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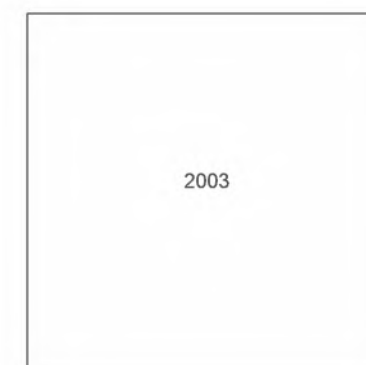
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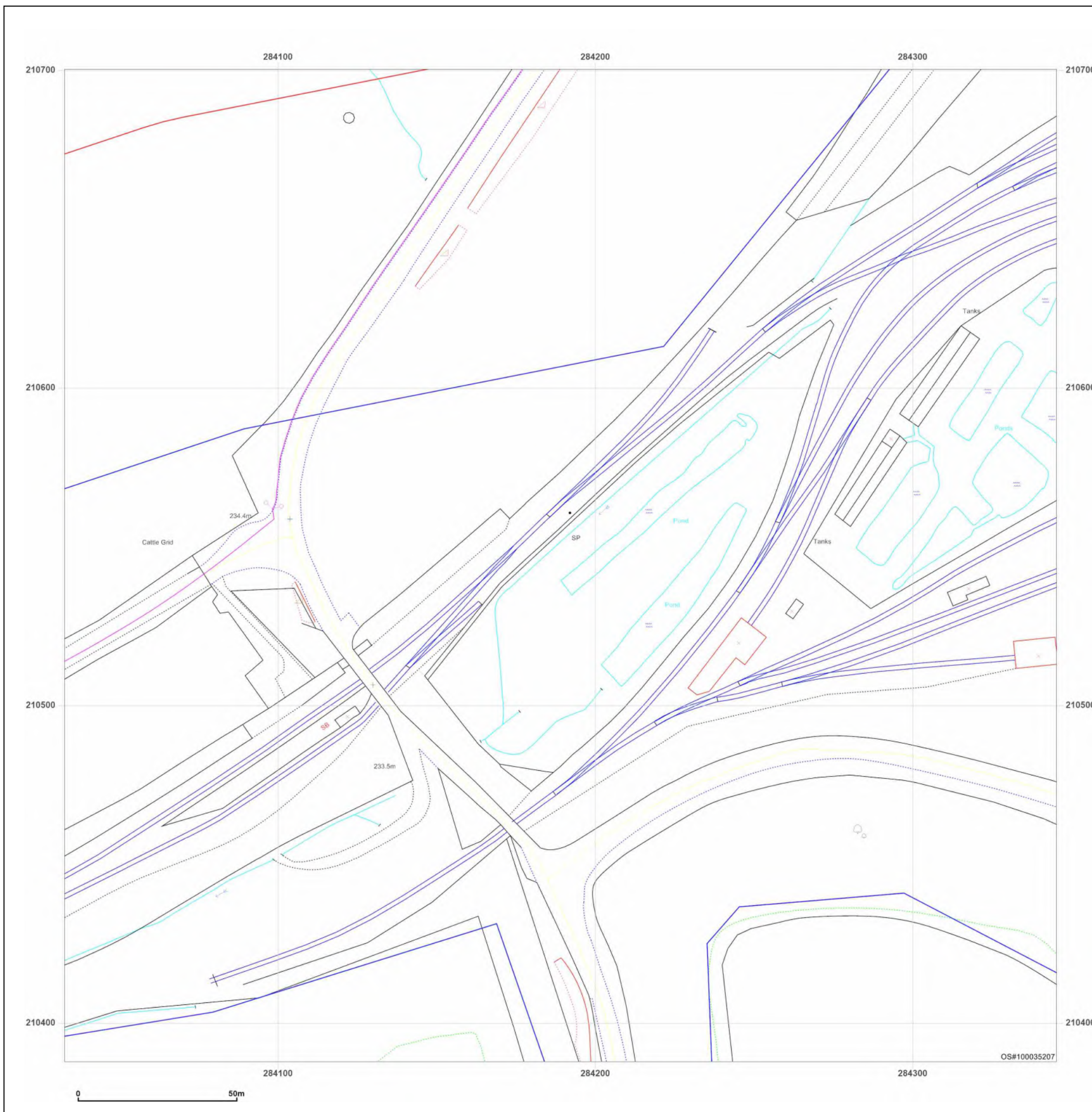


