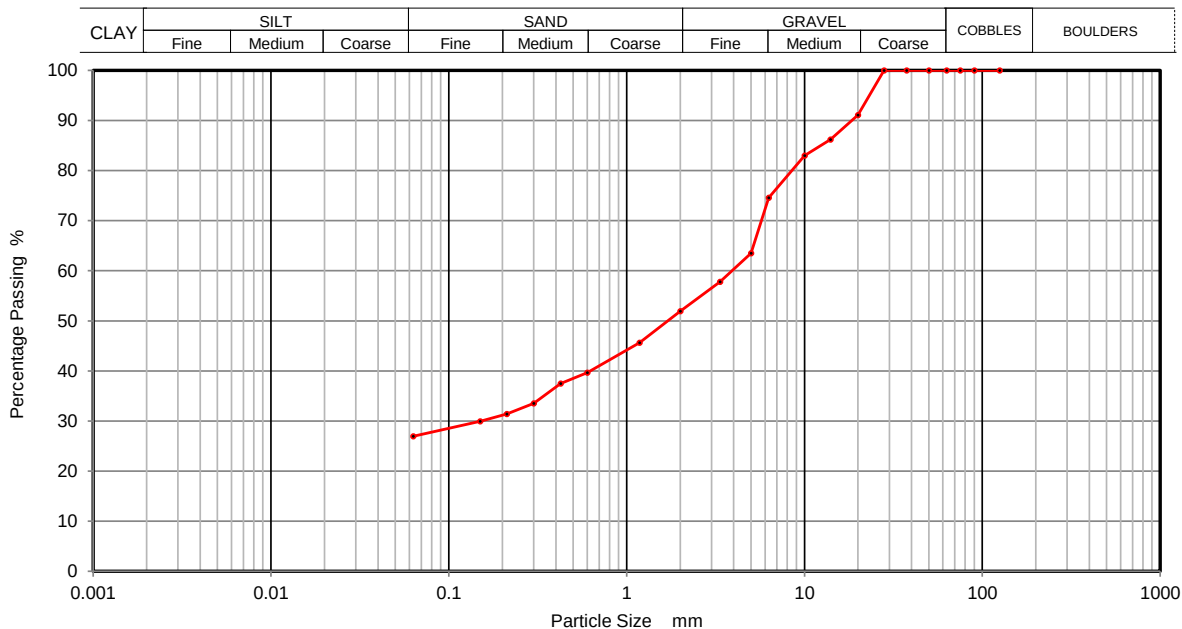
Soil Description Dark grey fine to coarse sandy clayey/silty fine to coarse GRAVEL

Depth Top 1.20

Depth Base 1.70

Date Tested 20/01/2022

Sample Type B



Sieving		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	91		
14	86		
10	83		
6.3	75		
5	64		
3.35	58		
2	52		
1.18	46		
0.6	40		
0.425	37		
0.3	34		
0.212	31		
0.15	30		
0.063	27		

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	25
Silt and Clay	27

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

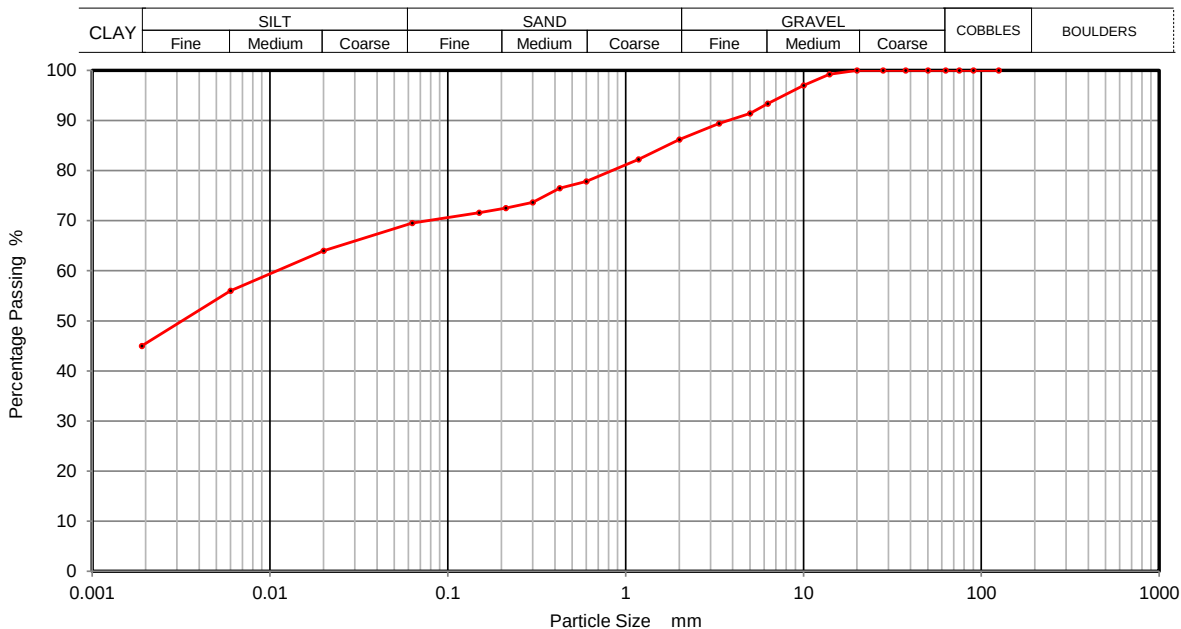




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH34
Sample No.	12
Depth Top	3.30
Depth Base	3.80
Sample Type	B

Site Name	GCRE
Soil Description	Grey fine to medium gravelly fine to coarse sandy silty CLAY
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	64
90	100	0.0060	56
75	100	0.0020	45
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	97		
6.3	93		
5	91		
3.35	89		
2	86		
1.18	82		
0.6	78		
0.425	76		
0.3	74		
0.212	72		
0.15	72		
0.063	69		

Sample Proportions	% dry mass
Cobbles	0
Gravel	14
Sand	17
Silt	24
Clay	45

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

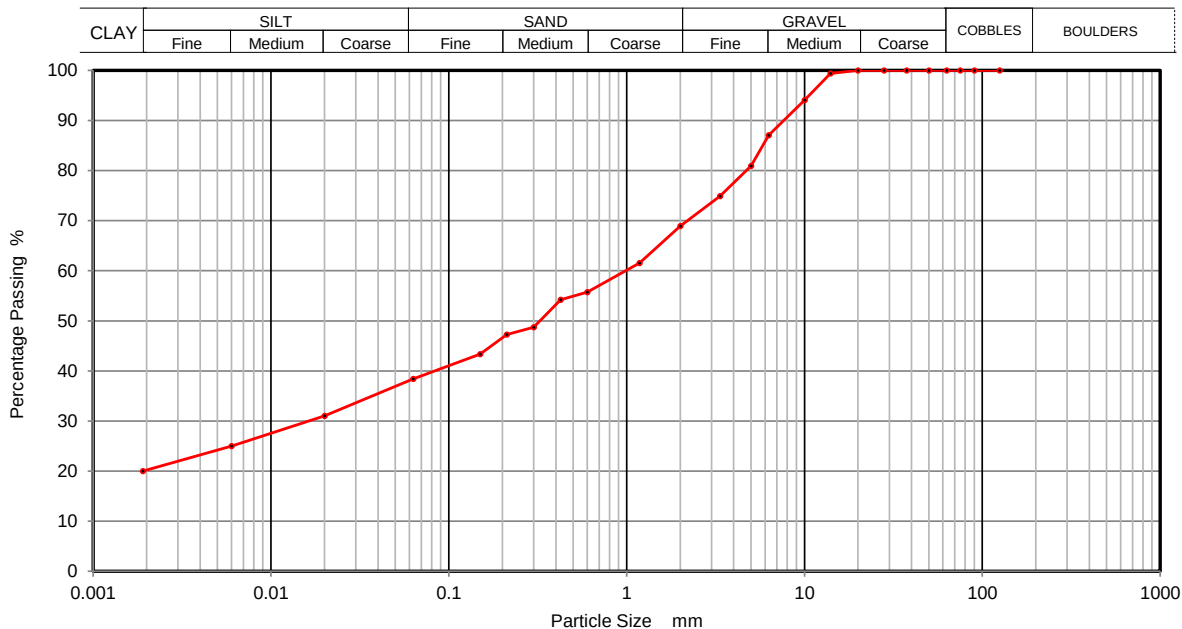




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH34
Sample No.	18
Depth Top	6.00
Depth Base	6.50
Sample Type	B

Site Name	GCRE
Soil Description	Grey organic silty clayey fine to coarse sandy fine to medium GRAVEL
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	31
90	100	0.0060	25
75	100	0.0020	20
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	94		
6.3	87		
5	81		
3.35	75		
2	69		
1.18	62		
0.6	56		
0.425	54		
0.3	49		
0.212	47		
0.15	43		
0.063	38		

Sample Proportions	% dry mass
Cobbles	0
Gravel	31
Sand	31
Silt	18
Clay	20

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	

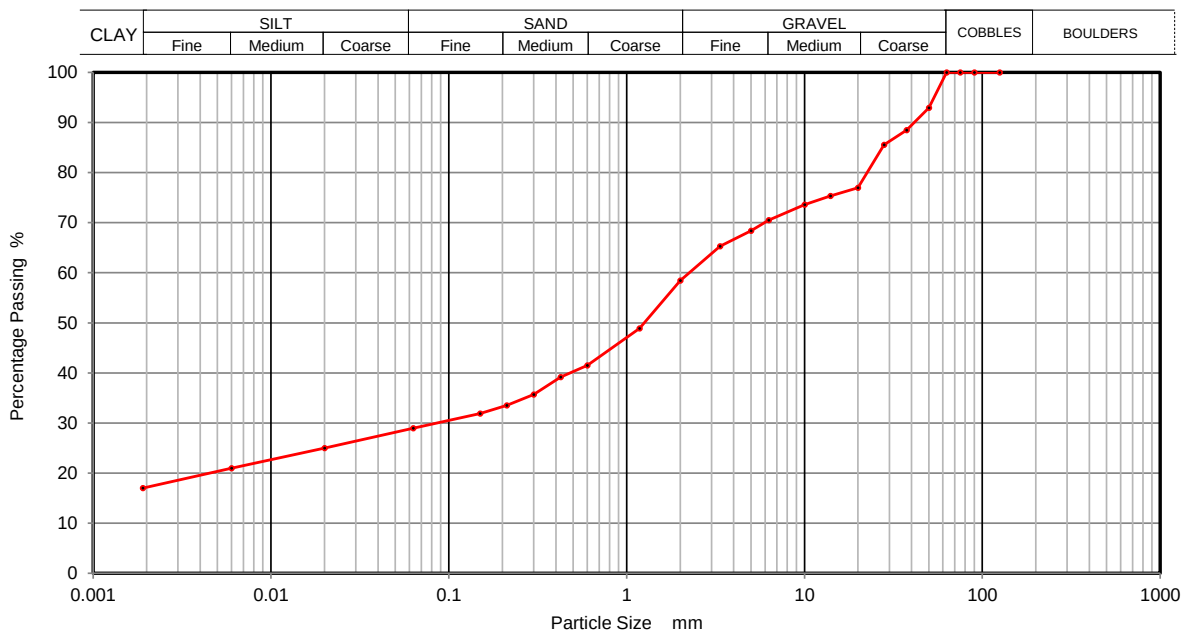




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57361
Borehole/Pit No.	BH34
Sample No.	24
Depth Top	8.00
Depth Base	8.50
Sample Type	B

Site Name	GCRE
Soil Description	Grey silty clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	20/01/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	25
90	100	0.0060	21
75	100	0.0020	17
63	100		
50	93		
37.5	88		
28	86		
20	77		
14	75		
10	74		
6.3	71		
5	68		
3.35	65		
2	58		
1.18	49		
0.6	42		
0.425	39		
0.3	36		
0.212	34		
0.15	32		
0.063	29		

Sample Proportions	% dry mass
Cobbles	0
Gravel	42
Sand	29
Silt	12
Clay	17

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	23/01/2022	Richard John	
David	Approved	24/01/2022	Paul Evans	





ANALYTICAL TEST REPORT

Contract no: 104496

Contract name: GCRE

Client reference: Q0652

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 13 January 2022

Analysis started: 13 January 2022

Analysis completed: 20 January 2022

Report issued: 20 January 2022

Key

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

Approved by:

Rachael Burton

Reporting Team Lead

Chemtech Environmental Limited

SOILS

Lab number			104496-1	104496-2	104496-3	104496-4	104496-5	104496-6
Sample id			BH29	BH30	BH30	BH31	BH31	BH32
Depth (m)			1.00-1.50	1.20-1.70	5.00-5.50	2.00-2.50	8.00-8.50	2.00-2.50
Sample Type			B5	B5	B17	B8	B25	B8
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^U	units	7.2	7.5	6.2	8.1	7.0	8.2
Magnesium (2:1 water soluble)	CE061	mg/l Mg	11	13	-	21	-	-
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	20	4.2	-	28	-	-
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	<1	<1	-	9.2	-	-
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	124	96	34	166	22	354
Sulphate (total)	CE062 ^U	mg/kg SO ₄	352	333	167	949	103	1775
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.04	0.03	0.02	0.09	0.01	0.18
Sulphur (total)	CE119	mg/kg S	1919	2650	2898	8164	338	15311
Sulphur (total)	CE119	% w/w S	0.19	0.27	0.29	0.82	0.03	1.53
Total Organic Carbon (TOC)	CE197	% w/w C	-	-	2.2	-	-	24.8
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	-	3.8	-	-	42.8

Chemtech Environmental Limited

SOILS

Lab number			104496-7	104496-8	104496-9	104496-10	104496-11	104496-12
Sample id			BH33	BH33	BH34	BH34	BH34	BH34
Depth (m)			0.50-1.00	2.00-2.50	1.20-1.70	3.30-3.80	6.00-6.50	8.00-8.50
Sample Type			B25	B8	B5	B12	B18	B24
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^U	units	8.1	7.1	7.5	-	6.2	7.8
Magnesium (2:1 water soluble)	CE061	mg/l Mg	15	-	25	-	-	-
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	6.8	-	5.3	-	-	-
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	3.2	-	1.9	-	-	-
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	245	264	204	-	127	54
Sulphate (total)	CE062 ^U	mg/kg SO ₄	888	782	954	-	619	187
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.09	0.08	0.10	-	0.06	0.02
Sulphur (total)	CE119	mg/kg S	3263	3044	-	-	1290	487
Sulphur (total)	CE119	% w/w S	0.33	0.30	-	-	0.13	0.05
Total Organic Carbon (TOC)	CE197	% w/w C	-	-	-	2.5	-	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	-	-	4.2	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO ₃
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	0.01	% w/w SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
104496-1	BH29	1.00-1.50	Y	All (NSD)
104496-2	BH30	1.20-1.70	Y	All (NSD)
104496-3	BH30	5.00-5.50	Y	All (NSD)
104496-4	BH31	2.00-2.50	Y	All (NSD)
104496-5	BH31	8.00-8.50	Y	All (NSD)
104496-6	BH32	2.00-2.50	Y	All (NSD)
104496-7	BH33	0.50-1.00	Y	All (NSD)
104496-8	BH33	2.00-2.50	Y	All (NSD)
104496-9	BH34	1.20-1.70	Y	All (NSD)
104496-10	BH34	3.30-3.80	Y	All (NSD)
104496-11	BH34	6.00-6.50	Y	All (NSD)
104496-12	BH34	8.00-8.50	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

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

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

Methods, procedures and performance data are available on request.

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

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

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

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

Analytical results are inclusive of stones, where applicable.



Contract Number: 57649

Client Ref: **Q0652**

Report Date: **10-02-2022**

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Phil Darby**

Date Received: **17-01-2022**

Date Completed: **10-02-2022**

Test Description	Qty
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	8
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	8
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	21
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	8
Organic Matter Content-dichromate method Sub-contracted Test	2
BRE Reduced Suite includes pH, water & acid soluble sulphate and total sulphur Sub-contracted Test	8

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 57649

Test Description	Qty
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould/CBR Mould) BS 1377:1990 - Part 4 : 3.5 - * UKAS	7
MCV/Moisture Content Relationship BS 1377:1990 - Part 4 : 5.5 - * UKAS	7
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

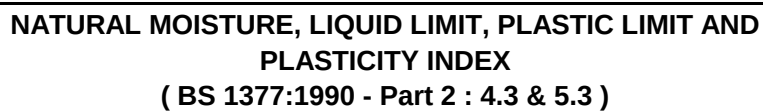
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

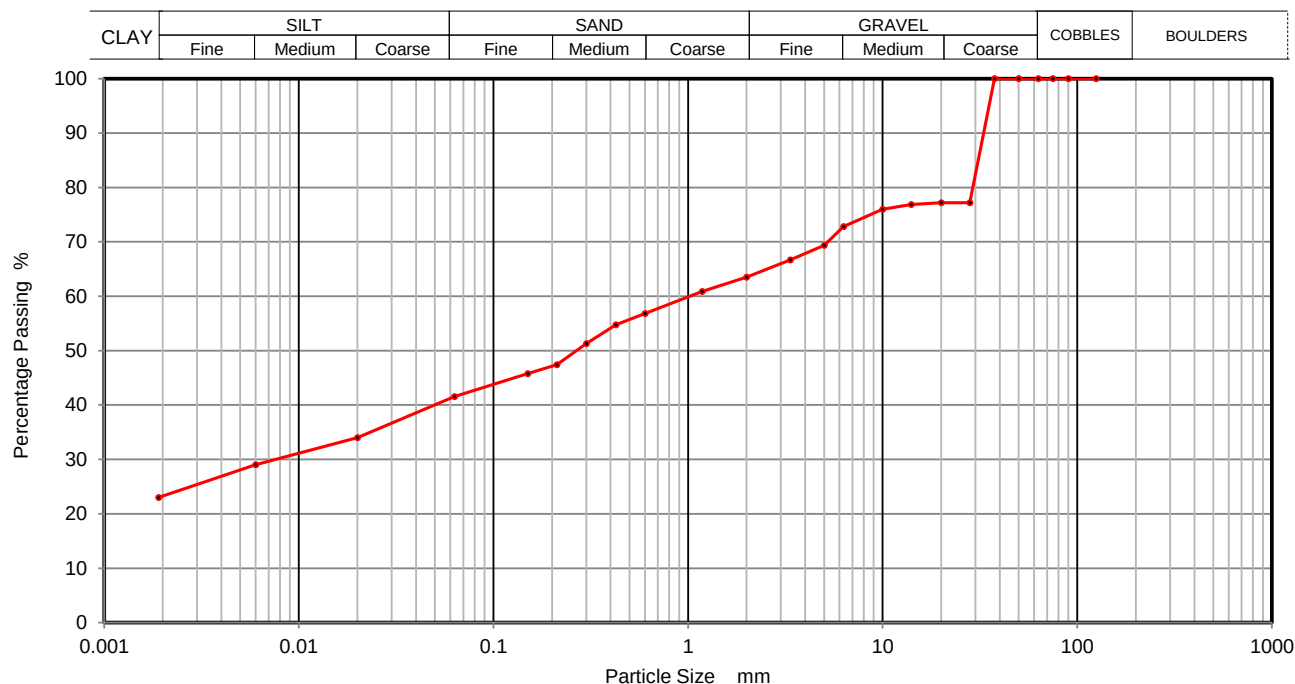
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57649
	Borehole/Pit No.
Site Name	GCRE
Soil Description	Depth Top
	Depth Base
Date Tested	07/02/2022
Sample No.	5
Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	34
90	100	0.0060	29
75	100	0.0020	23
63	100		
50	100		
37.5	100		
28	77		
20	77		
14	77		
10	76		
6.3	73		
5	69		
3.35	67		
2	64		
1.18	61		
0.6	57		
0.425	55		
0.3	51		
0.212	47		
0.15	46		
0.063	42		

Sample Proportions	% dry mass
Cobbles	0
Gravel	36
Sand	22
Silt	19
Clay	23

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	09/02/2022	Richard John	
David	Approved	10/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP10

Site Name GCRE

Sample No. 4

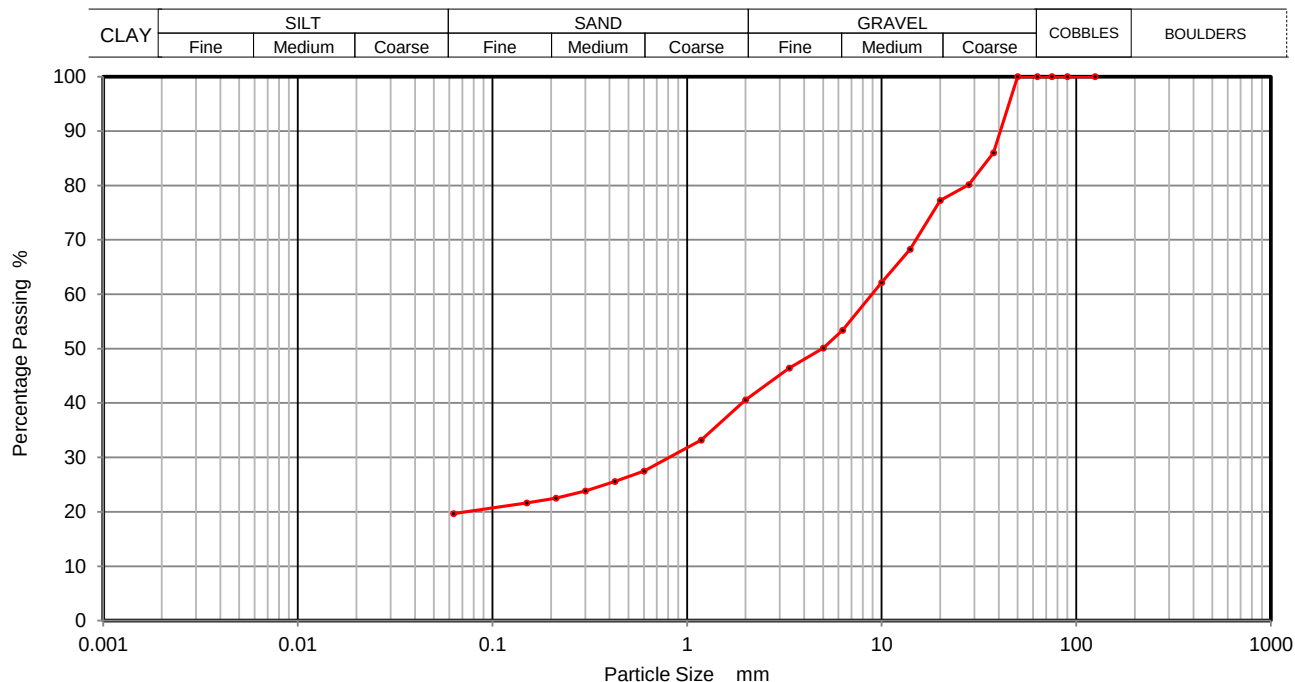
Soil Description Brown silty clayey fine to coarse sandy fine to coarse GRAVEL

Depth Top 1.00

Depth Base 1.50

Date Tested 07/02/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	86		
28	80		
20	77		
14	68		
10	62		
6.3	53		
5	50		
3.35	46		
2	41		
1.18	33		
0.6	27		
0.425	26		
0.3	24		
0.212	22		
0.15	22		
0.063	20		

Sample Proportions	% dry mass
Cobbles	0
Gravel	59
Sand	21
Silt and Clay	20

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	

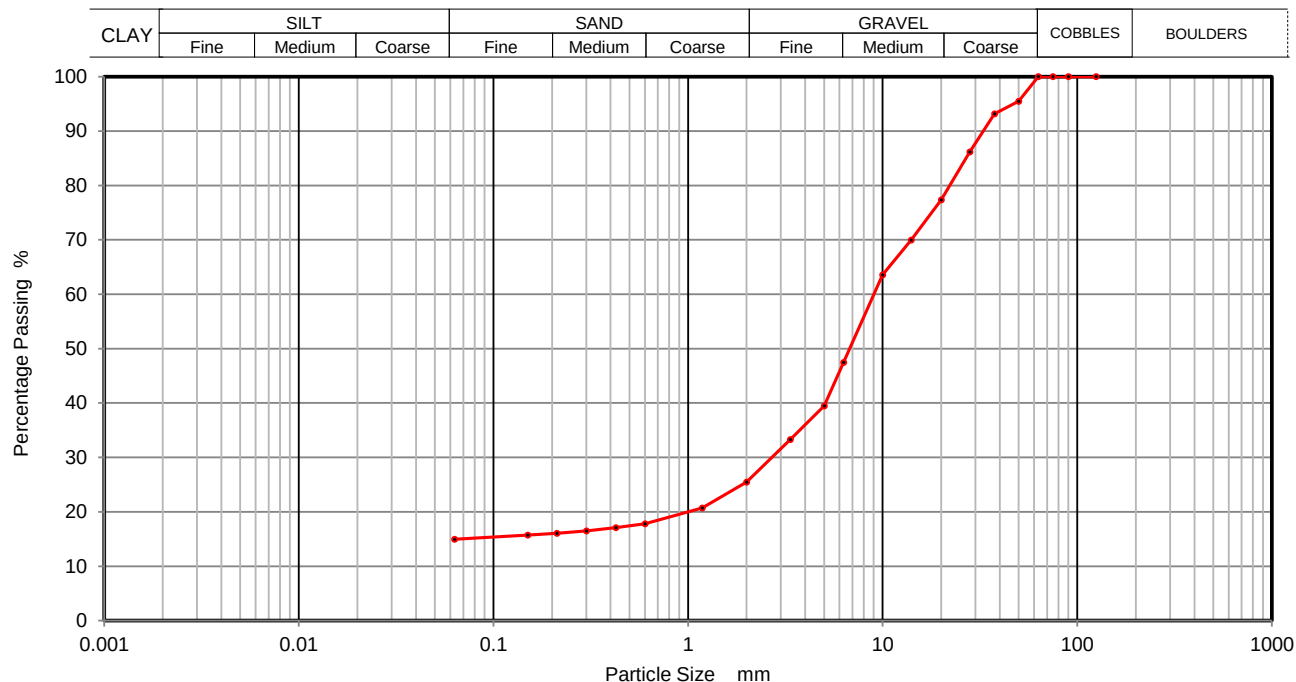


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**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	57649
		Borehole/Pit No.	TP11
Site Name	GCRE	Sample No.	3
Soil Description	Grey fine to coarse sand silty clayey fine to coarse GRAVEL	Depth Top	0.50
		Depth Base	1.00
Date Tested	07/02/2022	Sample Type	LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	93		
28	86		
20	77		
14	70		
10	64		
6.3	47		
5	40		
3.35	33		
2	25		
1.18	21		
0.6	18		
0.425	17		
0.3	17		
0.212	16		
0.15	16		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	10
Silt and Clay	15

Remarks
Preparation and testing in accordance with BS1377 unless noted below

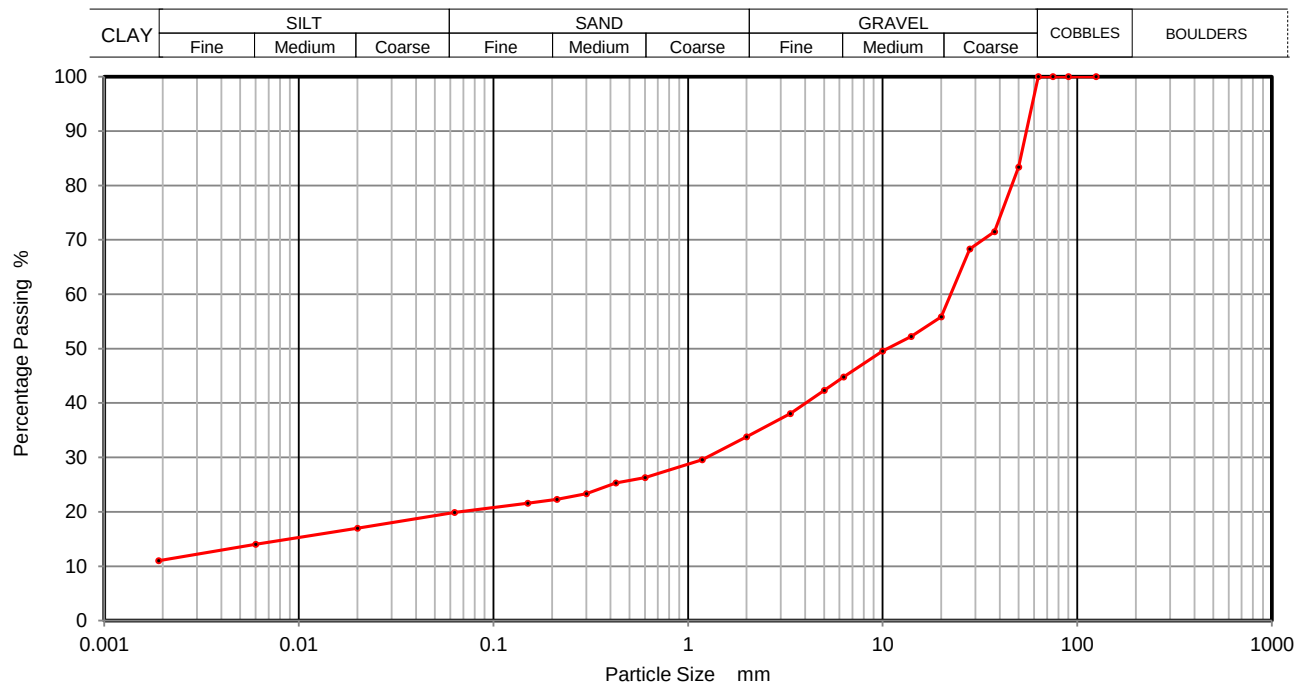
Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	57649
		Borehole/Pit No.	TP19
Site Name	GCRE	Sample No.	4
Soil Description	Brown slightly silty clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.50
		Depth Base	
Date Tested	07/02/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	17
90	100	0.0060	14
75	100	0.0020	11
63	100		
50	83		
37.5	72		
28	68		
20	56		
14	52		
10	50		
6.3	45		
5	42		
3.35	38		
2	34		
1.18	30		
0.6	26		
0.425	25		
0.3	23		
0.212	22		
0.15	22		
0.063	20		

Sample Proportions	% dry mass
Cobbles	0
Gravel	66
Sand	14
Silt	9
Clay	11

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	



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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP20

Site Name GCRE

Sample No. 4

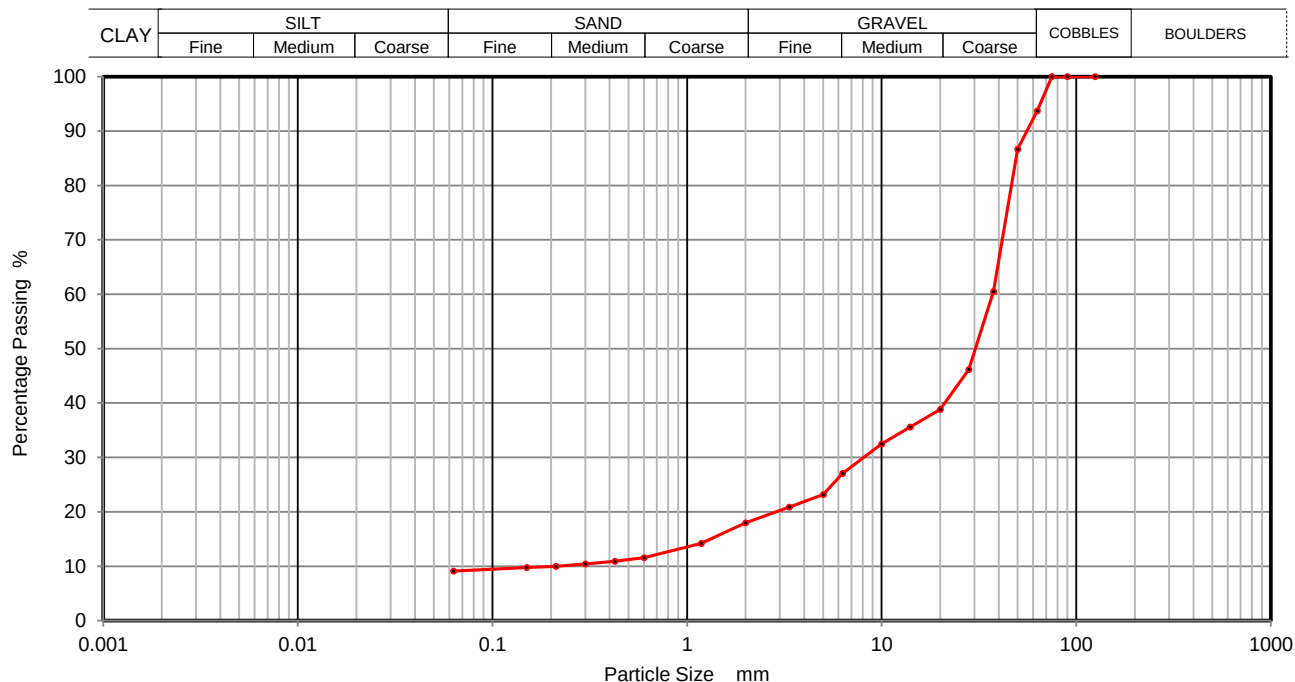
Soil Description Grey slightly slity clayey slightly sandy fine to coarse GRAVEL

Depth Top 1.50

Depth Base 2.00

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	94		
50	87		
37.5	61		
28	46		
20	39		
14	36		
10	32		
6.3	27		
5	23		
3.35	21		
2	18		
1.18	14		
0.6	12		
0.425	11		
0.3	10		
0.212	10		
0.15	10		
0.063	9		

Sample Proportions	% dry mass
Cobbles	6
Gravel	76
Sand	9
Silt and Clay	9

Remarks

Preparation and testing in accordance with BS1377 unless noted below

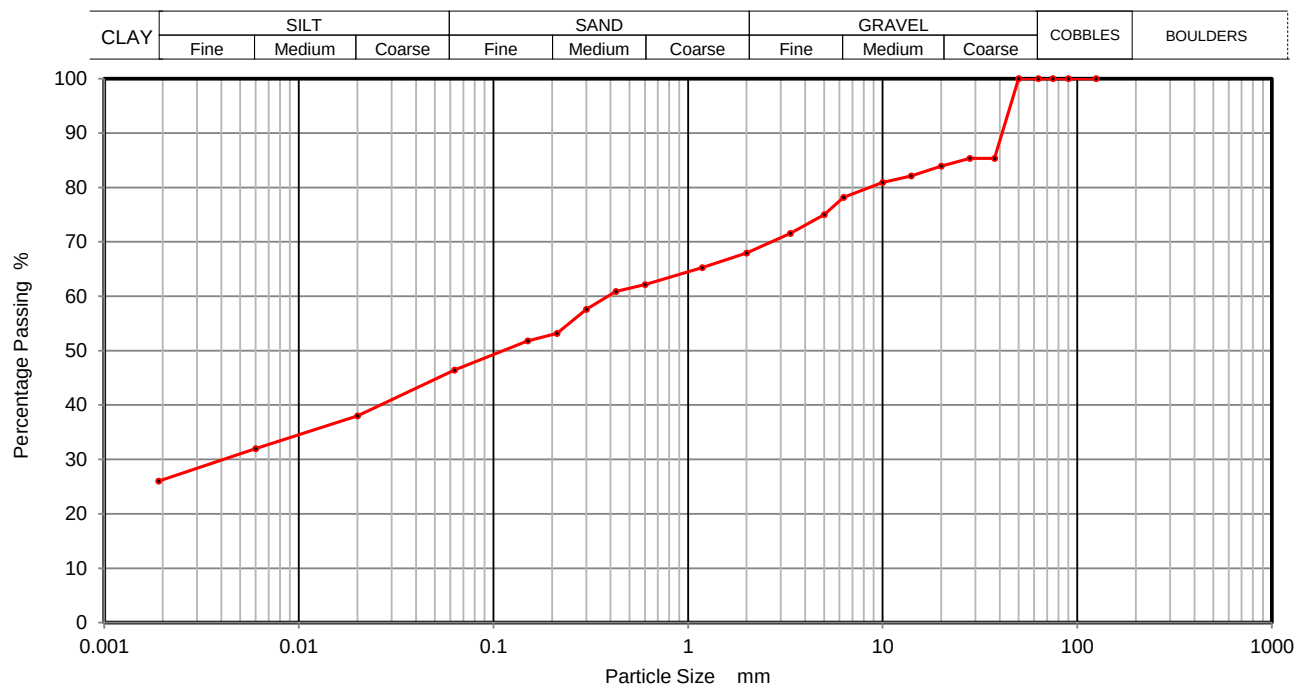
Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57649
	Borehole/Pit No. TP20
Site Name	GCRE
Soil Description	Brown silty fine to coarse sandy clayey fine to coarse GRAVEL
Date Tested	07/02/2022
Sample No.	6
Depth Top	3.50
	Depth Base 4.00
Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	38
90	100	0.0060	32
75	100	0.0020	26
63	100		
50	100		
37.5	85		
28	85		
20	84		
14	82		
10	81		
6.3	78		
5	75		
3.35	72		
2	68		
1.18	65		
0.6	62		
0.425	61		
0.3	58		
0.212	53		
0.15	52		
0.063	46		

Sample Proportions	% dry mass
Cobbles	0
Gravel	32
Sand	22
Silt	20
Clay	26

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP21

Site Name GCRE

Sample No. 4

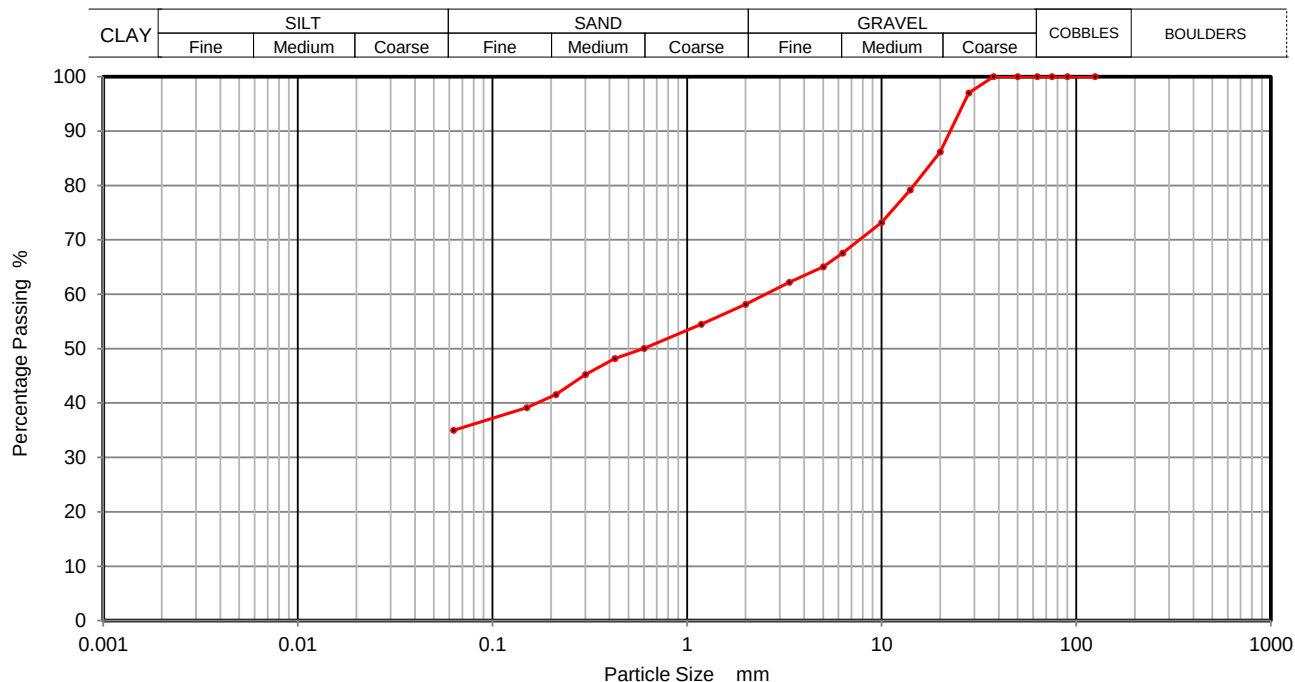
Soil Description Brown fine to coarse sandy silty clayey fine to coarse GRAVEL

Depth Top 1.00

Depth Base 1.50

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	86		
14	79		
10	73		
6.3	68		
5	65		
3.35	62		
2	58		
1.18	54		
0.6	50		
0.425	48		
0.3	45		
0.212	42		
0.15	39		
0.063	35		

Sample Proportions	% dry mass
Cobbles	0
Gravel	42
Sand	23
Silt and Clay	35

Remarks

Preparation and testing in accordance with BS1377 unless noted below

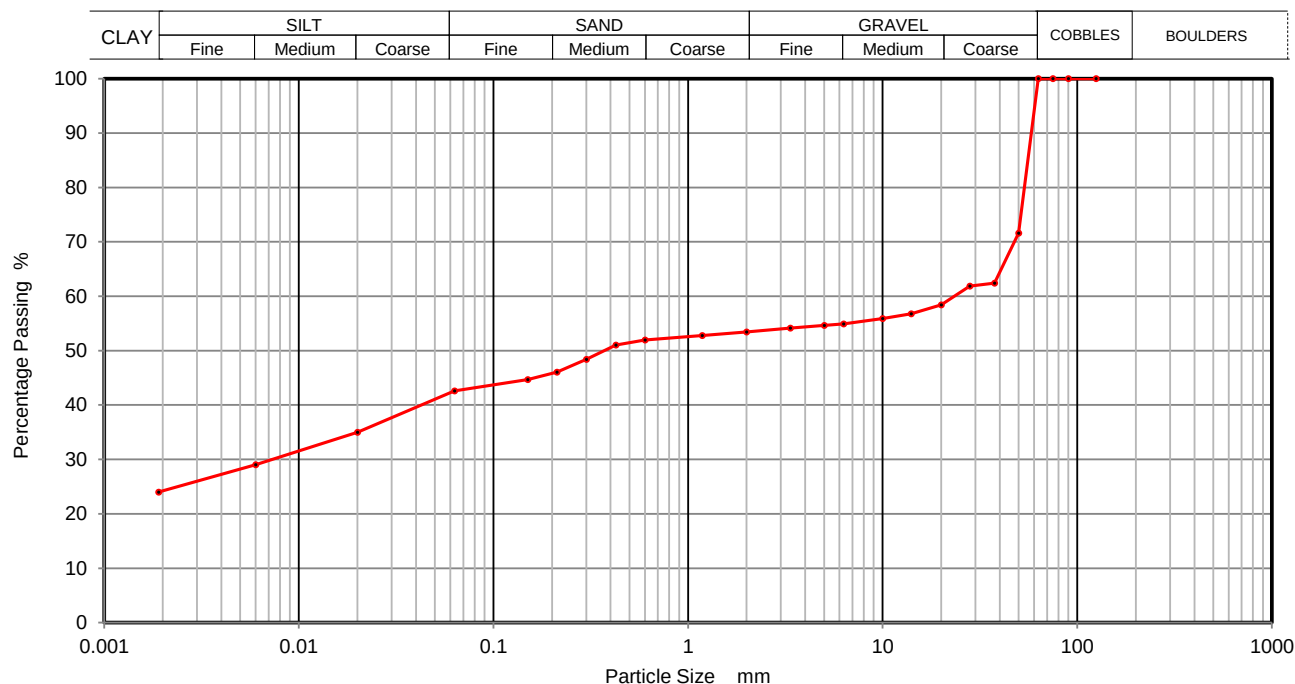
Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57649
	Borehole/Pit No. TP21
Site Name	GCRE
Soil Description	Brown fine to coarse sandy silty clayey fine to coarse GRAVEL
	Sample No. 7
Date Tested	07/02/2022
	Depth Top 3.00
Sample Type	B
	Depth Base 3.50



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	35
90	100	0.0060	29
75	100	0.0020	24
63	100		
50	72		
37.5	62		
28	62		
20	58		
14	57		
10	56		
6.3	55		
5	55		
3.35	54		
2	53		
1.18	53		
0.6	52		
0.425	51		
0.3	48		
0.212	46		
0.15	45		
0.063	43		