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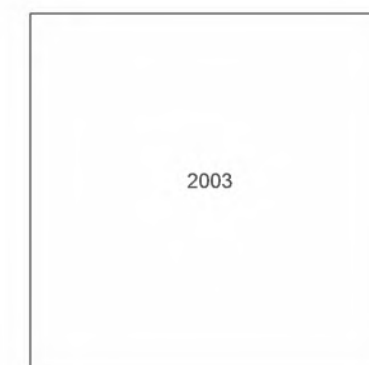
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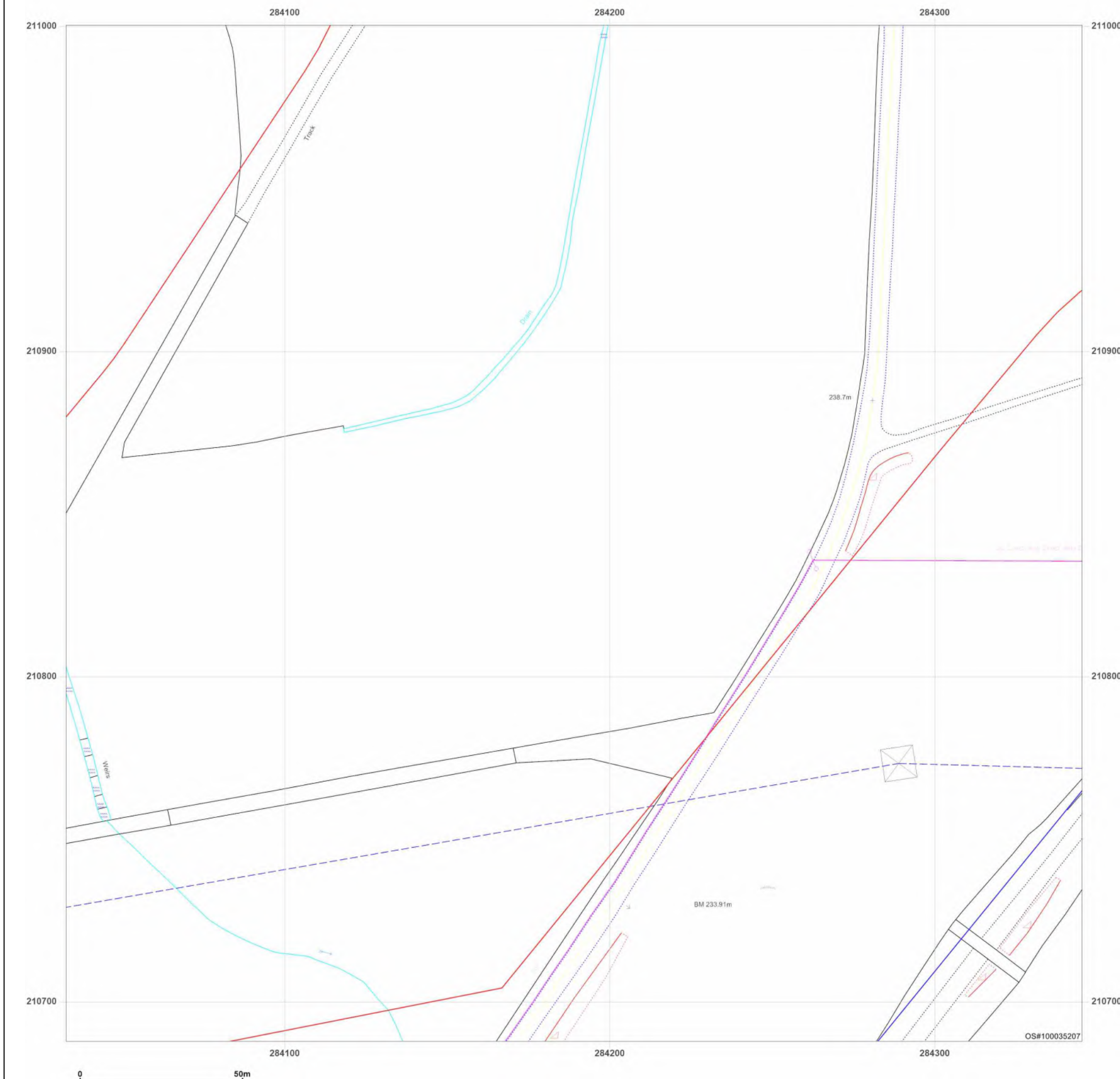


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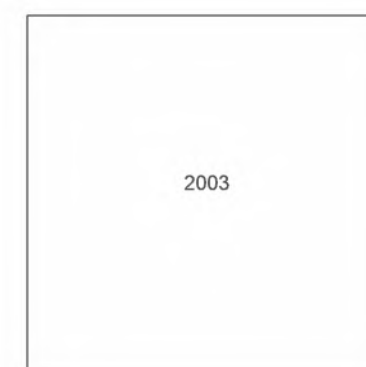
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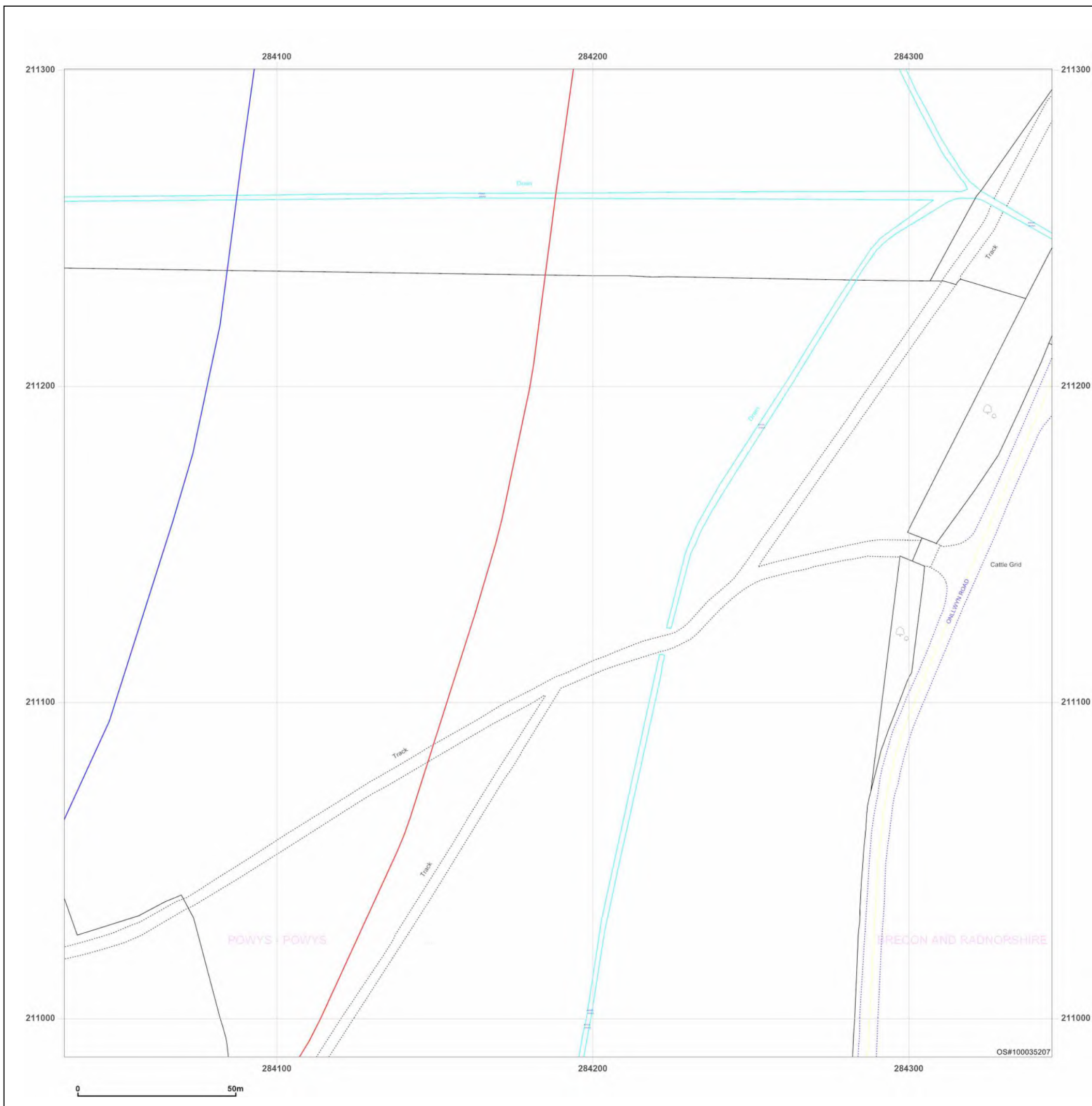