Sample Proportions	% dry mass
Cobbles	0
Gravel	47
Sand	10
Silt	19
Clay	24

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP22

Site Name GCRE

Sample No. 5

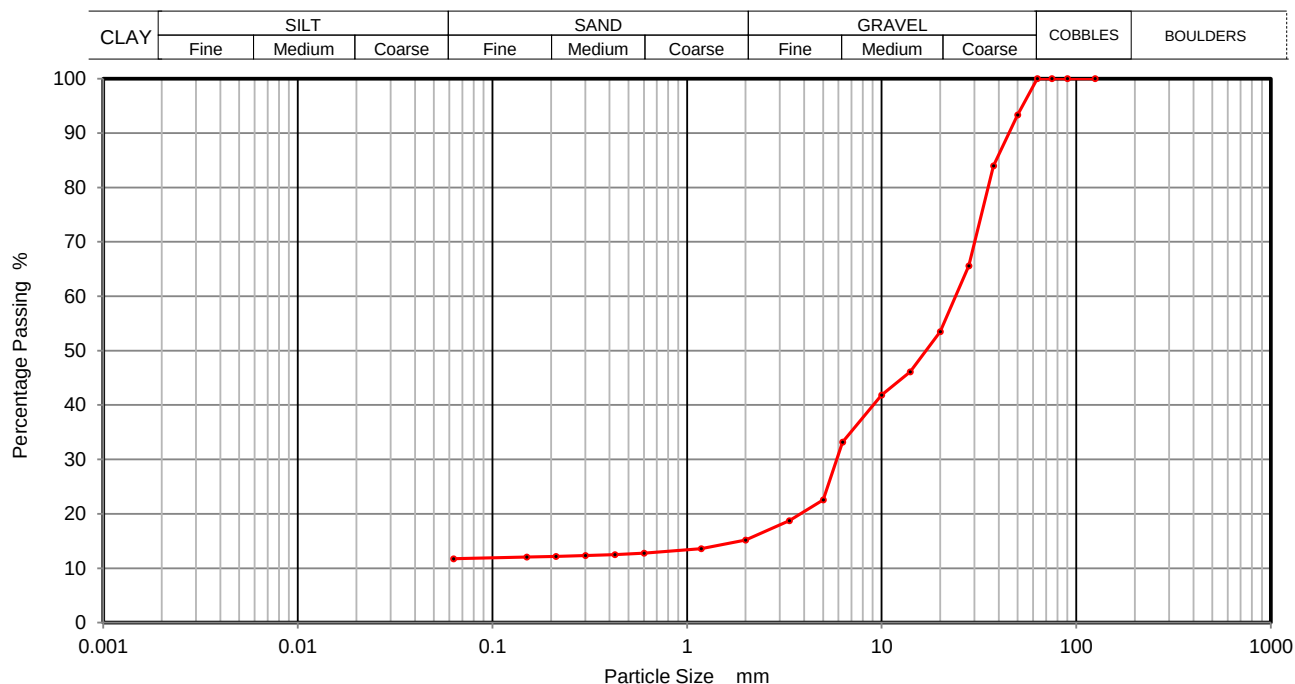
Soil Description Grey slightly sandy silty clayey fine to coarse GRAVEL

Depth Top 2.00

Depth Base 2.50

Date Tested 07/02/2022

Sample Type LB





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP24

Site Name GCRE

Sample No. 3

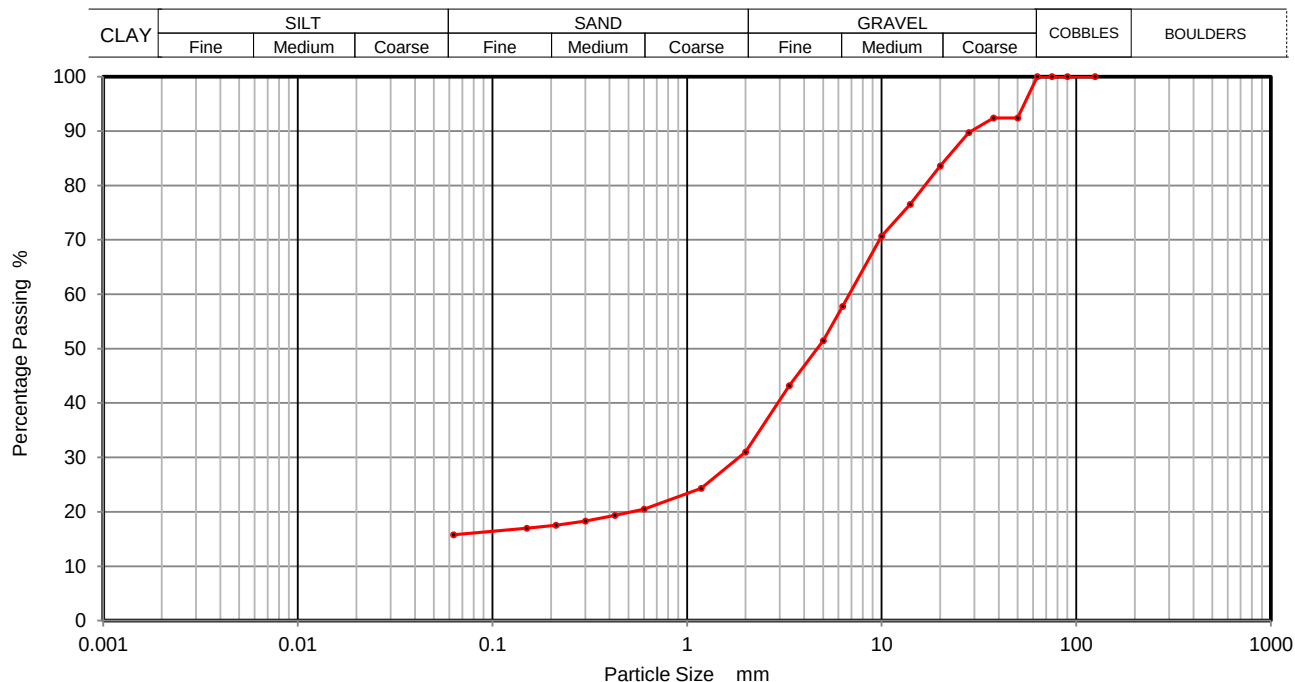
Soil Description Brown fine to coarse sandy silty clayey fine to coarse GRAVEL

Depth Top 1.00

Depth Base 1.50

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	92		
37.5	92		
28	90		
20	84		
14	77		
10	71		
6.3	58		
5	51		
3.35	43		
2	31		
1.18	24		
0.6	20		
0.425	19		
0.3	18		
0.212	18		
0.15	17		
0.063	16		

Sample Proportions	% dry mass
Cobbles	0
Gravel	69
Sand	15
Silt and Clay	16

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP25

Site Name GCRE

Sample No. 5

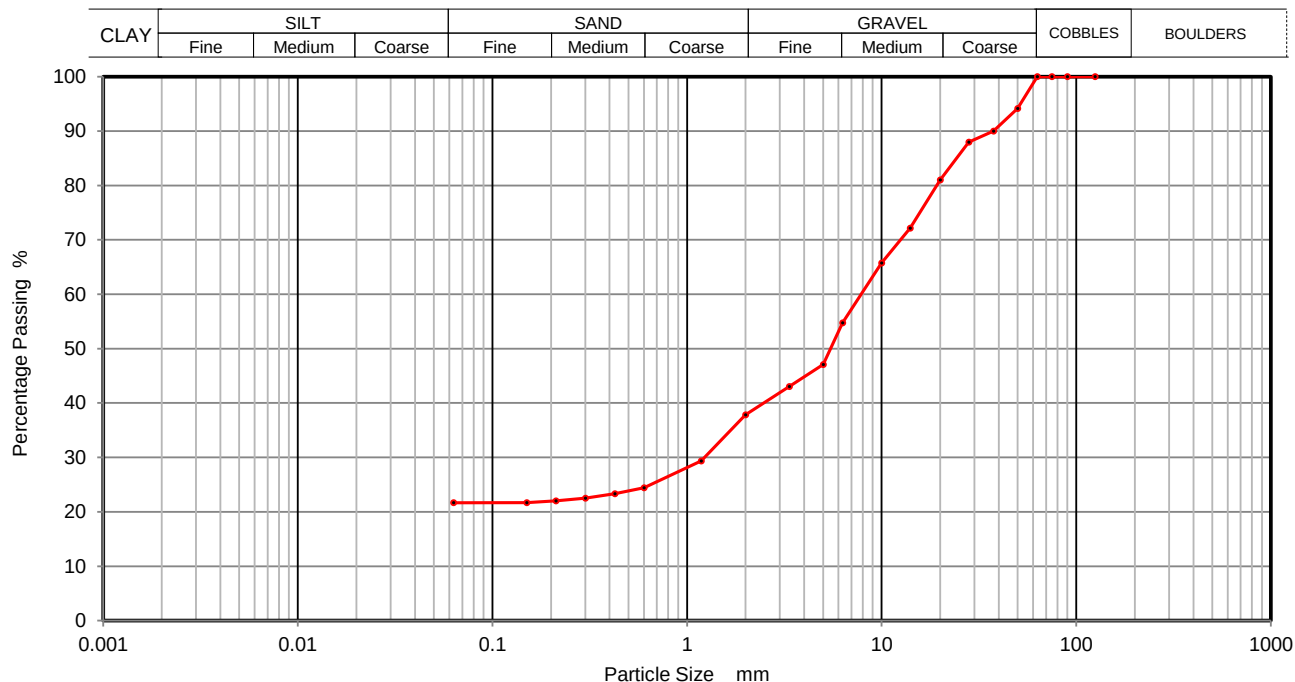
Soil Description Grey fine to coarse sandy silty clayey fine to coarse GRAVEL

Depth Top 2.50

Depth Base 3.00

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	90		
28	88		
20	81		
14	72		
10	66		
6.3	55		
5	47		
3.35	43		
2	38		
1.18	29		
0.6	24		
0.425	23		
0.3	23		
0.212	22		
0.15	22		
0.063	22		

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	16
Silt and Clay	22

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	09/02/2022	Richard John	
David	Approved	10/02/2022	Paul Evans	



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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP26

Site Name GCRE

Sample No. 5

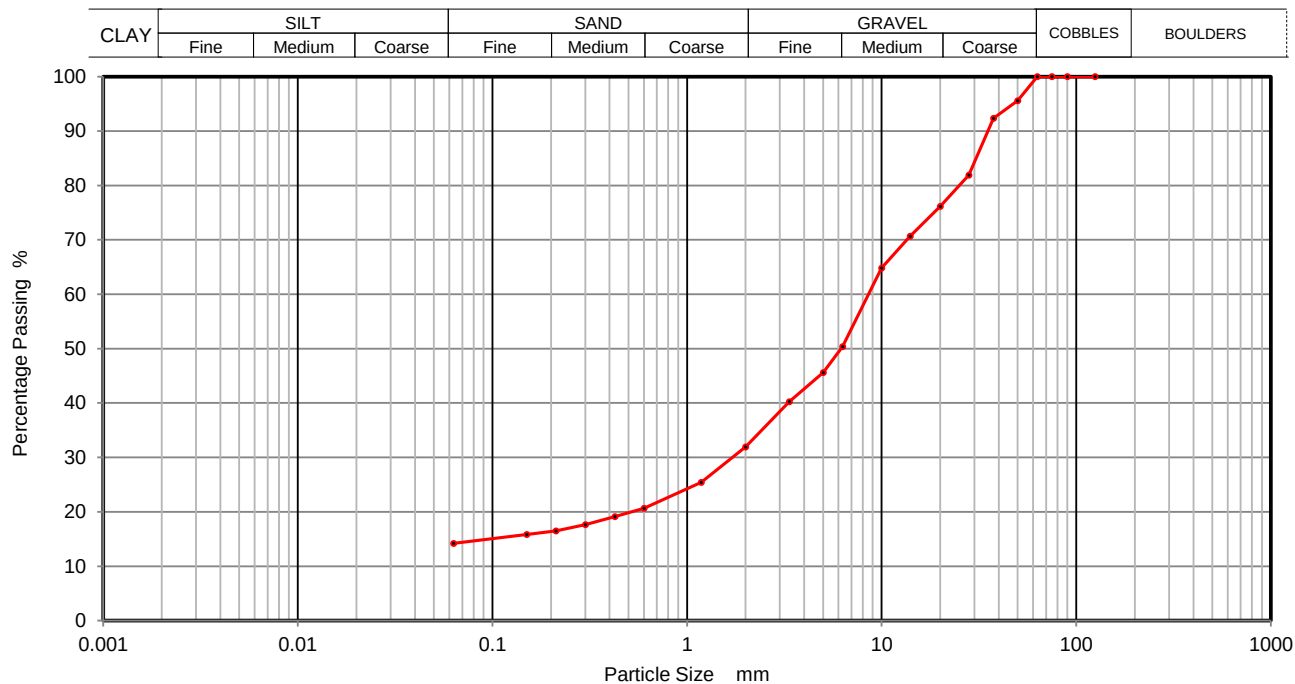
Soil Description Brown silty clayey fine to coarse sandy fine to coarse GRAVEL

Depth Top 1.50

Depth Base 2.00

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	92		
28	82		
20	76		
14	71		
10	65		
6.3	50		
5	46		
3.35	40		
2	32		
1.18	25		
0.6	21		
0.425	19		
0.3	18		
0.212	17		
0.15	16		
0.063	14		

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	18
Silt and Clay	14

Remarks

Preparation and testing in accordance with BS1377 unless noted below

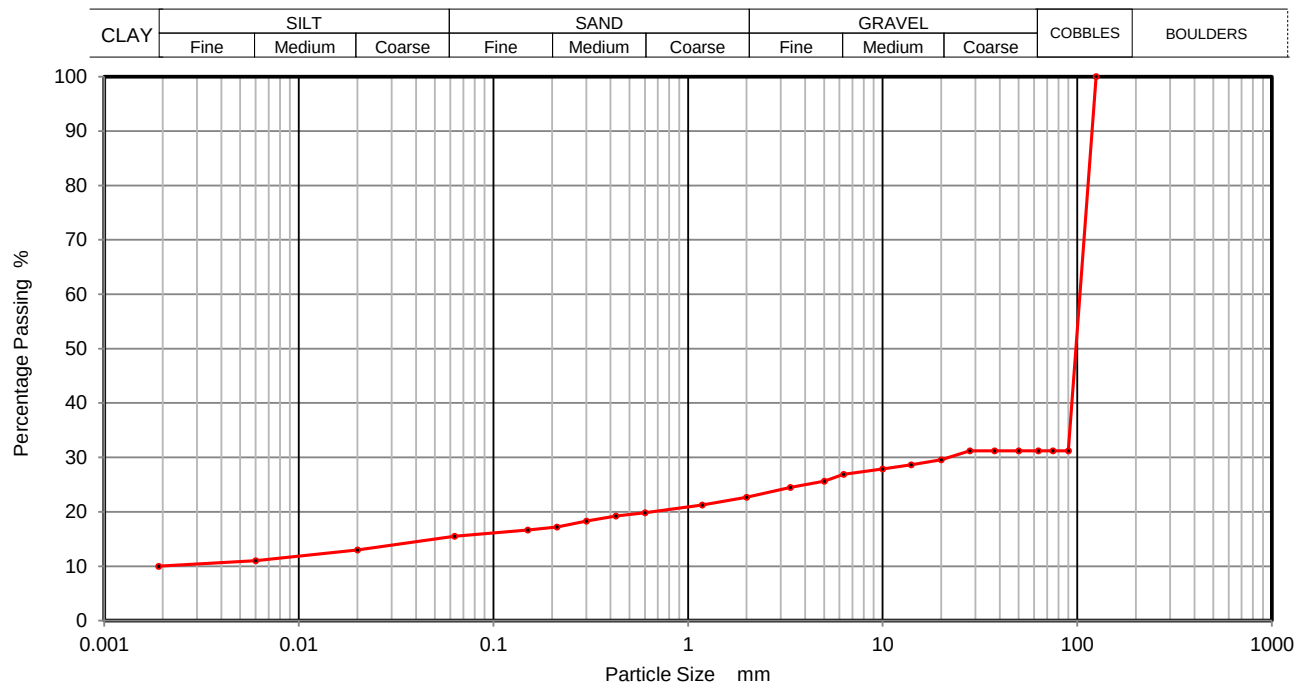
Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57649
	Borehole/Pit No. TP27
Site Name	GCRE
Soil Description	Depth Top 1.50
	Depth Base 2.00
Date Tested	07/02/2022
Sample No.	8
Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	13
90	31	0.0060	11
75	31	0.0020	10
63	31		
50	31		
37.5	31		
28	31		
20	30		
14	29		
10	28		
6.3	27		
5	26		
3.35	24		
2	23		
1.18	21		
0.6	20		
0.425	19		
0.3	18		
0.212	17		
0.15	17		
0.063	16		

Sample Proportions	% dry mass
Cobbles	69
Gravel	8
Sand	7
Silt	6
Clay	10

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	09/02/2022	Richard John	
David	Approved	10/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP29

Site Name GCRE

Sample No. 2

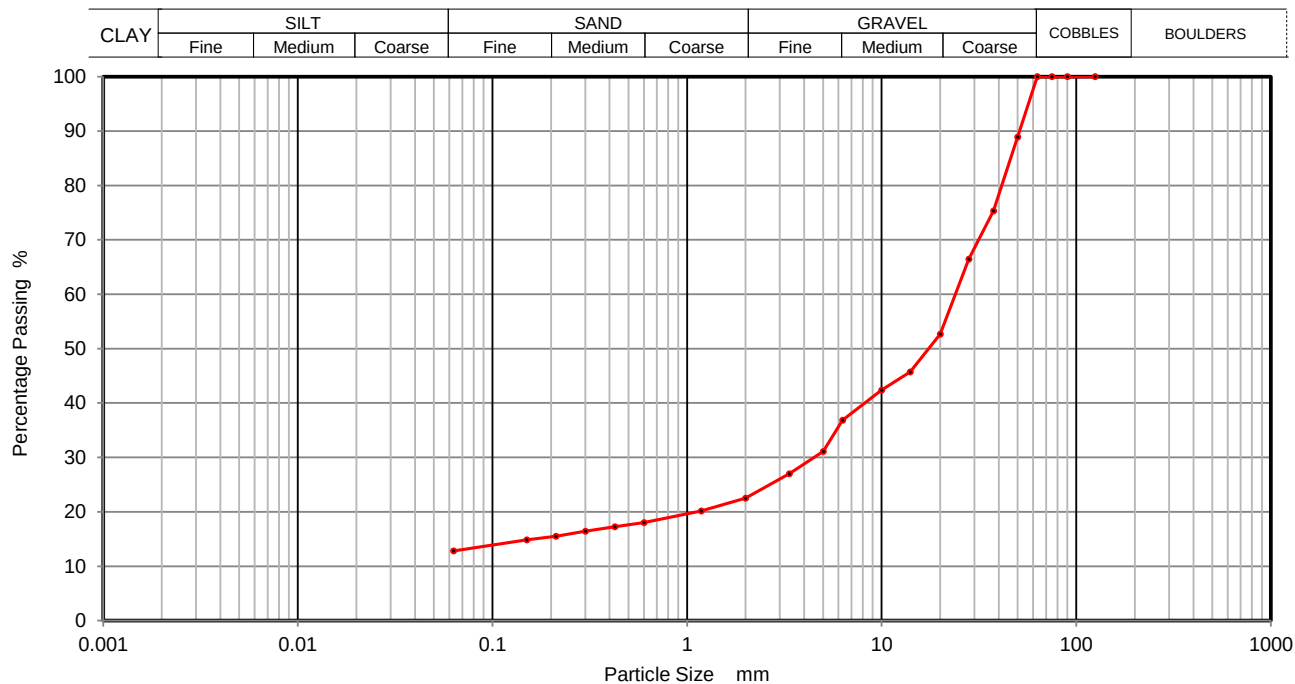
Soil Description Grey slightly sandy silty clayey fine to coarse GRAVEL

Depth Top 1.50

Depth Base 2.00

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	89		
37.5	75		
28	66		
20	53		
14	46		
10	42		
6.3	37		
5	31		
3.35	27		
2	23		
1.18	20		
0.6	18		
0.425	17		
0.3	16		
0.212	15		
0.15	15		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	10
Silt and Clay	13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	

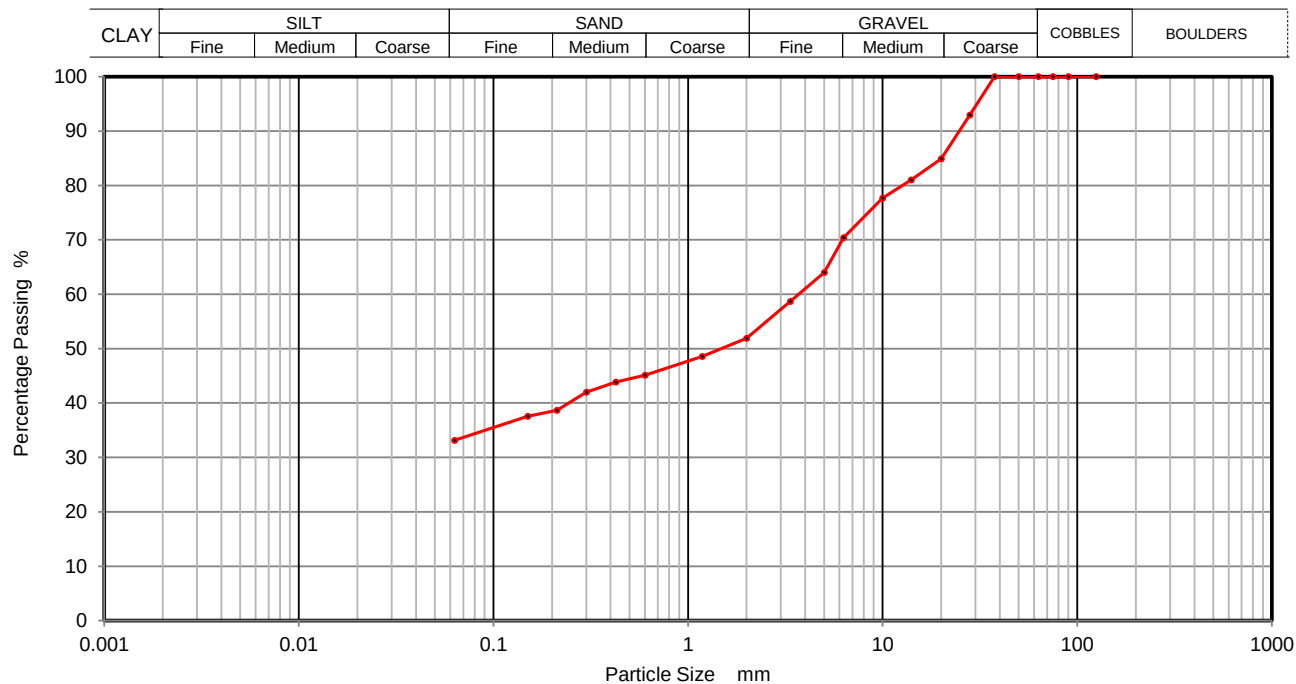


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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	57649
		Borehole/Pit No.	TP30
Site Name	GCRE	Sample No.	5
Soil Description	Grey/brown fine to coarse sandy silty clayey fine to coarse GRAVEL	Depth Top	2.00
		Depth Base	2.50
Date Tested	07/02/2022	Sample Type	LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	85		
14	81		
10	78		
6.3	70		
5	64		
3.35	59		
2	52		
1.18	49		
0.6	45		
0.425	44		
0.3	42		
0.212	39		
0.15	38		
0.063	33		

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	19
Silt and Clay	33

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	

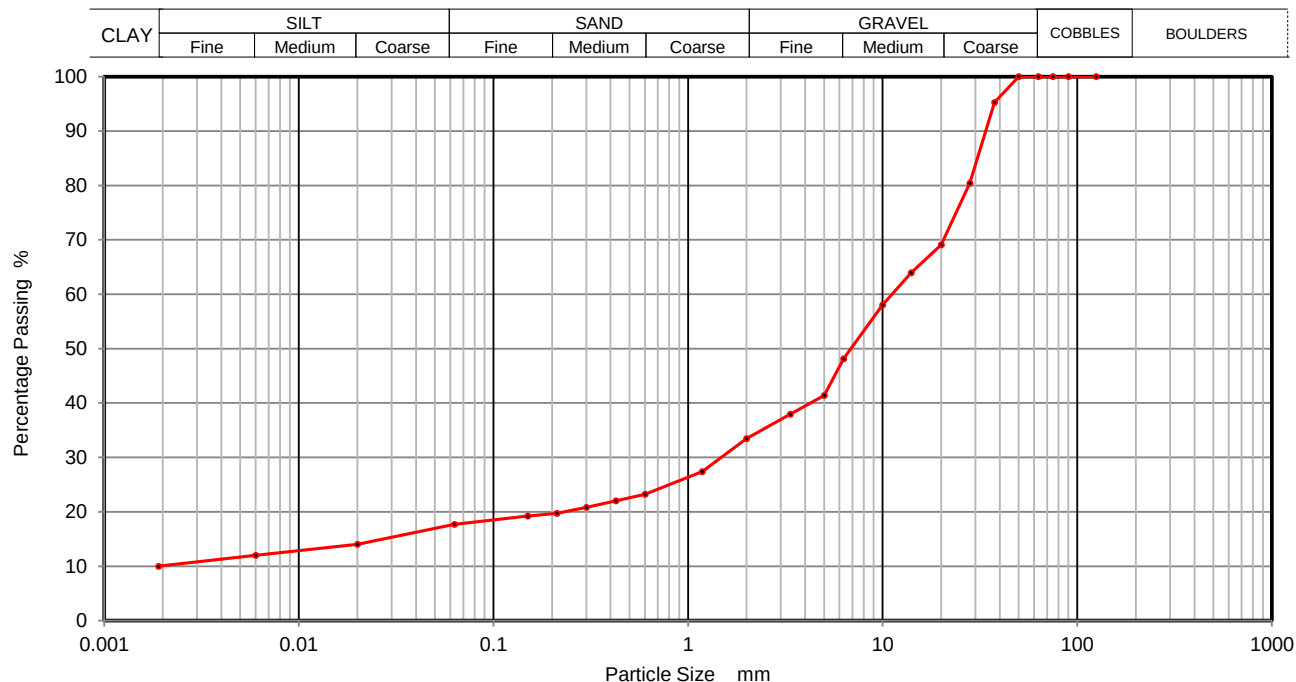


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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57649
	Borehole/Pit No.
TP31	Sample No.
3	Depth Top
1.50	Depth Base
2.00	Sample Type
LB	Date Tested
07/02/2022	Site Name
GCRE	Soil Description
Grey slightly silty clayey fine to coarse sandy fine to coarse GRAVEL	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	14
90	100	0.0060	12
75	100	0.0020	10
63	100		
50	100		
37.5	95		
28	80		
20	69		
14	64		
10	58		
6.3	48		
5	41		
3.35	38		
2	33		
1.18	27		
0.6	23		
0.425	22		
0.3	21		
0.212	20		
0.15	19		
0.063	18		

Sample Proportions	% dry mass
Cobbles	0
Gravel	67
Sand	15
Silt	8
Clay	10

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	09/02/2022	Richard John	
David	Approved	10/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP32

Site Name GCRE

Sample No. 4

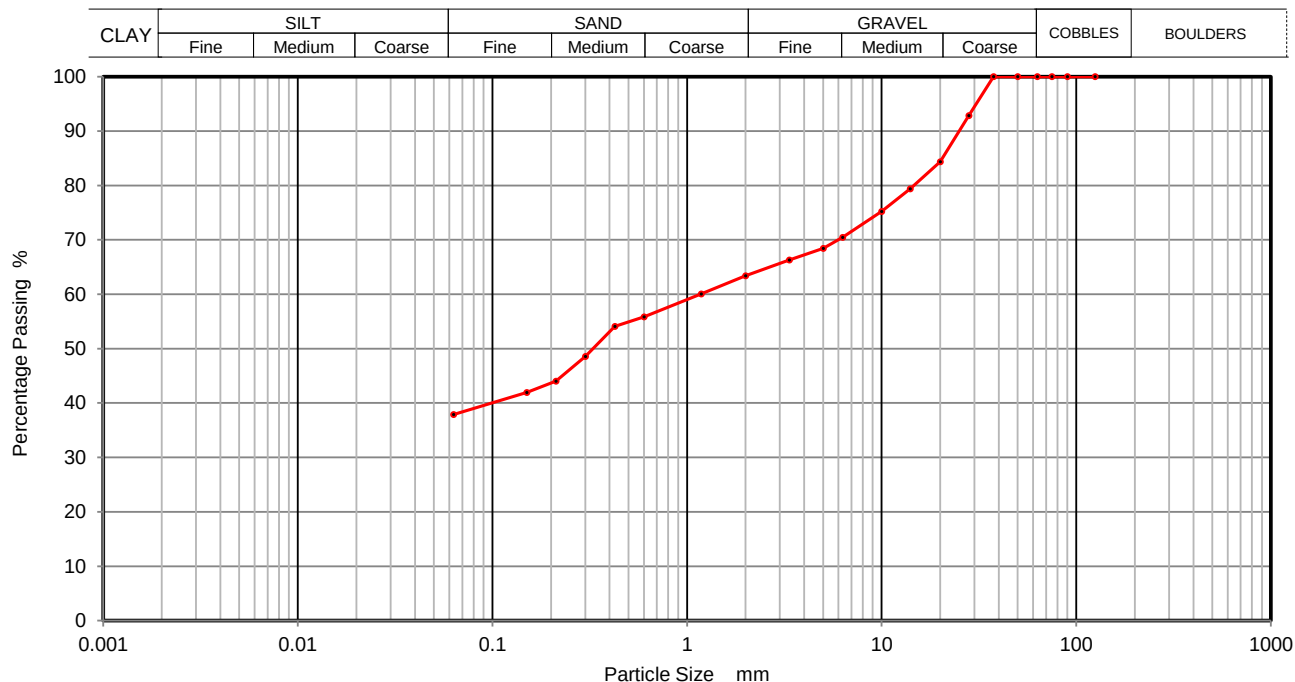
Soil Description Brown fine to coarse sandy fine to coarse gravelly SILT/CLAY

Depth Top 2.00

Depth Base 2.50

Date Tested 07/02/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	84		
14	79		
10	75		
6.3	70		
5	68		
3.35	66		
2	63		
1.18	60		
0.6	56		
0.425	54		
0.3	49		
0.212	44		
0.15	42		
0.063	38		

Sample Proportions	% dry mass
Cobbles	0
Gravel	37
Sand	25
Silt and Clay	38

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	

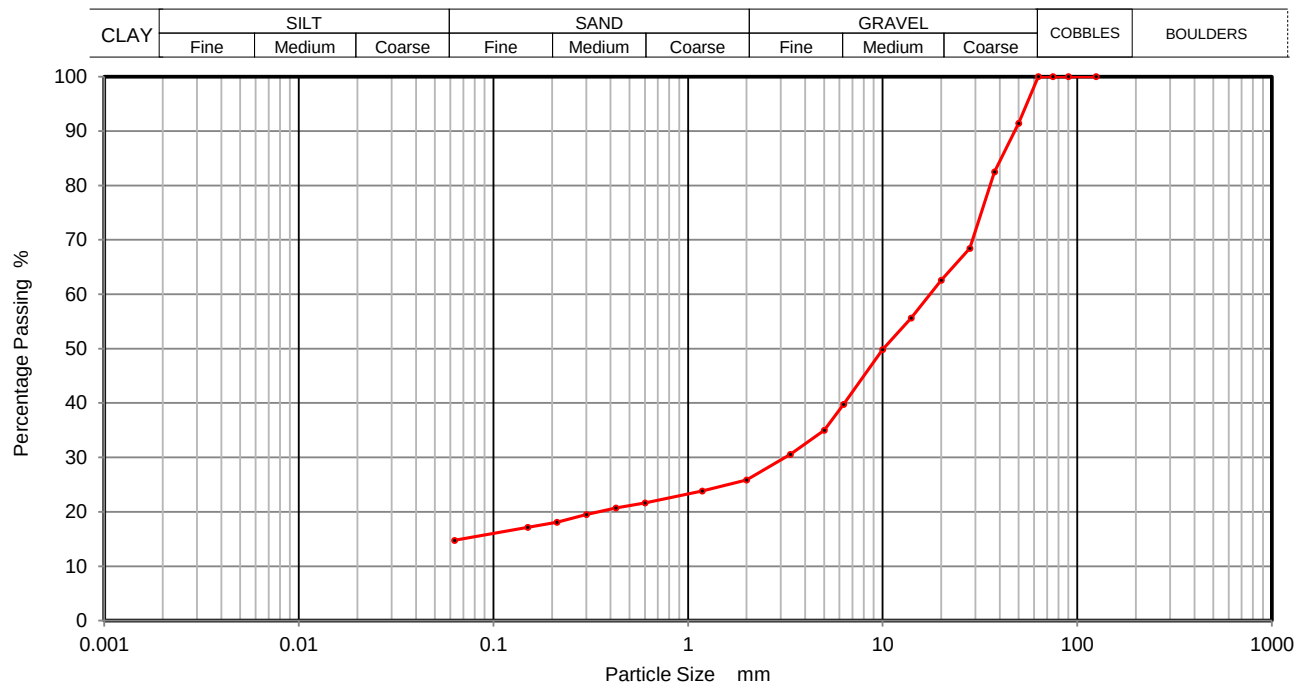


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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	57649
		Borehole/Pit No.	TP33
Site Name	GCRE	Sample No.	2
Soil Description	Grey fine to coarse sandy silty clayey fine to coarse GRAVEL	Depth Top	0.50
		Depth Base	
Date Tested	07/02/2022	Sample Type	LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	91		
37.5	82		
28	68		
20	63		
14	56		
10	50		
6.3	40		
5	35		
3.35	31		
2	26		
1.18	24		
0.6	22		
0.425	21		
0.3	20		
0.212	18		
0.15	17		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	74
Sand	11
Silt and Clay	15

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	

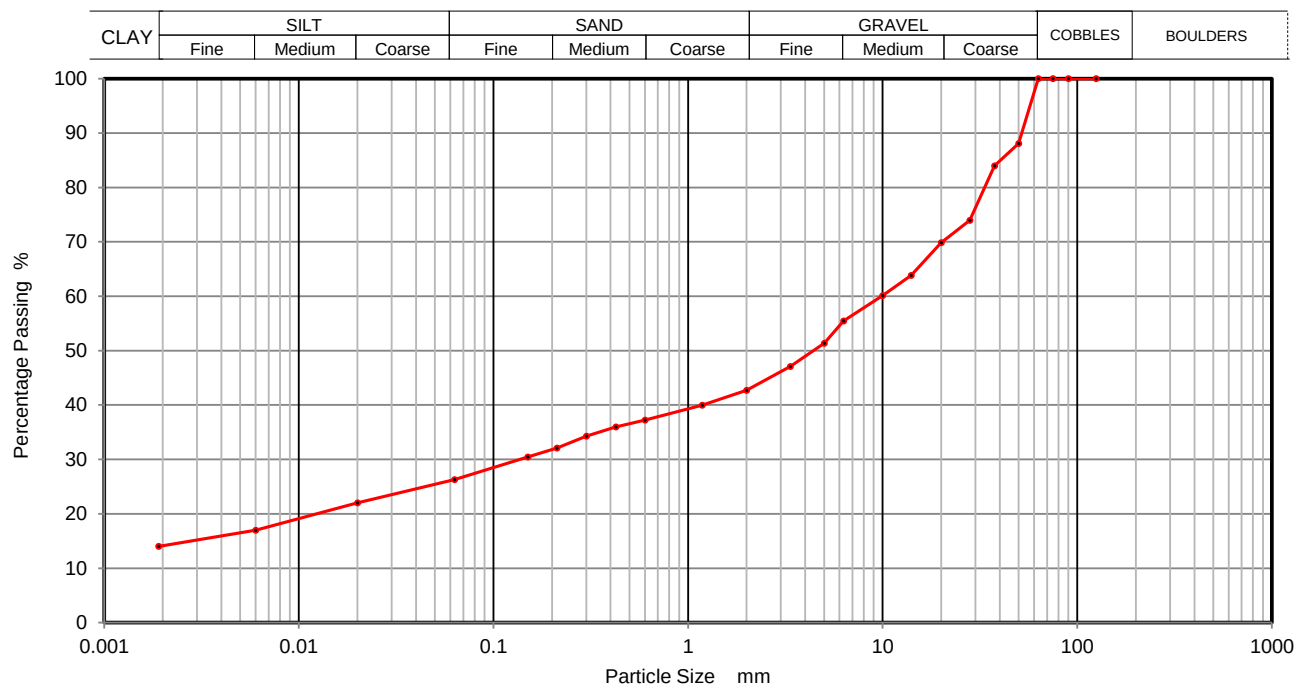


2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	57649
		Borehole/Pit No.	TP33
Site Name	GCRE	Sample No.	3
Soil Description	Brown silty clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.50
		Depth Base	2.00
Date Tested	07/02/2022	Sample Type	LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	22
90	100	0.0060	17
75	100	0.0020	14
63	100		
50	88		
37.5	84		
28	74		
20	70		
14	64		
10	60		
6.3	55		
5	51		
3.35	47		
2	43		
1.18	40		
0.6	37		
0.425	36		
0.3	34		
0.212	32		
0.15	30		
0.063	26		

Sample Proportions	% dry mass
Cobbles	0
Gravel	57
Sand	17
Silt	12
Clay	14

Remarks

Preparation and testing in accordance with BS1377 unless noted below

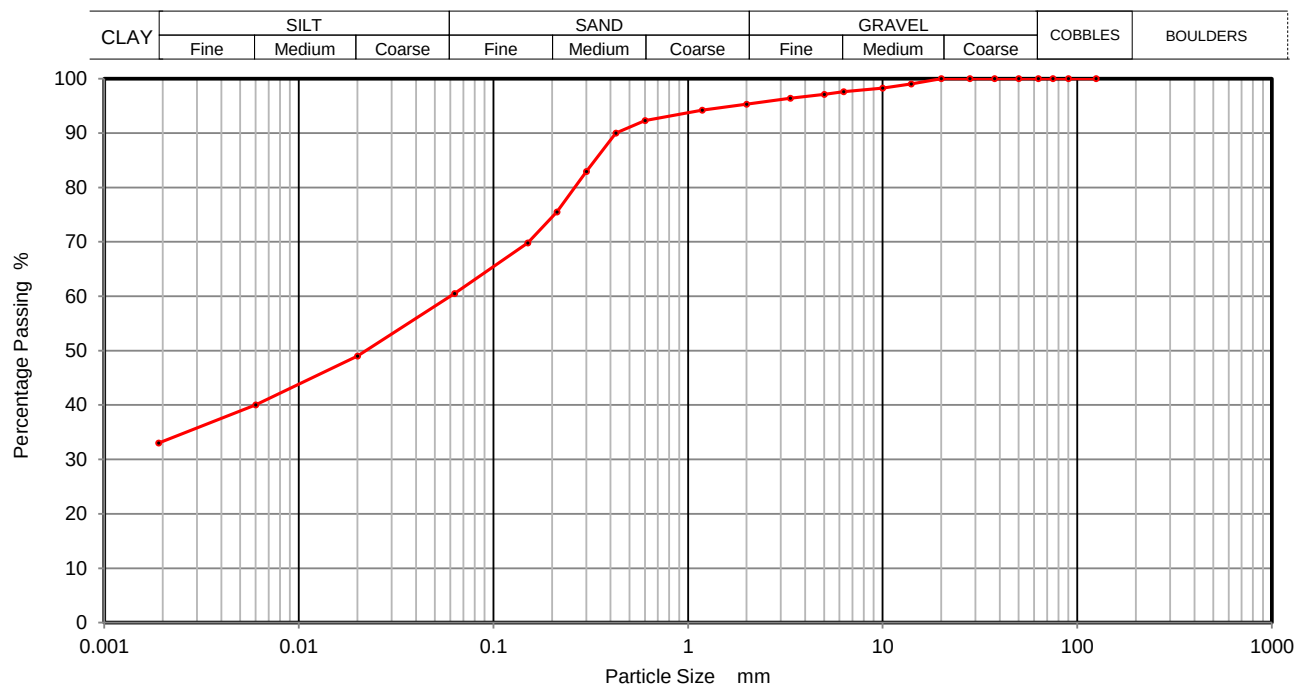
Operator	Checked	09/02/2022	Richard John	
David	Approved	10/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	57649
		Borehole/Pit No.	TP33
Site Name	GCRE	Sample No.	6
Soil Description	Brown slightly fine to coarse gravelly silty clayey fine to coarse SAND	Depth Top	2.80
		Depth Base	3.20
Date Tested	07/02/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	49
90	100	0.0060	40
75	100	0.0020	33
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	98		
6.3	98		
5	97		
3.35	96		
2	95		
1.18	94		
0.6	92		
0.425	90		
0.3	83		
0.212	76		
0.15	70		
0.063	61		

Sample Proportions	% dry mass
Cobbles	0
Gravel	5
Sand	34
Silt	28
Clay	33

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	09/02/2022	Richard John	
David	Approved	10/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57649

Borehole/Pit No. TP34

Site Name GCRE

Sample No. 4

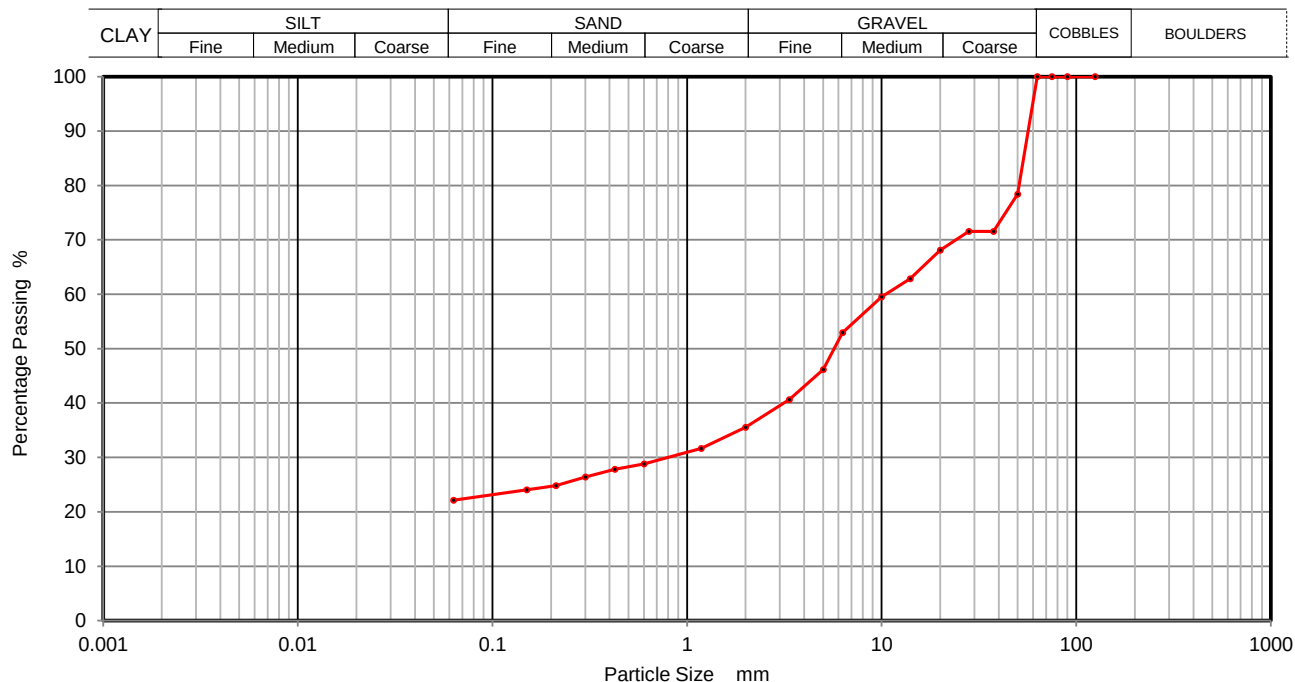
Soil Description Grey fine to coarse sandy silty clayey fine to coarse GRAVEL

Depth Top 2.50

Depth Base 3.00

Date Tested 07/02/2022

Sample Type LB



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	78		
37.5	72		
28	72		
20	68		
14	63		
10	60		
6.3	53		
5	46		
3.35	41		
2	36		
1.18	32		
0.6	29		
0.425	28		
0.3	26		
0.212	25		
0.15	24		
0.063	22		

Sample Proportions	% dry mass
Cobbles	0
Gravel	64
Sand	14
Silt and Clay	22

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	08/02/2022	Richard John	
David	Approved	09/02/2022	Paul Evans	



Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 57649

Borehole / Pit No TP10

Project Location GCRE

Sample No 5

Date Tested 31/01/2022

Depth Top 2.00

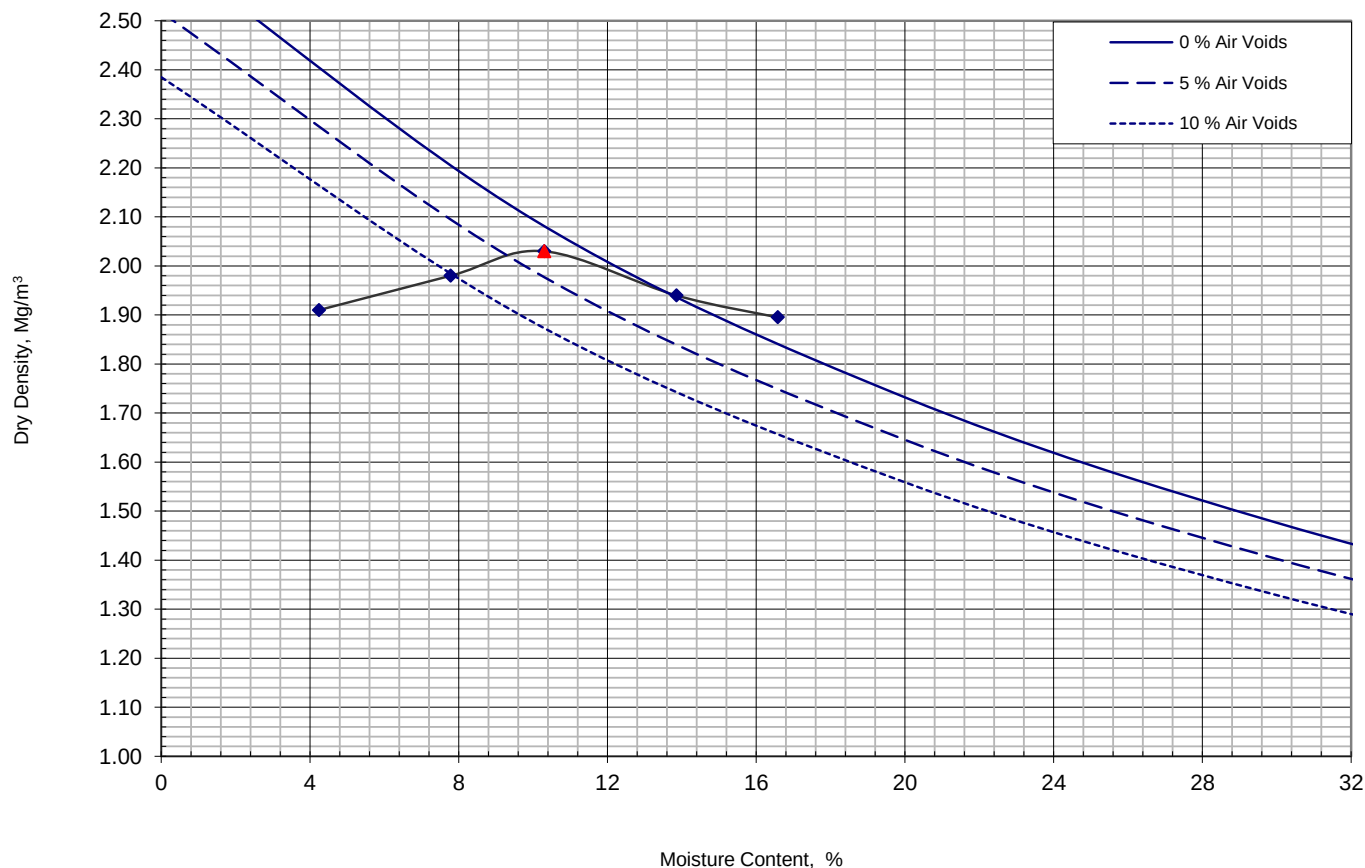
Compaction Method 4.5 Kg Rammer

Depth Base 2.50

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type LB

Sample Description Grey/brown silty fine to coarse gravelly CLAY



Compaction Point	1	2	3	4	5						
Moisture Content	4.2	7.8	10	14	17						
Bulk Density	1.99	2.13	2.24	2.21	2.21						
Dry Density	1.91	1.98	2.03	1.94	1.90						

Initial Moisture Content	14	%
Maximum Dry Density	2.03	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	0	%

Operator Checked 09/02/2022 Richard John

Chris G Approved 10/02/2022 Paul Evans

Richard John

Chris G

Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 57649

Borehole / Pit No TP19

Project Location GCRE

Sample No 4

Date Tested 01/05/2019

Depth Top 1.50

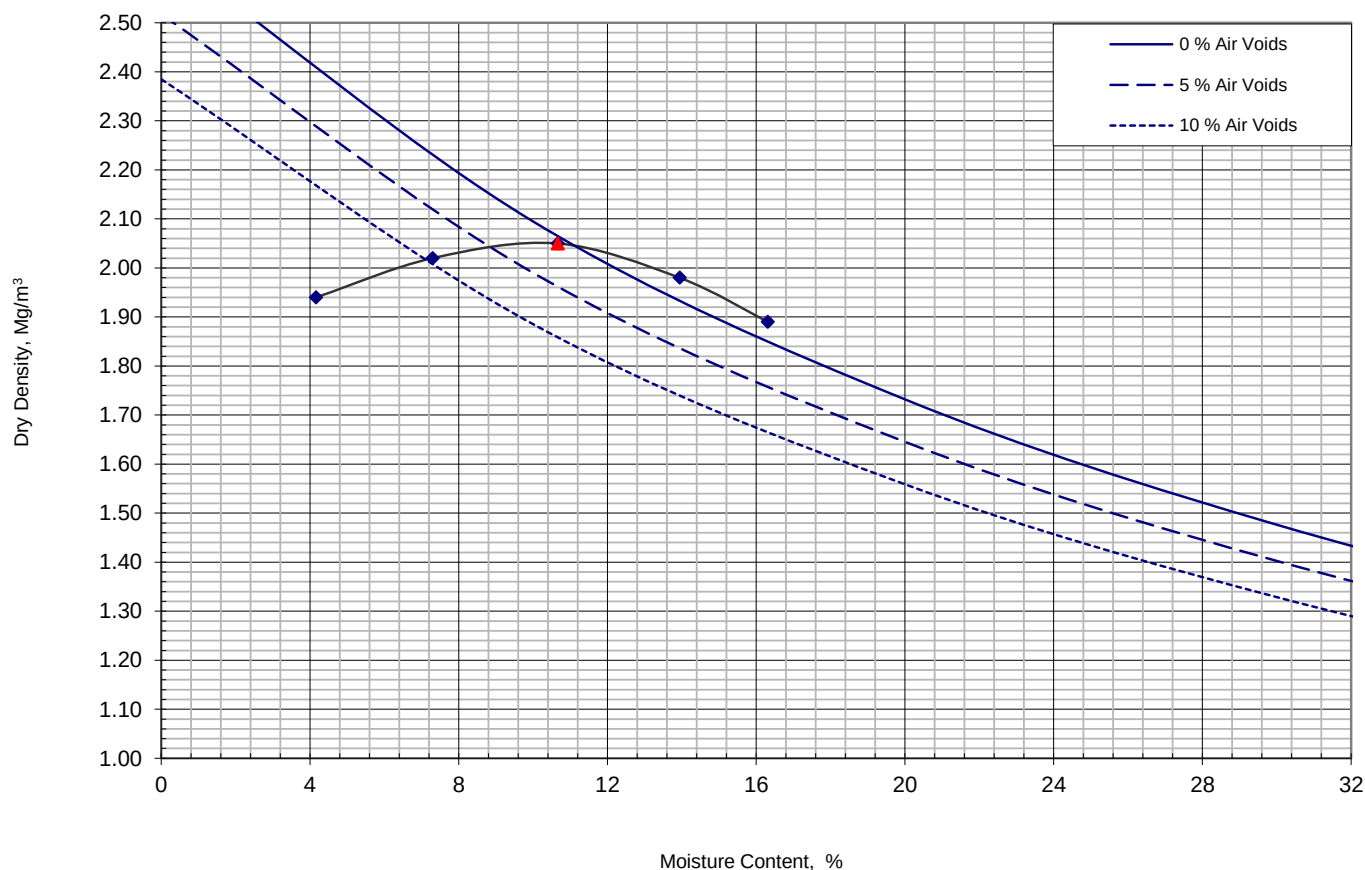
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description Brown slightly silty clayey fine to coarse sandy fine to coarse GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	4.2	7.3	11	14	16						
Bulk Density	2.02	2.17	2.27	2.26	2.20						
Dry Density	1.94	2.02	2.05	1.98	1.89						

Initial Moisture Content	16	%
Maximum Dry Density	2.05	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	28	%
Material Retained 20mm	16	%

Operator Checked 09/02/2022 Richard John

Chris G Approved 10/02/2022 Paul Evans

Richard John

Chris G

Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 57649

Borehole / Pit No TP20

Project Location GCRE

Sample No 4

Date Tested 31/01/2022

Depth Top 1.50

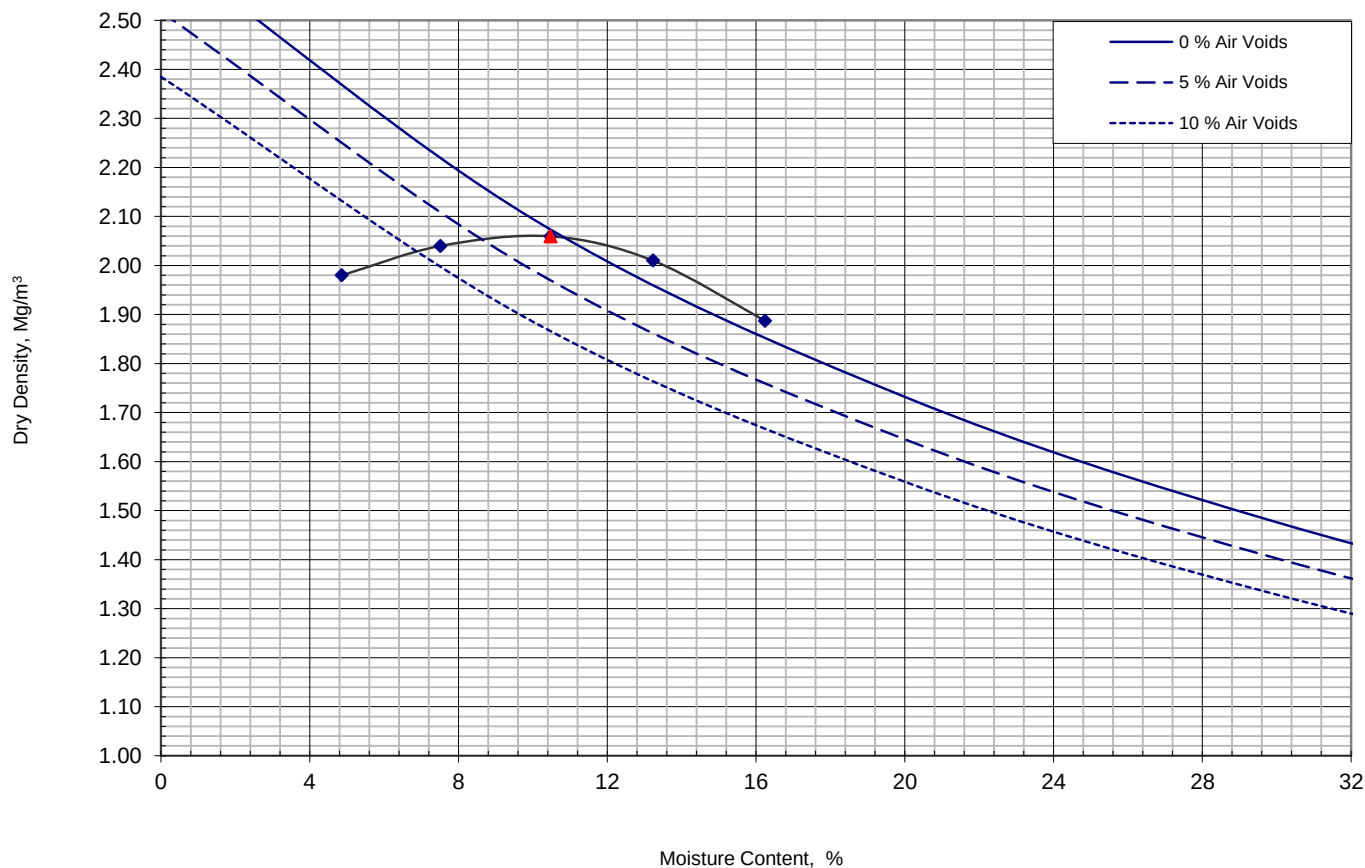
Compaction Method 4.5 Kg Rammer

Depth Base 2.00

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type LB

Sample Description Grey slightly silty clayey slightly sandy fine to coarse GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	4.9	7.5	10	13	16						
Bulk Density	2.08	2.19	2.28	2.28	2.19						
Dry Density	1.98	2.04	2.06	2.01	1.89						

Initial Moisture Content	16	%
Maximum Dry Density	2.06	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	39	%
Material Retained 20mm	22	%

Operator Checked 09/02/2022 Richard John

Chris G Approved 10/02/2022 Paul Evans

Richard John

Chris G



**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number 57649

Borehole / Pit No TP21

Project Location GCRE

Sample No 4

Date Tested 31/01/2022

Depth Top 1.00

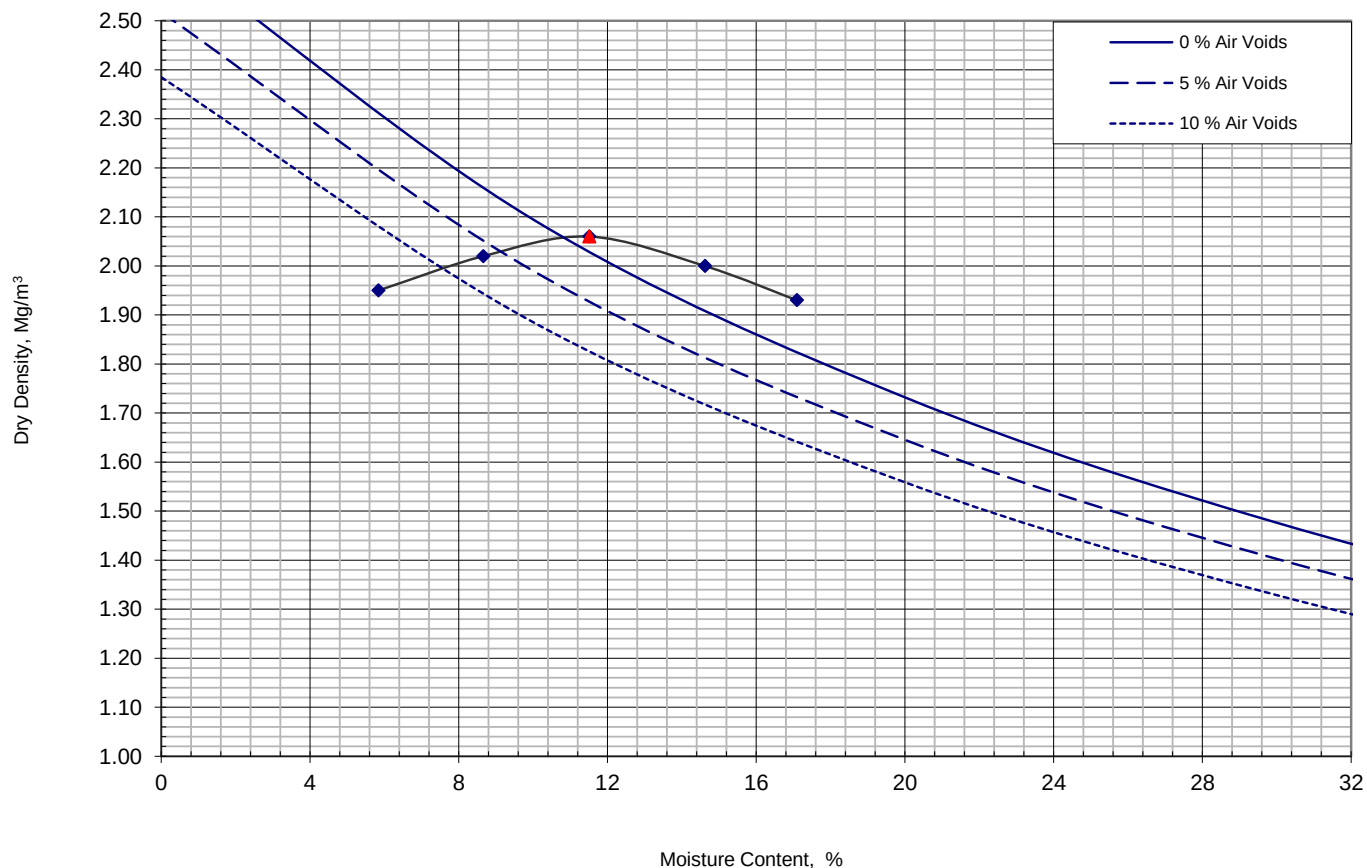
Compaction Method 4.5 Kg Rammer

Depth Base 1.50

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type LB

Sample Description Brown fine to coarse sandy silty clayey fine to coarse GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	5.8	8.7	12	15	17						
Bulk Density	2.06	2.19	2.30	2.29	2.26						
Dry Density	1.95	2.02	2.06	2.00	1.93						

Initial Moisture Content	15	%
Maximum Dry Density	2.06	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	14	%

Operator Checked 09/02/2022 Richard John

Chris G Approved 10/02/2022 Paul Evans

[Signatures]



Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 57649

Borehole / Pit No TP25

Project Location GCRE

Sample No 5

Date Tested 31/01/2022

Depth Top 2.50

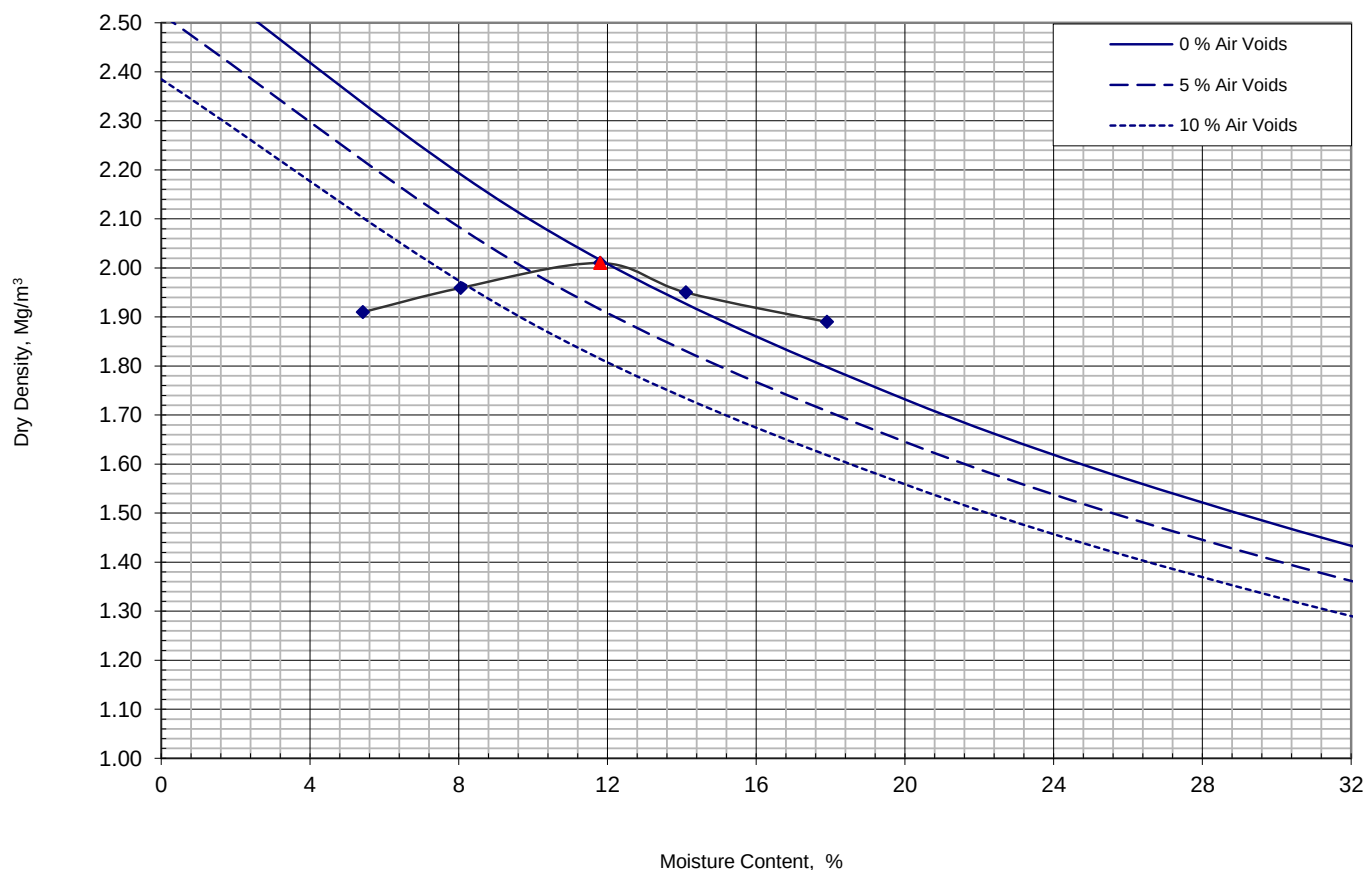
Compaction Method 4.5 Kg Rammer

Depth Base 3.00

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type LB

Sample Description Grey fine to coarse sandy silty clayey fine to coarse GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	5.4	8.1	12	14	18						
Bulk Density	2.01	2.12	2.25	2.23	2.23						
Dry Density	1.91	1.96	2.01	1.95	1.89						

Initial Moisture Content	12	%
Maximum Dry Density	2.01	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	10	%
Material Retained 20mm	9	%

Operator Checked 09/02/2022 Richard John

Chris G Approved 10/02/2022 Paul Evans

Richard John

Chris G

Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 57649

Borehole / Pit No TP26

Project Location GCRE

Sample No 5

Date Tested 31/01/2022

Depth Top 1.50

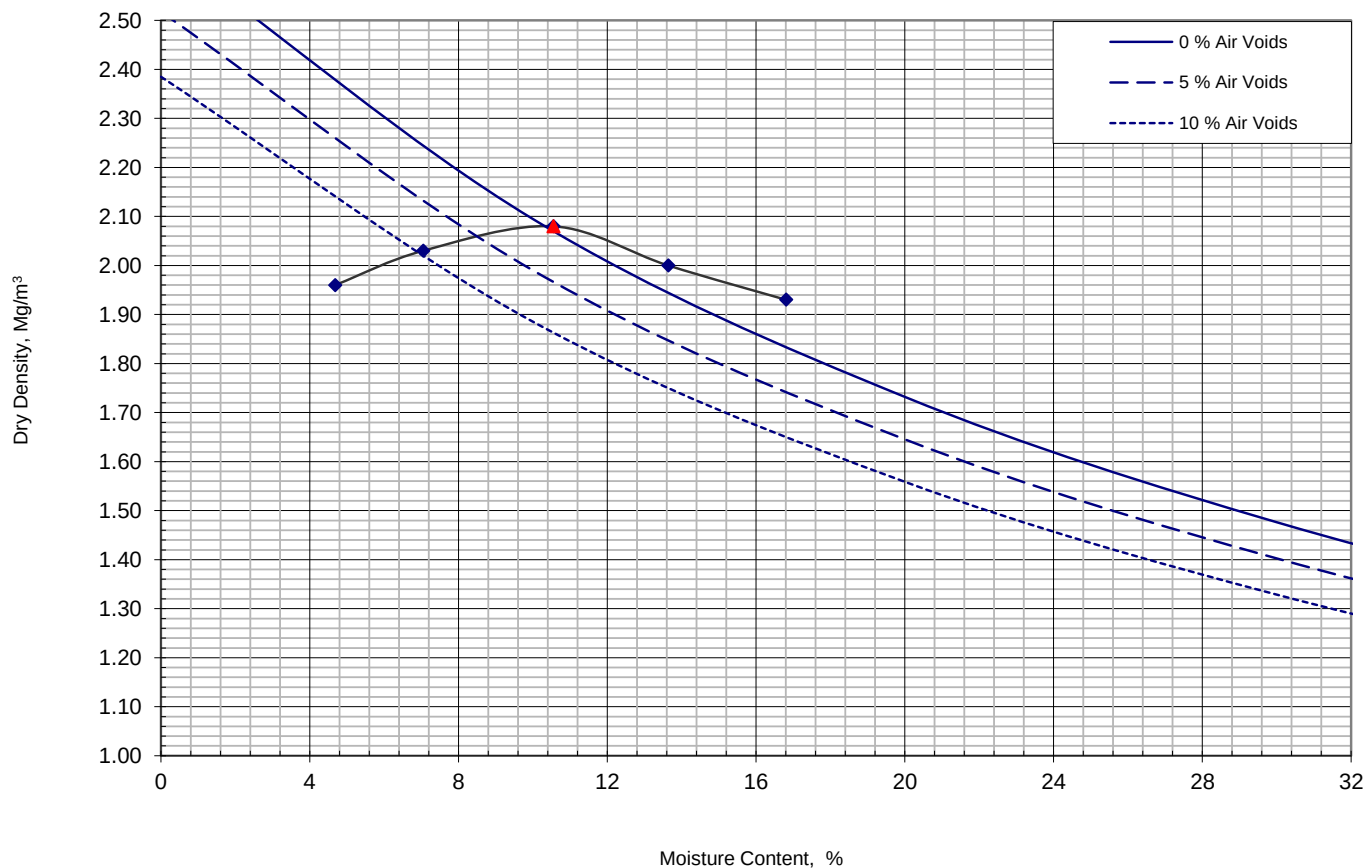
Compaction Method 4.5 Kg Rammer

Depth Base 2.00

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type LB

Sample Description Brown silty clayey fine to coarse sandy fine to coarse GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	4.7	7.1	11	14	17						
Bulk Density	2.05	2.17	2.30	2.27	2.25						
Dry Density	1.96	2.03	2.08	2.00	1.93						

Initial Moisture Content	14	%
Maximum Dry Density	2.08	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	8	%
Material Retained 20mm	16	%

Operator Checked 09/02/2022 Richard John

Chris G Approved 10/02/2022 Paul Evans

Richard John

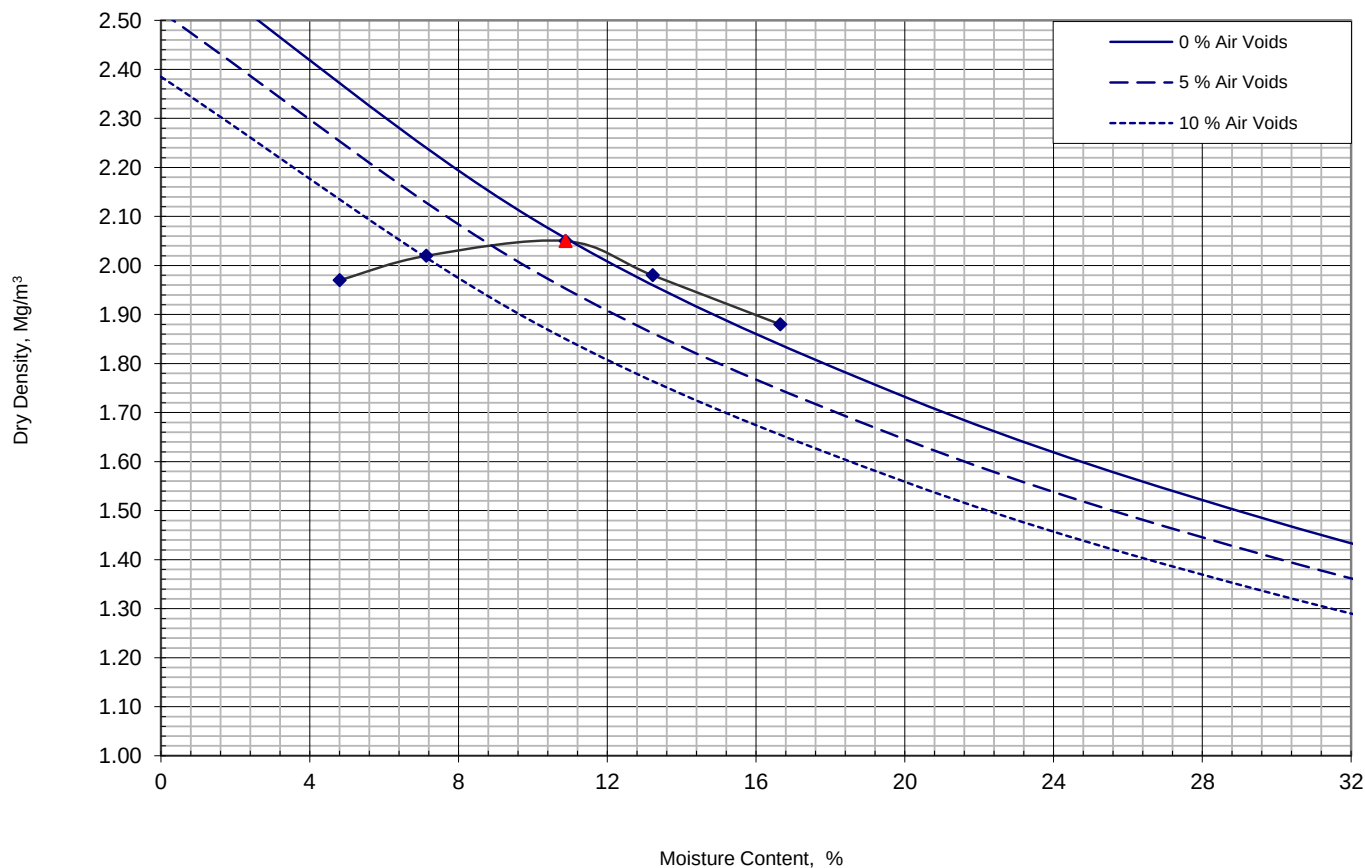
Chris G



**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	57649
Borehole / Pit No	TP34
Sample No	5
Depth Top	3.50
Depth Base	4.00
Sample Type	fine to coarse sandy fine

Project Location	GCRE
Date Tested	31/01/2022
Compaction Method	4.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.5
Sample Description	Dark grey/brown fine to coarse gravelly CLAY



Compaction Point	1	2	3	4	5						
Moisture Content	4.8	7.1	11	13	17						
Bulk Density	2.06	2.16	2.27	2.24	2.19						
Dry Density	1.97	2.02	2.05	1.98	1.88						

Initial Moisture Content	11	%
Maximum Dry Density	2.05	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	0	%

Operator	Checked	09/02/2022	Richard John	
Chris G	Approved	10/02/2022	Paul Evans	

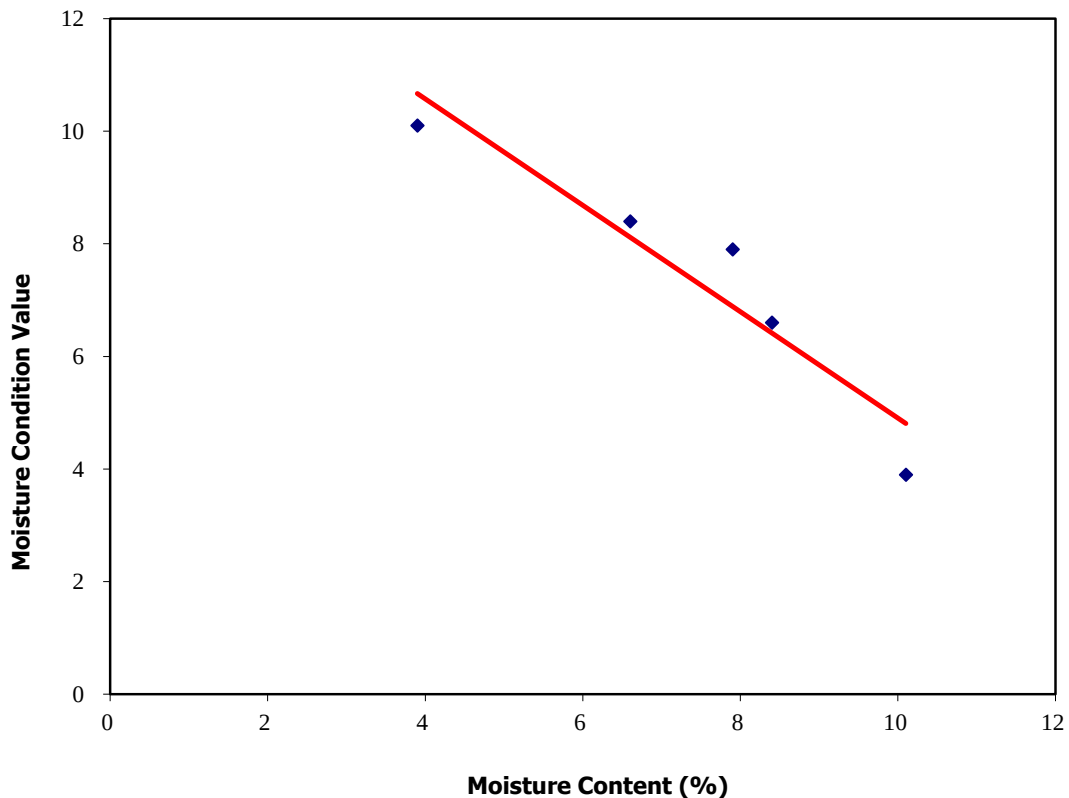


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP10
Sample Number: 5
Depth (m) : 2.00
Sample Type: LB
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	14
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	0



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	3.9	6.6	7.9	8.4	10
MCV	10.1	8.4	7.9	6.6	3.9

* reading unobtainable.



Checked by
Richard John
Date approved:

10/2/22

Approved by
Richard John

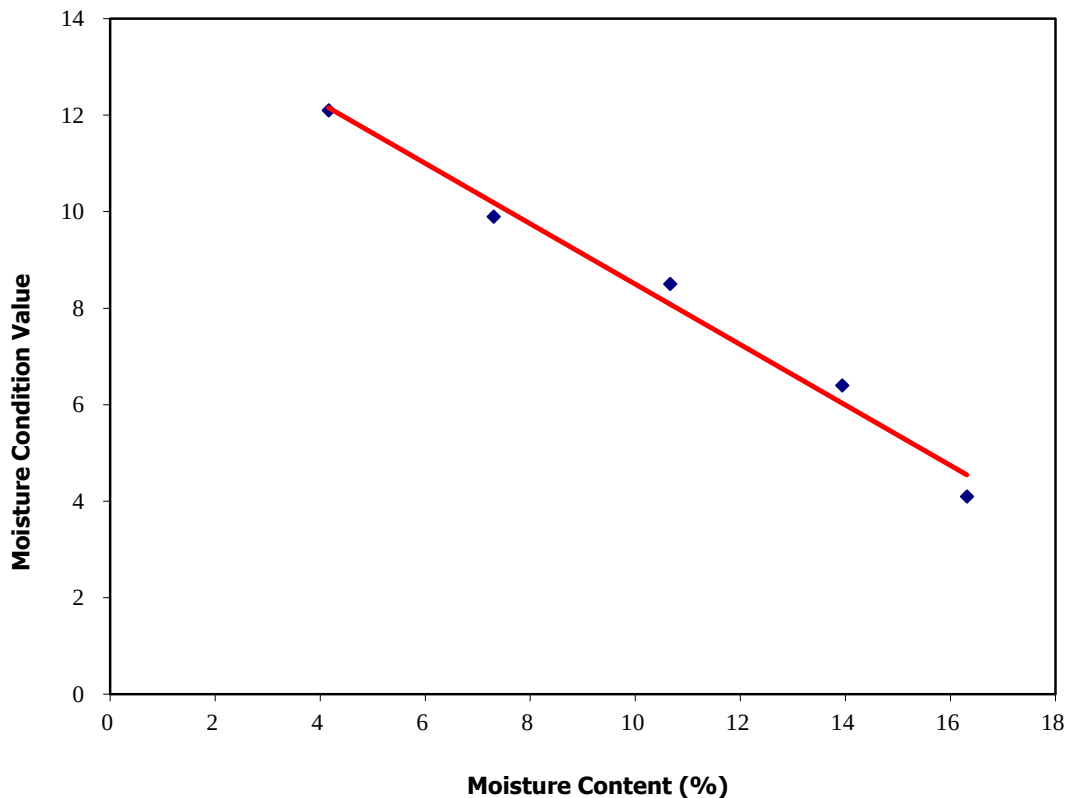


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP19
Sample Number: 4
Depth (m) : 1.50
Sample Type B
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	16
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	44



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	4.2	7.3	11	14	16
MCV	12.1	9.9	8.5	6.4	4.1

* reading unobtainable.



Checked by
Richard John
Date approved:

10/2/22

Approved by
Richard John

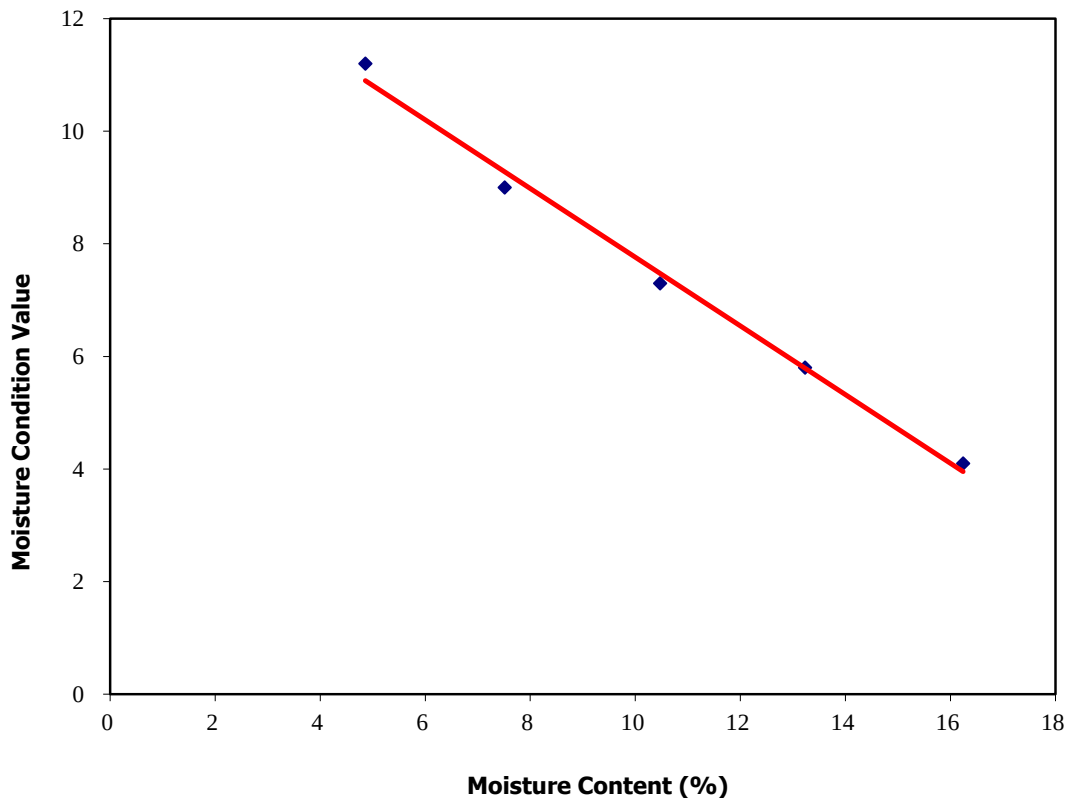


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP20
Sample Number: 4
Depth (m) : 1.50
Sample Type: LB
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	16
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	61



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	4.9	7.5	10	13	16
MCV	11.2	9.0	7.3	5.8	4.1

* reading unobtainable.



Checked by
Richard John
Date approved: 10/2/22


Approved by
Richard John

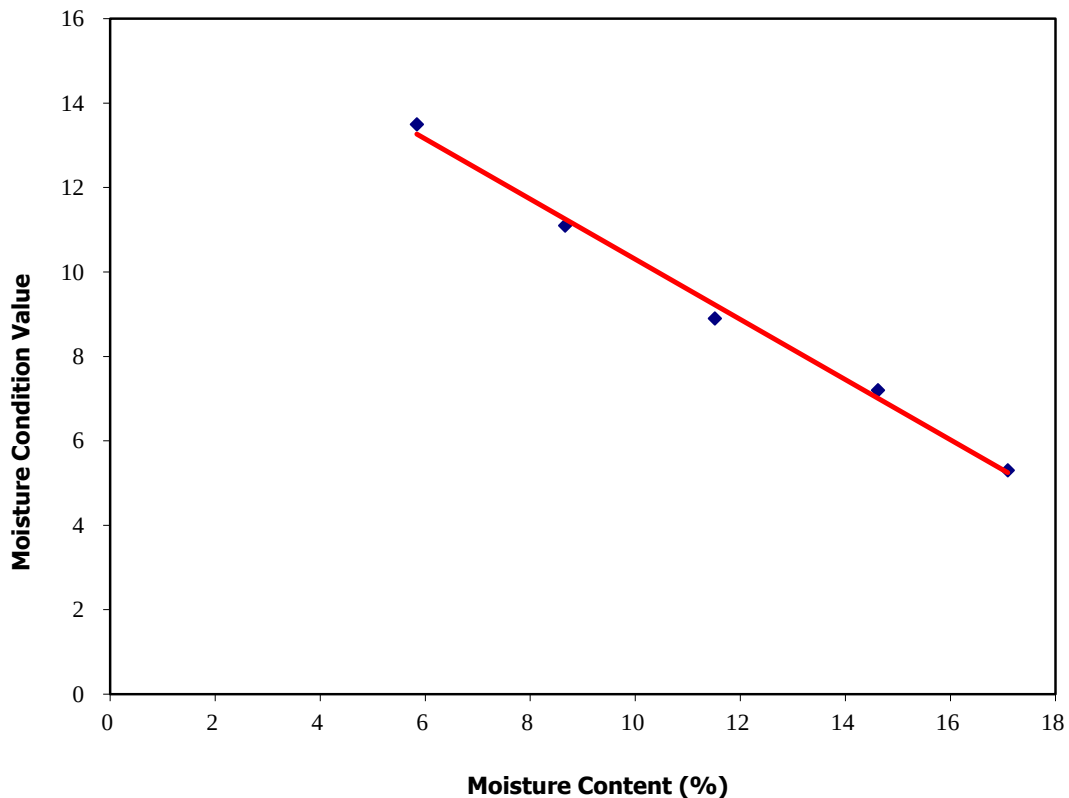


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP21
Sample Number: 4
Depth (m) : 1.00
Sample Type: LB
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	15
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	14



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	5.8	8.7	12	15	17
MCV	13.5	11.1	8.9	7.2	5.3

* reading unobtainable.



Checked by
Richard John
Date approved:

10/2/22

Approved by
Richard John

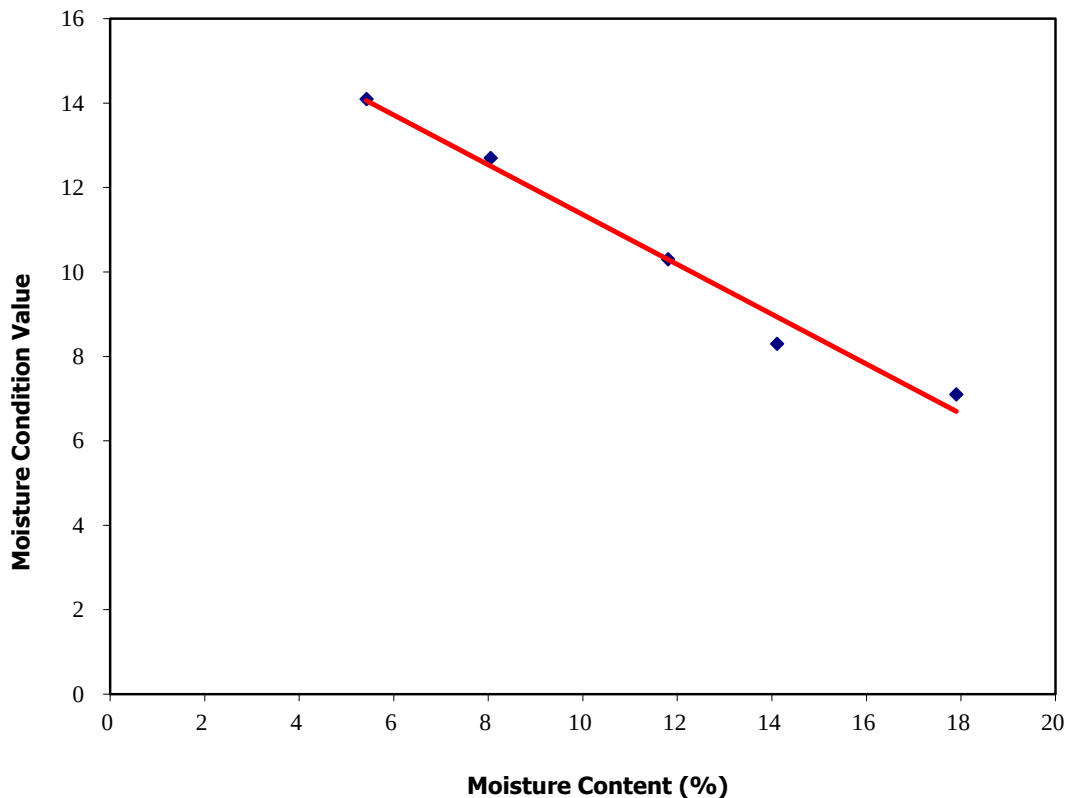


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP25
Sample Number: 5
Depth (m) : 2.50
Sample Type: LB
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	12
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	19



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	5.4	8.1	12	14	18
MCV	14.1	12.7	10.3	8.3	7.1

* reading unobtainable.



Checked by
Richard John
Date approved:

10/2/22


Approved by
Richard John

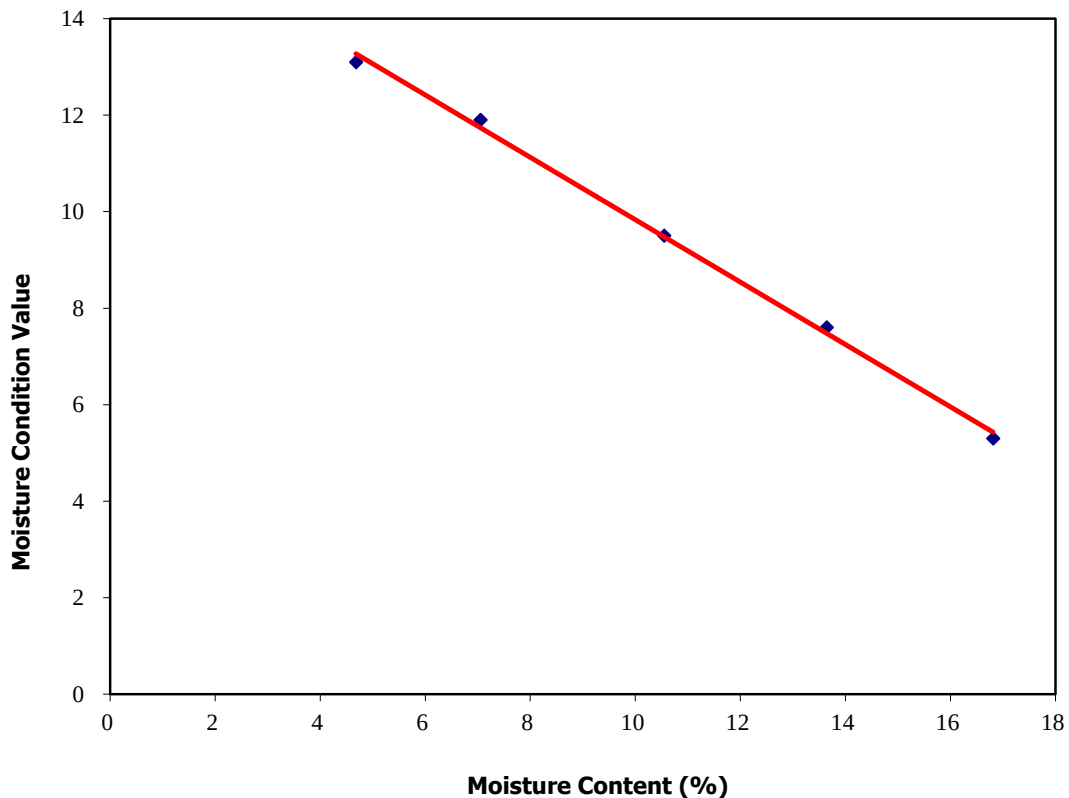


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP26
Sample Number: 5
Depth (m) : 1.50
Sample Type: LB
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	14
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	24



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	4.7	7.1	11	14	17
MCV	13.1	11.9	9.5	7.6	5.3

* reading unobtainable.



Checked by
Richard John
Date approved:

10/2/22

Approved by
Richard John

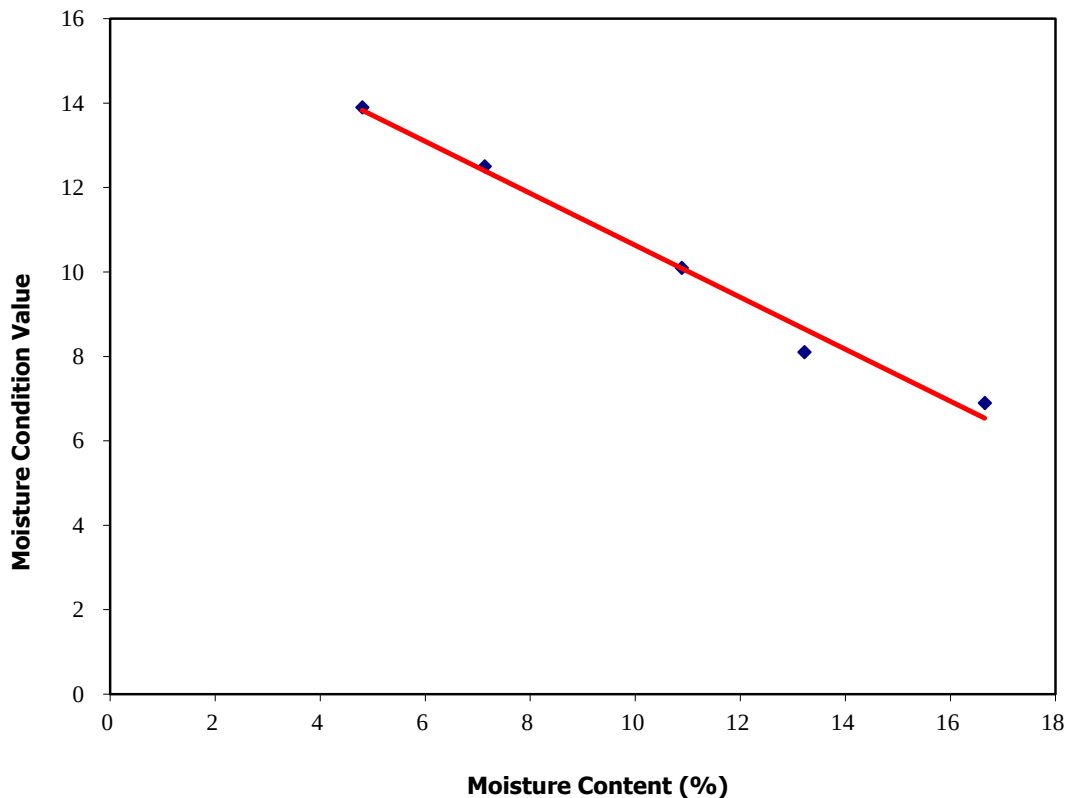


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57649
Hole Number: TP34
Sample Number: 5
Depth (m) : 3.50
Sample Type: B
Date Tested: 31/01/2022
Technician: Dan Hammond

Initial Moisture Content (%):	676
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	0



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	4.8	7.1	11	13	17
MCV	13.9	12.5	10.1	8.1	6.9

* reading unobtainable.



Checked by
Richard John
Date approved:

10/2/22

Approved by
Richard John





ANALYTICAL TEST REPORT

Contract no: 105141

Contract name: GCRE

Client reference: Q0652

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 28 January 2022

Analysis started: 28 January 2022

Analysis completed: 04 February 2022

Report issued: 04 February 2022

Key

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

Approved by:

Megan Harris

Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			105141-1	105141-2	105141-3	105141-4	105141-5	105141-6
Sample id			BH32	TP10	TP11	TP19	TP20	TP20
Depth (m)			2.00-2.50	1.00-1.50	0.50-1.00	1.50	1.50-2.00	3.50-4.00
Sample Type			B8	B4	LB3	B4	LB4	B6
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^U	units	6.4	6.6	6.8	-	7.0	6.1
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	16	21	36	-	23	32
Sulphate (total)	CE062 ^U	mg/kg SO ₄	185	209	339	-	180	462
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.02	0.02	0.03	-	0.02	0.05
Sulphur (total)	CE119	mg/kg S	767	251	2339	-	479	212
Sulphur (total)	CE119	% w/w S	0.08	0.03	0.23	-	0.05	0.02
Total Organic Carbon (TOC)	CE197	% w/w C	2.7	-	-	2.1	-	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	4.7	-	-	3.6	-	-

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Sample Type Date sampled			105141-7 TP24 1.00-1.50 LB3 -	105141-8 TP25 2.50-3.00 LB5 -	105141-9 TP26 1.50-2.00 LB5 -
Test	Method	Units			
pH	CE004 ^U	units	8.1	7.4	6.3
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	<10	23	85
Sulphate (total)	CE062 ^U	mg/kg SO ₄	179	311	958
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.02	0.03	0.10
Sulphur (total)	CE119	mg/kg S	225	836	524
Sulphur (total)	CE119	% w/w S	0.02	0.08	0.05
Total Organic Carbon (TOC)	CE197	% w/w C	-	-	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	0.01	% w/w SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
105141-1	BH32	2.00-2.50	Y	All (NSD)
105141-2	TP10	1.00-1.50	Y	All (NSD)
105141-3	TP11	0.50-1.00	Y	All (NSD)
105141-5	TP20	1.50-2.00	Y	All (NSD)
105141-6	TP20	3.50-4.00	Y	All (NSD)
105141-7	TP24	1.00-1.50	Y	All (NSD)
105141-8	TP25	2.50-3.00	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

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

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

Methods, procedures and performance data are available on request.

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

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

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

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

Analytical results are inclusive of stones, where applicable.



Contract Number: 57657

Client Ref: **Q0652**

Report Date: **25-02-2022**

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Steffan Picton**

Date Received: **17-01-2022**

Date Completed: **25-02-2022**

Test Description	Qty
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	4
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	4
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	2
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	1
LOI Sub-contracted Test	1
BRE Reduced Suite includes pH, water & acid soluble sulphate and total sulphur Sub-contracted Test	13

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 57657

Test Description	Qty
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould/CBR Mould) BS 1377:1990 - Part 4 : 3.5 - * UKAS	1
MCV/Moisture Content Relationship BS 1377:1990 - Part 4 : 5.5 - * UKAS	1
Determination of Point Load Value Axial or Diametrical including WC *Please note GSTL is not accredited for the water content of rock* ISRM Suggested Method for Point Load Strength - * UKAS	28
Uniaxial Compressive Strength of Rock inc sample prep 54-165mm diameter cores ISRM Suggested Method for determining uniaxial compressive strength - @ Non Accredited Test	1
Los Angeles Abrasion Value BS EN 1097-2 - * UKAS	5
Determination of the slake durability index, two cycles. ISRM Suggested Method For Determining Slake Durability - @ Non Accredited Test	5
Magnesium sulfate test soundness value. BS EN 1367-2 - * UKAS	5
Resistance to Freezing & Thawing (CELTEEST) BS EN 1367-1:2007 - * UKAS	5
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

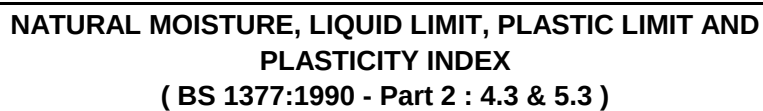
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



Contract Number	57657	
Site Name	GCRE	
Date Tested	29/01/2022	
	DESCRIPTIONS	

[illegible]

Operators	Checked	25/02/2022	Richard John (Advanced Testing Manager)
Luke Williams	Approved	25/02/2022	Paul Evans (Quality/Technical Manager)





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57657

Borehole/Pit No. BH04

Site Name GCRE

Sample No. 3

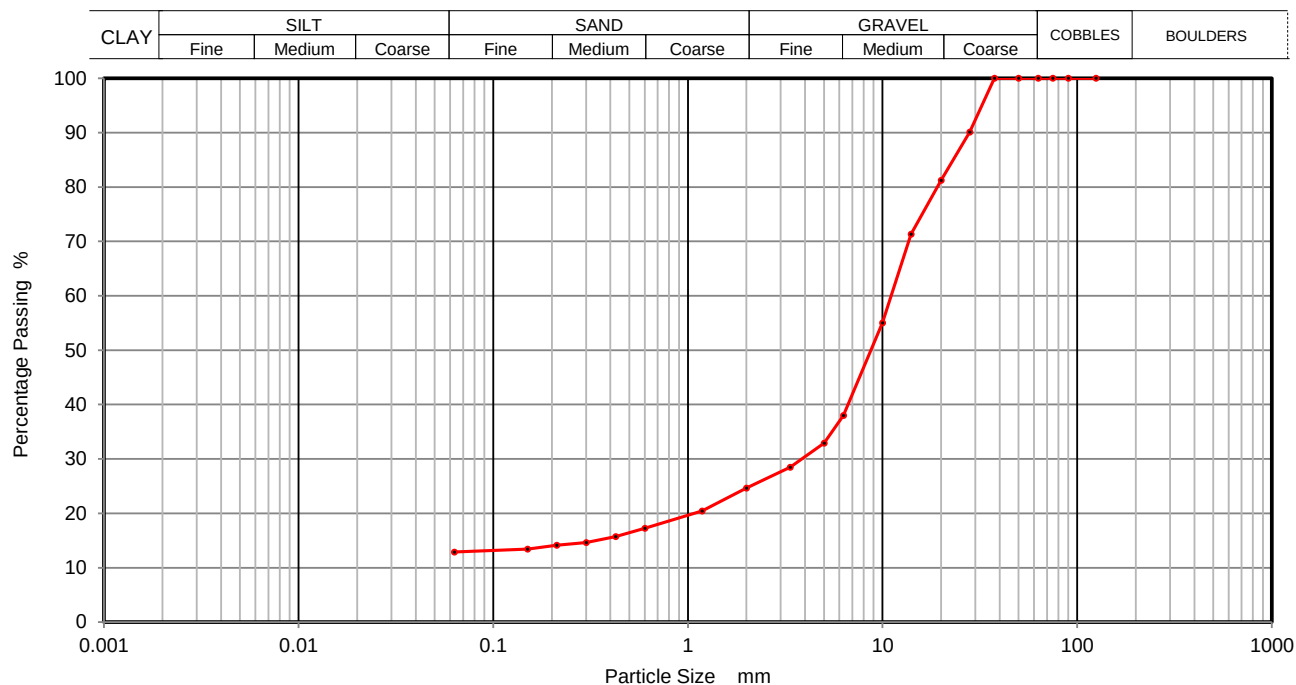
Soil Description Grey slightly silty clayey fine to coarse sandy fine to medium GRAVEL

Depth Top 4.20

Depth Base 5.20

Date Tested 09/02/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	90		
20	81		
14	71		
10	55		
6.3	38		
5	33		
3.35	28		
2	25		
1.18	20		
0.6	17		
0.425	16		
0.3	15		
0.212	14		
0.15	13		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	12
Silt and Clay	13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	24/02/2022	Richard John	
David	Approved	25/02/2022	Paul Evans	

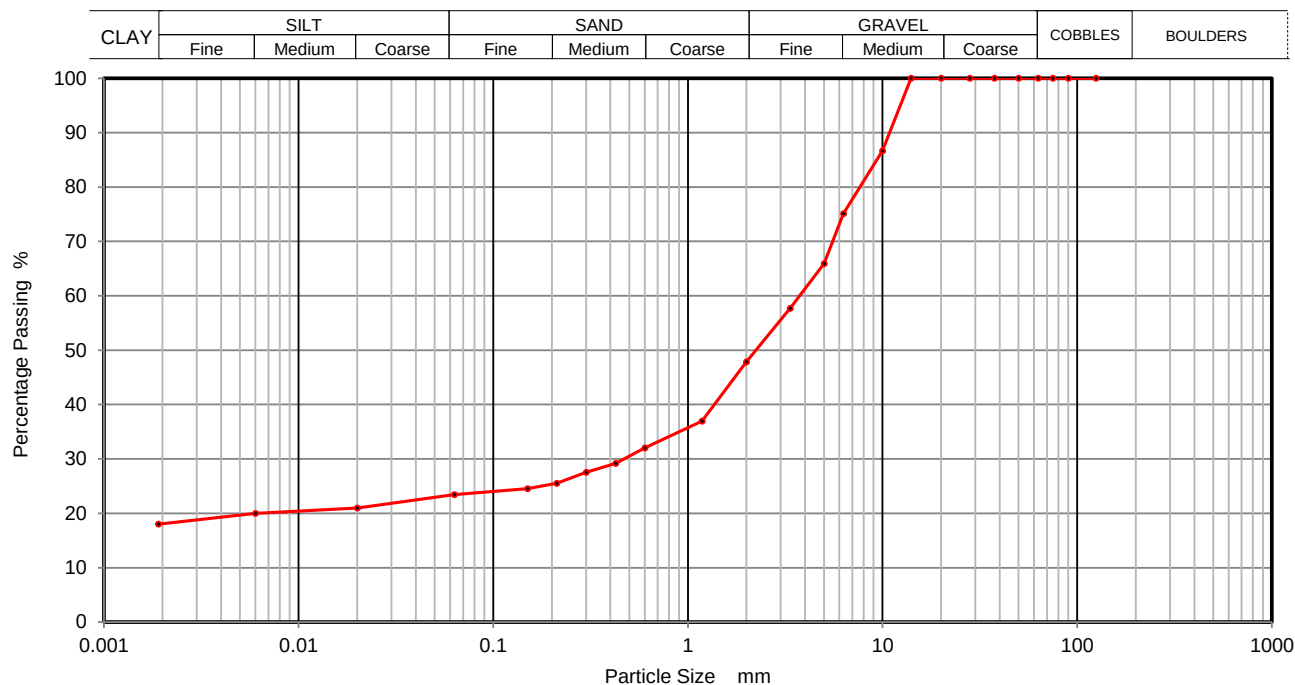


2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57657	
	Borehole/Pit No.	
BH05		
Site Name	GCRE	
Sample No.	2	
	Depth Top	
4.70		
Soil Description	Grey slightly silty clayey fine to coarse sandy fine to medium GRAVEL	
	Depth Base	
5.70		
Date Tested	09/02/2022	
Sample Type		B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	21
90	100	0.0060	20
75	100	0.0020	18
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	87		
6.3	75		
5	66		
3.35	58		
2	48		
1.18	37		
0.6	32		
0.425	29		
0.3	28		
0.212	26		
0.15	25		
0.063	23		

Sample Proportions	% dry mass
Cobbles	0
Gravel	52
Sand	25
Silt	5
Clay	18

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	24/02/2022	Richard John	
David	Approved	25/02/2022	Paul Evans	



Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 57657

Borehole / Pit No BH04

Project Location GCRE

Sample No 3

Date Tested 31/01/2022

Depth Top 4.20

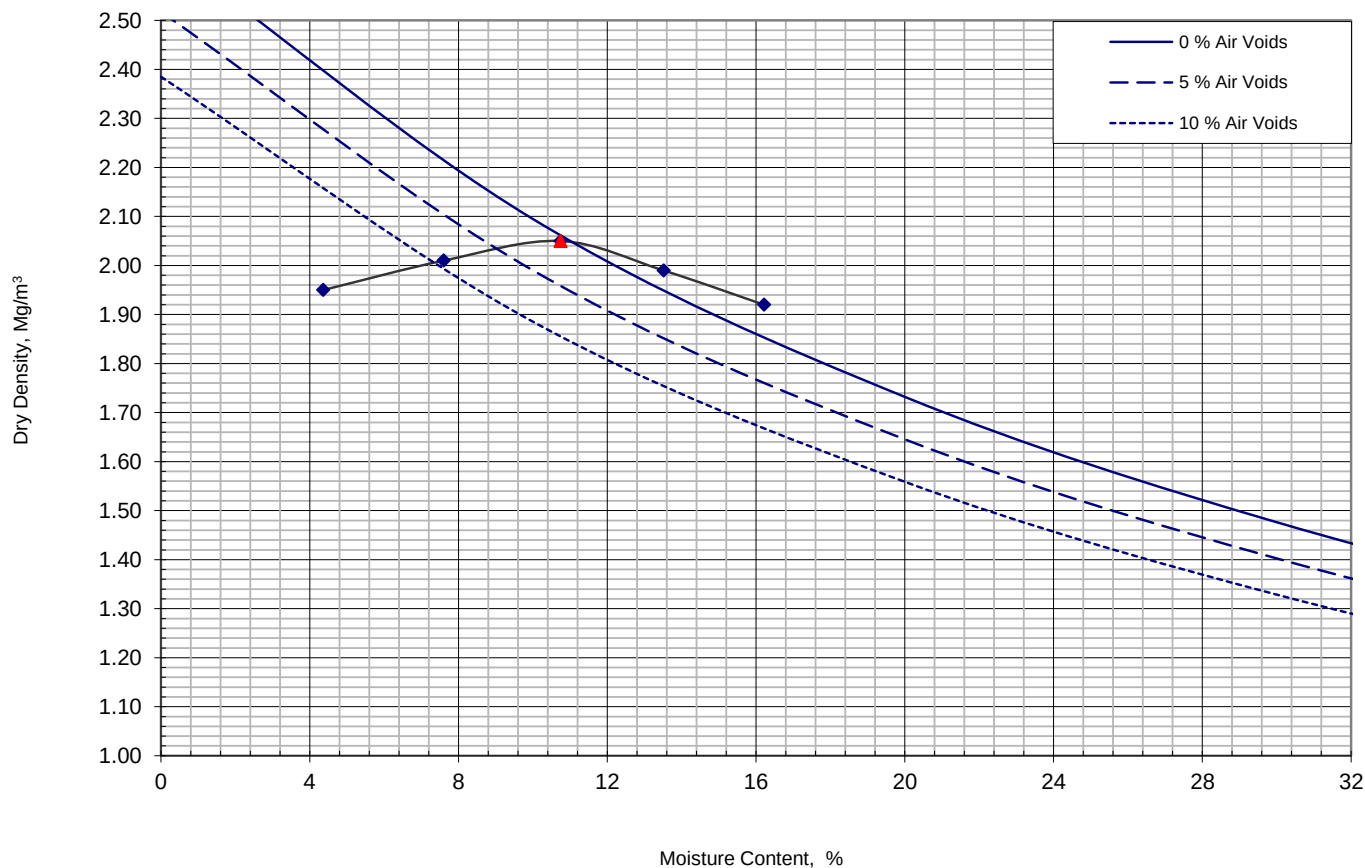
Compaction Method 4.5 Kg Rammer

Depth Base 5.20

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description Grey slightly silty clayey sandy GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	4.4	7.6	11	14	16						
Bulk Density	2.03	2.16	2.27	2.26	2.23						
Dry Density	1.95	2.01	2.05	1.99	1.92						

Initial Moisture Content	16	%
Maximum Dry Density	2.05	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	19	%

Operator Checked 24/02/2022 Richard John

Chris G Approved 25/02/2022 Paul Evans

Richard John

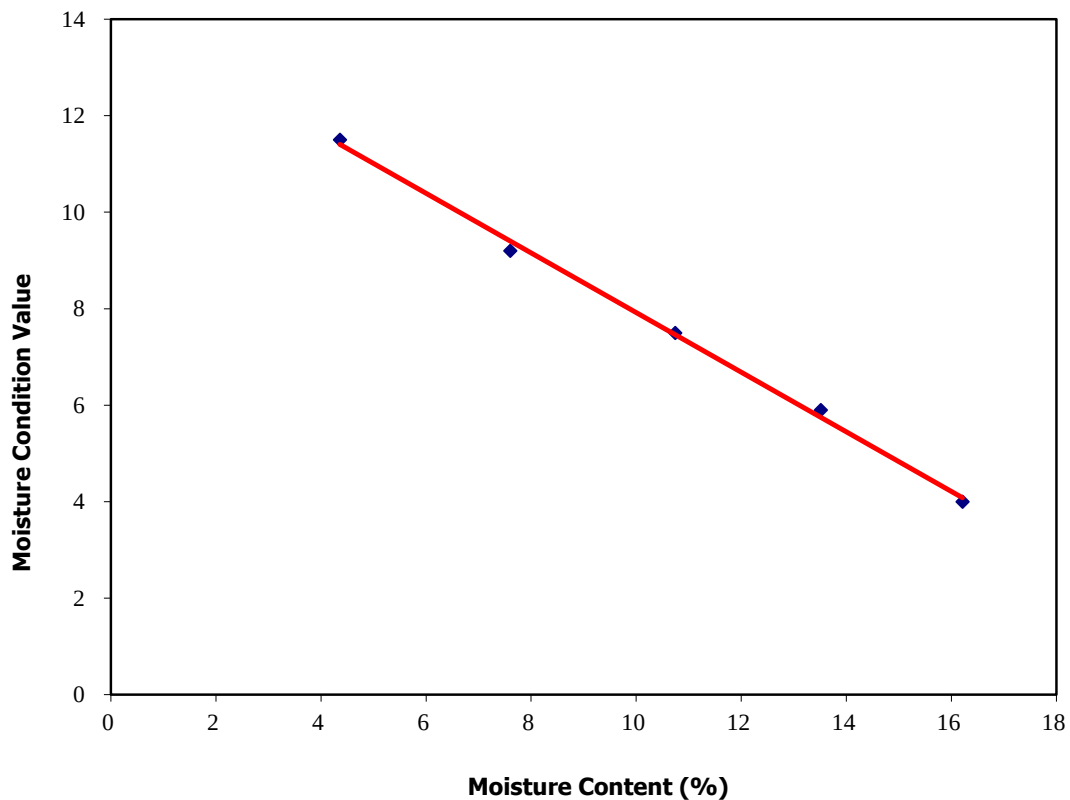
Chris G

Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57657
Hole Number: BH04
Sample Number: 3
Depth (m) : 4.20
Sample Type: B
Date Tested: 31/01/2022
Technician: Dan H

Initial Moisture Content (%):	16
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	19



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	4.4	7.6	11	14	16
MCV	11.5	9.2	7.5	5.9	4.0

* reading unobtainable.



Checked by
Richard John
Date approved:

25/2/22

Approved by
Richard John

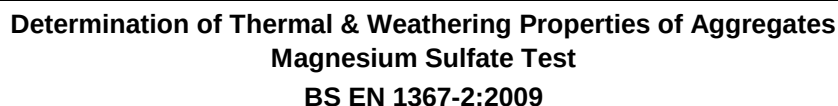


[illegible]

Method of Sampling in accordance with
BS932-1 General Requirements and Sample
Preparation



Operators	Checked	24/02/2022	Emma Sharp	
Julian	Approved	25/02/2022	Paul Evans	

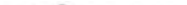


Contract Number	57657	
Site Name	GCRE	
Sample Preparation	Crushed rock core	
Date Tested	26/01/2022	

[illegible]

<u>Key</u>	<u>Reported As</u>
Size Fraction Max	mm
Size Fraction Min	mm
Mass of test portions	g
Magnesium Sulfate Value	%

Method of Sampling in accordance with BS932-1
General Requirements and Sample Preparation

Operators	Checked	24/02/2022	Wayne Honey	
JJ	Approved	25/02/2022	Emma Sharp	

**Determination of Slake Durability Index****ISRM Part 2.2**

Contract Number	57657	
Site Name	GCRE	
Nature of Slaking Fluid	Water at 20°C	
Date Tested	26/01/2022	

Hole Reference	Depth (m)			Slake First Cycle	Slake Second Cycle	Appearance Of Material Retained In The Drum	Appearance Of Material Passing Through The Drum
BH04	5.20	-	8.70	84.85	73.75	Many pieces of Subangular to well rounded rock core with some pieces with ground corners and edges	Sub-angular to well rounded <2mm fragments to a silt/ clay.
BH06	4.00	-	8.00	93.05	90.10	Many pieces of Subangular to well rounded rock core with some pieces with ground corners and edges	Sub-angular to well rounded <2mm fragments to a silt/ clay.
BH12	2.70	-	9.00	97.87	96.18	Many pieces of Subangular to well rounded rock core with some pieces with ground corners and edges	Sub-angular to well rounded <2mm fragments to a silt/ clay.
BH15	2.70	-	10.00	97.49	96.17	Many pieces of Subangular to well rounded rock core with some pieces with ground corners and edges	Sub-angular to well rounded <2mm fragments to a silt/ clay.
BH17	7.20	-	11.00	92.37	86.37	Many pieces of Subangular to well rounded rock core with some pieces with ground corners and edges	Sub-angular to well rounded <2mm fragments to a silt/ clay.
		-					
		-					
		-					
		-					
		-					
		-					
		-					

Key**Reported As**

Slake First Cycle	%
Slake Second Cycle	%

Operators	Checked	24/02/2022	Wayne Honey	<i>W. Honey</i>
KS	Approved	25/02/2022	Paul Evans	<i>P. Evans</i>

GEO Site & Testing Services Ltd
Unit 4 Hoel Aur Dafen Ind Estate
Dafen
Carmarthenshire
Wales
SA14 8QN
Contract: Dafen

Date: 23 February 2022
Test Report Ref: TR 860296

Order No: 57657

Page 1 of 1

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S100455
Client Ref. No:	BH04-5.2-8.7
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	31/01/2022
Date of Start of Test:	11/02/2022
Sampling Location:	Unknown
Name of Source:	GCRE (57657)
Method of Sampling:	Unknown
Sampled By:	Client (Test results apply to sample as received)
Tested By:	DW
Material Description:	Gravel
Target Specification:	N/A

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 25.3 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed, very weak mudstone/ shale.

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure

No departure from specified procedure

Report checked and approved by:



Chantelle Kopec-Williams
Job Coordinator

GEO Site & Testing Services Ltd
Unit 4 Hoel Aur Dafen Ind Estate
Dafen
Carmarthenshire
Wales
SA14 8QN
Contract: Dafen

Date: 23 February 2022
Test Report Ref: TR 860297

Order No: 57657

Page 1 of 1

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S100455
Client Ref. No:	BH06-4-8
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	31/01/2022
Date of Start of Test:	11/02/2022
Sampling Location:	Unknown
Name of Source:	GCRE (57657)
Method of Sampling:	Unknown
Sampled By:	Client (Test results apply to sample as received)
Tested By:	DW
Material Description:	Gravel
Target Specification:	N/A

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 18.9 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed, very weak mudstone/shale.

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure

No departure from specified procedure

Report checked and approved by:



Chantelle Kopec-Williams
Job Coordinator

GEO Site & Testing Services Ltd
Unit 4 Hoel Aur Dafen Ind Estate
Dafen
Carmarthenshire
Wales
SA14 8QN
Contract: Dafen

Date: 23 February 2022
Test Report Ref: TR 860298

Order No: 57657

Page 1 of 1

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S100455
Client Ref. No:	BH12-2.7-9.0
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	31/01/2022
Date of Start of Test:	11/02/2022
Sampling Location:	Unknown
Name of Source:	GCRE (57657)
Method of Sampling:	Unknown
Sampled By:	Client (Test results apply to sample as received)
Tested By:	DW
Material Description:	Gravel
Target Specification:	N/A

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 22.3 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed, very weak mudstone/ shale.

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure

No departure from specified procedure

Report checked and approved by:



Chantelle Kopec-Williams
Job Coordinator

GEO Site & Testing Services Ltd
Unit 4 Hoel Aur Dafen Ind Estate
Dafen
Carmarthenshire
Wales
SA14 8QN
Contract: Dafen

Date: 09 March 2022
Test Report Ref: TR 860299

Order No: 57657

Page 1 of 1

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S100455
Client Ref. No:	BH15-2.7-10
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	31/01/2022
Date of Start of Test:	21/02/2022
Sampling Location:	Unknown
Name of Source:	GCRE (57657)
Method of Sampling:	Unknown
Sampled By:	Client (Test results apply to sample as received)
Tested By:	DW
Material Description:	Gravel
Target Specification:	N/A

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 21.1 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure

No departure from specified procedure

Report checked and approved by:



Chantelle Kopec-Williams
Job Coordinator

GEO Site & Testing Services Ltd
Unit 4 Hoel Aur Dafen Ind Estate
Dafen
Carmarthenshire
Wales
SA14 8QN
Contract: Dafen

Date: 09 March 2022
Test Report Ref: TR 860300

Order No: 57657

Page 1 of 1

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S100455
Client Ref. No:	BH17-7.2-11
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	31/01/2022
Date of Start of Test:	21/02/2022
Sampling Location:	Unknown
Name of Source:	GCRE (57657)
Method of Sampling:	Unknown
Sampled By:	Client (Test results apply to sample as received)
Tested By:	DW
Material Description:	Gravel
Target Specification:	N/A

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 23.8 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure

No departure from specified procedure

Report checked and approved by:



Chantelle Kopec-Williams
Job Coordinator



ANALYTICAL TEST REPORT

Contract no: 105387

Contract name: GCRE

Client reference: Q0652

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 03 February 2022

Analysis started: 03 February 2022

Analysis completed: 10 February 2022

Report issued: 10 February 2022

Key

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

Approved by:

Rachael Burton

Reporting Team Lead

Chemtech Environmental Limited

SOILS

Lab number			105387-1	105387-2	105387-3	105387-4	105387-5	105387-6
Sample id			BH03	BH04	BH04	BH05	BH17	BH18
Depth (m)			2.70-3.70	1.60-2.00	2.70	4.70-5.70	4.20-5.70	4.20-5.70
Sample Type			D2	D2	SPTLS1	B2	D3	D2
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^U	units	8.3	-	I/S	8.2	7.4	7.9
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	112	-	<10	57	18	58
Sulphate (total)	CE062 ^U	mg/kg SO ₄	407	-	<100	184	<100	165
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.04	-	<0.01	0.02	<0.01	0.02
Sulphur (total)	CE119	mg/kg S	1491	-	123	645	235	630
Sulphur (total)	CE119	% w/w S	0.15	-	0.01	0.06	0.02	0.06
Loss On Ignition at 440°C	CE006 ^U	% w/w	-	6.1	-	-	-	-

Chemtech Environmental Limited

SOLIDS

Lab number			105387-7	105387-8	105387-9	105387-10	105387-11	105387-12
Sample id			BH04	BH05	BH06	BH12	BH15	BH17
Depth (m)			5.70	11.60-11.85	6.00-6.05	4.30	6.08	7.90-8.00
Sample Type			C1	C1	C2	C2	C3	C1
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004	units	6.9	8.1	8.1	8.0	8.2	8.4
Sulphate (2:1 water soluble)	CE061	mg/l SO ₄	18	18	26	<10	14	14
Sulphate (total)	CE062	mg/kg SO ₄	<100	<100	4160	176	<100	<100
Sulphate (total)	CE062	% w/w SO ₄	<0.01	<0.01	0.42	0.02	<0.01	<0.01
Sulphur (total)	CE119	mg/kg S	574	1114	3795	<100	424	<100
Sulphur (total)	CE119	% w/w S	0.06	0.11	0.38	<0.01	0.04	<0.01

Chemtech Environmental Limited

SOLIDS

Lab number			105387-13	105387-14
Sample id			BH30R	BH33R
Depth (m)			8.70-8.80	9.20
Sample Type			C1	C2
Date sampled			-	-
Test	Method	Units		
pH	CE004	units	8.7	8.8
Sulphate (2:1 water soluble)	CE061	mg/l SO ₄	<10	15
Sulphate (total)	CE062	mg/kg SO ₄	<100	<100
Sulphate (total)	CE062	% w/w SO ₄	<0.01	<0.01
Sulphur (total)	CE119	mg/kg S	190	521
Sulphur (total)	CE119	% w/w S	0.02	0.05

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	0.01	% w/w SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S
CE006	Loss On Ignition at 440°C	Based on BS 1377, Gravimetry	Dry	U	0.1	% w/w

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOLIDS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received		-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry		100	mg/kg SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
105387-1	BH03	2.70-3.70	Y	All (NSD)
105387-2	BH04	1.60-2.00	Y	All (NSD)
105387-3	BH04	2.70	Y	All (NSD)
105387-4	BH05	4.70-5.70	Y	All (NSD)
105387-5	BH17	4.20-5.70	Y	All (NSD)
105387-6	BH18	4.20-5.70	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

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

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

Methods, procedures and performance data are available on request.

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

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

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

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

Analytical results are inclusive of stones, where applicable.



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 57819

Client Ref: **Q0652**

Report Date: **24-02-2022**

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Phil Darby**

Date Received: **27-01-2022**

Date Completed: **24-02-2022**

Test Description	Qty
Los Angeles Abrasion Value BS EN 1097-2 - * UKAS	1
Magnesium sulfate test soundness value. BS EN 1367-2 - * UKAS	1
Determination of the slake durability index, two cycles. ISRM Suggested Method For Determining Slake Durability - @ Non Accredited Test	1
Resistance to Freezing & Thawing (CELTEEST) BS EN 1367-1:2007 - * UKAS	1
BRE Reduced Suite includes pH, water & acid soluble sulphate and total sulphur Sub-contracted Test	2
Determination of Point Load Value Axial or Diametrical including WC *Please note GSTL is not accredited for the water content of rock* ISRM Suggested Method for Point Load Strength - * UKAS	19
Disposal of samples for job Notes: Observations and Interpretations are outside the UKAS Accreditation * - denotes test included in laboratory scope of accreditation # - denotes test carried out by approved contractor @ - denotes non accredited tests	1

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



Contract Number	57819	
Site Name	GCRE	
Sample Preparation		
Date Tested	07/02/2022	

[illegible][illegible]

Method of Sampling in accordance with
BS932-1 General Requirements and Sample
Preparation



Operators	Checked	02/03/2022	Emma Sharp	
Julian	Approved	03/03/2022	Paul Evans	



[illegible]

Method of Sampling in accordance with BS932-1
General Requirements and Sample Preparation





Determination of Slake Durability Index

ISRM Part 2.2

Contract Number

57819

Site Name

GCRE

Nature of Slaking Fluid

Water at 20°C

Date Tested

04/02/2022

Hole Reference	Depth (m)			Slake First Cycle	Slake Second Cycle	Appearance Of Material Retained In The Drum	Appearance Of Material Passing Through The Drum
BH13	8.20	-	8.29	97.64	96.36	10 Pieces of Subangular to well rounded rock core with many pieces with ground corners and edges	Sub-angular to well rounded <2mm fragments to a silt
		-					
		-					
		-					
		-					
		-					
		-					
		-					
		-					
		-					
		-					
		-					

Key

Reported As

Slake First Cycle	%
Slake Second Cycle	%

Operators	Checked	23/02/2022	Wayne Honey	<i>W. Honey</i>
KS	Approved	24/02/2022	Paul Evans	<i>DP Evans</i>

GEO Site & Testing Services Ltd
Unit 4 Hoel Aur Dafen Ind Estate
Dafen
Carmarthenshire
Wales
SA14 8QN
Contract: Dafen

Date: 09 March 2022
Test Report Ref: TR 860303

Order No: 57819

Page 1 of 1

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S100456
Client Ref. No:	BH13-8.20m
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	31/01/2022
Date of Start of Test:	21/02/2022
Sampling Location:	Unknown
Name of Source:	GCRE (57819)
Method of Sampling:	Unknown
Sampled By:	Client (Test results apply to sample as received)
Tested By:	DW
Material Description:	Gravel
Target Specification:	N/A

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 23.2 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure

No departure from specified procedure

Report checked and approved by:



Chantelle Kopec-Williams
Job Coordinator



ANALYTICAL TEST REPORT

Contract no: 105762

Contract name: GCRE

Client reference: Q0652

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 10 February 2022

Analysis started: 10 February 2022

Analysis completed: 16 February 2022

Report issued: 16 February 2022

Key

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

Approved by:

Megan Harris

Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			105762-1	105762-2
Sample id			BH14	BH16
Depth (m)			6.20	4.50
Sample Type			C1	C1
Date sampled			-	-
Test	Method	Units		
pH	CE004 ^U	units	7.1	7.2
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	49	43
Sulphate (total)	CE062 ^U	mg/kg SO ₄	652	156
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.07	0.02
Sulphur (total)	CE119	mg/kg S	396	234
Sulphur (total)	CE119	% w/w S	0.04	0.02

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	0.01	% w/w SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
105762-1	BH14	6.20	Y	All (NSD)
105762-2	BH16	4.50	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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Analytical results are inclusive of stones, where applicable.