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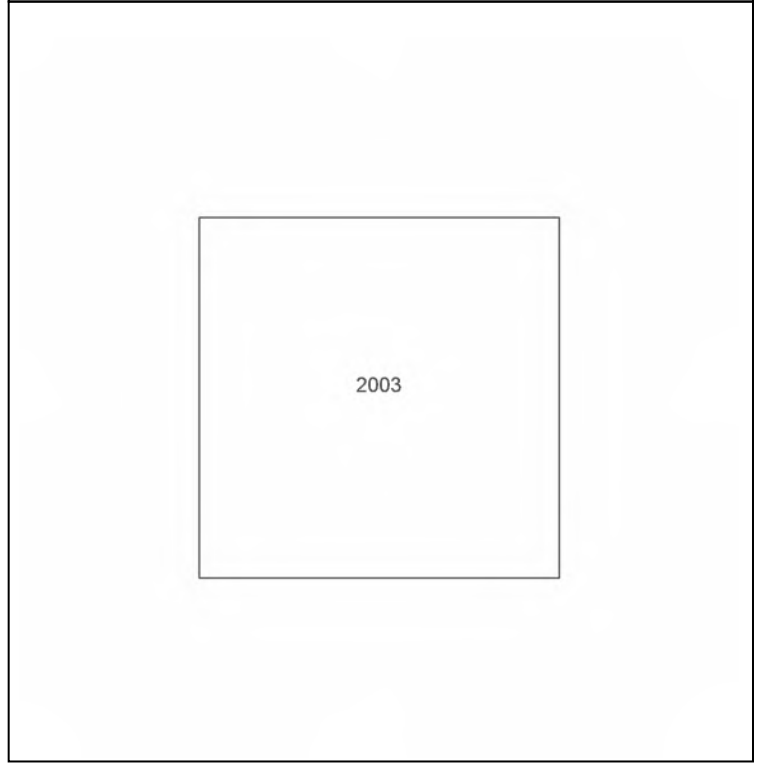
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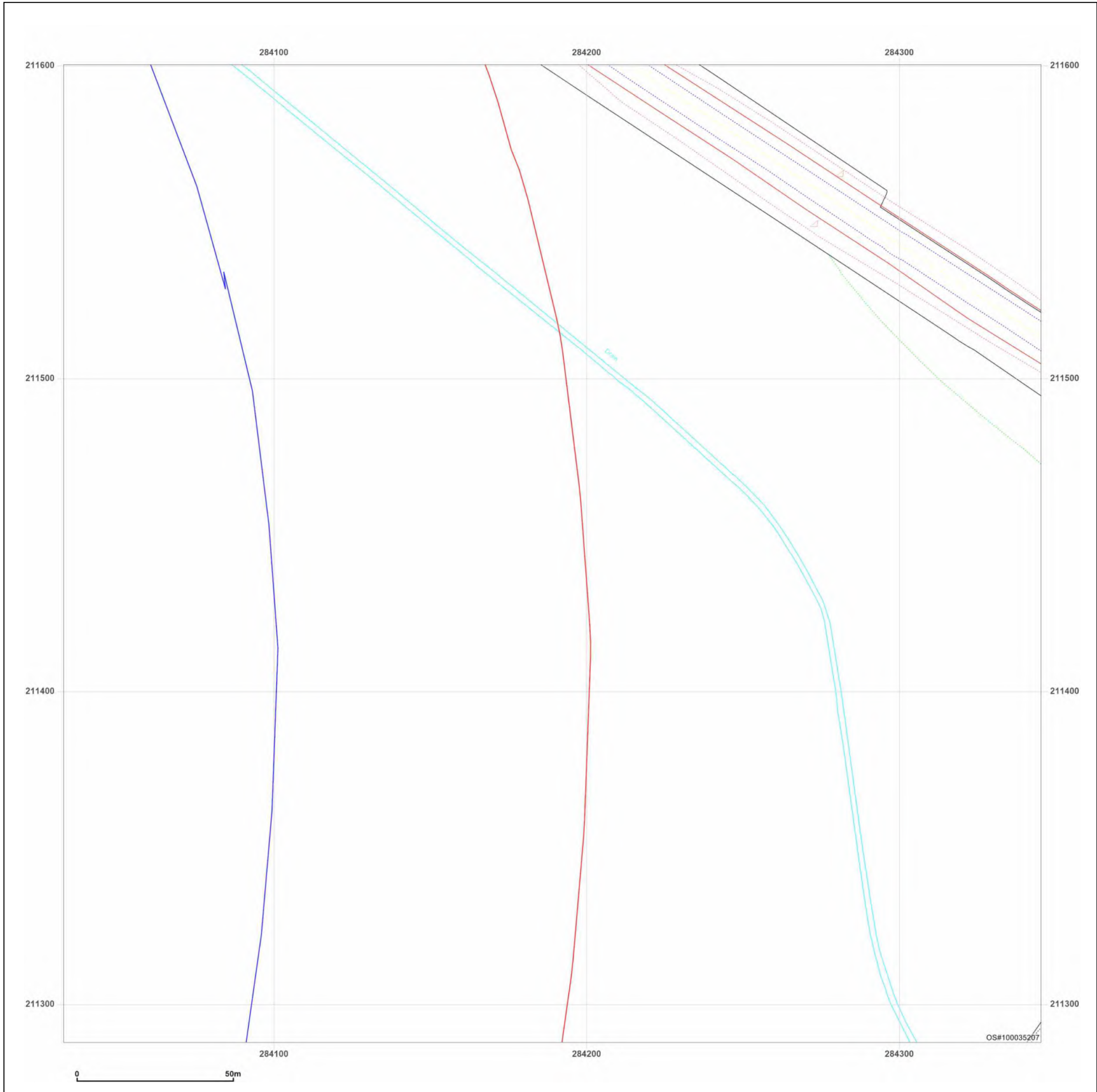