Contract Number: 57820

Client Ref: **Q0652**

Report Date:

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Steffan Picton**

Date Received: **27-01-2022**

Date Completed:

Test Description	Qty
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	1
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	12
BRE Reduced Suite includes pH, water & acid soluble sulphate and total sulphur Sub-contracted Test	2
BRE Full Suite includes pH, water & acid soluble sulphate, total sulphur, magnesium, chloride and nitrate Sub-contracted Test	4
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould/CBR Mould) BS 1377:1990 - Part 4 : 3.5 - * UKAS	3
MCV/Moisture Content Relationship BS 1377:1990 - Part 4 : 5.5 - * UKAS	3
Disposal of samples for job	1

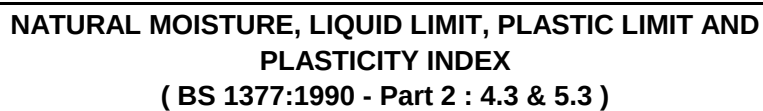
Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

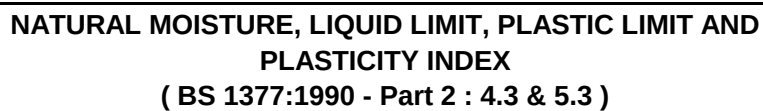


Contract Number	57820	
Site Name	GCRE	
Date Tested	09/02/2022	
	DESCRIPTIONS	

[illegible]

Operators	Checked	19/02/2022	Richard John (Advanced Testing Manager)
Darcy Etheridge	Approved	19/02/2022	Paul Evans (Quality/Technical Manager)







PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57820

Borehole/Pit No. TP01

Site Name GCRE

Sample No. 2

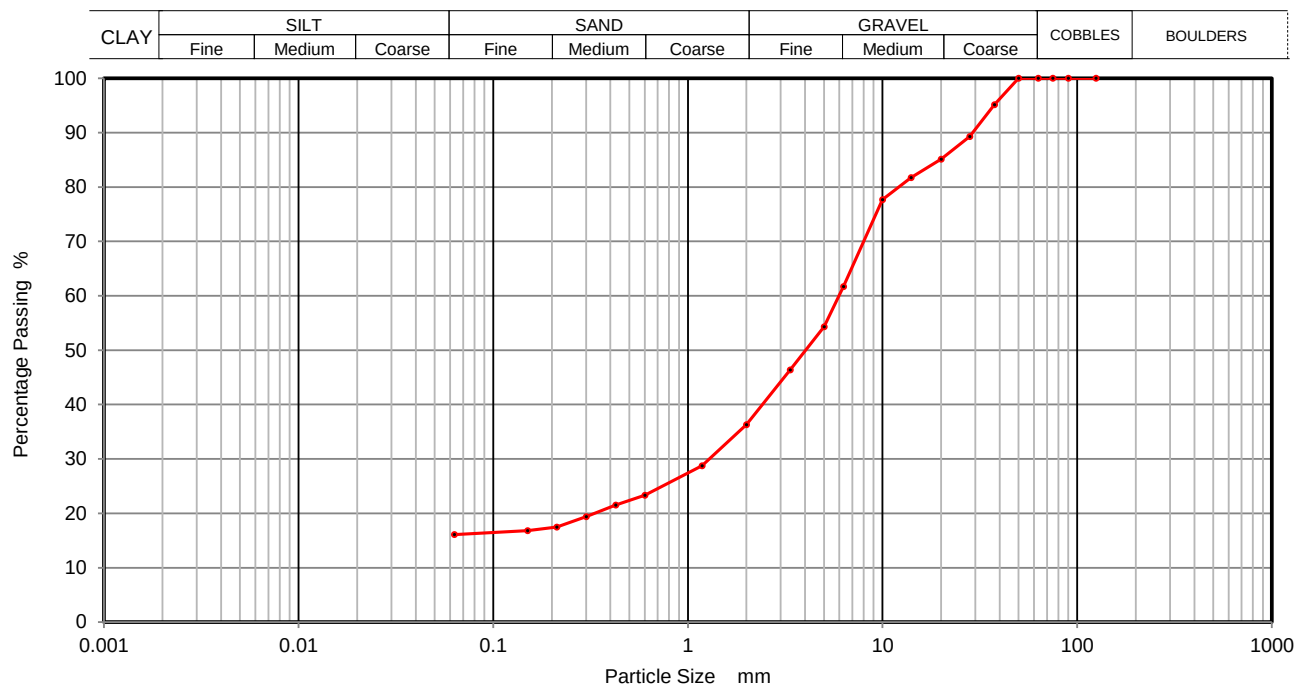
Soil Description Black silty/ clayey fine to coarse sandy fine to coarse GRAVEL

Depth Top 1.00

Depth Base

Date Tested 15/02/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	89		
20	85		
14	82		
10	78		
6.3	62		
5	54		
3.35	46		
2	36		
1.18	29		
0.6	23		
0.425	22		
0.3	19		
0.212	17		
0.15	17		
0.063	16		

Sample Proportions	% dry mass
Cobbles	0
Gravel	64
Sand	20
Silt and Clay	16

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	

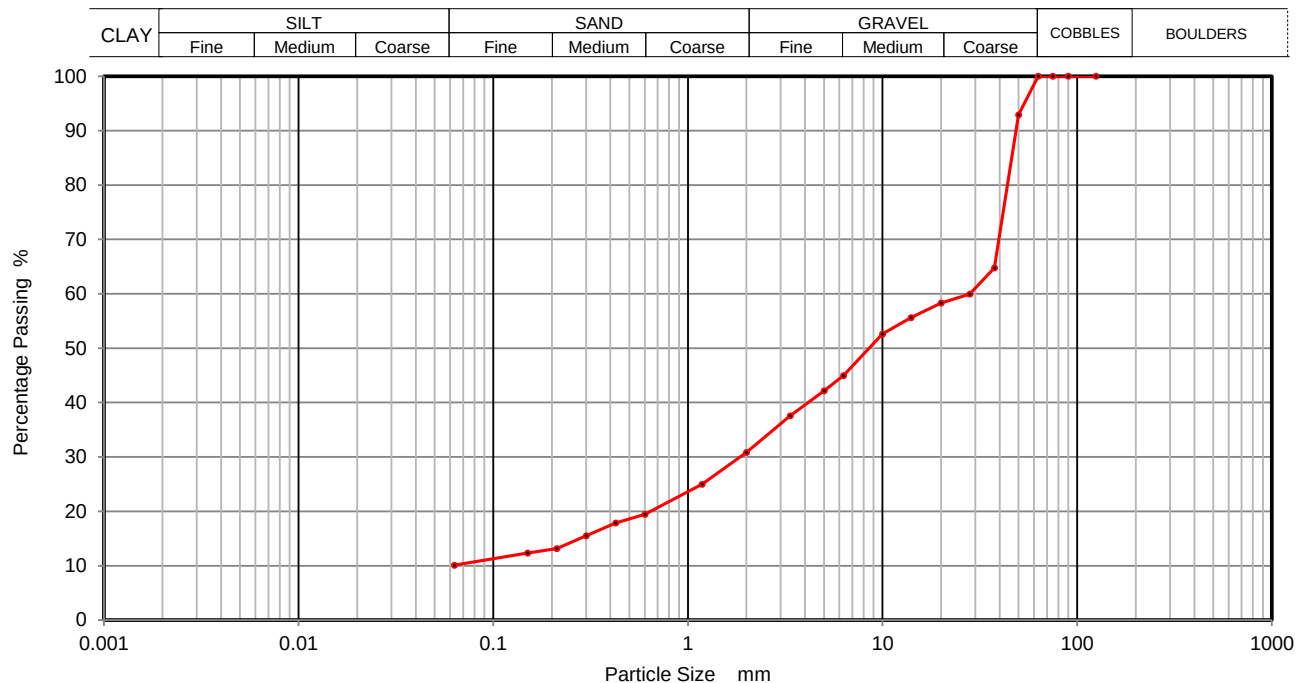


2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	57820	
	Borehole/Pit No.	
TP02		
Site Name	GCRE	
Sample No.	3	
	Depth Top	
Soil Description	1.00	
	Depth Base	
Black silty/ clayey fine to coarse sandy fine to coarse GRAVEL		
Date Tested	15/02/2022	
Sample Type	B	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	93		
37.5	65		
28	60		
20	58		
14	56		
10	53		
6.3	45		
5	42		
3.35	38		
2	31		
1.18	25		
0.6	19		
0.425	18		
0.3	16		
0.212	13		
0.15	12		
0.063	10		

Sample Proportions	% dry mass
Cobbles	0
Gravel	69
Sand	21
Silt and Clay	10

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	

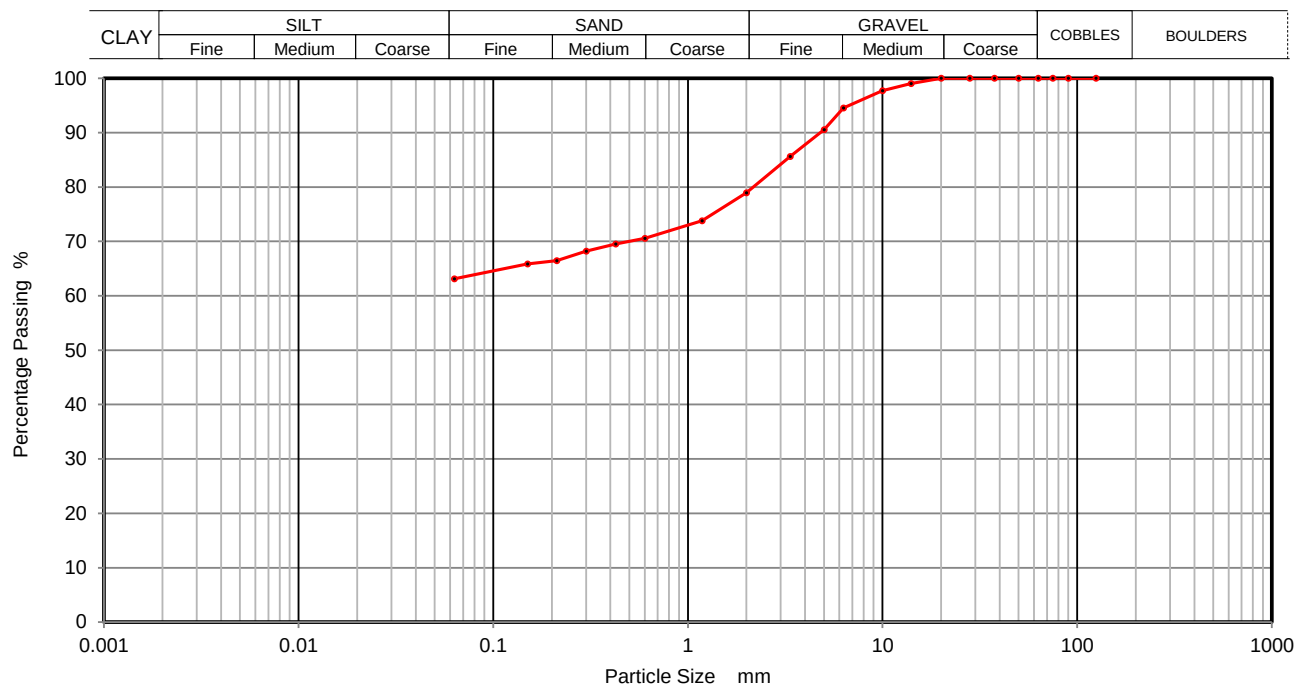


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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	57820	
	Borehole/Pit No.	
TP03		
Site Name	GCRE	
Sample No.	3	
	Depth Top	
Soil Description	Grey fine to coarse sandy fine to medium gravelly SILT/ CLAY	
	Depth Base	
Date Tested	15/02/2022	
Sample Type	B	



Sieving		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	99		
10	98		
6.3	95		
5	91		
3.35	86		
2	79		
1.18	74		
0.6	71		
0.425	70		
0.3	68		
0.212	66		
0.15	66		
0.063	63		

Sample Proportions	% dry mass
Cobbles	0
Gravel	21
Sand	16
Silt and Clay	63

Remarks
Preparation and testing in accordance with BS1377 unless noted below

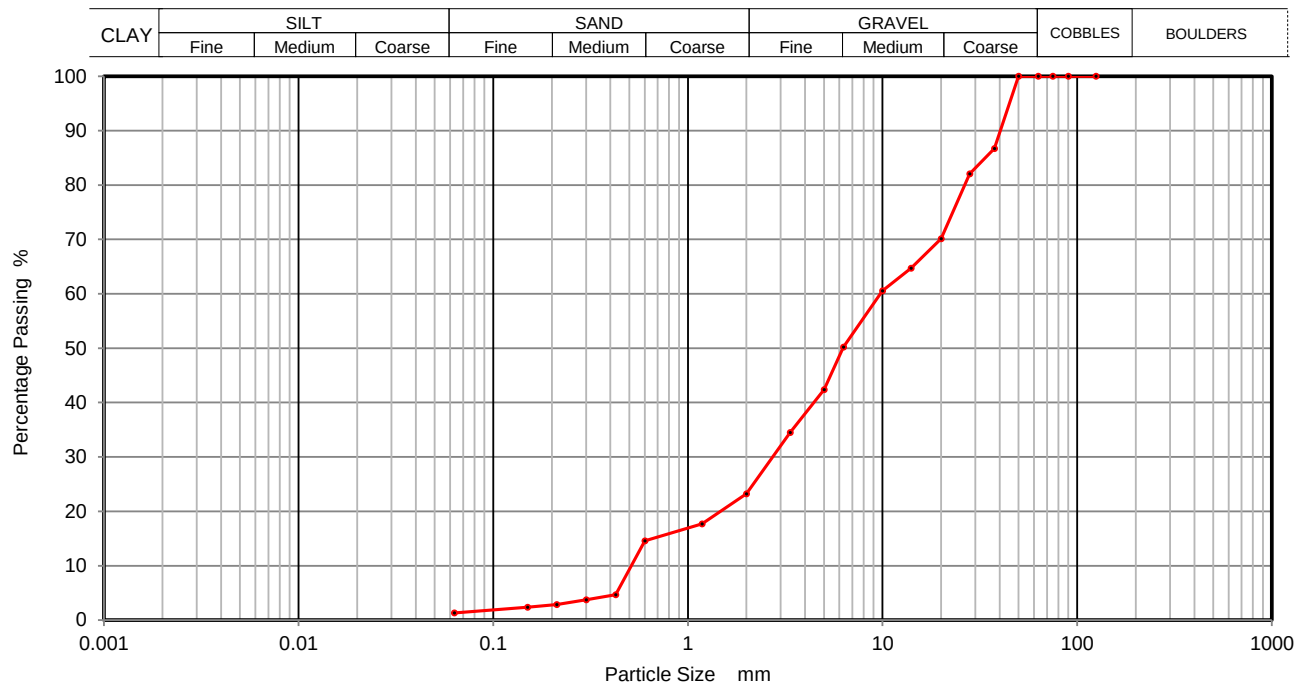
Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	57820	
	Borehole/Pit No.	
TP04		
Site Name	GCRE	
Sample No.	2	
	Depth Top	
1.00		
Soil Description	Black slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	
	Depth Base	
Date Tested	15/02/2022	
Sample Type	B	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	87		
28	82		
20	70		
14	65		
10	61		
6.3	50		
5	42		
3.35	34		
2	23		
1.18	18		
0.6	15		
0.425	5		
0.3	4		
0.212	3		
0.15	2		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	22
Silt and Clay	1

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	

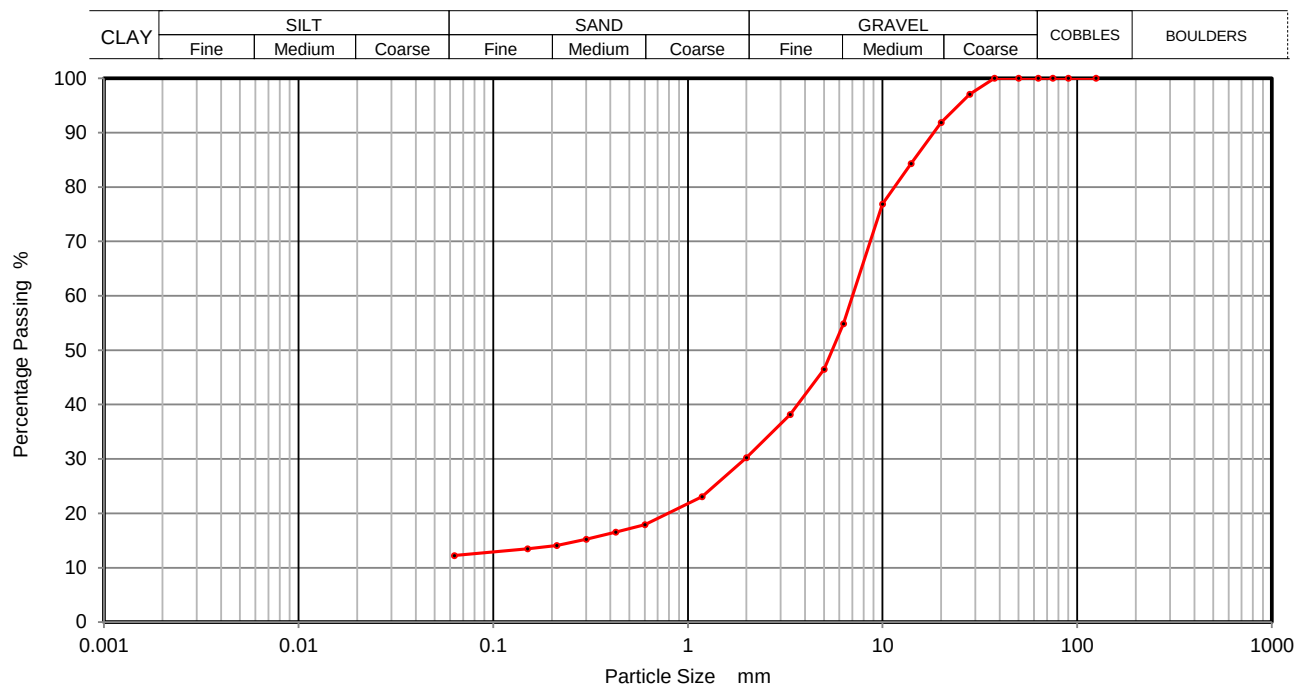


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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	57820	
	Borehole/Pit No.	
TP05		
Site Name	GCRE	
Sample No.	2	
	Depth Top	
Soil Description	Grey silty/ clayey fine to coarse sandy fine to coarse GRAVEL	
	Depth Base	
Date Tested	15/02/2022	
Sample Type	B	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	92		
14	84		
10	77		
6.3	55		
5	46		
3.35	38		
2	30		
1.18	23		
0.6	18		
0.425	17		
0.3	15		
0.212	14		
0.15	13		
0.063	12		

Sample Proportions	% dry mass
Cobbles	0
Gravel	70
Sand	18
Silt and Clay	12

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57820

Borehole/Pit No. TP06

Site Name GCRE

Sample No. 2

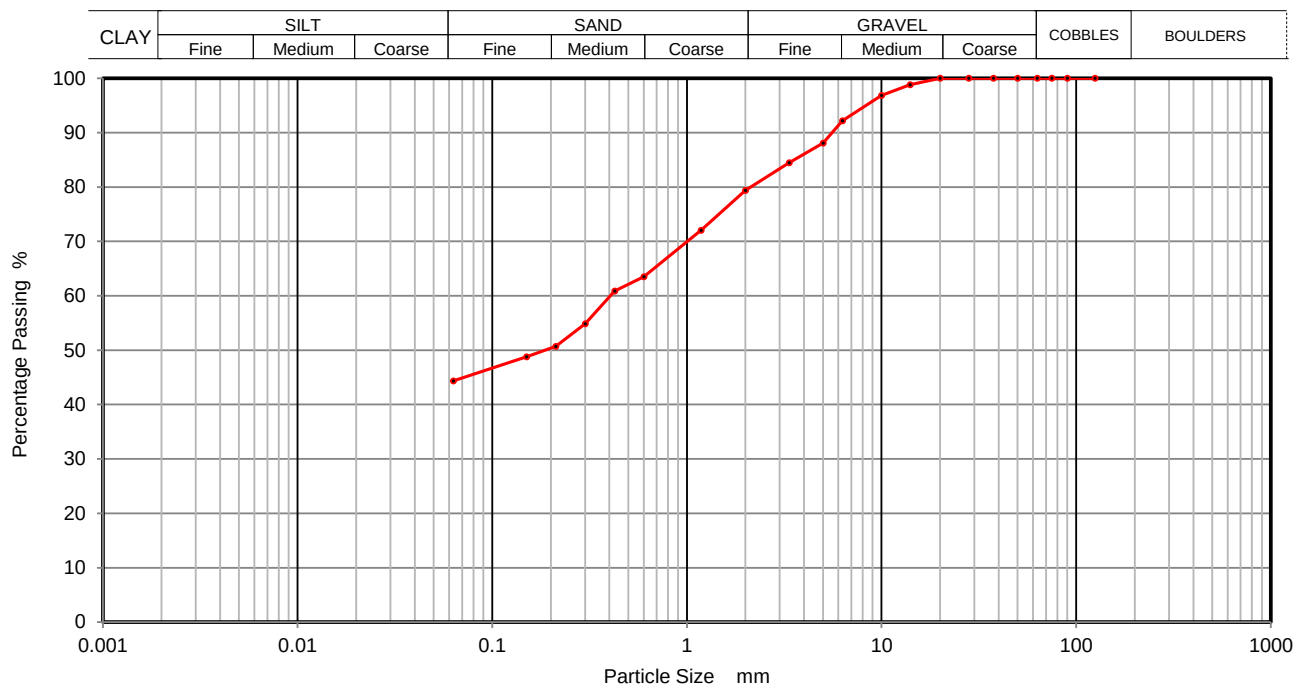
Soil Description Brown/ grey fine to medium gravelly fine to coarse sandy SILT/ CLAY

Depth Top 1.00

Depth Base

Date Tested 15/02/2022

Sample Type B



Sieving		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	99		
10	97		
6.3	92		
5	88		
3.35	84		
2	79		
1.18	72		
0.6	63		
0.425	61		
0.3	55		
0.212	51		
0.15	49		
0.063	44		

Sample Proportions	% dry mass
Cobbles	0
Gravel	21
Sand	35
Silt and Clay	44

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	

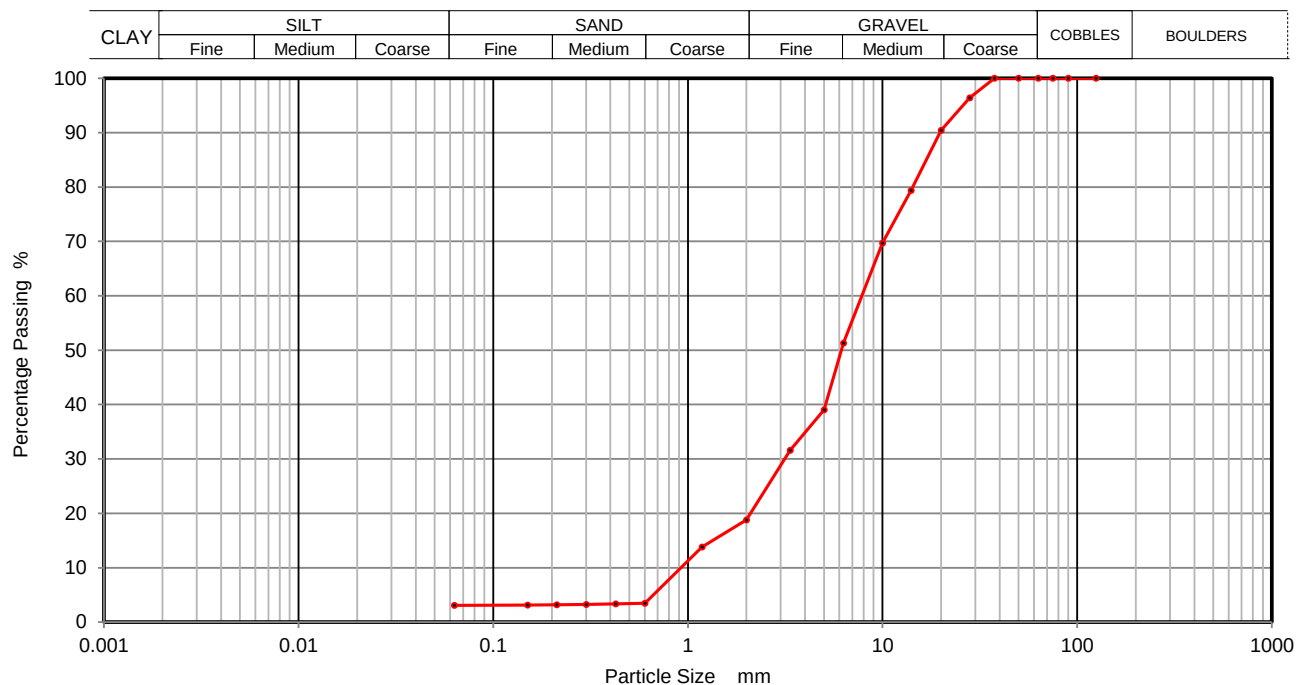


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PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	57820	
	Borehole/Pit No.	
TP07		
Site Name	GCRE	
Sample No.	4	
	Depth Top	
3.00		
Soil Description	Black slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	
	Depth Base	
Date Tested	15/02/2022	
Sample Type	B	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	90		
14	79		
10	70		
6.3	51		
5	39		
3.35	32		
2	19		
1.18	14		
0.6	3		
0.425	3		
0.3	3		
0.212	3		
0.15	3		
0.063	3		

Sample Proportions	% dry mass
Cobbles	0
Gravel	81
Sand	16
Silt and Clay	3

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57820

Borehole/Pit No. TP08

Site Name GCRE

Sample No. 3

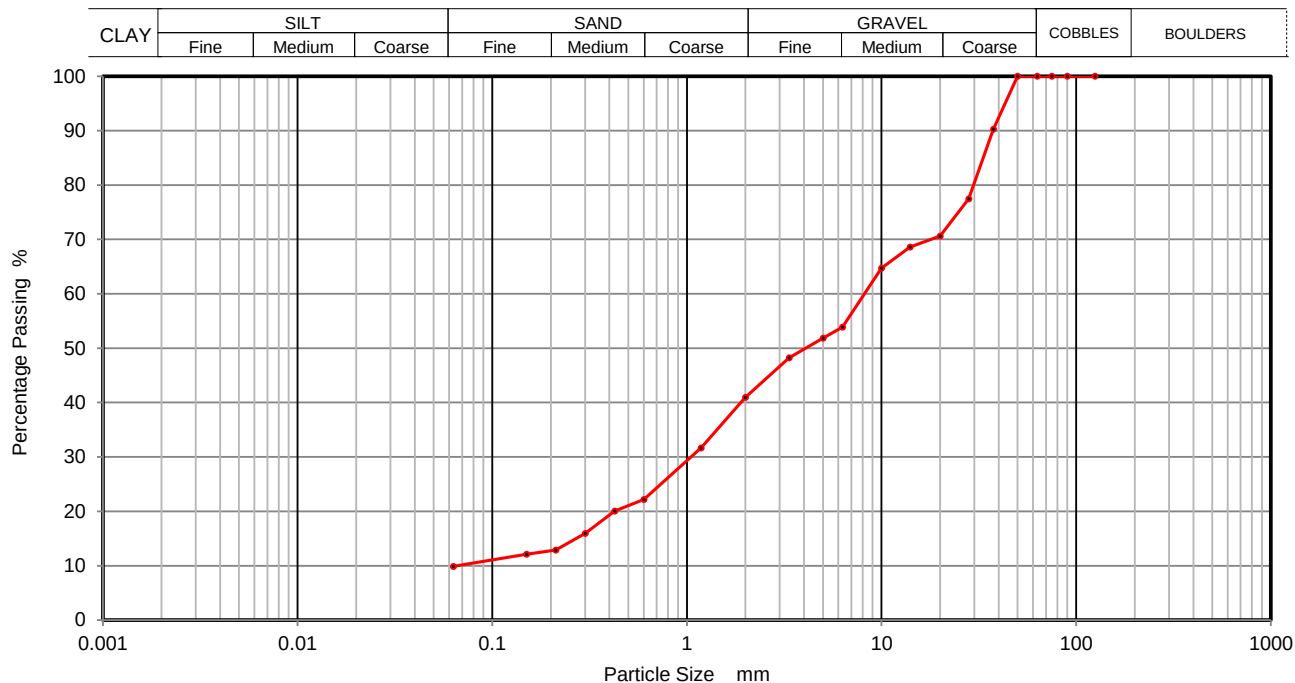
Soil Description Grey silty/ clayey fine to coarse sandy fine to coarse GRAVEL

Depth Top 2.00

Depth Base

Date Tested 15/02/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	90		
28	77		
20	71		
14	69		
10	65		
6.3	54		
5	52		
3.35	48		
2	41		
1.18	32		
0.6	22		
0.425	20		
0.3	16		
0.212	13		
0.15	12		
0.063	10		

Sample Proportions	% dry mass
Cobbles	0
Gravel	59
Sand	31
Silt and Clay	10

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	

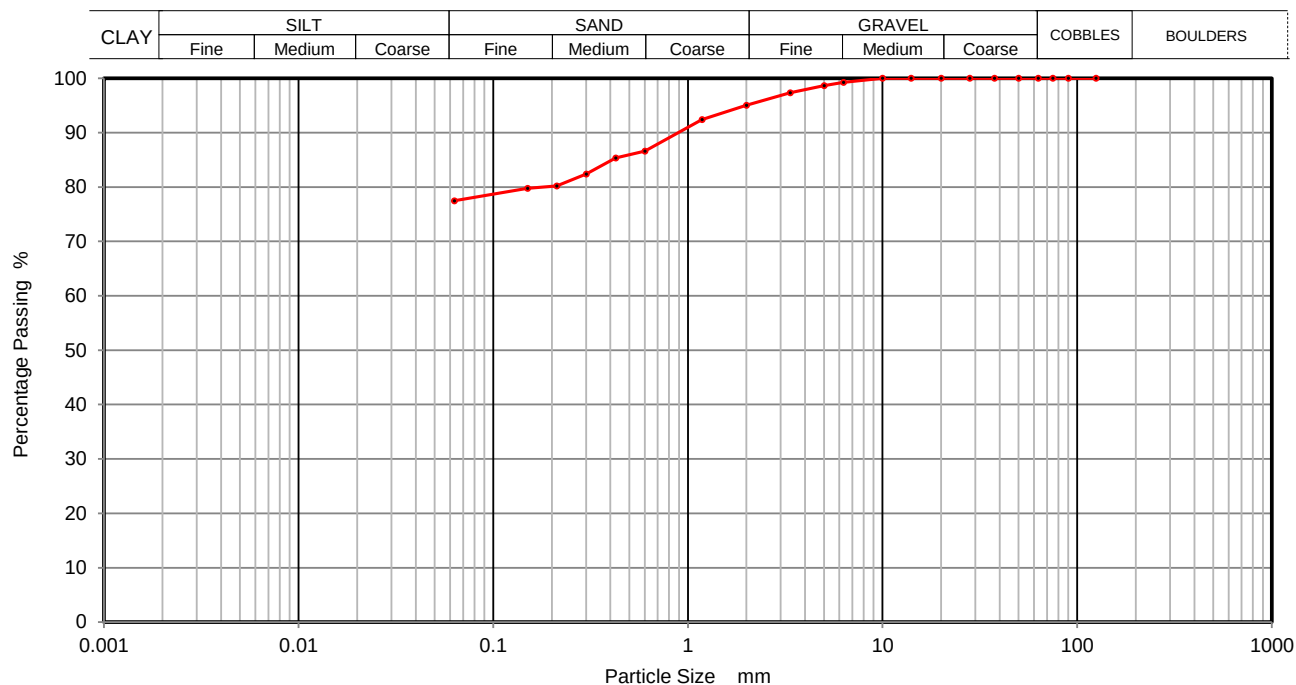


2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	57820
		Borehole/Pit No.	TP09
Site Name	GCRE	Sample No.	2
Soil Description	Black slightly fine to medium gravelly fine to coarse sandy silty CLAY	Depth Top	1.00
		Depth Base	
Date Tested	15/02/2022	Sample Type	B



Sieving		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	100		
10	100		
6.3	99		
5	99		
3.35	97		
2	95		
1.18	92		
0.6	87		
0.425	85		
0.3	82		
0.212	80		
0.15	80		
0.063	77		

Sample Proportions	% dry mass
Cobbles	0
Gravel	5
Sand	18
Silt and Clay	77

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	

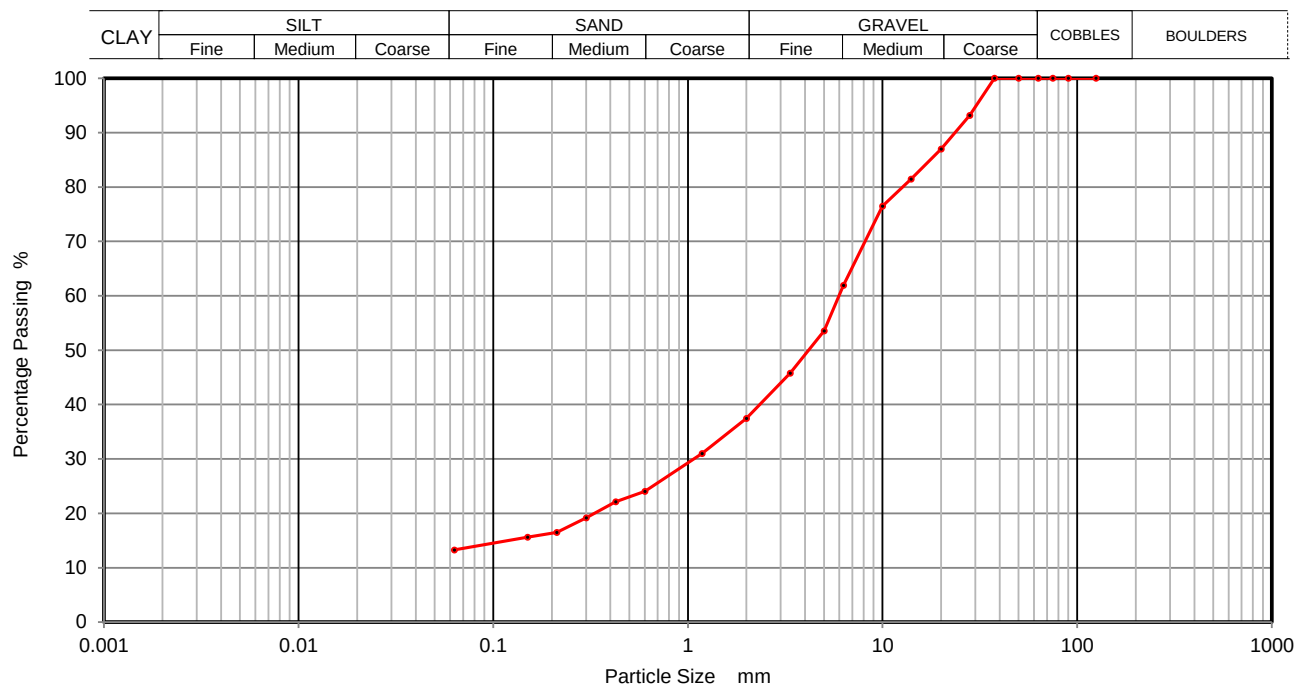


2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	57820	
	Borehole/Pit No.	
TP23		
Site Name	GCRE	
Sample No.	2	
	Depth Top	
Soil Description	Black silty/ clayey fine to coarse sandy fine to coarse GRAVEL	
	Depth Base	
Date Tested	15/02/2022	
Sample Type	B	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	87		
14	81		
10	76		
6.3	62		
5	54		
3.35	46		
2	37		
1.18	31		
0.6	24		
0.425	22		
0.3	19		
0.212	17		
0.15	16		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	63
Sand	24
Silt and Clay	13

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 57820

Borehole/Pit No. TP34A

Site Name GCRE

Sample No. 3

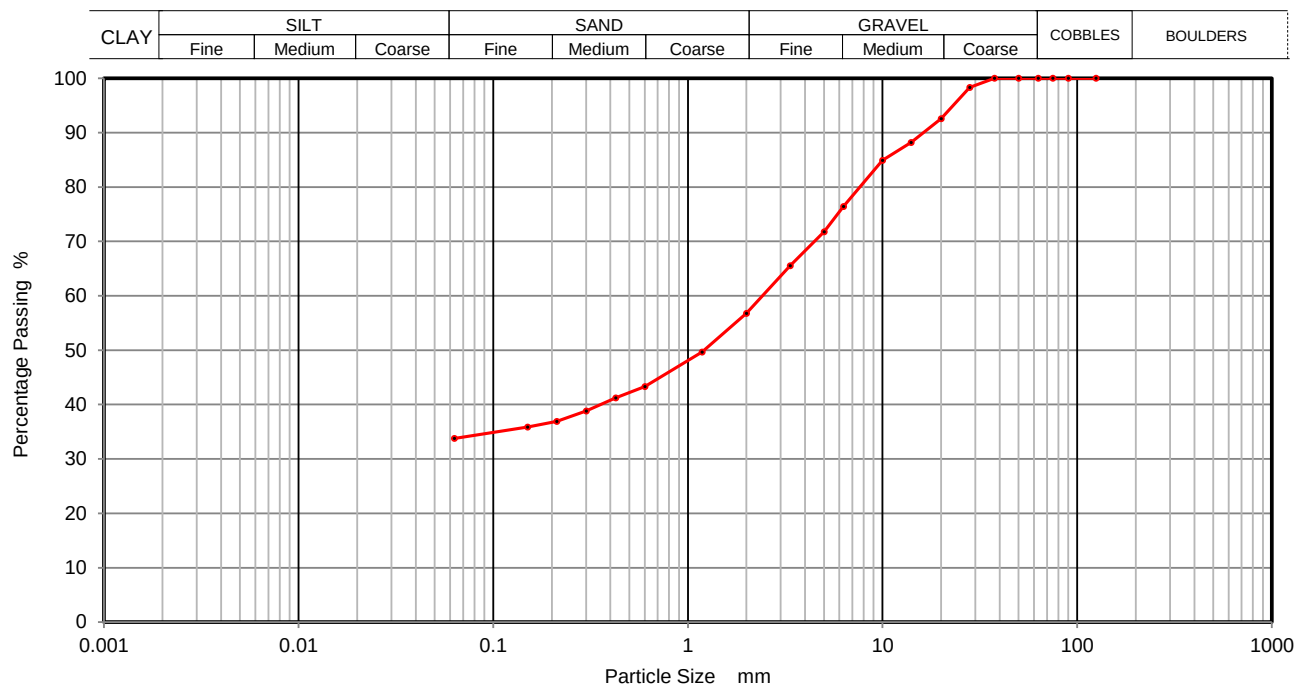
Soil Description Black fine to coarse sandy silty/ clayey fine to coarse GRAVEL

Depth Top 2.00

Depth Base 2.50

Date Tested 15/02/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	93		
14	88		
10	85		
6.3	76		
5	72		
3.35	66		
2	57		
1.18	50		
0.6	43		
0.425	41		
0.3	39		
0.212	37		
0.15	36		
0.063	34		

Sample Proportions	% dry mass
Cobbles	0
Gravel	43
Sand	23
Silt and Clay	34

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	18/02/2022	Richard John	
David	Approved	19/02/2022	Paul Evans	





Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990

Contract Number 57820

Borehole / Pit No TP04

Project Location GCRE

Sample No 2

Date Tested 03/02/2022

Depth Top 1.00

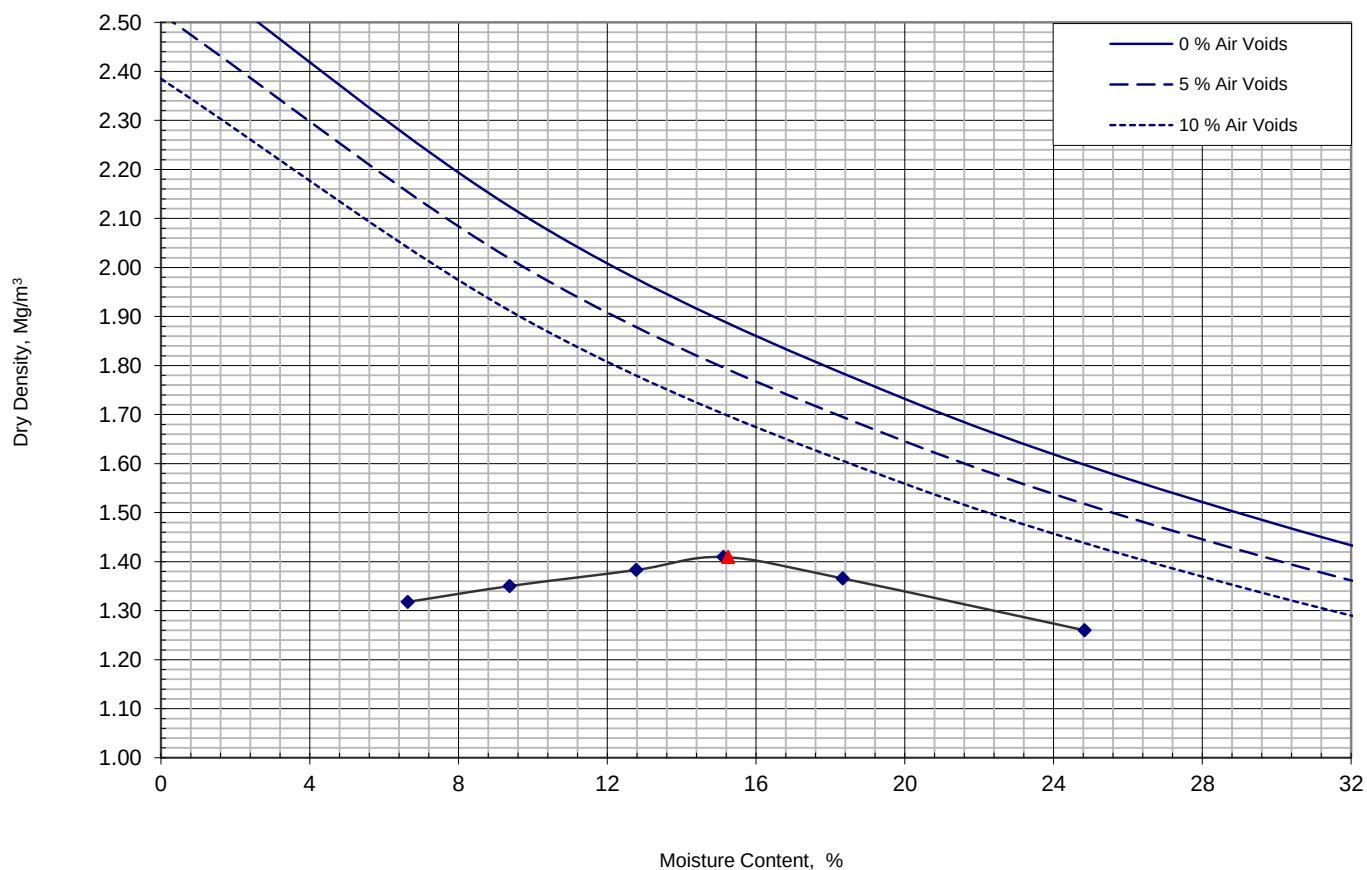
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.6

Sample Type B

Sample Description Black slightly silty/ clayey sandy GRAVEL



Compaction Point	1	2	3	4	5	6						
Moisture Content	6.6	9.4	13	15	18	25						
Bulk Density	1.41	1.48	1.56	1.62	1.62	1.57						
Dry Density	1.32	1.35	1.38	1.41	1.37	1.26						

Initial Moisture Content	25	%
Maximum Dry Density	1.41	Mg/m3
Optimum Moisture Content	15	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	13	%
Material Retained 20mm	17	%

Operator Checked 18/02/2022 Richard John

Chris G Approved 19/02/2022 Paul Evans

Richard John

Chris G





Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990

Contract Number 57820

Borehole / Pit No TP09

Project Location GCRE

Sample No 2

Date Tested 03/02/2022

Depth Top 1.00

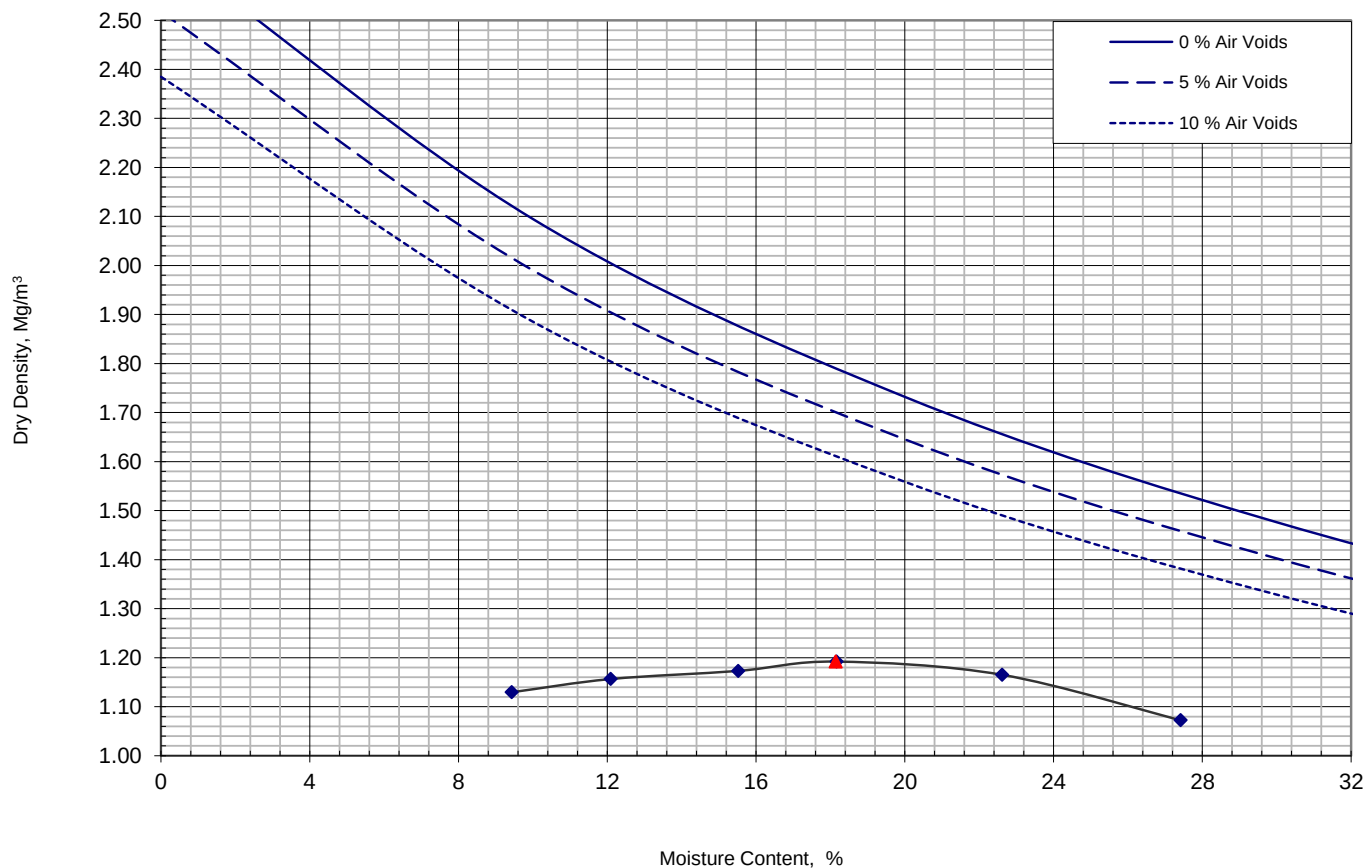
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.6

Sample Type B

Sample Description Black slightly gravelly sandy silty CLAY



Compaction Point	1	2	3	4	5	6						
Moisture Content	9.4	12	16	18	23	27						
Bulk Density	1.24	1.30	1.36	1.41	1.43	1.37						
Dry Density	1.13	1.16	1.17	1.19	1.17	1.07						

Initial Moisture Content	27	%
Maximum Dry Density	1.19	Mg/m3
Optimum Moisture Content	18	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	0	%

Operator Checked 18/02/2022 Richard John

Chris G Approved 19/02/2022 Paul Evans

Richard John

Chris G





Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990

Contract Number 57820

Borehole / Pit No TP23

Project Location GCRE

Sample No 2

Date Tested 03/02/2022

Depth Top 1.00

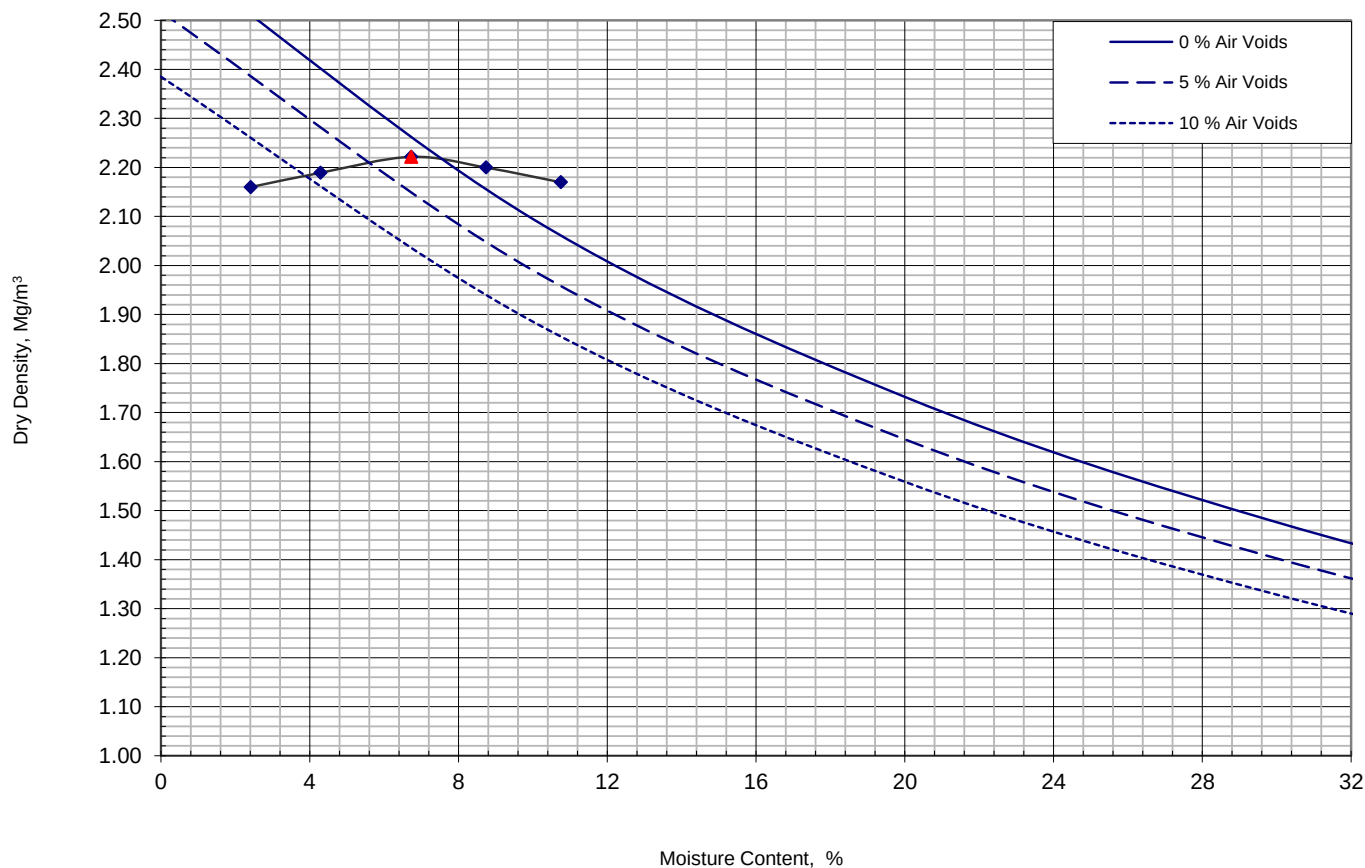
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.6

Sample Type B

Sample Description Black silty/ clayey sandy GRAVEL



Compaction Point	1	2	3	4	5						
Moisture Content	2.4	4.3	6.7	8.7	11						
Bulk Density	2.21	2.28	2.37	2.39	2.40						
Dry Density	2.16	2.19	2.22	2.20	2.17						

Initial Moisture Content	6.7	%
Maximum Dry Density	2.22	Mg/m3
Optimum Moisture Content	6.7	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	13	%

Operator Checked 18/02/2022 Richard John

Chris G Approved 19/02/2022 Paul Evans

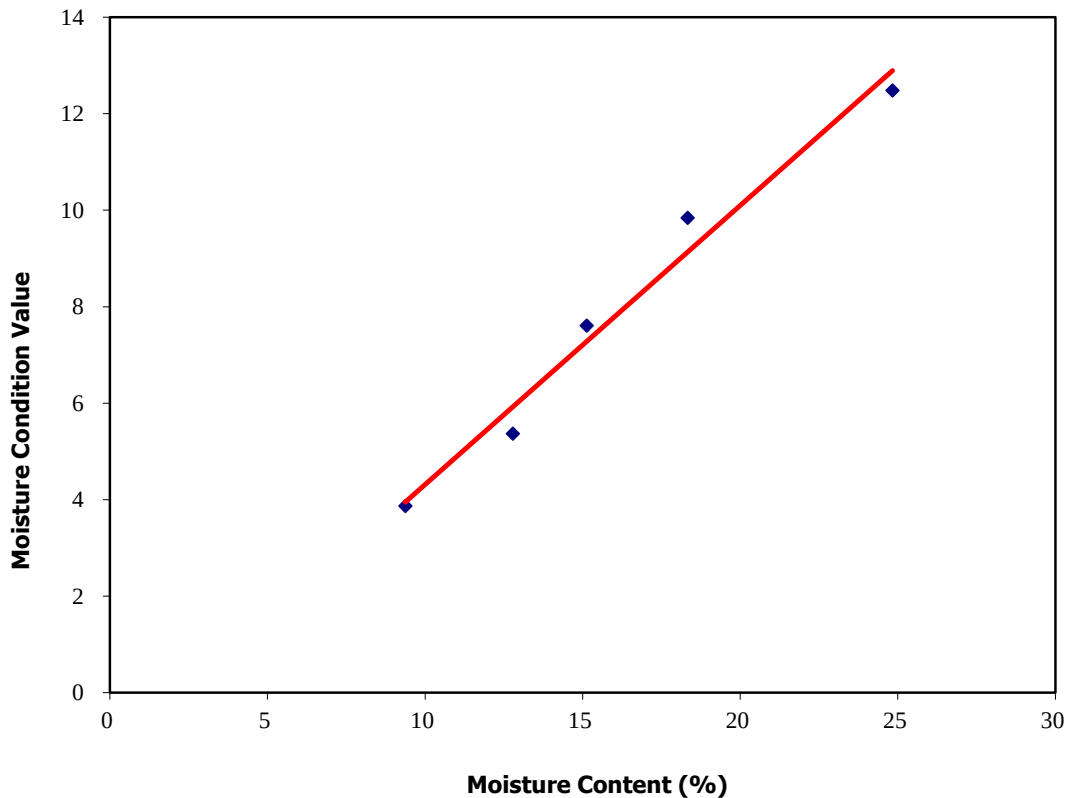


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57820
Hole Number: TP04
Sample Number: 2
Depth (m) : 1.00
Sample Type B
Date Tested: 02/02/2022
Technician: Chris

Initial Moisture Content (%):	25
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	30



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	9.4	13	15	18	25
MCV	3.9	5.4	7.6	9.8	12.5

* reading unobtainable.



Checked by
Richard John
Date approved:

19/2/22


Approved by
Richard John

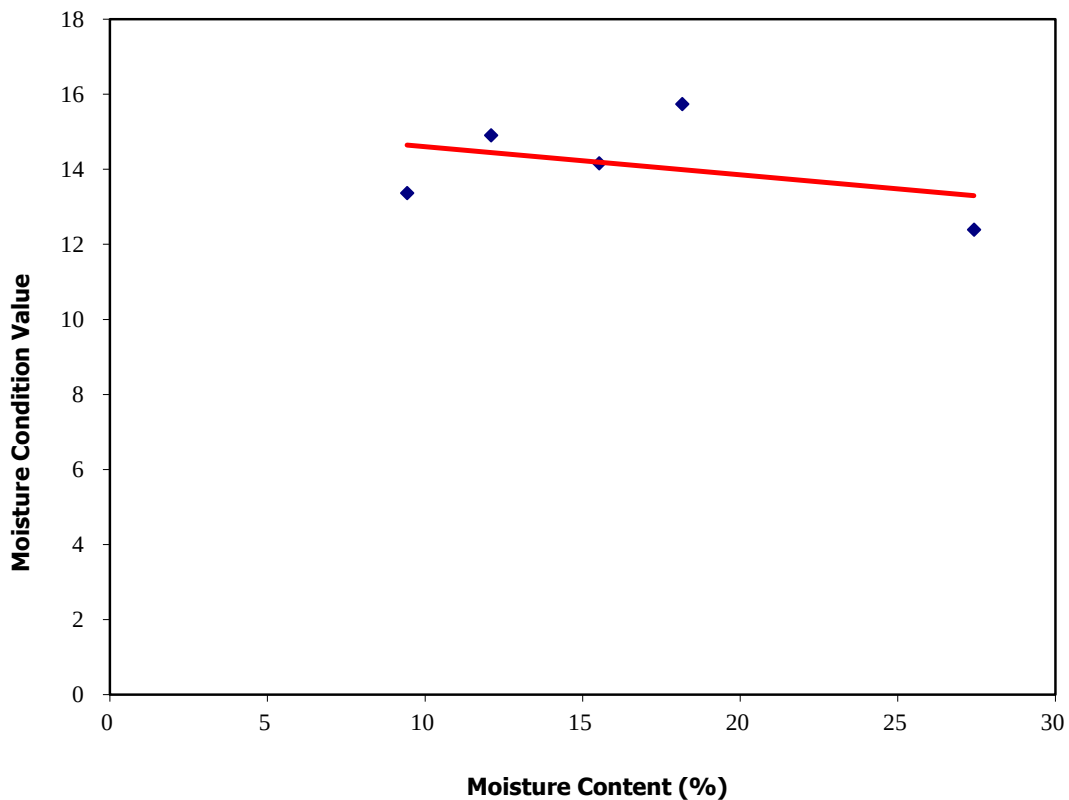


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57820
Hole Number: TP09
Sample Number: 2
Depth (m) : 1.00
Sample Type B
Date Tested: 02/02/2022
Technician: Chris

Initial Moisture Content (%):	27
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	30



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	9.4	12	16	18	27
MCV	13.4	14.9	14.2	15.7	12.4

* reading unobtainable.



Checked by
Richard John
Date approved:

19/2/22


Approved by
Richard John

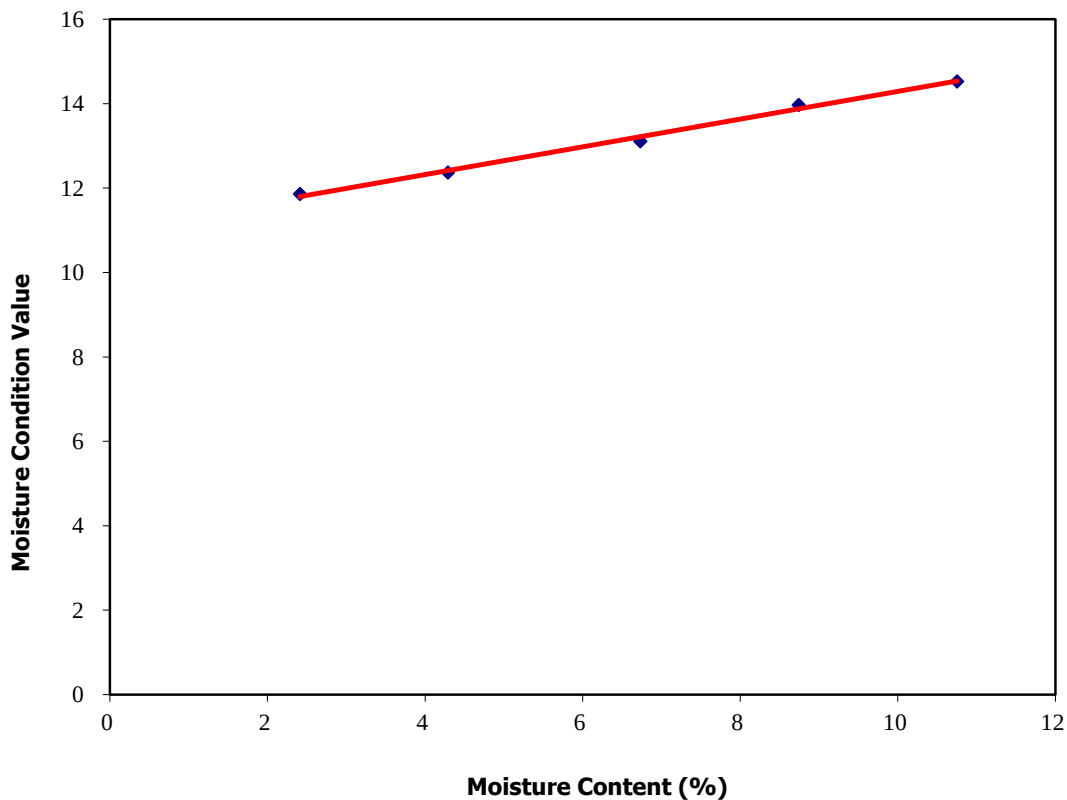


Moisture Condition Value Calibration

BS 1377:Part 4:1990

Client ref: Q0652
Location: GCRE
Contract Number: 57820
Hole Number: TP23
Sample Number: 2
Depth (m) : 1.00
Sample Type B
Date Tested: 02/02/2022
Technician: Chris

Initial Moisture Content (%):	6.7
Single/Separate Samples Tested.	Single
Material Retained on the 20mm BS Test Sieve (%):	30



Test Results.

Test Number.	1	2	3	4	5
Moisture Content (%).	2.4	4.3	6.7	8.7	11
MCV	11.9	12.4	13.1	14.0	14.5

* reading unobtainable.



Checked by
Richard John
Date approved:

19/2/22


Approved by
Richard John





ANALYTICAL TEST REPORT

Contract no: 105801

Contract name: GCRE

Client reference: Q0652

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 10 February 2022

Analysis started: 10 February 2022

Analysis completed: 17 February 2022

Report issued: 17 February 2022

Key

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

Approved by:

Rachael Burton

Reporting Team Lead

Chemtech Environmental Limited

SOILS

Lab number			105801-1	105801-2	105801-3	105801-4	105801-5	105801-6
Sample id			TP01	TP04	TP06	TP06	TP09	TP23
Depth (m)			1.00	1.00	1.00	2.00	1.00	1.00
Sample Type			B2	B2	B2	B3	B2	B2
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^U	units	8.3	8.0	5.8	5.6	7.2	9.1
Magnesium (2:1 water soluble)	CE061	mg/l Mg	5.1	9.5	14	-	7.0	-
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	9.1	1.4	1.3	-	<1	-
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	52	4.5	<1	-	<1	-
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	44	161	163	123	128	34
Sulphate (total)	CE062 ^U	mg/kg SO ₄	1795	439	643	552	449	180
Sulphur (total)	CE119	mg/kg S	811	2519	505	192	1663	485
Sulphur (total)	CE119	% w/w S	0.08	0.25	0.05	0.02	0.17	0.05

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO ₃
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
105801-1	TP01	1.00	Y	All (NSD)
105801-2	TP04	1.00	Y	All (NSD)
105801-3	TP06	1.00	Y	All (NSD)
105801-4	TP06	2.00	Y	All (NSD)
105801-5	TP09	1.00	Y	All (NSD)
105801-6	TP23	1.00	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

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

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

Methods, procedures and performance data are available on request.

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

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

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

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

Analytical results are inclusive of stones, where applicable.



Contract Number: 57860

Client Ref: **Q0652**

Report Date: **16-02-2022**

Client PO:

Client **Quantum Geotechnic Ltd**
Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contract Title: **GCRE**
For the attention of: **Phil Darby**

Date Received: **31-01-2022**

Date Completed: **16-02-2022**

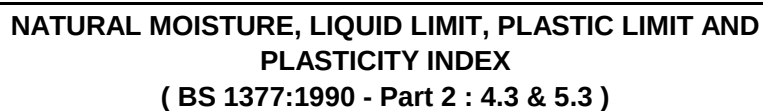
Test Description	Qty
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	2
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	2
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	2
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	2
Samples Received - @ Non Accredited Test	2
Disposal of samples for job	1

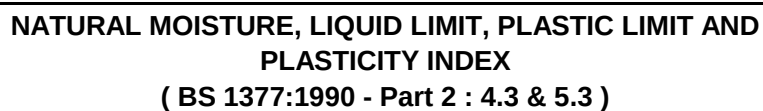
Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)
Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

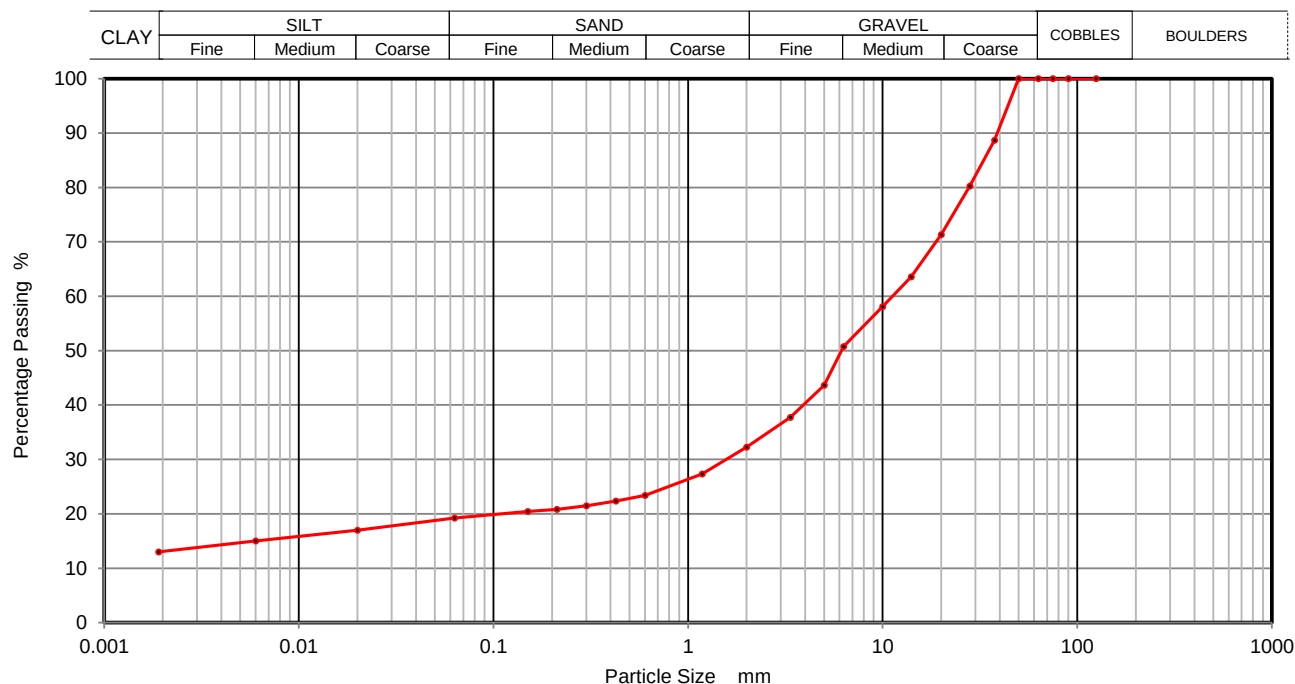
[illegible]





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57860
	Borehole/Pit No.
BH22	
Site Name	GCRC
Sample No.	2
Soil Description	Black silty clayey sandy fine to coarse GRAVEL with cobbles
	Depth Top
	Depth Base
	7.50
Date Tested	15/02/2022
Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	17
90	100	0.0060	15
75	100	0.0020	13
63	100		
50	100		
37.5	89		
28	80		
20	71		
14	64		
10	58		
6.3	51		
5	44		
3.35	38		
2	32		
1.18	27		
0.6	23		
0.425	22		
0.3	21		
0.212	21		
0.15	20		
0.063	19		

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	13
Silt	6
Clay	13

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

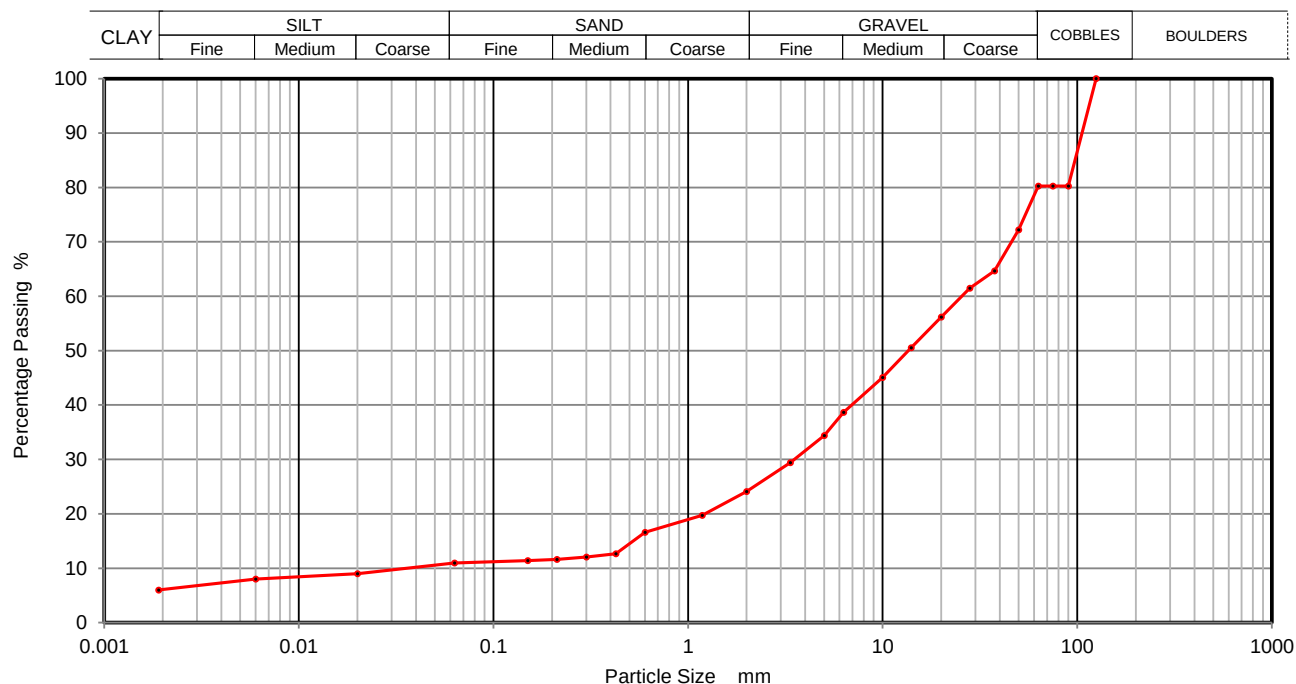
Operator	Checked	15/02/2022	Richard John	
David	Approved	16/02/2022	Paul Evans	





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	57860
	Borehole/Pit No.
Site Name	GCRE
Soil Description	Black silty clayey sandy fine to coarse GRAVEL with cobbles
Date Tested	15/02/2022
Sample No.	4
Depth Top	15.00
Depth Base	16.50
Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	9
90	80	0.0060	8
75	80	0.0020	6
63	80		
50	72		
37.5	65		
28	61		
20	56		
14	51		
10	45		
6.3	39		
5	34		
3.35	29		
2	24		
1.18	20		
0.6	17		
0.425	13		
0.3	12		
0.212	12		
0.15	11		
0.063	11		

Sample Proportions	% dry mass
Cobbles	20
Gravel	56
Sand	13
Silt	5
Clay	6

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	15/02/2022	Richard John	
David	Approved	16/02/2022	Paul Evans	



2788

APPENDIX VIII – CHEMICAL LABORATORY TEST RESULTS



Final Report

Report No.: 21-43554-1

Initial Date of Issue: 16-Dec-2021

Client Quantum Geotechnic Ltd

Client Address: 13A Bishops Court Gardens
Clyst St Mary
Exeter
EX5 1DH

Contact(s): Adam Parnell
Ben Tucker
Jim Dennis
Logan Richmond-Clarke
Ross McDermott

Project Q0652 Global Centre of Rail Excellence

Quotation No.: Q21-24761 **Date Received:** 07-Dec-2021

Order No.: **Date Instructed:** 09-Dec-2021

No. of Samples: 2

Turnaround (Wkdays): 5 **Results Due:** 15-Dec-2021

Date Approved: 16-Dec-2021

Approved By:


Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		21-43554			
Quotation No.: Q21-24761	Chemtest Sample ID.:		1336895			
	Client Sample ID.:		1			
	Sample Location:		BH30			
	Sample Type:		SOIL			
	Top Depth (m):		0.20			
Determinand	Accred.	SOP	Type	Units	LOD	
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	0.67
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	1.0
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	0.68
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5
Chromium (Total)	N	1455	10:1	µg/l	0.50	< 0.50
Naphthalene	N	1800	10:1	µg/l	0.010	< 0.010
Acenaphthylene	N	1800	10:1	µg/l	0.010	< 0.010
Acenaphthene	N	1800	10:1	µg/l	0.010	< 0.010
Fluorene	N	1800	10:1	µg/l	0.010	< 0.010
Phenanthrene	N	1800	10:1	µg/l	0.010	< 0.010
Anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010
Pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[a]anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Chrysene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[b]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[k]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[a]pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	10:1	µg/l	0.010	< 0.010
Total Of 16 PAH's	N	1800	10:1	µg/l	0.20	< 0.20
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.: 21-43554				21-43554	
Quotation No.: Q21-24761	Chemtest Sample ID.: 1336895				1336895	
	Client Sample ID.:				1	12
	Sample Location:				BH30	BH30
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.20	4.00
	Asbestos Lab:				DURHAM	
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	12	18
Soil Colour	N	2040		N/A	Black	
Other Material	N	2040		N/A	Stones	
Soil Texture	N	2040		N/A	Gravel	
pH	M	2010		4.0	8.7	6.9
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	0.55
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	2.6	27
Cadmium	M	2450	mg/kg	0.10	< 0.10	0.32
Chromium	M	2450	mg/kg	1.0	1.3	11
Copper	M	2450	mg/kg	0.50	17	7.8
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	6.4	5.2
Lead	M	2450	mg/kg	0.50	8.0	16
Selenium	M	2450	mg/kg	0.20	0.27	0.87
Zinc	M	2450	mg/kg	0.50	52	21
Total Organic Carbon	M	2625	%	0.20	82	11
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10		< 10
TPH >C6-C10	N	2670	mg/kg	1.0		< 1.0
TPH >C10-C25	N	2670	mg/kg	1.0		< 1.0
TPH >C25-C40	N	2670	mg/kg	1.0		< 1.0
Total TPH >C6-C40	M	2670	mg/kg	10		< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	7.4	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	13	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	4.6	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	22	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	47	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-43554	21-43554
Quotation No.: Q21-24761	Chemtest Sample ID.:				1336895	1336899
	Client Sample ID.:				1	12
	Sample Location:				BH30	BH30
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.20	4.00
	Asbestos Lab:				DURHAM	
Determinand	Accred.	SOP	Units	LOD		
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	220	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	220	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	270	
Benzene	M	2760	mg/kg	0.0010	< 0.0010	
Toluene	M	2760	mg/kg	0.0010	< 0.0010	
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010	
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010	
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	0.72
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	0.23
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	1.2
Fluorene	M	2800	mg/kg	0.10	< 0.10	1.3
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	8.3
Anthracene	M	2800	mg/kg	0.10	< 0.10	2.3
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	11
Pyrene	M	2800	mg/kg	0.10	< 0.10	9.0
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	4.8
Chrysene	M	2800	mg/kg	0.10	< 0.10	4.3
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	7.5
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	2.8
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	6.6
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	5.1
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	0.79
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	3.7
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	70
PCB 81	N	2815	mg/kg	0.0010	< 0.0010	
PCB 77	N	2815	mg/kg	0.0010	< 0.0010	
PCB 105	N	2815	mg/kg	0.0010	< 0.0010	
PCB 114	N	2815	mg/kg	0.0010	< 0.0010	
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	
PCB 123	N	2815	mg/kg	0.0010	< 0.0010	
PCB 126	N	2815	mg/kg	0.0010	< 0.0010	
PCB 156	N	2815	mg/kg	0.0010	< 0.0010	
PCB 157	N	2815	mg/kg	0.0010	< 0.0010	
PCB 167	N	2815	mg/kg	0.0010	< 0.0010	
PCB 169	N	2815	mg/kg	0.0010	< 0.0010	
PCB 189	N	2815	mg/kg	0.0010	< 0.0010	

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-43554	21-43554
Quotation No.: Q21-24761	Chemtest Sample ID.:				1336895	1336899
	Client Sample ID.:				1	12
	Sample Location:				BH30	BH30
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.20	4.00
	Asbestos Lab:				DURHAM	
Determinand	Accred.	SOP	Units	LOD		
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010	< 0.0010	
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10

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:
1336895		1	BH30		A	Amber Glass 250ml
1336895		1	BH30		A	Amber Glass 60ml
1336895		1	BH30		A	Plastic Tub 1000g
1336899		12	BH30		A	Amber Glass 250ml
1336899		12	BH30		A	Amber Glass 60ml
1336899		12	BH30		A	Plastic Tub 1000g

Test Methods

SOP	Title	Parameters included	Method summary
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

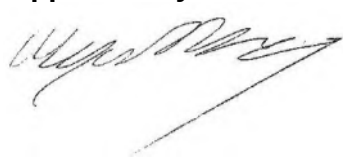
Charges may apply to extended sample storage

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



2183

Final Report

Report No.:	21-43564-1		
Initial Date of Issue:	16-Dec-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	13A Bishops Court Gardens Clyst St Mary Exeter EX5 1DH		
Contact(s):	Adam Parnell Ben Tucker Jim Dennis Logan Richmond-Clarke Ross McDermott		
Project	Q0652 Global Centre of Rail Excellence		
Quotation No.:	Q21-24761	Date Received:	07-Dec-2021
Order No.:		Date Instructed:	09-Dec-2021
No. of Samples:	1		
Turnaround (Wkdays):	5	Results Due:	15-Dec-2021
Date Approved:	16-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		21-43564			
Quotation No.: Q21-24761	Chemtest Sample ID.:		1336944			
Order No.:	Client Sample Ref.:		1			
	Sample Location:		BH32			
	Sample Type:		SOIL			
	Top Depth (m):		0.20			
Determinand	Accred.	SOP	Type	Units	LOD	
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	15
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	9.1
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	1.7
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	5.6
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	13
Chromium (Total)	N	1455	10:1	µg/l	0.50	1.1
Naphthalene	N	1800	10:1	µg/l	0.010	< 0.010
Acenaphthylene	N	1800	10:1	µg/l	0.010	< 0.010
Acenaphthene	N	1800	10:1	µg/l	0.010	< 0.010
Fluorene	N	1800	10:1	µg/l	0.010	< 0.010
Phenanthrene	N	1800	10:1	µg/l	0.010	< 0.010
Anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010
Pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[a]anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Chrysene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[b]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[k]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[a]pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	10:1	µg/l	0.010	< 0.010
Total Of 16 PAH's	N	1800	10:1	µg/l	0.20	< 0.20
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		21-43564		
Quotation No.: Q21-24761	Chemtest Sample ID.:		1336944		
Order No.:	Client Sample Ref.:		1		
	Sample Location:		BH32		
	Sample Type:		SOIL		
	Top Depth (m):		0.20		
	Asbestos Lab:		COVENTRY		
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	22
pH	U	2010		4.0	[A] 8.1
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	[A] < 0.40
Cyanide (Total)	U	2300	mg/kg	0.50	[A] < 0.50
Arsenic	U	2450	mg/kg	1.0	23
Cadmium	U	2450	mg/kg	0.10	0.77
Chromium	U	2450	mg/kg	1.0	10
Copper	U	2450	mg/kg	0.50	27
Mercury	U	2450	mg/kg	0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	28
Lead	U	2450	mg/kg	0.50	26
Selenium	U	2450	mg/kg	0.20	0.78
Zinc	U	2450	mg/kg	0.50	120
Total Organic Carbon	U	2625	%	0.20	[A] 6.9
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10
TPH >C6-C10	N	2670	mg/kg	1.0	[A] < 1.0
TPH >C10-C25	N	2670	mg/kg	1.0	[A] < 1.0
TPH >C25-C40	N	2670	mg/kg	1.0	[A] < 1.0
Total TPH >C6-C40	U	2670	mg/kg	10	[A] < 10
Naphthalene	U	2800	mg/kg	0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	0.45
Anthracene	U	2800	mg/kg	0.10	0.11
Fluoranthene	U	2800	mg/kg	0.10	0.86
Pyrene	U	2800	mg/kg	0.10	0.56
Benzo[a]anthracene	U	2800	mg/kg	0.10	0.45
Chrysene	U	2800	mg/kg	0.10	0.47
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	0.90
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	0.29
Benzo[a]pyrene	U	2800	mg/kg	0.10	0.52
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	0.48
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.24
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	0.40
Total Of 16 PAH's	N	2800	mg/kg	2.0	5.7

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		21-43564		
Quotation No.: Q21-24761	Chemtest Sample ID.:		1336944		
Order No.:	Client Sample Ref.:		1		
	Sample Location:		BH32		
	Sample Type:		SOIL		
	Top Depth (m):		0.20		
	Asbestos Lab:		COVENTRY		
Determinand	Accred.	SOP	Units	LOD	
Total Phenols	U	2920	mg/kg	0.10	< 0.10

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:
1336944	1		BH32		A	Amber Glass 250ml
1336944	1		BH32		A	Amber Glass 60ml
1336944	1		BH32		A	Plastic Tub 1000g

Test Methods

SOP	Title	Parameters included	Method summary
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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.
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
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
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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



Final Report

Report No.: 22-00477-1

Initial Date of Issue: 19-Jan-2022

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Steffan Picton

Project Q0652 GCRE - ONLLWYN

Quotation No.: Q21-24761 **Date Received:** 11-Jan-2022

Order No.: **Date Instructed:** 14-Jan-2022

No. of Samples: 4

Turnaround (Wkdays): 5 **Results Due:** 20-Jan-2022

Date Approved: 19-Jan-2022

Approved By:

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: Q0652 GCRE - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00477	22-00477	22-00477	22-00477
Quotation No.: Q21-24761	Chemtest Sample ID.:				1349251	1349252	1349255	1349256
Order No.:	Client Sample Ref.:				1	2	2	3
	Client Sample ID.:				ES	ES	ES	ES
	Sample Location:				TP1	TP1	TP2	TP2
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	1.0	0.3	1.0
	Date Sampled:				07-Jan-2022	07-Jan-2022	07-Jan-2022	07-Jan-2022
	Asbestos Lab:				COVENTRY	COVENTRY	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	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	13	22	8.1	8.8
Soil Colour	N	2040		N/A	Black	Black		Black
Other Material	N	2040		N/A	Stones and Roots	Stones		Stones
Soil Texture	N	2040		N/A	Loam	Gravel		Gravel
pH	M	2010		4.0	8.2	9.0	8.5	8.5
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	12	17	14	17
Cadmium	M	2450	mg/kg	0.10	0.26	0.46	0.11	0.34
Chromium	M	2450	mg/kg	1.0	18	13	11	5.5
Copper	M	2450	mg/kg	0.50	69	260	38	62
Mercury	M	2450	mg/kg	0.10	< 0.10	0.15	0.10	0.13
Nickel	M	2450	mg/kg	0.50	34	26	18	18
Lead	M	2450	mg/kg	0.50	26	69	23	47
Selenium	M	2450	mg/kg	0.20	0.61	1.1	1.0	1.7
Zinc	M	2450	mg/kg	0.50	110	240	41	150
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50		< 0.50
LOI	M	2610	%	0.10		22		65
Total Organic Carbon	M	2625	%	0.20	22	43	39	44
Aliphatic TPH >C5-C6	N	2680	mg/kg	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
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	3700
Aliphatic TPH >C35-C44	N	2680	mg/kg	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	3700
Aromatic TPH >C5-C7	N	2680	mg/kg	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
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: Q0652 GCRE - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00477	22-00477	22-00477	22-00477
Quotation No.: Q21-24761	Chemtest Sample ID.:				1349251	1349252	1349255	1349256
Order No.:	Client Sample Ref.:				1	2	2	3
	Client Sample ID.:				ES	ES	ES	ES
	Sample Location:				TP1	TP1	TP2	TP2
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	1.0	0.3	1.0
	Date Sampled:				07-Jan-2022	07-Jan-2022	07-Jan-2022	07-Jan-2022
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	1100	< 1.0	< 1.0	2300
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	1100	< 5.0	< 5.0	2300
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	1100	< 10	< 10	6000
Benzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	0.0014	< 0.0010
Toluene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	0.0013	< 0.0010
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Naphthalene	M	2800	mg/kg	0.10	1.2	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	0.22	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.22	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.30	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	2.4	2.8	1.4	2.6
Anthracene	M	2800	mg/kg	0.10	0.46	0.64	0.25	0.48
Fluoranthene	M	2800	mg/kg	0.10	4.3	4.0	1.0	2.5
Pyrene	M	2800	mg/kg	0.10	4.1	3.3	0.83	2.0
Benzo[a]anthracene	M	2800	mg/kg	0.10	2.3	1.7	0.37	1.1
Chrysene	M	2800	mg/kg	0.10	2.5	2.0	0.55	1.3
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	2.9	2.5	0.57	1.4
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	1.1	0.82	0.20	0.41
Benzo[a]pyrene	M	2800	mg/kg	0.10	2.0	1.6	0.26	0.76
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	1.4	1.2	< 0.10	0.46
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.35	0.24	< 0.10	0.14
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	1.3	1.2	< 0.10	0.45
Total Of 16 PAH's	N	2800	mg/kg	2.0	27	22	5.4	14
PCB 81	N	2815	mg/kg	0.0010	< 0.0010			
PCB 77	N	2815	mg/kg	0.0010	< 0.0010			
PCB 105	N	2815	mg/kg	0.0010	< 0.0010			
PCB 114	N	2815	mg/kg	0.0010	< 0.0010			
PCB 118	N	2815	mg/kg	0.0010	< 0.0010			
PCB 123	N	2815	mg/kg	0.0010	< 0.0010			
PCB 126	N	2815	mg/kg	0.0010	< 0.0010			
PCB 156	N	2815	mg/kg	0.0010	< 0.0010			
PCB 157	N	2815	mg/kg	0.0010	< 0.0010			
PCB 167	N	2815	mg/kg	0.0010	< 0.0010			

Results - Soil

Project: Q0652 GCRE - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		22-00477	22-00477	22-00477	22-00477
Quotation No.: Q21-24761	Chemtest Sample ID.:		1349251	1349252	1349255	1349256
Order No.:	Client Sample Ref.:		1	2	2	3
	Client Sample ID.:		ES	ES	ES	ES
	Sample Location:		TP1	TP1	TP2	TP2
	Sample Type:		SOIL	SOIL	SOIL	SOIL
	Top Depth (m):		0.2	1.0	0.3	1.0
	Date Sampled:		07-Jan-2022	07-Jan-2022	07-Jan-2022	07-Jan-2022
	Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
PCB 169	N	2815	mg/kg	0.0010	< 0.0010	
PCB 189	N	2815	mg/kg	0.0010	< 0.0010	
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010	< 0.0010	
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10

Results - Single Stage WAC

Project: Q0652 GCRE - ONLLWYN

Chemtest Job No: 22-00477					Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 1349252					Limits		
Sample Ref: 2					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID: ES							
Sample Location: TP1							
Top Depth(m): 1.0							
Bottom Depth(m):							
Sampling Date: 07-Jan-2022							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	M	%	43	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	41	100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455	U	0.0050	0.050	0.5	2	25
Barium	1455	U	0.018	0.18	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0056	0.056	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0011	0.011	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	0.0005	0.0054	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.005	0.050	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.29	2.9	10	150	500
Sulphate	1220	U	18	180	1000	20000	50000
Total Dissolved Solids	1020	N	72	710	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.1	51	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	22

Waste Acceptance Criteria

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

Results - Single Stage WAC

Project: Q0652 GCRE - ONLLWYN

Chemtest Job No: 22-00477					Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 1349256					Limits		
Sample Ref: 3					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID: ES							
Sample Location: TP2							
Top Depth(m): 1.0							
Bottom Depth(m):							
Sampling Date: 07-Jan-2022							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	M	%	44	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	6000	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	12	100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455	U	0.0002	0.0024	0.5	2	25
Barium	1455	U	0.017	0.17	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0012	0.012	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0006	0.0059	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.003	0.027	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.21	2.1	10	150	500
Sulphate	1220	U	8.6	86	1000	20000	50000
Total Dissolved Solids	1020	N	46	460	4000	60000	100000
Phenol Index	1920	U	0.35	3.5	1	-	-
Dissolved Organic Carbon	1610	U	5.3	53	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	8.8

Waste Acceptance Criteria

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

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.: 22-00598-1

Initial Date of Issue: 20-Jan-2022

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Steffan Picton

Project Q0652 GCRR - ONLLWYN

Quotation No.: Q21-24761 **Date Received:** 12-Jan-2022

Order No.: **Date Instructed:** 14-Jan-2022

No. of Samples: 15

Turnaround (Wkdays): 5 **Results Due:** 20-Jan-2022

Date Approved: 20-Jan-2022

Approved By:

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: Q0652 GCRR - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598
Quotation No.: Q21-24761	Chemtest Sample ID.:				1349746	1349747	1349750	1349751	1349752	1349755	1349756	1349757	1349758
Order No.:	Client Sample Ref.:				ES	ES	ES	ES	ES	ES	ES	ES	ES
	Client Sample ID.:				1	2	1	2	3	2	3	4	1
	Sample Location:				TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP5	TP6
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.8	0.2	1.0	2.0	1.0	2.0	3.0	0.2
	Date Sampled:				10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022
	Asbestos Lab:				DURHAM	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 Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	30	13	12	11	11	12	10	11	14
Soil Colour	N	2040		N/A	Brown		Black						Black
Other Material	N	2040		N/A	Stones and Roots		Stones						Stones
Soil Texture	N	2040		N/A	Sand		Sand						Sand
pH	M	2010		4.0	8.3	8.6	8.4		8.3	8.4		8.1	8.1
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	< 0.40	0.46		0.49	< 0.40		< 0.40	< 0.40
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	15	15	14		20	23		20	20
Cadmium	M	2450	mg/kg	0.10	0.46	0.41	< 0.10		0.14	0.25		0.19	0.16
Chromium	M	2450	mg/kg	1.0	37	11	4.4		5.9	7.8		11	21
Copper	M	2450	mg/kg	0.50	52	67	51		110	84		60	77
Mercury	M	2450	mg/kg	0.10	0.12	0.10	0.17		0.27	0.24		0.13	0.22
Nickel	M	2450	mg/kg	0.50	21	37	22		88	39		37	36
Lead	M	2450	mg/kg	0.50	40	27	42		42	37		29	38
Selenium	M	2450	mg/kg	0.20	0.74	0.67	2.8		4.2	1.7		1.6	2.2
Zinc	M	2450	mg/kg	0.50	120	120	44		92	130		110	89
Chromium (Hexavalent)	N	2490	mg/kg	0.50									< 0.50
LOI	M	2610	%	0.10									15
Total Organic Carbon	M	2625	%	0.20	37	2.8	24		15	34		28	23
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10					< 10			< 10	
TPH >C6-C10	N	2670	mg/kg	1.0					< 1.0			< 1.0	
TPH >C10-C25	N	2670	mg/kg	1.0					< 1.0			< 1.0	
TPH >C25-C40	N	2670	mg/kg	1.0					< 1.0			< 1.0	
Total TPH >C6-C40	M	2670	mg/kg	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	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0			< 1.0			< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0			< 1.0			< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0			< 1.0			< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0			< 1.0			< 1.0
Aliphatic TPH >C21-C35	M	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

Results - Soil

Project: Q0652 GCRR - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598
Quotation No.: Q21-24761	Chemtest Sample ID.:				1349746	1349747	1349750	1349751	1349752	1349755	1349756	1349757
Order No.:	Client Sample Ref.:				ES	ES	ES	ES	ES	ES	ES	ES
	Client Sample ID.:				1	2	1	2	3	2	3	4
	Sample Location:				TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.8	0.2	1.0	2.0	1.0	2.0	3.0
	Date Sampled:				10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022
	Asbestos Lab:				DURHAM	DURHAM	DURHAM		DURHAM	DURHAM		DURHAM
Determinand	Accred.	SOP	Units	LOD								
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	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0			< 1.0		< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0			< 1.0		< 1.0
Aromatic TPH >C12-C16	M	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	< 1.0	< 1.0			< 1.0		< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	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
Total Aromatic Hydrocarbons	N	2680	mg/kg	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
Benzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010			< 0.0010		< 0.0010
Toluene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010			< 0.0010		< 0.0010
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010			< 0.0010		< 0.0010
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010			< 0.0010		< 0.0010
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010			< 0.0010		< 0.0010
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Phenanthrene	M	2800	mg/kg	0.10	0.69	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Fluoranthene	M	2800	mg/kg	0.10	0.71	< 0.10	< 0.10		< 0.10	0.36		0.31
Pyrene	M	2800	mg/kg	0.10	0.50	< 0.10	< 0.10		< 0.10	0.30		0.27
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.48	< 0.10	< 0.10		< 0.10	0.16		0.14
Chrysene	M	2800	mg/kg	0.10	0.79	< 0.10	< 0.10		< 0.10	0.23		0.20
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.84	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.22	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.35	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.29	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.11	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.29	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	5.3	< 2.0	< 2.0		< 2.0	< 2.0		< 2.0
PCB 81	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010					< 0.0010
PCB 77	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010					< 0.0010
PCB 105	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010					< 0.0010
PCB 114	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010					< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010					< 0.0010