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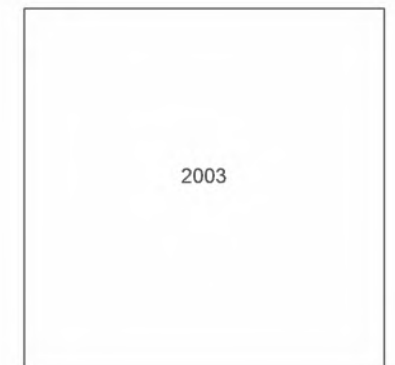
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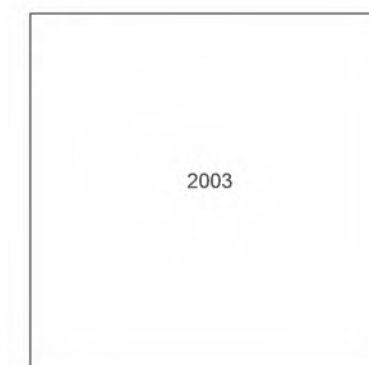
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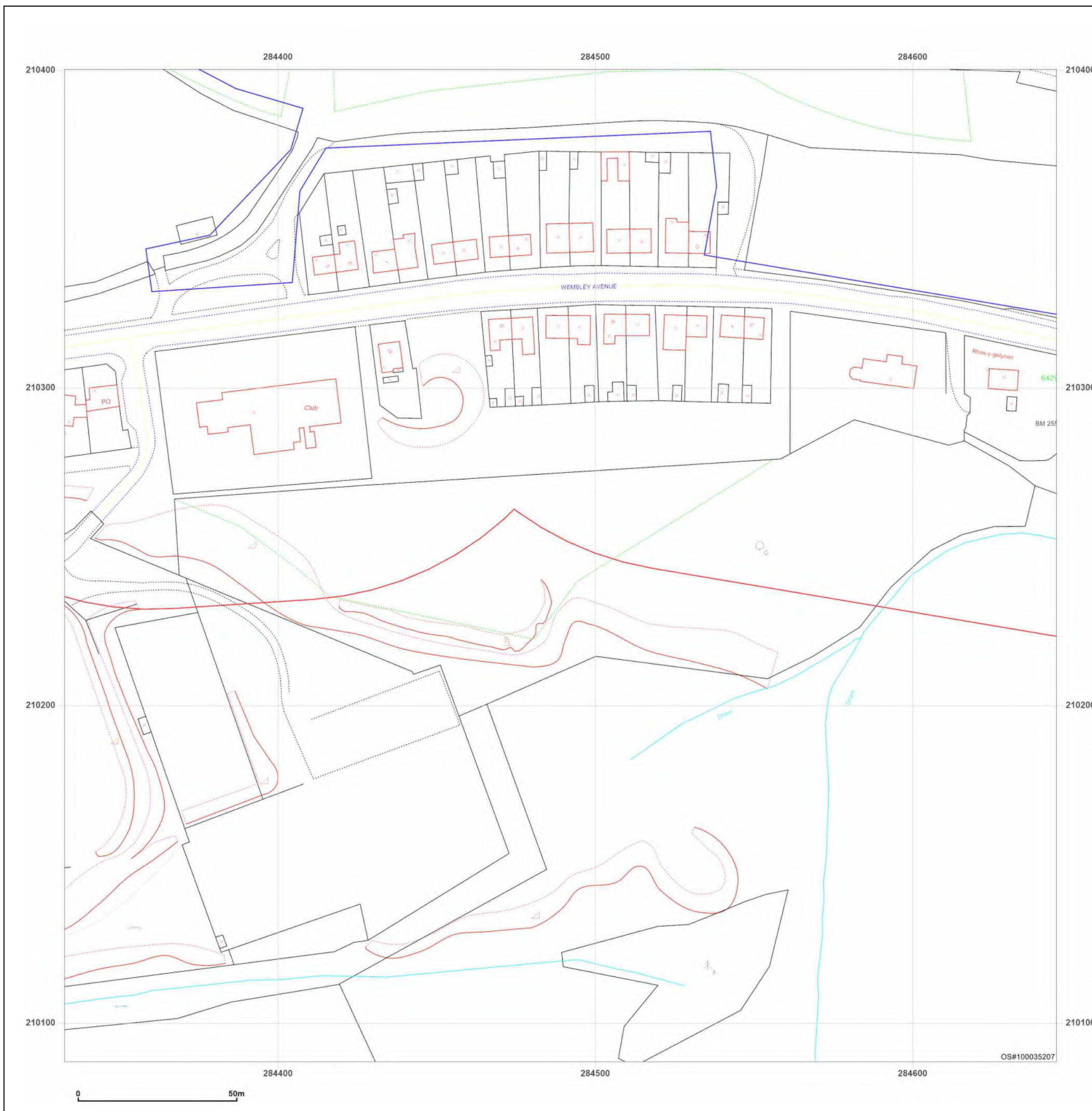


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