Results - Soil

Project: Q0652 GCRR - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598	22-00598
Quotation No.: Q21-24761	Chemtest Sample ID.:		1349746	1349747	1349750	1349751	1349752	1349755	1349756	1349757	1349758
Order No.:	Client Sample Ref.:		ES	ES	ES	ES	ES	ES	ES	ES	ES
	Client Sample ID.:		1	2	1	2	3	2	3	4	1
	Sample Location:		TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP5	TP6
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):		0.2	0.8	0.2	1.0	2.0	1.0	2.0	3.0	0.2
	Date Sampled:		10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022
	Asbestos Lab:		DURHAM	DURHAM	DURHAM		DURHAM	DURHAM		DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD							
PCB 123	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
PCB 126	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
PCB 156	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
PCB 157	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
PCB 167	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
PCB 169	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
PCB 189	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010	< 0.0010		< 0.0010				< 0.0010
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: Q0652 GCRR - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00598	22-00598	22-00598	22-00598	22-00598	22-00598
Quotation No.: Q21-24761	Chemtest Sample ID.:				1349759	1349760	1349762	1349763	1349764	1349765
Order No.:	Client Sample Ref.:				ES	ES	ES	ES	ES	ES
	Client Sample ID.:				2	3	2	3	4	5
	Sample Location:				TP6	TP6	TP7	TP7	TP7	TP7
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				1.0	2.0	1.0	2.0	3.0	4.0
	Date Sampled:				10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022
	Asbestos 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	13	11	20	15	19	19
Soil Colour	N	2040		N/A			Black			
Other Material	N	2040		N/A			Stones			
Soil Texture	N	2040		N/A			Sand			
pH	M	2010		4.0		5.6	7.4		7.8	7.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40		< 0.40	0.41		0.50	0.46
Cyanide (Total)	M	2300	mg/kg	0.50		< 0.50	< 0.50		< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0		8.9	15		14	33
Cadmium	M	2450	mg/kg	0.10		0.13	0.38		0.46	0.64
Chromium	M	2450	mg/kg	1.0		23	120		11	14
Copper	M	2450	mg/kg	0.50		48	74		70	25
Mercury	M	2450	mg/kg	0.10		< 0.10	0.64		0.22	< 0.10
Nickel	M	2450	mg/kg	0.50		46	140		26	23
Lead	M	2450	mg/kg	0.50		28	59		54	17
Selenium	M	2450	mg/kg	0.20		0.52	1.6		1.7	0.29
Zinc	M	2450	mg/kg	0.50		130	130		140	84
Chromium (Hexavalent)	N	2490	mg/kg	0.50						
LOI	M	2610	%	0.10						
Total Organic Carbon	M	2625	%	0.20		1.2	36		37	1.6
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10		< 10			< 10	69
TPH >C6-C10	N	2670	mg/kg	1.0		< 1.0			< 1.0	< 1.0
TPH >C10-C25	N	2670	mg/kg	1.0		< 1.0			< 1.0	50
TPH >C25-C40	N	2670	mg/kg	1.0		< 1.0			< 1.0	49
Total TPH >C6-C40	M	2670	mg/kg	10		< 10			< 10	98
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0			< 1.0			
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0			< 1.0			
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0			< 5.0			

Results - Soil

Project: Q0652 GCRR - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00598	22-00598	22-00598	22-00598	22-00598	22-00598
Quotation No.: Q21-24761	Chemtest Sample ID.:				1349759	1349760	1349762	1349763	1349764	1349765
Order No.:	Client Sample Ref.:				ES	ES	ES	ES	ES	ES
	Client Sample ID.:				2	3	2	3	4	5
	Sample Location:				TP6	TP6	TP7	TP7	TP7	TP7
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				1.0	2.0	1.0	2.0	3.0	4.0
	Date Sampled:				10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022
	Asbestos Lab:						DURHAM		DURHAM	
Determinand	Accred.	SOP	Units	LOD						
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0			< 1.0			
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0			< 1.0			
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0			< 5.0			
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0			< 10			
Benzene	M	2760	mg/kg	0.0010			< 0.0010			
Toluene	M	2760	mg/kg	0.0010			< 0.0010			
Ethylbenzene	M	2760	mg/kg	0.0010			< 0.0010			
m & p-Xylene	M	2760	mg/kg	0.0010			< 0.0010			
o-Xylene	M	2760	mg/kg	0.0010			< 0.0010			
Naphthalene	M	2800	mg/kg	0.10		0.25	< 0.10		< 0.10	0.55
Acenaphthylene	N	2800	mg/kg	0.10		0.12	< 0.10		< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10		0.18	< 0.10		< 0.10	0.18
Fluorene	M	2800	mg/kg	0.10		0.22	< 0.10		< 0.10	0.15
Phenanthrene	M	2800	mg/kg	0.10		1.0	< 0.10		1.4	1.2
Anthracene	M	2800	mg/kg	0.10		0.39	< 0.10		0.27	0.25
Fluoranthene	M	2800	mg/kg	0.10		2.6	< 0.10		1.5	1.9
Pyrene	M	2800	mg/kg	0.10		2.5	< 0.10		1.2	2.3
Benzo[a]anthracene	M	2800	mg/kg	0.10		1.6	< 0.10		0.67	1.3
Chrysene	M	2800	mg/kg	0.10		1.7	< 0.10		0.77	1.6
Benzo[b]fluoranthene	M	2800	mg/kg	0.10		2.7	< 0.10		0.84	1.8
Benzo[k]fluoranthene	M	2800	mg/kg	0.10		1.0	< 0.10		0.32	0.57
Benzo[a]pyrene	M	2800	mg/kg	0.10		2.3	< 0.10		0.53	1.4
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10		1.9	< 0.10		0.34	0.78
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		0.40	< 0.10		< 0.10	0.28
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10		1.7	< 0.10		0.33	0.78
Total Of 16 PAH's	N	2800	mg/kg	2.0		21	< 2.0		8.2	15
PCB 81	N	2815	mg/kg	0.0010			< 0.0010			
PCB 77	N	2815	mg/kg	0.0010			< 0.0010			
PCB 105	N	2815	mg/kg	0.0010			< 0.0010			
PCB 114	N	2815	mg/kg	0.0010			< 0.0010			
PCB 118	N	2815	mg/kg	0.0010			< 0.0010			

Results - Soil

Project: Q0652 GCRR - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		22-00598	22-00598	22-00598	22-00598	22-00598	22-00598
Quotation No.: Q21-24761	Chemtest Sample ID.:		1349759	1349760	1349762	1349763	1349764	1349765
Order No.:	Client Sample Ref.:		ES	ES	ES	ES	ES	ES
	Client Sample ID.:		2	3	2	3	4	5
	Sample Location:		TP6	TP6	TP7	TP7	TP7	TP7
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):		1.0	2.0	1.0	2.0	3.0	4.0
	Date Sampled:		10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022	10-Jan-2022
	Asbestos Lab:				DURHAM		DURHAM	
Determinand	Accred.	SOP	Units	LOD				
PCB 123	N	2815	mg/kg	0.0010		< 0.0010		
PCB 126	N	2815	mg/kg	0.0010		< 0.0010		
PCB 156	N	2815	mg/kg	0.0010		< 0.0010		
PCB 157	N	2815	mg/kg	0.0010		< 0.0010		
PCB 167	N	2815	mg/kg	0.0010		< 0.0010		
PCB 169	N	2815	mg/kg	0.0010		< 0.0010		
PCB 189	N	2815	mg/kg	0.0010		< 0.0010		
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010		< 0.0010		
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Single Stage WAC

Project: Q0652 GCRR - ONLLWYN

Chemtest Job No: 22-00598					Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 1349758					Limits		
Sample Ref: ES					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID: 1							
Sample Location: TP6							
Top Depth(m): 0.2							
Bottom Depth(m):							
Sampling Date: 10-Jan-2022							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	M	%	23	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	< 0.0005	< 0.0005	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	< 0.0002	< 0.0002	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.078	< 1.0	10	150	500
Sulphate	1220	U	3.3	33	1000	20000	50000
Total Dissolved Solids	1020	N	13	130	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	< 2.5	< 50	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

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

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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-diphenylcarbazine.
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
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.: 22-00969-1

Initial Date of Issue: 19-Jan-2022

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Steffan Picton

Project Q0652 Global Centre of Rail Excellence

Quotation No.: Q21-24761 **Date Received:** 14-Jan-2022

Order No.: **Date Instructed:** 14-Jan-2022

No. of Samples: 4

Turnaround (Wkdays): 5 **Results Due:** 20-Jan-2022

Date Approved: 19-Jan-2022

Approved By:



Details: Stuart Henderson, Technical Manager

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00969	22-00969	22-00969	22-00969
Quotation No.: Q21-24761	Chemtest Sample ID.:				1351161	1351163	1351166	1351168
	Client Sample ID.:				1	3	2	4
	Sample Location:				TP08	TP08	TP09	TP09
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	2.0	1.0	3.0
	Asbestos Lab:				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
Moisture	N	2030	%	0.020	8.7	9.1	22	8.2
Soil Colour	N	2040		N/A			Black	
Other Material	N	2040		N/A			Stones	
Soil Texture	N	2040		N/A			Sand	
pH	M	2010		4.0	8.4	8.4	8.6	8.5
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	8.2	5.3	< 1.0	15
Cadmium	M	2450	mg/kg	0.10	0.18	0.13	< 0.10	0.23
Chromium	M	2450	mg/kg	1.0	7.3	6.5	2.9	5.6
Copper	M	2450	mg/kg	0.50	96	87	43	120
Mercury	M	2450	mg/kg	0.10	0.22	0.21	0.10	0.26
Nickel	M	2450	mg/kg	0.50	37	27	7.8	19
Lead	M	2450	mg/kg	0.50	57	48	28	60
Selenium	M	2450	mg/kg	0.20	2.0	1.9	1.6	2.7
Zinc	M	2450	mg/kg	0.50	96	73	15	96
Chromium (Hexavalent)	N	2490	mg/kg	0.50			< 0.50	
LOI	M	2610	%	0.10			31	
Total Organic Carbon	M	2625	%	0.20	16	13	61	41
Aliphatic TPH >C5-C6	N	2680	mg/kg	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
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	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
Total Aliphatic Hydrocarbons	N	2680	mg/kg	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
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	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
Aromatic TPH >C21-C35	M	2680	mg/kg	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

Results - Soil

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-00969	22-00969	22-00969	22-00969
Quotation No.: Q21-24761	Chemtest Sample ID.:				1351161	1351163	1351166	1351168
	Client Sample ID.:				1	3	2	4
	Sample Location:				TP08	TP08	TP09	TP09
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	2.0	1.0	3.0
	Asbestos Lab:				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
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10
Benzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	8.1	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.22	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.1	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.7	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	6.9	0.91
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.94	0.12
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.13	3.9	0.59
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	2.9	0.55
Benzoanthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.0	0.22
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	2.2	0.37
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.9	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.31	< 0.10
Benzopyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.45	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.24	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.21	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.46	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	33	2.8
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

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:
1351161		1	TP08		A	Amber Glass 250ml
1351161		1	TP08		A	Amber Glass 60ml
1351161		1	TP08		A	Plastic Tub 500g
1351163		3	TP08		A	Amber Glass 250ml
1351163		3	TP08		A	Amber Glass 60ml
1351163		3	TP08		A	Plastic Tub 500g
1351166		2	TP09		A	Amber Glass 250ml
1351166		2	TP09		A	Amber Glass 60ml
1351166		2	TP09		A	Plastic Tub 500g
1351168		4	TP09		A	Amber Glass 250ml
1351168		4	TP09		A	Amber Glass 60ml
1351168		4	TP09		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
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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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Sample Retention and Disposal

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Final Report

Report No.:	22-00970-1		
Initial Date of Issue:	21-Jan-2022		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	Q0652 Global centre of Rail Excellence		
Quotation No.:	Q21-24761	Date Received:	14-Jan-2022
Order No.:		Date Instructed:	14-Jan-2022
No. of Samples:	1		
Turnaround (Wkdays):	7	Results Due:	24-Jan-2022
Date Approved:	21-Jan-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - 2 Stage WAC

Project: Q0652 Global centre of Rail Excellence

Chemtest Job No: 22-00970							Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 1351170							Limits		
Sample Ref:							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:									
Sample Location: TP09									
Top Depth(m): 1.0									
Bottom Depth(m): 2.0									
Sampling Date:									
Determinand	SOP	Accred.	Units						
Total Organic Carbon	2625	M	%				[A] 58		
Loss On Ignition	2610	M	%				25		
Total BTEX	2760	M	mg/kg				[A] < 0.010		
Total PCBs (7 Congeners)	2815	M	mg/kg				< 0.10		
TPH Total WAC	2670	M	mg/kg				[A] 120		
Total (Of 17) PAH's	2700	N	mg/kg				6.5		
pH	2010	M					8.7		
Acid Neutralisation Capacity	2015	N	mol/kg	0.026					
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455	U	0.0008	0.0006	0.0016	0.0059	0.5	2	25
Barium	1455	U	0.094	0.034	0.19	0.43	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0014	0.0013	0.0028	0.0021	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0062	0.0026	0.012	0.031	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	0.0029	0.0014	0.0058	0.016	0.06	0.7	5
Selenium	1455	U	0.0031	0.0024	0.0061	0.025	0.1	0.5	7
Zinc	1455	U	0.003	< 0.003	0.006	0.005	4	50	200
Chloride	1220	U	< 1.0	< 1.0	< 10	< 10	800	15000	25000
Fluoride	1220	U	0.19	0.096	< 1.0	1.1	10	150	500
Sulphate	1220	U	14	2.3	28	41	1000	20000	50000
Total Dissolved Solids	1020	N	200	52	390	740	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	3.9	3.3	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	15

Leachate Test Information	
Leachant volume 1st extract/l	0.320
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.264

Waste Acceptance Criteria

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

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:
1351170			TP09		A	Amber Glass 250ml
1351170			TP09		A	Amber Glass 60ml
1351170			TP09		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
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
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.: 22-03571-1

Initial Date of Issue: 04-Feb-2022

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Steffan Picton

Project Q0652 Global Centre of Rail Excellence

Quotation No.: Q21-24761 **Date Received:** 01-Feb-2022

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

No. of Samples: 9

Turnaround (Wkdays): 5 **Results Due:** 07-Feb-2022

Date Approved: 04-Feb-2022

Approved By:


Details: Stuart Henderson, Technical Manager

Results - Water

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				22-03571	22-03571	22-03571	22-03571	22-03571	22-03571	22-03571	22-03571	22-03571
Quotation No.: Q21-24761	Chemtest Sample ID.:				1363311	1363312	1363313	1363314	1363315	1363316	1363317	1363318	1363319
	Sample Location:				BH15	BH16	BH25	BH29	BH30	BH31	BH32	BH33	BH34
	Sample Type:				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	Top Depth (m):				0.40	4.52	5.00	0.83	3.20	4.50	4.76	0.41	5.09
Determinand	Accred.	SOP	Units	LOD									
pH	U	1010		N/A	8.4	8.3	7.4	8	8.2	7.9	8.2	8.3	8.4
Alkalinity (Bicarbonate)	U	1220	mg CaCO ₃ /l	10	180	110	540	310	300	370	340	440	320
Chloride	U	1220	mg/l	1.0	10	10	22	16	170	49	51	17	28
Fluoride	U	1220	mg/l	0.050	0.14	0.11	0.17	0.29	0.14	0.12	0.18	0.15	0.15
Ammonia (Free)	N	1220	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.081	0.073	< 0.050	0.14	0.5
Nitrate	U	1220	mg/l	0.50	< 0.50	1.1	0.88	1.7	< 0.50	1.4	0.88	< 0.50	< 0.50
Sulphate	U	1220	mg/l	1.0	34	18	86	6.3	32	310	67	60	49
Cyanide (Total)	U	1300	mg/l	0.050	0.05	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Calcium	U	1455	mg/l	2.00	44	18	41	40	68	120	43	47	11
Potassium	U	1455	mg/l	0.50	0.71	5.8	31	11	29	11	17	40	8.3
Magnesium	U	1455	mg/l	0.20	16	14	28	11	16	38	13	18	28
Sodium	U	1455	mg/l	1.50	9.2	7.9	140	46	93	75	100	97	71
Total Hardness as CaCO ₃	U	1270	mg/l	15	170	100	220	140	240	450	160	190	140
Arsenic (Dissolved)	U	1455	µg/l	0.20	0.29	< 0.20	0.44	2.2	0.56	0.39	1.4	0.83	< 0.20
Cadmium (Dissolved)	U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	µg/l	0.50	14	9	9.6	< 0.50	8.9	< 0.50	8.8	0.66	< 0.50
Copper (Dissolved)	U	1455	µg/l	0.50	1.6	0.86	2.1	0.98	2.2	2.4	3.3	1.2	0.58
Mercury (Dissolved)	U	1455	µg/l	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)	U	1455	µg/l	0.50	17	1.7	23	1.2	2.4	4.4	2.8	2	3.3
Lead (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	1.4	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	µg/l	2.5	48	9.6	54	16	17	11	33	21	12
Dissolved Organic Carbon	U	1610	mg/l	2.0	100	26	120	65	62	82	73	100	67
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	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	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Water

Project: Q0652 Global Centre of Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:					22-03571	22-03571	22-03571	22-03571	22-03571	22-03571	22-03571	22-03571
Quotation No.: Q21-24761	Chemtest Sample ID.:					1363311	1363312	1363313	1363314	1363315	1363316	1363317	1363318
	Sample Location:					BH15	BH16	BH25	BH29	BH30	BH31	BH32	BH33
	Sample Type:					WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	Top Depth (m):					0.40	4.52	5.00	0.83	3.20	4.50	4.76	0.41
Determinand	Accred.	SOP	Units	LOD									
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzoanthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzopyrene	N	1800	µg/l	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	1800	µg/l	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	1800	µg/l	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	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	1800	µg/l	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
PCB 28	N	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 52	N	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 90+101	N	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 118	N	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 153	N	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 138	N	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
PCB 180	N	1815	µg/l	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	1815	µg/l	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

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:
1363311			BH15		A	Coloured Winchester 1000ml
1363311			BH15		A	EPA Vial 40ml
1363311			BH15		A	Plastic Bottle 1000ml
1363312			BH16		A	Coloured Winchester 1000ml
1363312			BH16		A	EPA Vial 40ml
1363312			BH16		A	Plastic Bottle 1000ml
1363313			BH25		A	Coloured Winchester 1000ml
1363313			BH25		A	EPA Vial 40ml
1363313			BH25		A	Plastic Bottle 1000ml
1363314			BH29		A	Coloured Winchester 1000ml
1363314			BH29		A	EPA Vial 40ml
1363314			BH29		A	Plastic Bottle 1000ml
1363315			BH30		A	Coloured Winchester 1000ml
1363315			BH30		A	EPA Vial 40ml
1363315			BH30		A	Plastic Bottle 1000ml
1363316			BH31		A	Coloured Winchester 1000ml
1363316			BH31		A	EPA Vial 40ml
1363316			BH31		A	Plastic Bottle 1000ml
1363317			BH32		A	Coloured Winchester 1000ml
1363317			BH32		A	EPA Vial 40ml

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:
1363317			BH32		A	Plastic Bottle 1000ml
1363318			BH33		A	Coloured Winchester 1000ml
1363318			BH33		A	EPA Vial 40ml
1363318			BH33		A	Plastic Bottle 1000ml
1363319			BH34		A	Coloured Winchester 1000ml
1363319			BH34		A	EPA Vial 40ml
1363319			BH34		A	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH 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.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO ₃ equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1815	Polychlorinated Biphenyls (PCB) ICES7 Congeners in Waters by GC-MS	ICES7 PCB congeners	Solvent extraction / GCMS detection
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.

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

Charges may apply to extended sample storage

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



Final Report

Report No.:	21-41633-1		
Initial Date of Issue:	06-Dec-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	Q0652 Global Centre off Rail Excellence		
Quotation No.:	Q21-24761	Date Received:	26-Nov-2021
Order No.:		Date Instructed:	30-Nov-2021
No. of Samples:	2		
Turnaround (Wkdays):	5	Results Due:	06-Dec-2021
Date Approved:	06-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Soil

Project: Q0652 Global Centre off Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-41633	21-41633
Quotation No.: Q21-24761	Chemtest Sample ID.:				1328375	1328377
Order No.:	Client Sample Ref.:				ES3	ES9
	Sample Location:				BH34	BH34
	Sample Type:				SOIL	SOIL
	Top Depth (m):				1.0	3.0
	Date Sampled:				24-Nov-2021	24-Nov-2021
	Asbestos 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	12	8.8
Soil Colour	N	2040		N/A	Brown	
Other Material	N	2040		N/A	Stones and Roots	
Soil Texture	N	2040		N/A	Sand	
pH	M	2010		4.0	8.1	8.4
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	< 0.40
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	1.1
Arsenic	M	2450	mg/kg	1.0	11	17
Cadmium	M	2450	mg/kg	0.10	0.14	0.15
Chromium	M	2450	mg/kg	1.0	11	2.8
Copper	M	2450	mg/kg	0.50	47	63
Mercury	M	2450	mg/kg	0.10	0.14	0.39
Nickel	M	2450	mg/kg	0.50	44	25
Lead	M	2450	mg/kg	0.50	30	46
Selenium	M	2450	mg/kg	0.20	0.84	2.9
Zinc	M	2450	mg/kg	0.50	270	59
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	
LOI	M	2610	%	0.10	7.0	
Total Organic Carbon	M	2625	%	0.20	7.2	27
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	M	2680	mg/kg	1.0	170	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	510	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	550	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	6.6	< 1.0
Aliphatic TPH >C21-C35	M	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	1200	< 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	M	2680	mg/kg	1.0	11	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	120	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	170	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0

Results - Soil

Project: Q0652 Global Centre off Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-41633	21-41633
Quotation No.: Q21-24761	Chemtest Sample ID.:				1328375	1328377
Order No.:	Client Sample Ref.:				ES3	ES9
	Sample Location:				BH34	BH34
	Sample Type:				SOIL	SOIL
	Top Depth (m):				1.0	3.0
	Date Sampled:				24-Nov-2021	24-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
Aromatic TPH >C21-C35	M	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	300	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	1500	< 10
Benzene	M	2760	mg/kg	0.0010	< 0.0010	0.0021
Toluene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Naphthalene	M	2800	mg/kg	0.10	0.61	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	0.36	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	1.5	< 0.10
Fluorene	M	2800	mg/kg	0.10	1.9	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	8.9	< 0.10
Anthracene	M	2800	mg/kg	0.10	4.4	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	31	0.21
Pyrene	M	2800	mg/kg	0.10	23	0.20
Benzo[a]anthracene	M	2800	mg/kg	0.10	25	0.14
Chrysene	M	2800	mg/kg	0.10	26	0.21
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	34	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	12	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	21	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	17	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	4.8	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	13	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	220	< 2.0
PCB 81	N	2815	mg/kg	0.0010	< 0.0010	
PCB 77	N	2815	mg/kg	0.0010	< 0.0010	
PCB 105	N	2815	mg/kg	0.0010	< 0.0010	
PCB 114	N	2815	mg/kg	0.0010	< 0.0010	
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	
PCB 123	N	2815	mg/kg	0.0010	< 0.0010	
PCB 126	N	2815	mg/kg	0.0010	< 0.0010	
PCB 156	N	2815	mg/kg	0.0010	< 0.0010	
PCB 157	N	2815	mg/kg	0.0010	< 0.0010	
PCB 167	N	2815	mg/kg	0.0010	< 0.0010	
PCB 169	N	2815	mg/kg	0.0010	< 0.0010	
PCB 189	N	2815	mg/kg	0.0010	< 0.0010	

Results - Soil

Project: Q0652 Global Centre off Rail Excellence

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-41633	21-41633
Quotation No.: Q21-24761	Chemtest Sample ID.:				1328375	1328377
Order No.:	Client Sample Ref.:				ES3	ES9
	Sample Location:				BH34	BH34
	Sample Type:				SOIL	SOIL
	Top Depth (m):				1.0	3.0
	Date Sampled:				24-Nov-2021	24-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010	< 0.0010	
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10

Results - Single Stage WAC

Project: Q0652 Global Centre off Rail Excellence

Chemtest Job No: 21-41633					Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 1328375					Limits		
Sample Ref: ES3					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: BH34							
Top Depth(m): 1.0							
Bottom Depth(m):							
Sampling Date: 24-Nov-2021							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	M	%	7.2	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	1500	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	220	100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455	U	0.0007	0.0069	0.5	2	25
Barium	1455	U	0.035	0.35	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0013	0.013	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0027	0.027	0.5	10	30
Nickel	1455	U	0.0007	0.0072	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	0.0025	0.025	0.06	0.7	5
Selenium	1455	U	0.0008	0.0081	0.1	0.5	7
Zinc	1455	U	0.004	0.036	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.080	< 1.0	10	150	500
Sulphate	1220	U	9.5	95	1000	20000	50000
Total Dissolved Solids	1020	N	37	370	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	2.6	< 50	500	800	1000

Solid Information

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

Waste Acceptance Criteria

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

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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-diphenylcarbazine.
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
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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U/S	Unsuitable Sample
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- C - Sample not received in appropriate containers
- D - Broken Container
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All water samples will be retained for 14 days from the date of receipt

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customerservices@chemtest.com



Final Report

Report No.:	21-41964-1		
Initial Date of Issue:	14-Dec-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	Q0652 G.C.R.E - ONLLWYN		
Quotation No.:	Q21-24761	Date Received:	29-Nov-2021
Order No.:		Date Instructed:	07-Dec-2021
No. of Samples:	1		
Turnaround (Wkdays):	5	Results Due:	13-Dec-2021
Date Approved:	14-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: Q0652 G.C.R.E - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:					21-41964
Quotation No.: Q21-24761	Chemtest Sample ID.:					1329698
Order No.:	Client Sample Ref.:					ES1
	Sample Location:					BH33
	Sample Type:					SOIL
	Top Depth (m):					0.2
	Date Sampled:					25-Nov-2021
Determinand	Accred.	SOP	Type	Units	LOD	
Cyanide (Total)	U	1300	10:1	mg/l	0.050	0.14
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	< 0.20
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	3.0
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	2.2
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5
Chromium (Total)	N	1455	10:1	µg/l	0.50	4.0
Naphthalene	N	1800	10:1	µg/l	0.010	0.67
Acenaphthylene	N	1800	10:1	µg/l	0.010	< 0.010
Acenaphthene	N	1800	10:1	µg/l	0.010	1.3
Fluorene	N	1800	10:1	µg/l	0.010	0.93
Phenanthrene	N	1800	10:1	µg/l	0.010	5.1
Anthracene	N	1800	10:1	µg/l	0.010	1.4
Fluoranthene	N	1800	10:1	µg/l	0.010	5.4
Pyrene	N	1800	10:1	µg/l	0.010	4.6
Benzo[a]anthracene	N	1800	10:1	µg/l	0.010	2.4
Chrysene	N	1800	10:1	µg/l	0.010	1.4
Benzo[b]fluoranthene	N	1800	10:1	µg/l	0.010	2.2
Benzo[k]fluoranthene	N	1800	10:1	µg/l	0.010	1.1
Benzo[a]pyrene	N	1800	10:1	µg/l	0.010	1.8
Indeno(1,2,3-c,d)Pyrene	N	1800	10:1	µg/l	0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	10:1	µg/l	0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	10:1	µg/l	0.010	< 0.010
Total Of 16 PAH's	N	1800	10:1	µg/l	0.20	28
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: Q0652 G.C.R.E - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-41964
Quotation No.: Q21-24761	Chemtest Sample ID.:				1329698
Order No.:	Client Sample Ref.:				ES1
	Sample Location:				BH33
	Sample Type:				SOIL
	Top Depth (m):				0.2
	Date Sampled:				25-Nov-2021
	Asbestos Lab:				DURHAM
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	11
Soil Colour	N	2040		N/A	Black
Other Material	N	2040		N/A	Stones
Soil Texture	N	2040		N/A	Clay
pH	M	2010		4.0	7.9
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40
Cyanide (Total)	M	2300	mg/kg	0.50	2.9
Arsenic	M	2450	mg/kg	1.0	7.8
Cadmium	M	2450	mg/kg	0.10	0.16
Chromium	M	2450	mg/kg	1.0	16
Copper	M	2450	mg/kg	0.50	39
Mercury	M	2450	mg/kg	0.10	0.15
Nickel	M	2450	mg/kg	0.50	42
Lead	M	2450	mg/kg	0.50	23
Selenium	M	2450	mg/kg	0.20	0.86
Zinc	M	2450	mg/kg	0.50	250
Total Organic Carbon	M	2625	%	0.20	5.7
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0

Results - Soil

Project: Q0652 G.C.R.E - ONLLWYN

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-41964
Quotation No.: Q21-24761	Chemtest Sample ID.:				1329698
Order No.:	Client Sample Ref.:				ES1
	Sample Location:				BH33
	Sample Type:				SOIL
	Top Depth (m):				0.2
	Date Sampled:				25-Nov-2021
	Asbestos Lab:				DURHAM
Determinand	Accred.	SOP	Units	LOD	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10
Benzene	M	2760	mg/kg	0.0010	< 0.0010
Toluene	M	2760	mg/kg	0.0010	< 0.0010
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010
Naphthalene	M	2800	mg/kg	0.10	2.0
Acenaphthylene	N	2800	mg/kg	0.10	0.28
Acenaphthene	M	2800	mg/kg	0.10	0.74
Fluorene	M	2800	mg/kg	0.10	0.95
Phenanthrene	M	2800	mg/kg	0.10	4.3
Anthracene	M	2800	mg/kg	0.10	1.8
Fluoranthene	M	2800	mg/kg	0.10	12
Pyrene	M	2800	mg/kg	0.10	9.4
Benzo[a]anthracene	M	2800	mg/kg	0.10	9.2
Chrysene	M	2800	mg/kg	0.10	11
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	13
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	4.3
Benzo[a]pyrene	M	2800	mg/kg	0.10	7.4
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	4.9
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	2.1
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	4.7
Total Of 16 PAH's	N	2800	mg/kg	2.0	88
PCB 81	N	2815	mg/kg	0.0010	< 0.0010
PCB 77	N	2815	mg/kg	0.0010	< 0.0010
PCB 105	N	2815	mg/kg	0.0010	< 0.0010
PCB 114	N	2815	mg/kg	0.0010	< 0.0010
PCB 118	N	2815	mg/kg	0.0010	< 0.0010
PCB 123	N	2815	mg/kg	0.0010	< 0.0010
PCB 126	N	2815	mg/kg	0.0010	< 0.0010
PCB 156	N	2815	mg/kg	0.0010	< 0.0010
PCB 157	N	2815	mg/kg	0.0010	< 0.0010
PCB 167	N	2815	mg/kg	0.0010	< 0.0010
PCB 169	N	2815	mg/kg	0.0010	< 0.0010
PCB 189	N	2815	mg/kg	0.0010	< 0.0010
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010	< 0.0010
Total Phenols	M	2920	mg/kg	0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.:	21-42327-1		
Initial Date of Issue:	08-Dec-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	Q0652 GCRE (Onllwyn)		
Quotation No.:	Q21-24761	Date Received:	01-Dec-2021
Order No.:		Date Instructed:	02-Dec-2021
No. of Samples:	2		
Turnaround (Wkdays):	5	Results Due:	08-Dec-2021
Date Approved:	08-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Soil

Project: Q0652 GCRE (Onllwyn)

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-42327	21-42327
Quotation No.: Q21-24761	Chemtest Sample ID.:				1331184	1331186
Order No.:	Client Sample Ref.:				ES1	ES6
	Sample Location:				BH29	BH29
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.2	2.0
	Date Sampled:				26-Nov-2021	26-Nov-2021
	Asbestos Lab:				COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	5.1	1.7
Soil Colour	N	2040		N/A	Black	
Other Material	N	2040		N/A	Stones	
Soil Texture	N	2040		N/A	Sand	
pH	M	2010		4.0	8.9	7.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	< 0.40
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	6.4	1.5
Cadmium	M	2450	mg/kg	0.10	0.16	< 0.10
Chromium	M	2450	mg/kg	1.0	9.6	3.7
Copper	M	2450	mg/kg	0.50	35	27
Mercury	M	2450	mg/kg	0.10	< 0.10	0.14
Nickel	M	2450	mg/kg	0.50	24	5.8
Lead	M	2450	mg/kg	0.50	19	10
Selenium	M	2450	mg/kg	0.20	0.49	0.44
Zinc	M	2450	mg/kg	0.50	63	19
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	
LOI	M	2610	%	0.10	3.5	
Total Organic Carbon	M	2625	%	0.20	16	46
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	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	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	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0

Results - Soil

Project: Q0652 GCRE (Onllwyn)

Client: Quantum Geotechnic Ltd		Chemtest Job No.:			21-42327	21-42327
Quotation No.: Q21-24761		Chemtest Sample ID.:			1331184	1331186
Order No.:		Client Sample Ref.:			ES1	ES6
		Sample Location:			BH29	BH29
		Sample Type:			SOIL	SOIL
		Top Depth (m):			0.2	2.0
		Date Sampled:			26-Nov-2021	26-Nov-2021
		Asbestos Lab:			COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
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
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Benzene	M	2760	mg/kg	0.0010	< 0.0010	0.0013
Toluene	M	2760	mg/kg	0.0010	< 0.0010	0.0010
Ethylbenzene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
m & p-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
o-Xylene	M	2760	mg/kg	0.0010	< 0.0010	< 0.0010
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	0.97	< 0.10
Anthracene	M	2800	mg/kg	0.10	0.21	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	1.0	0.21
Pyrene	M	2800	mg/kg	0.10	0.83	0.22
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.37	< 0.10
Chrysene	M	2800	mg/kg	0.10	0.56	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.61	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.18	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.30	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	5.0	< 2.0
PCB 81	N	2815	mg/kg	0.0010	< 0.0010	
PCB 77	N	2815	mg/kg	0.0010	< 0.0010	
PCB 105	N	2815	mg/kg	0.0010	< 0.0010	
PCB 114	N	2815	mg/kg	0.0010	< 0.0010	
PCB 118	N	2815	mg/kg	0.0010	< 0.0010	
PCB 123	N	2815	mg/kg	0.0010	< 0.0010	
PCB 126	N	2815	mg/kg	0.0010	< 0.0010	
PCB 156	N	2815	mg/kg	0.0010	< 0.0010	
PCB 157	N	2815	mg/kg	0.0010	< 0.0010	
PCB 167	N	2815	mg/kg	0.0010	< 0.0010	
PCB 169	N	2815	mg/kg	0.0010	< 0.0010	
PCB 189	N	2815	mg/kg	0.0010	< 0.0010	
Total PCBs (12 Congeners)	N	2815	mg/kg	0.0010	< 0.0010	

Results - Soil

Project: Q0652 GCRE (Onllwyn)

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				21-42327	21-42327
Quotation No.: Q21-24761	Chemtest Sample ID.:				1331184	1331186
Order No.:	Client Sample Ref.:				ES1	ES6
	Sample Location:				BH29	BH29
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.2	2.0
	Date Sampled:				26-Nov-2021	26-Nov-2021
	Asbestos Lab:				COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10

Results - Single Stage WAC

Project: Q0652 GCRE (Onllwyn)

Chemtest Job No: 21-42327					Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 1331184					Limits		
Sample Ref: ES1					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:							
Sample Location: BH29							
Top Depth(m): 0.2							
Bottom Depth(m):							
Sampling Date: 26-Nov-2021							
Determinand	SOP	Accred.	Units				
Total Organic Carbon	2625	M	%	16	3	5	6
Loss on Ignition					--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	2.1	100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455	U	0.0021	0.021	0.5	2	25
Barium	1455	U	0.006	0.060	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0025	0.026	0.5	10	70
Copper	1455	U	0.0087	0.087	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0013	0.013	0.5	10	30
Nickel	1455	U	0.0008	0.0083	0.4	10	40
Lead	1455	U	0.0010	0.010	0.5	10	50
Antimony	1455	U	0.0025	0.025	0.06	0.7	5
Selenium	1455	U	0.0005	0.0055	0.1	0.5	7
Zinc	1455	U	0.004	0.044	4	50	200
Chloride	1220	U	2.1	21	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	17	170	1000	20000	50000
Total Dissolved Solids	1020	N	98	980	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.2	< 50	500	800	1000

Solid Information

Dry mass of test portion/kg	0.090
Moisture (%)	5.1

Waste Acceptance Criteria

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

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.:	21-42332-1		
Initial Date of Issue:	13-Dec-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	Q0652 GCRE (Onllwyn)		
Quotation No.:	Q21-24761	Date Received:	01-Dec-2021
Order No.:		Date Instructed:	07-Dec-2021
No. of Samples:	1		
Turnaround (Wkdays):	5	Results Due:	13-Dec-2021
Date Approved:	13-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Soil

Project: Q0652 GCRE (Onllwyn)

Client: Quantum Geotechnic Ltd	Chemtest Job No.:		21-42332	
Quotation No.: Q21-24761	Chemtest Sample ID.:		1331207	
Order No.:	Client Sample Ref.:		ES12	
	Sample Location:		BH31	
	Sample Type:		SOIL	
	Top Depth (m):		4.0	
	Date Sampled:		30-Nov-2021	
	Asbestos Lab:		NEW-ASB	
Determinand	Accred.	SOP	Units	LOD
ACM Type	U	2192		N/A
Asbestos Identification	U	2192		N/A
				No Asbestos Detected

Test Methods

SOP	Title	Parameters included	Method summary
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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customerservices@chemtest.com

APPENDIX IX – GEOPHYSICAL SURVEY REPORT

GEOPHYSICAL SURVEY REPORT

Project

Geophysical survey to detect historical mine workings

Location

Onllwyn Coal Washery, Neath - Port Talbot

Client

Quantum

Unit 1
Link Trade Park
Penarth Road
Cardiff
CF11 8TQ
United Kingdom

Tel: +44 (0) 2920 700127
Web: www.terradata.co.uk



Job reference: 7591
Date: January 2022
Version: 1

GEOPHYSICAL SURVEY REPORT

Project

Geophysical survey to detect historical mine workings

Location

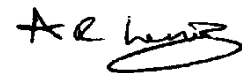
Onllwyn Coal Washery, Neath - Port Talbot

Client

Quantum

Project Geophysicists:

Alexander Lewis BSC (Hons)



Mag. Kathrin Zorn MSc FGS



Reviewer:

Dr S Hughes BSc FGS



Job Reference:

7591

Date:

January 2022

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Appendices

- Magnetic survey
- Electromagnetic survey
- Microgravity survey

1 EXECUTIVE SUMMARY

TerraDat were commissioned to conduct a geophysical survey to locate a number of historical mine workings by Quantum (the Client) at the Onllwyn Coal Washery, Neath Port Talbot.

The survey areas were split into four zones which covered entry sites of historical mineshafts and adits. A magnetic and electromagnetic survey was conducted over all accessible areas within the zones to identify localised anomalies and general ground characteristics. Targeted microgravity surveys were undertaken on approximate 50m x 50m grids centred on the proposed adit and mineshaft locations given by the Coal Authority to identify shallow anomalous features which may relate to the presence of mine workings.

The magnetic and electromagnetic survey results correlate well and highlight different ground characteristics and potential structures or features buried in the subsurface. The microgravity surveys mapped ground density variations across the survey areas and highlighted a number of features that are recommended for intrusive investigation.

Surveys completed in Zone 1 characterised the ground and highlighted some anomalous instrument responses on the track, but no significant responses were mapped in close proximity to the mineshaft 284210-029. Some anomalous instrument responses were recorded at the location of 284210-035, which may warrant further investigation.

Surveys completed in Zone 2 were partially limited due to overgrown zones, metal structures and a building. The surveys indicate a number of features in close proximity to the four targeted mine workings, which are recommended for intrusive investigation.

Surveys completed in Zone 3 show the heterogeneity of the fill material and made ground, with some isolated features which may be targeted in further investigations.

Surveys in Zone 4 mapped a cluster of anomalous responses close to adit 285210-025, which may relate to mine workings and warrant further investigation.

It is recommended that the features identified by the geophysical surveys are ground-truthed to prove their origin.

2 INTRODUCTION

This report describes a geophysical survey that was conducted on the site of the Onllwyn Coal Washery plant, Neath-Port Talbot. The survey work was commissioned by Quantum (the Client) for Arup and took place between the 15th November and the 10th December 2021. The site is proposed for redevelopment, and the geophysical investigation forms part of a remediation package associated with numerous historical mine workings recorded at the site. The Coal Authority records identify numerous adits and mineshafts at the site, some of which are in key redevelopment zones and have been designated by the Client as areas requiring geophysical investigation.

2.1 Site description

The survey sites are situated within the boundary of The Onllwyn Coal Washery plant, east of Abercraf, Neath-Port Talbot. According to the location of historical mine workings, the survey areas were divided into four zones (Plate 1, Figure 1).



Plate 1: Overview of the survey Zones 1-4 indicating the proposed mineshaft and adit locations according to the Coal Authority (Google Imagery, 2021).

Zone 1 is in the northern part of the Coal Washery and targeted adits 284210-023 and 284210-035, and mineshaft 284210-029. Adit 284210-023 was located within an overgrown wooded zone that was not accessible at the time of the survey.

The main survey area comprised open land and a scrub-covered mound of spoil, and a flat area used for coal stockpiles in the south. The northern part of the survey area, including the spoil mound, was separated from the Coal Washery land by a fence and is believed to be underlain by several meters of colliery spoil. The southern part of Zone 1 is currently used as a coal storage area, and large piles of coal had to be moved during the surveys to make the area accessible. The western part of Zone 1 comprised small strips of land between buildings with considerable metallic surface debris, which caused instrument interference.

Zone 2 targeted adits 285210-001, 285210-026, 285210-028 and mineshaft 285210-27 and is in the northeastern area of the Coal Washery. It borders the main access road and comprises open land, a small wooded area north of the wheel-wash, a small zone within the Onllwyn Distribution centre (Coal Dealer) and the land south of the ponds in the east. The area close to the road was littered with metal debris, street furniture and fences, therefore making this area unsuitable for magnetic and ground conductivity surveying; a number of fences intersected this survey zone. The immediate location of mineshaft 285210-27 was accessible for the microgravity survey only (located in a wooded area). Adit 285210-026 is located adjacent to the boundary of an onsite coal dealer and is obstructed by a large metal fence and buildings. The microgravity survey was completed in this area where accessible, but the EM and magnetic survey could not be conducted in this area due to extreme interference that would overload the instruments.

Zone 3 targeted adits 284210-019 and 284210-019 and was in the southwestern area of the Coal Washery. It is comprised of a flat tarmacked area in the north, and an approximately 8m high spoil slope in the middle of the survey zone leading to an upper flat area used for coal storage and an access road.

The 50m zone around the adits was surveyed using the microgravity technique where accessible; however, the Electromagnetic conductivity (EM) and magnetic survey was limited due to the steep slope and uneven and overgrown ground; the flat area at the base of the slope in the north of the zone was obstructed by metallic tools, equipment and railings making this part of the survey area unsuitable for the magnetic and EM surveys.

Zone 4 is in the southeast of the Coal Washery site and was comprised of grass and scrubland believed to be underlain by spoil. This zone incorporates a public footpath, a field used for keeping horses and a fenced-off wooded area in the centre that needed some ground-level clearance. This zone targeted adit 285210-025, which is located within the wooden area; adit 285210-002 is situated within dense woodland and is awaiting clearance to complete the survey at a later phase of works.



Plate 2A: Flat area within the coal storage area in Zone 1, looking east.



Plate 2B: Area of adit 285210-028 in the east of Zone 2, looking east.



Plate 2C: Steep slope in the centre of Zone 3, looking west.



Plate 2D: North edge of woodland strip where adit may be located in Zone 4

2.2 Geological setting

The survey area is underlain by South Wales Lower Coal Measures Formation and described by the British Geological Survey (BGS) as interbedded mudstone, siltstone and sandstone. Several coal seams traverse the site that has been historically mined, resulting in surface adits and mineshaft entries.

All survey areas are underlain by made-ground and believed to be comprised of several meters of colliery spoil material.

2.3 Survey objectives

The primary survey objective is to characterise ground conditions and to confirm the location of the historical mine workings recorded by the Coal Authority. Overall, nine historical adit and mineshaft mine entries were targeted in this survey.

2.4 Survey design

Given the survey brief, it was decided to adopt an integrated survey approach comprising of the following techniques:

- **Magnetics (Geometrics G858)** – *to map distortions in the Earth's magnetic field due to the presence of buried ferrous material that may be related to mine workings.*
- **Electromagnetics (Geophex GEM-2)** – *to map variations in the near-surface ground conductivity and in-phase response associated with different shallow materials/structures.*
- **Microgravity (Scintrex CG-5)** – *to confirm the presence of any localised areas of mass deficiency within the subsurface that may be associated with voiding or less dense in-fill material associated with the mine entry features.*

2.5 Quality control

The geophysical data were collected in line with normal operating procedures as outlined by the instrument manufacturer and TerraDat company policy. On completion of the survey, the data was downloaded from the survey instrument onto a computer and backed up

appropriately. The acquired data set was initially checked for errors that may be caused by instrument noise, low batteries, positional discrepancies, etc., and any field notes were either written up or incorporated in the initial data processing stage. The data set is then processed using the standard processing routines, and once completed, the resulting plots are subject to peer review to ensure the integrity of the interpretation. Our quality control standards are BS EN ISO 9001:2015 certified.