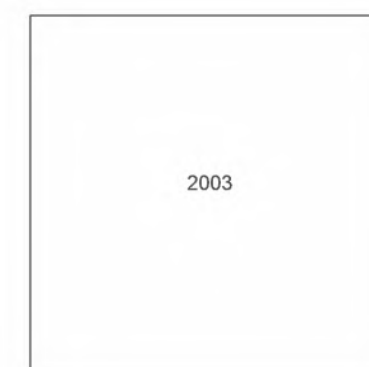
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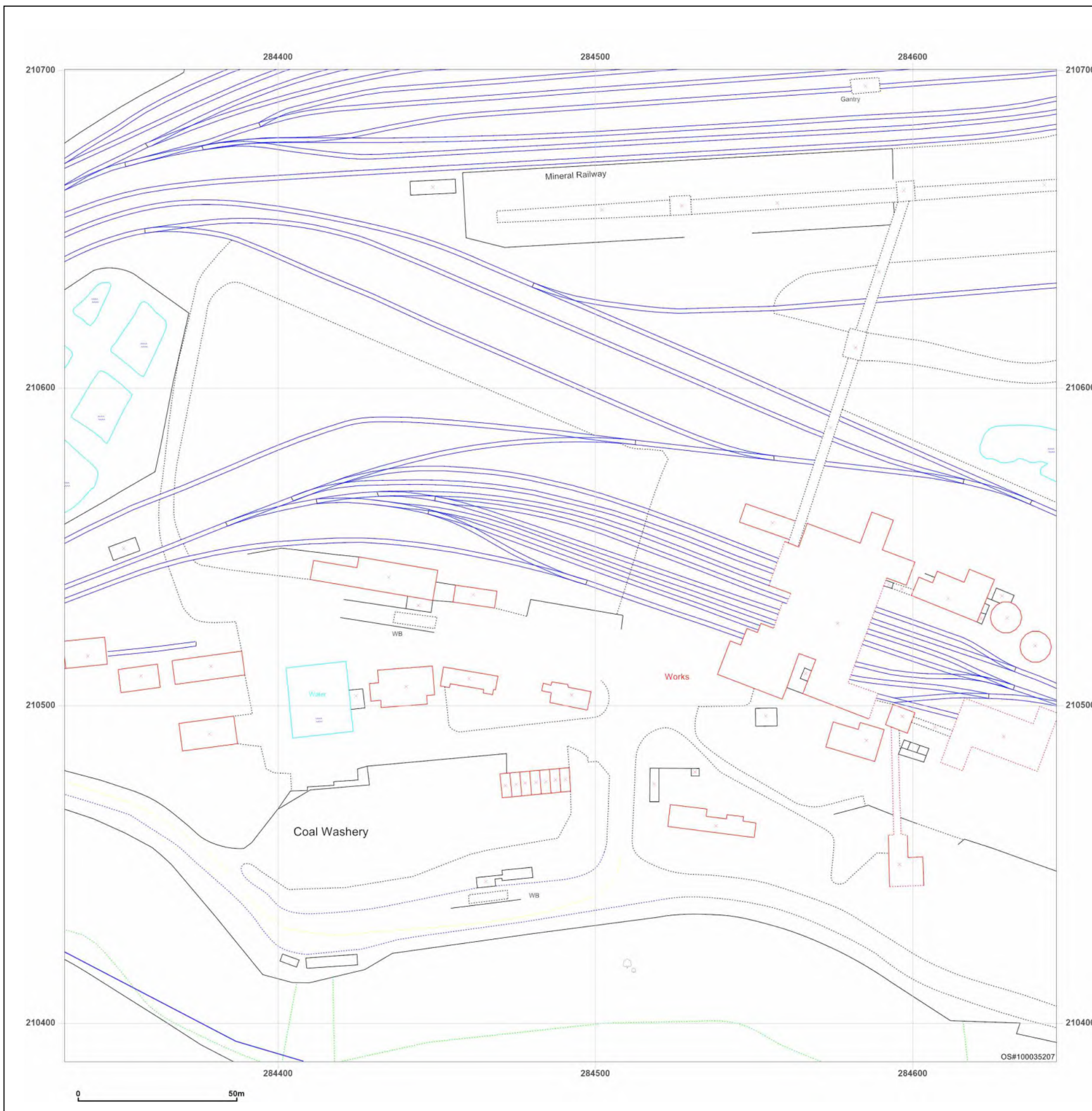


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