3 SURVEY DESCRIPTION

The survey was carried out using the following geophysical techniques:

- Magnetism (Geometrics G-858)
- Electromagnetics (EM, Geophex GEM-2)
- Microgravity (Scintrex CG-5)

The extents of the survey zones are indicated in Figure 1. Some areas could not be surveyed with the magnetic and electromagnetic techniques due to access difficulties, overgrown land or woods and metallic inference from nearby objects or structures. The microgravity surveys were carried out over best fit 50m x 50m grids, centred on the recorded location of the mineshaft or adit.

The results of the surveys are presented in the form of interpreted data plans and sections indicating the location and physical characteristics of identified anomalous features, together with a description.

Background information for each of the survey technique is provided in the appendices, and descriptions of the actual survey work carried out on site are provided in the sections below.

3.1 Survey layout and topographic survey

A Network RTK dGPS system was used to set out a number of control points. The local survey grids were preferentially aligned to suit the alignment of the survey areas, which were consequently transformed to National Grid (OSTN02) using the Trimble network correction (+/- 2.5cm). For the microgravity survey technique, a Trimble R6 robotic Total Station was used to record the position and height of the gravity meter.

3.2 Magnetic survey (G-858)

A magnetic survey is a passive technique that measures local perturbations in the Earth's wider magnetic field caused by the presence of magnetically susceptible objects in the subsurface. These subtle perturbations are mainly a result of the presence of ferrous metals, but some ferrous-bearing materials, such as fired red brick, slags, and ash, can also give a measurable response.

3.2.1 Magnetism survey - field activity

A *GEOMETRICS G-858* magnetometer (Plate 3) was used to acquire total field data in “near-continuous” walking mode along a series of 2m-3m spaced parallel survey lines across the survey zones which were set out to incorporate adits and mineshafts as well as background for general ground characterisation. The magnetic dataset was acquired under *EGNOS* corrected GPS control to an accuracy of +/- 0.5m.

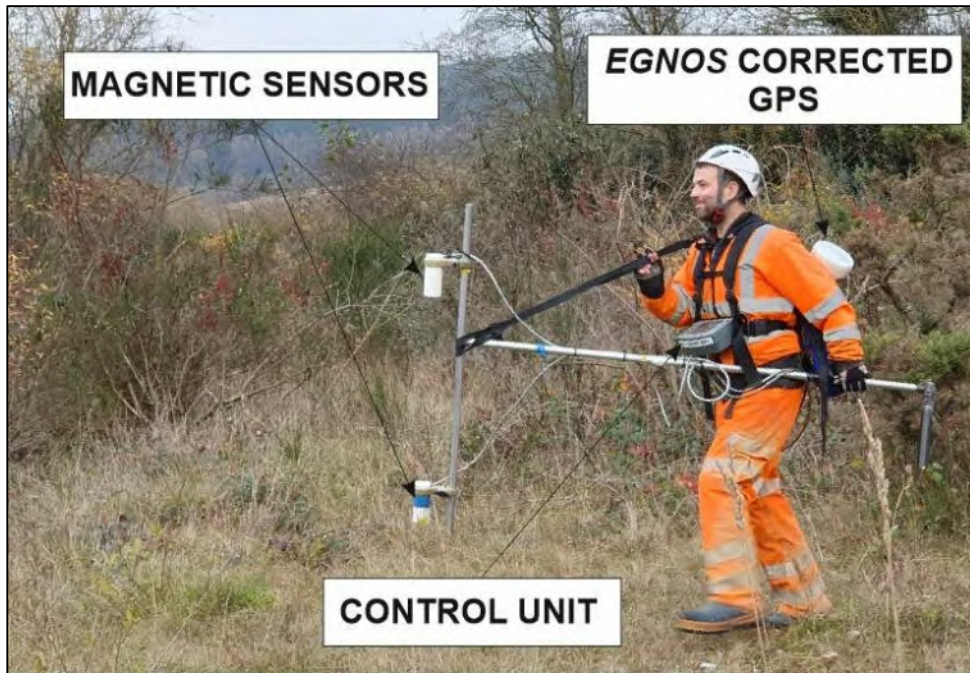


Plate 3: Magnetic survey set up on site in Zone 4.

3.2.2 Magnetism survey – data processing

The magnetic data were downloaded to a computer and edited for positional errors and rogue values. Depending on the length of the survey and atmospheric conditions, a drift correction may be applied. The data were then exported as an ‘XYZ’ file and, if required, translated into the appropriate coordinate system. The next step was to bring the data into *OASIS MONTAJ*, where they can be edited and manipulated to enhance any features of interest. The colour contour plots were then integrated with the base plan information, and the resulting plans were exported to *CORELDRAW* for final annotation.

3.3 Electromagnetic (EM) survey

An electromagnetic survey is based on measuring the response of the ground due to the propagation of an electromagnetic field. The magnitude of this response depends on the type and distribution of conductive material in the subsurface and can be broken into two components, namely the quadrature and in-phase components. The quadrature is usually converted to ground conductivity, which reflects the electrical properties of the subsurface (i.e. clay, water, ash, metal), while the in-phase component is dependent on the magnetic susceptibility of the subsurface.

3.3.1 Electromagnetic survey - field activity

The electromagnetic data were acquired using a multi-frequency *GEOPHEX GEM-2* instrument, which was carried in “near-continuous” walking mode along a series of 2m spaced parallel survey lines across the survey zones (Plate 4). The dataset was acquired at a nominal 0.5m interval along a series of 2m spaced parallel survey lines. For this particular survey, the instrument was primarily configured to investigate depths of up to 4m below ground level. The GEM-2 dataset was acquired under *EGNOS* corrected GPS control to an accuracy of $\pm 0.5\text{m}$.

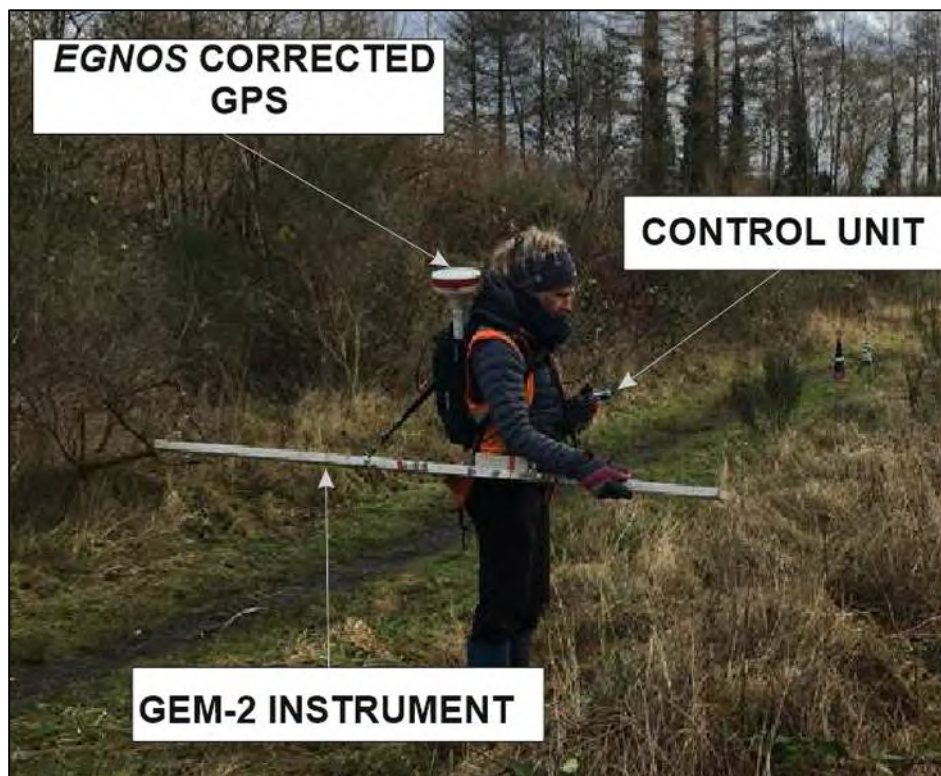


Plate 4: Electromagnetic survey set-up on site in Zone 4.

3.3.2 Electromagnetic survey – data processing

The conductivity data were downloaded from the data logger and compiled using dedicated software *WINGEM-3*. Initial editing was then carried out to remove positional errors and rogue values. The data was then exported as an 'XYZ' file and translated into the OSGB36 Coordinate system using the OSTN15 transformation. The next step was to bring the data into *GEOSOFT OASIS MONTAJ*, where it was compiled, edited and manipulated to enhance any features of interest. The colour contour plots were then integrated with the base plan information, and the resulting plans were exported to *CORELDRAW* for final annotation.

3.4 Microgravity Survey

The density contrast between different Earth materials provides a useful means for mapping subsurface structures through the measurement of associated localised variation in the Earth's gravitational field. The presence of an anomalously high (or low) density body in the subsurface causes a localised high (or low) anomaly in the measured gravitational field. The gravity effects described are small. However, modern instrumentation and exhaustive data processing techniques enable the detection of geological and artificial structures relevant to the engineering and groundwater industries.

An increase in both the size of a body and the density contrast with its host material proportionally increases its detectability using gravitational methods. However, there is a reduction in both spatial resolution and detectability with increased depth of burial. Typical targets for a microgravity survey include the location of buried channels, solution features, voiding, mine shafts, vertical structures, geological lineations, and groundwater movement through monitoring with time.

3.4.1 Microgravity survey - field activity

The microgravity survey was carried out using a very high precision *Scintrex CG-5* instrument (Plate 5). Microgravity surveying was conducted on a survey grid of 50m x 50m centred as reasonably as practicable on the recorded mineshaft and adit locations. The gravity readings were acquired on a staggered 5m x 5m spaced grid. For each reading station, the elevations of the gravity meter were acquired using a Total Station to a precision better than 0.5cm. One of the main advantages of the *Scintrex CG-5* is that it enables statistical averaging and filtering of readings taken every second over a fixed period (typically 2-3 minutes), thereby significantly reducing low-level noise from the wind, seismic activity and nearby roadways.



Plate 5: Microgravity survey with Scintrex CG-5 instrument in Zone 1

3.4.2 Microgravity survey – data processing

To remove (reduce) background gravitational effects, i.e. those that do not originate from the target features, some processing steps were applied to the acquired dataset using a combination of internal CG-5 software and TerraDat proprietary software *GRED*. The applied corrections include:

- Earth Tide, Temperature & Tilt Correction
- Un-modelled Temporal Residual Correction
- Latitude Correction
- Free-air Correction
- Bouguer Correction
- Terrain Correction

The resulting reduced gravity dataset (Bouguer Anomaly) was then assessed for terrain effects (topography, walls, known voids, etc.) and regional gravitational fields (trends). By removing these effects, a corrected plot was produced that was used to identify local anomalous features. The result is then presented as annotated colour contour plots overlaid on the base plan information using CORELDRAW.

4 RESULTS AND DISCUSSION

The results of the geophysical survey are presented as a series of interpreted colour contour plots in Figures 2 - 9. Figure 1 provides a site overview of the survey zones and technique coverage. A general description of the interpretation process and a broad discussion of the results for each technique is given below. Anomalous features/zones identified by the various techniques have been transposed onto a basic map to create the anomaly location plans in Figure 10.

Magnetic Survey

The results of the magnetic survey are presented as the total magnetic field as recorded by the top sensor (plot A within Figures 2, 4, 6 and 8) and the derived analytical signal of the total magnetic field (plot B in the same figures). As the top sensor is located further away from the ground surface, it is less prone to extreme responses in the presence of shallow magnetic material and therefore produces a smoother plot.

The total magnetic field records deviations superimposed onto the Earth's Total Magnetic Field (ETMF) by the presence of ferrous material within the subsurface. Several factors determine the character of a total field magnetic anomaly, such as magnetic susceptibility, size and the orientation of the causative body. The interpretation of a magnetic anomaly is based on observing the type (monopole/dipole), amplitude and wavelength of the anomalous feature.

As all magnetic fields are dipolar, the superimposition of a dipolar anomaly on the ETMF creates perturbations observed as localised relative increases and decreases in field strength intensity (i.e. 'positive' and 'negative'). Given these variations, total field magnetic anomalies are more difficult to interpret and are often much less closely related to the shape of the causative body than with other total field techniques (e.g. microgravity). The interpretation process is further complicated by the horizontal displacement of the anomalies relative to the source due to the non-vertical nature of the magnetic field. To counter this issue, the analytic signal routine is applied, and this is used to simplify magnetic dipoles into a single positive peak over the areas of the highest magnetic gradient (i.e. location of the source producing the response).

In terms of identifying shafts, the anomalies can either be discrete individual features or form a small cluster. These responses are usually associated with disturbed ground, ferrous backfill material, remnant foundations or metal capping structures.

Electromagnetic survey

The results of the electromagnetic survey are presented as a colour contoured plot of ground conductivity (plot C within Figures 2, 4, 6 and 8) and In-phase response (plot D in the relevant figures).

Following a review of the electromagnetic data, it was decided only to consider the response of the 40,925 MHz frequency channel. A relative increase in conductivity values usually indicates a localised increase in the clay/water content, which for example, could signify either a lateral change in lithology or a change in bedrock depth. However, it can also represent interference from adjacent metallic features (both above and below ground). Extreme fluctuations in conductivity/in-phase values are usually indicative of instrument ‘overload’ due to high metal content.

The interpretation of the conductivity data is based on both published electrical properties of typical sedimentary materials (Table 1) and, when available, correlation with onsite information.

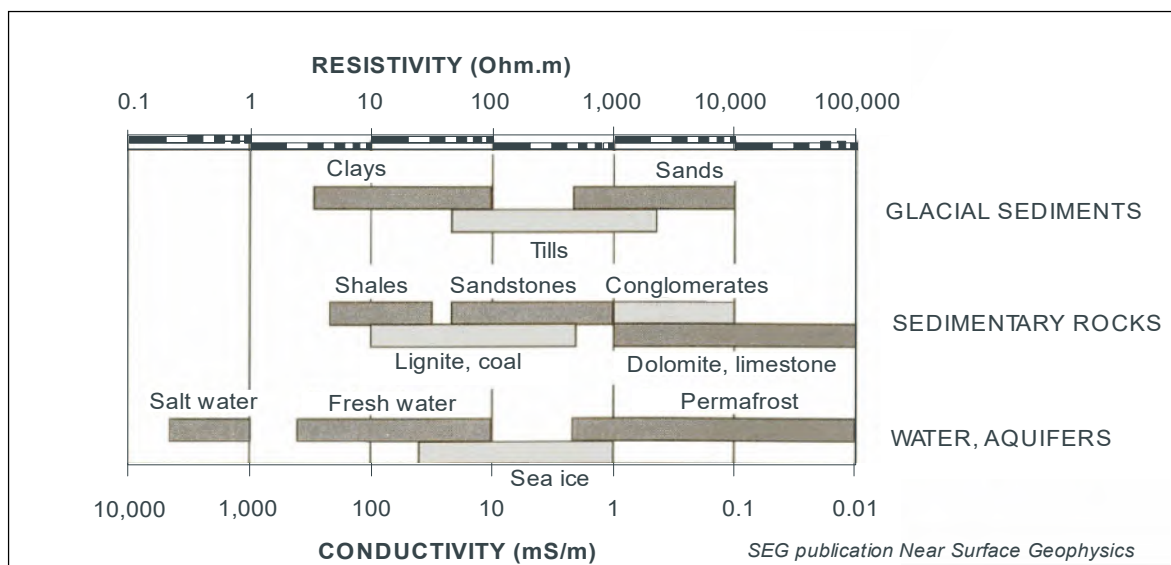


Table 1: Table of resistivity/conductivity of typical sedimentary materials.

The detection of mine workings/shafts using this particular technique typically involves looking for localised zones of ground heterogeneity which could either signify buried structures such as foundations or mineshaft capping structures or different material types such as backfill of a different composition to the natural ground. On a broader scale, it can be used to identify secondary effects of a shaft excavation, such as spoil distribution or preferential water drainage creating a drying out 'halo' at the surface.

Microgravity

The results from the microgravity survey are presented in Figures 3, 5, 7 and 9 as the corrected Bouguer Anomaly plots.

The gravity plots may be considered to represent variations in ground density targeting up to a maximum depth of approximately 10 m below ground level. For a given gravity feature or anomaly, its interpretation is based on observing its shape, amplitude and wavelength. For example, a localised decrease in the gravitational field indicates a zone of mass deficiency which could either represent void space, poorly compacted backfill material or an increase in the thickness of the superficial deposits.

4.1 Summary discussion of survey results for Zone 1

The results of the magnetic and the electromagnetic survey in Zone 1 correlate well and highlight different ground characteristics and potential structures or features buried in the shallow subsurface. Areas that show extreme values or instrument overload indicate buried metallic objects. There are some indications of anomalous responses in the vicinity of mineshaft 284210-029. Close to adit 284210-035, the magnetic survey has identified an isolated dipolar response that may be related to a borehole but may be related to the mine adit.

The main features detected in the surveys are highlighted and described in Table 2.

ID	Feature description
Z1-1	Isolated dipolar anomaly detected in the magnetic and EM survey, ferrous material buried in the shallow subsurface.
Z1-2	Large dipolar magnetic anomaly indicating ferrous material buried in the subsurface; due to its location at the edge of the grid, the full extent is unknown.
Z1-3	Extreme response believed to be caused by reinforced hard-standing.

Z1-4	Scattered high instrument responses associated with ferrous debris on the surface.
Z1-5	Area of reduced EM response over elevated mound (spoil heap).
Z1-6	Small, isolated dipolar response within the proposed location of the mineshaft.
Z1-7	Broad areas of elevated magnetic response in the ground off-site and in coal storage area, likely associated with ferrous material within the colliery spoil.
Z1-8	Area of high magnetic response east of proposed adit location; likely to be associated with made-ground.
Z1-9	Isolated magnetic dipolar anomaly, near proposed adit location.
Z1-10	High conductivity associated with fence and linear response from track.
Z1-11	High in-phase response and relatively low-density ground likely to be associated with the road edge construction, services and drainage.
Z1-12	Broad area of relatively homogenous ground density; correlating with relatively quiet ground conditions mapped in EM and magnetic survey. No evidence of adit feature.
Z1-13	Elongated zone of low gravity values representing low-density ground of unknown origin; this feature is offset to the west of the proposed mineshaft but close to the magnetic and EM anomalous feature (Z1-1).
Z1-14	Homogenous density area of lower-intermediate values associated with the spoil mound, surrounded by higher density material to the west, and lower density material (likely loose colliery spoil material) on the east edge of the mound; feature broadly correlating to Z1-5.
Z1-15	Area of low-density ground of unknown origin that is located along a zone of reduced ground density that appears to be associated with the access track.

Table 2: Main features identified by all three survey techniques in Zone 1.

4.2 Summary discussion of survey results for Zone 2

The results of the magnetic and the electromagnetic survey in Zone 2 correlate well and highlight different ground characteristics and potential structures or features buried in the subsurface. Areas that show extreme values or instrument overload indicate buried metal. The area of adit 285210-026 and mineshaft 285210-27 was only partially accessible. An elongated low gravity zone, a small distance to the north of adit 285210-026, has been identified, and a subtle circular low-density zone is also apparent to the west of shaft 285210-27. There are numerous EM and magnetic responses in the vicinity of adit 285210-001, as well as a large circular gravity anomaly indicating low-density ground centred close to the

proposed location of the adit. There are some changes in response close to adit 285210-028, which indicate changes in the ground composition.

The main features detected in the surveys are described in Table 3

ID	Feature description
Z2-1	Broad area of increased magnetic and EM response, indicating high ferrous composition of the made-ground (colliery spoil).
Z2-2	High instrument responses close to the road, interference from metallic debris, road, fencing and services.
Z2-3	Two isolated dipolar magnetic responses, indicating localised zone of ferrous material.
Z2-4	Circular zone of raised conductivity values in proximity to the proposed adit location indicating localised change in made-ground composition - increase in clay and moisture content in the subsurface, potentially related to adit 285210-001.
Z2-5	Circular, high magnetic instrument response in proximity to the proposed adit location, indicating localised concentration of ferrous material buried in the subsurface, potentially related to adit 285210-001.
Z2-6	Number of dipolar anomalous instrument responses in close proximity to the proposed adit location; may be related to adit 285210-001.
Z2-7	Isolated dipolar response, indicating manhole/service.
Z2-8	Linear anomalous response detected in the EM survey indicating trench or service in the shallow subsurface.
Z2-9	Isolated dipolar anomaly, indicating ferrous material.
Z2-10	Zone of scattered high magnetic responses associated with ferrous material or debris in the subsurface.
Z2-11	Broad area of increased magnetic responses, showing change in made-ground composition.
Z2-12	Linear zone of increased conductivity values, indicating change in made-ground composition - clay and moisture-rich material.
Z2-13	Linear zone of low gravity values (low-density ground) parallel to road at base of bank and along drainage channel.
Z2-14	Circular zone of low gravity values in proximity to proposed mineshaft location. Recommended for intrusive investigation.
Z2-15	Linear zone of low gravity values, near suggested adit 285210-026 location. Recommended for intrusive investigation.

Z3-16	Isolated zone of decreased gravity values indicating unknown change in ground composition to less dense material.
Z3-17	Distinct, large circular area of low gravity values, indicating lower density ground material. Due to its proximity to the proposed adit location and correlation with magnetic and EM anomalous features, it is recommended to ground-truth this area.
Z2-18	Linear zone of low gravity values coinciding with EM anomaly (Z2-12), in close proximity to proposed adit 285210-028 location. Recommended for intrusive investigation.

Table 3: Main features identified by all three survey techniques in Zone 2.

4.3 Summary discussion of survey results for Zone 3

Zone 3 can be divided north and south with a lower-lying flat area and sloped terrace base (north of steep-slope) to the north, and a flat area usually covered in coal stockpiles in the south (approximately 8m higher than the north area). Due to an uneven surface, large boulders and vegetation on the slope in the north part of the zone, the magnetic and EM survey could not be undertaken on the slope. The flat, lower-lying part of the north of Zone 3 was accessible in some parts; however, due to a large amount of metal interference (discarded rollers, rails and fencing), this area was not suitable to be surveyed with the EM and magnetic techniques.

The proposed location of adit 284210-020 was covered with all survey techniques; the proposed location of adit 284210-019 is on the break of slope at the top of the spoil, with limited accessibility for the geophysical surveys.

The results of the magnetic and electromagnetic surveys show relatively homogenous coal spoil material in this zone.

The main features detected in the surveys are described in Table 4

ID	Feature description
Z3-1	High instrument response/overload associated with reinforced access road.
Z3-2	Increase in magnetic response adjoining access road; may be linked to road construction, service or similar. Due to the relative proximity to the proposed adit 284210-020 location, this feature may warrant further investigation.
Z3-3	Instrument interference from metal containers bordering the survey grid.
Z3-4	Increase in magnetic values, indicating increase in ferrous material/spoil in the subsurface.
Z3-5	Relatively similar gravity values (homogenous ground) in south coal storage area.
Z3-6	Relatively broad zone of low gravity values associated with the sloped bank, indicating less dense material that would be expected on uncompacted, loose slip material. May warrant further investigation at closest proximity to proposed mine adit 284210-019 location.
Z3-7	Subtle localised decrease in ground density in proximity to proposed mine adit 284210-020 location that may warrant further investigation.

Table 4: Main features identified by all three survey techniques in Zone 3.

4.4 Summary discussion of survey results for Zone 4

This zone targets adits 285210-025 and 285210-002. Adit 285210-002 was located in the eastern part of Zone 4 and awaits tree clearance for the survey to be undertaken.

The area of adit 285210-025 was located within a narrow wooded zone, partially cleared for the survey to take place. The metallic fencing located within the survey area has caused some interference; however, large dipolar responses and a localised subtle decrease in ground density in close proximity to the adit may be related to mine workings and are recommended for intrusive investigation.

The results of the magnetic and the electromagnetic survey correlate well and highlight different ground characteristics and potential structures or features buried in the subsurface. Areas that show extreme values or instrument overload indicate buried metal.

The main features detected in the surveys are described in Table 5.

ID	Feature description
Z4-1	Zone of large dipolar instrument responses near suggested adit location.
Z4-2	Zone of high instrument response to the west of the proposed adit location, indicating high concentration of ferrous material and increased ground conductivity.
Z4-3	Overgrown, difficult to access area, with scattered high instrument responses indicating metallic debris or ferrous rich colliery spoil in the shallow subsurface.
Z4-4	Increased magnetic response in field likely indicates more ferrous rich colliery spoil.
Z4-5	Low gravity values close to the proposed adit location indicate less dense ground and correlating with a cluster of magnetic and EM anomalies. This area is recommended for intrusive investigation.
Z4-6	Low gravity zones likely indicate less dense areas of made-ground/colliery spoil.

Table 5: Main features identified by all three survey techniques in Zone 4.

5 CONCLUSIONS

- The geophysical survey provided a rapid means of obtaining information on the ground character and composition, as well as surveying the site for anomalous features that may indicate the presence of the proposed mineshafts and adits.
- Magnetic and electromagnetic surveys were conducted covering all accessible areas within the designated four zones, which were followed up with targeted microgravity surveys to identify shallow anomalous features which may relate to the presence of mine workings.
- Survey results for Zone 1 mapped general ground characteristics and highlighted some isolated responses. There are some indications of anomalous ground in the proximity of mineshaft 284210-029, and anomalous instrument responses were recorded close to the location of adit 284210-035, which may warrant further investigation.
- Surveys results in Zone 2 were partially limited due to trees and vegetation, metal structures and a building (area around adit 285210-026 and mineshaft 285210-27). There are a number of notable instrument responses in the area of adit 285210-001 and a gravity anomaly close to adit 285210-026, which are recommended to be intrusively investigated. There are some changes in instrument responses and a low-density zone close to adit 285210-028, which indicate changes in the ground composition and may warrant further investigation.
- Survey results in Zone 3 are partially limited due to accessibility issues and interference from metal structures and debris. There are minor localised anomalous responses near adit 284210-020 and adit 284210-019 within a generally homogenous ground composition.
- Survey results in Zone 4 mapped a cluster of anomalous responses near adit 285210-025, which may relate to the historical mine workings and warrant further investigation.
- It is recommended that some invasive work is carried out to ground truth the main anomalies identified by the geophysical survey. Following that process, it may be

possible to extend the interpretation further and calibrate the datasets by incorporating the additional information.

Disclaimer

This report represents an opinionated interpretation of the geophysical data. It is intended for guidance with follow-up invasive investigation. Features that do not produce measurable geophysical anomalies or are hidden by other features may remain undetected. Geophysical surveys complement invasive/destructive methods and provide a tool for investigating the subsurface; they do not produce data that can be taken to represent all of the ground conditions found within the surveyed area. Areas that have not been surveyed due to obstructed access or any other reason are excluded from the interpretation.

Figures

1A - SURVEY ZONES WITH LOCATIONS OF TARGETED MINE WORKINGS



NOTES - Mine entry information from Coal Authority records

ZONE 1
Targeting adits 284210-023 and 284210-035, mineshaft 284210-029.
Adit 284210-023 is located within an overgrown wooded zone, therefore not accessible at time of survey.

ZONE 2
Targeting adits 285210-001, 285210-026, 285210-028 and mineshaft 285210-27. The immediate location of mineshaft 285210-27 was accessible for the microgravity survey only (located in wooded area). Adit 285210-026 is located close to steel fence, and potentially obstructed by a building. The microgravity survey was completed in this area where access permitted. The EM and magnetic survey could not be undertaken as there was too much interference from surrounding metallic structures.

ZONE 3
Targeting adits 284210-019 and 284210-020. Most of Zone 3 was accessible for the microgravity survey, however, the EM and magnetic survey could not be undertaken in the north of the zone due to steep and overgrown ground and obstructions from metal objects and railings.

ZONE 4
Targeting 285210-025 and 285210-002; Adit 285210-002 was inaccessible within tree area. Awaiting clearance of this survey area. Adit 285210-025 was located within a narrow strip of woodland surrounded by metallic fencing. The data therefore suffers from some interference and partial coverage of the survey area due to some obstructions within the trees.
Adit 285210-003 is outside area of interest.

KEY

- Approximate outline of survey areas covered with magnetic and electromagnetic (EM) techniques
- Approximate outline of the microgravity survey areas
- Expected Mineshaft location (according to Coal Authority)
- Expected Adit location (according to Coal Authority)
- Location of linear geological feature (BGS, 2021)

NOTE
-Maps produced in QGIS, 2021.
-Site topography overlain onto Google Satellite Image and Map data, Imagery ©2021, TerraMetrics, ©2021.

1B - SITE PHOTOS



A - Overlooking Zone 1, divided into area of grassed colliery spoil in the north and coal storage area in the south, looking southwest.



B - Northern part of Zone 2 on top of grassed colliery spoil, looking north.



C - Northern part of Zone 3 on the slope, looking east.



D - Southern part of Zone 3, coal storage area, looking east.



E - Partially accessible area in Zone 4, in between the two targeted adits, looking northeast.

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Title: **SITE OVERVIEW**

Project: **ONLLWYN COAL WASHERY, NEATH-PORT TALBOT**

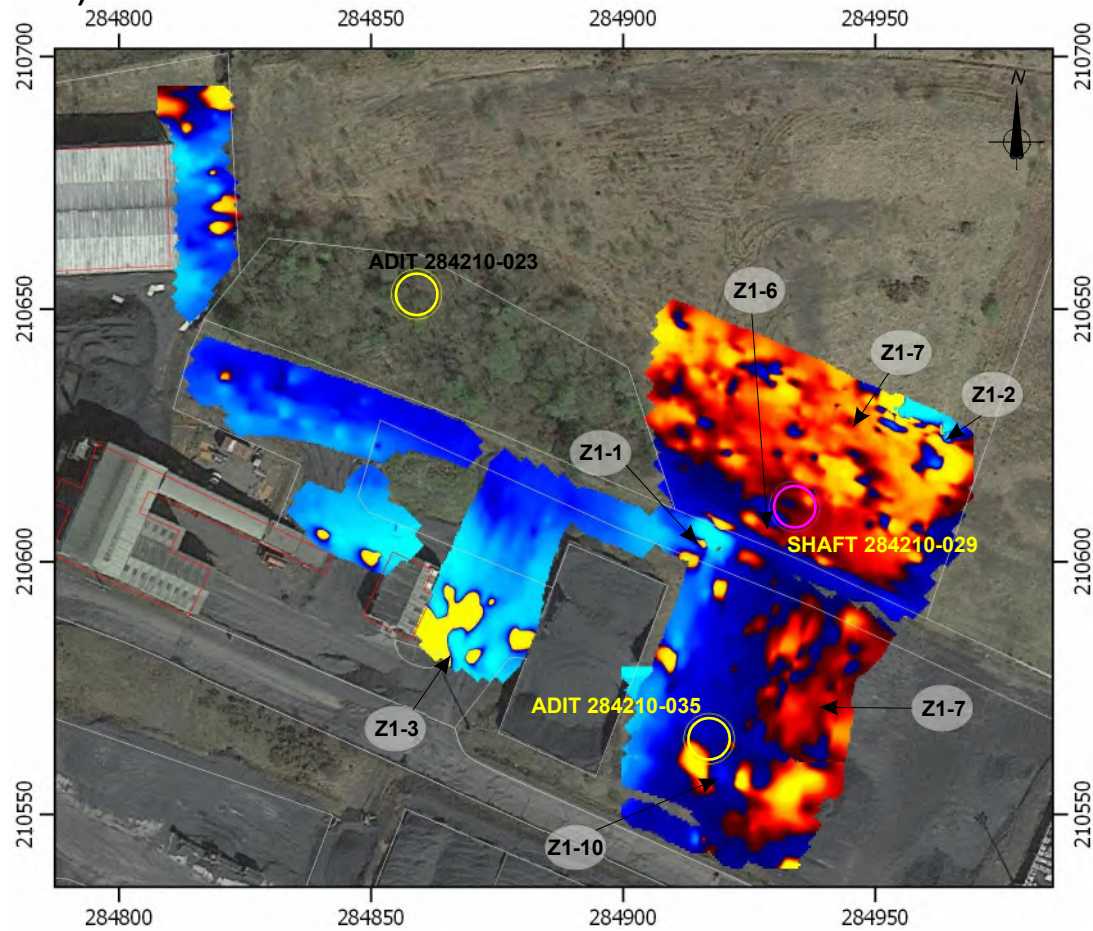
Scale: 1:4000 @ A3

Drawn by/Ref: KZ&AL/7591/1

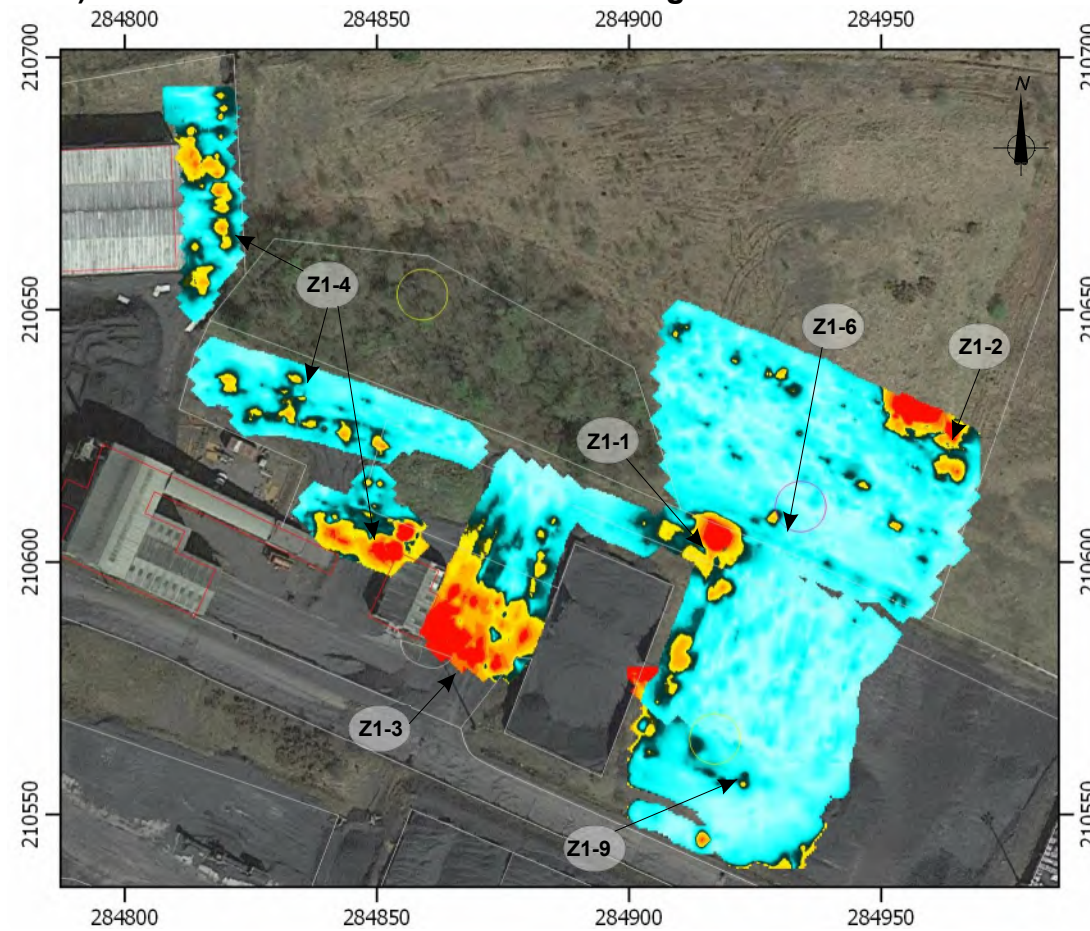
Date: December 2021

FIGURE 1

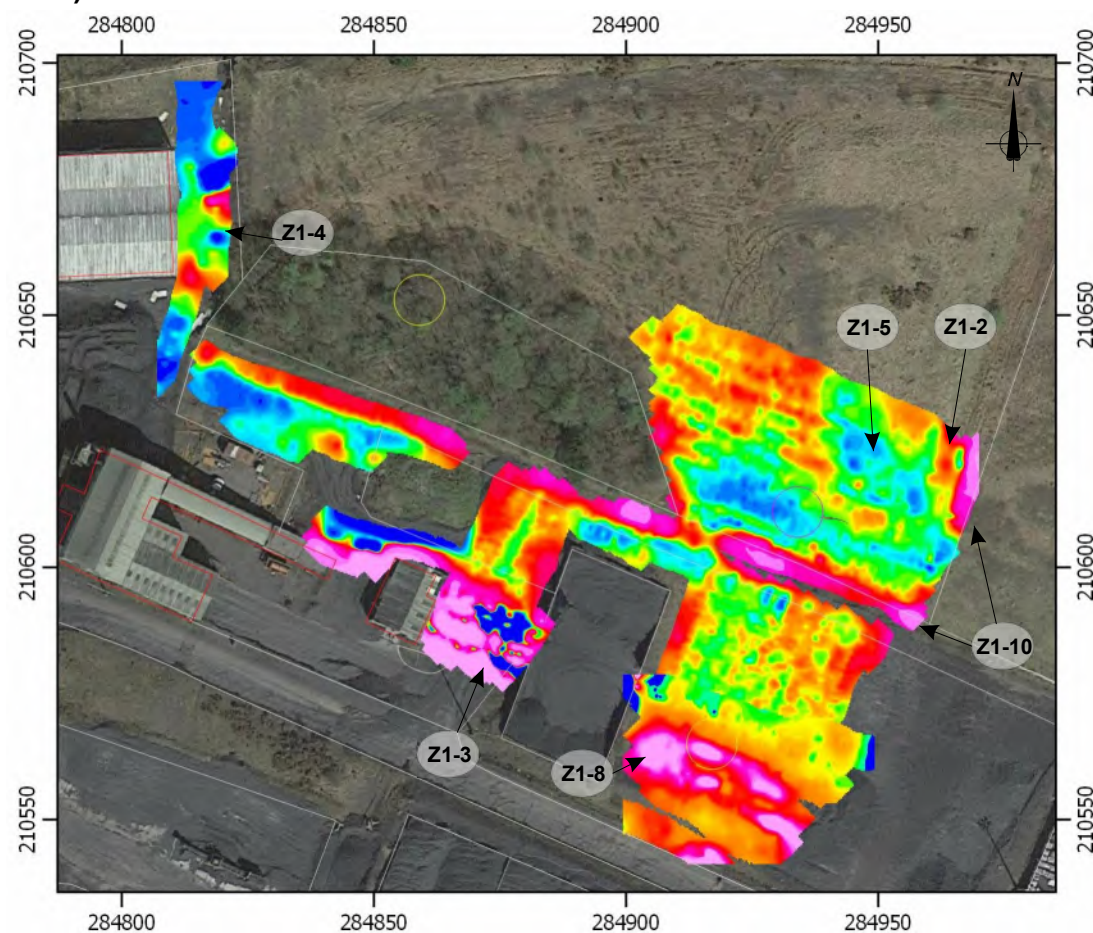
A) MAGNETIC TOTAL FIELD - Ferrous metal content



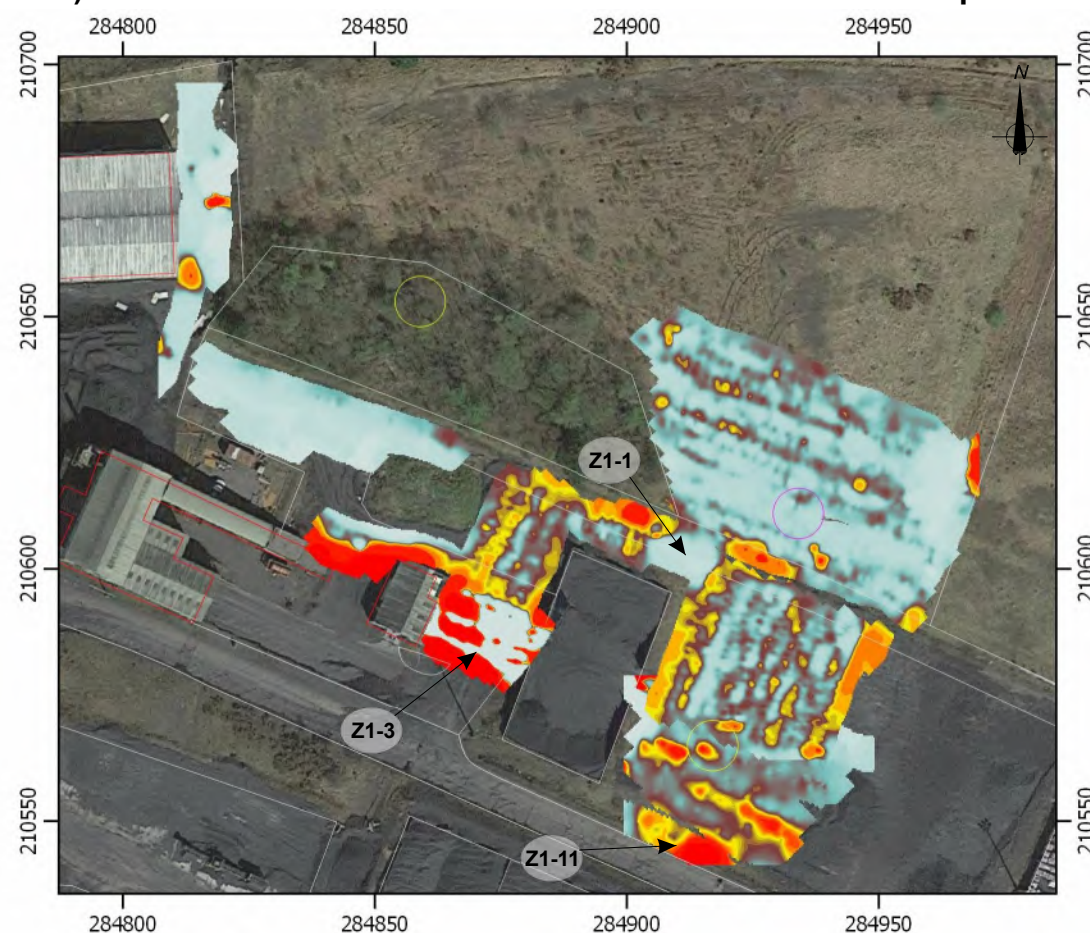
B) MAGNETIC ANALYTICAL SIGNAL - Significant ferrous metal anomalies



C) EM - GROUND CONDUCTIVITY

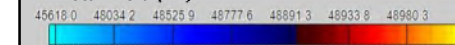


D) EM - IN-PHASE RESPONSE - Metal and cultural noise response

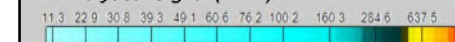


COLOUR SCALE

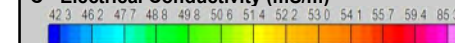
A - Total Field (nT)



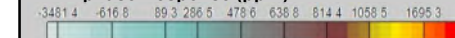
B - Analytical Signal (nT/m)



C - Electrical Conductivity (mS/m)



D - In-phase Response (ppm)



NOTES

The results of the magnetic and the electromagnetic survey correlate well and highlight different ground characteristics and potential structures or features buried in the shallow subsurface. Areas that show extreme values or instrument overload indicate buried metallic objects.

There are some indications of anomalous responses in close proximity of Mineshaft 284210-029. The zone of adit 284210-035 indicates an isolated dipolar response which may be related to the borehole or the potential location of the adit. Adit 284210-023 is inaccessible.

Main features detected in the surveys are highlighted and described below.

ID DESCRIPTION

Z1-1: Isolated dipolar anomaly detected in the magnetic and EM survey, ferrous material buried in the shallow subsurface.

Z1-2: Large dipolar magnetic anomaly and high EM response indicating ferrous material or object buried in this area of the spoil mound.

Z1-3: Extreme response believed to be caused by reinforced hard-standing.

Z1-4: Scattered high instrument responses believed to be interference from ferrous debris on the surface.

Z1-5: Area of reduced EM response over surface mound (spoil heap).

Z1-6: Small, isolated dipolar response within the expected location of the mineshaft.

Z1-7: Broad areas of elevated magnetic response likely associated with high ferrous composition of the colliery spoil.

Z1-8: Area of high magnetic response east of expected mineshaft location; likely made-ground.

Z1-9: Isolated dipolar anomalous response, near to expected adit location

Z1-10: High conductivity associated with fence and track.

Z1-11: High in-phase response associated with road edge construction, services, drainage.

KEY

- Expected location of mineshaft
- Expected location of adit
- ID of detected feature



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Title: **ZONE 1 - MAGNETIC AND ELECTROMAGNETIC SURVEY RESULTS**

Project: **ONLLWYN COAL WASHERY, NEATH-PORT TALBOT**

Scale: 1:1500 @ A3

Drawn by/Ref: KZ&AL/7591/2

Date: December 2021

FIGURE 2