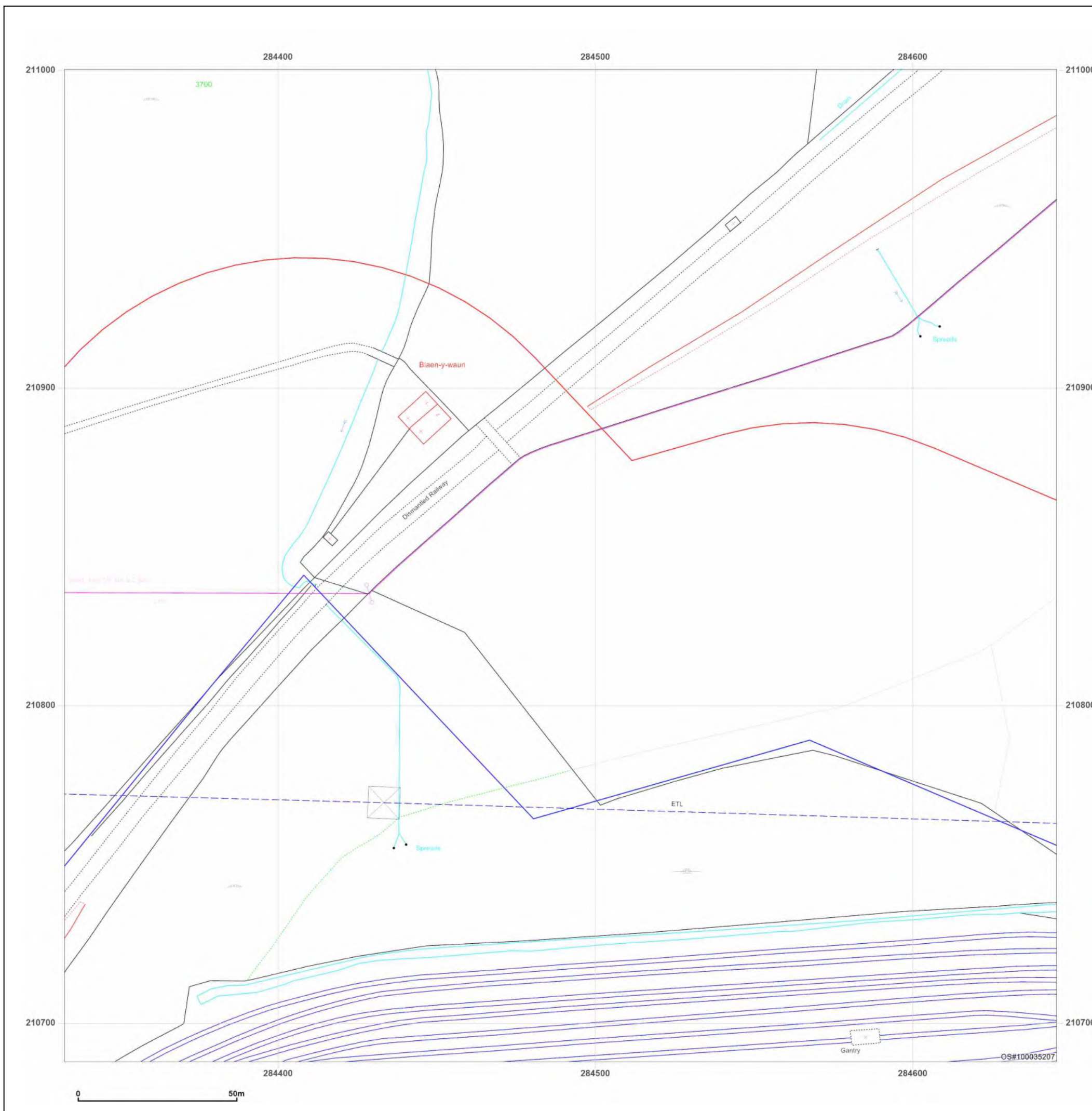


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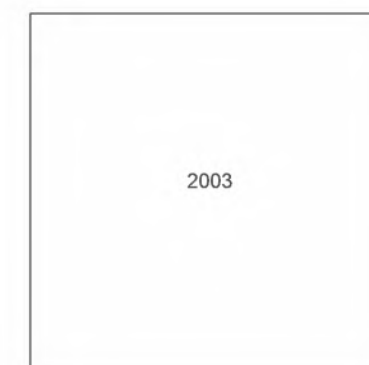
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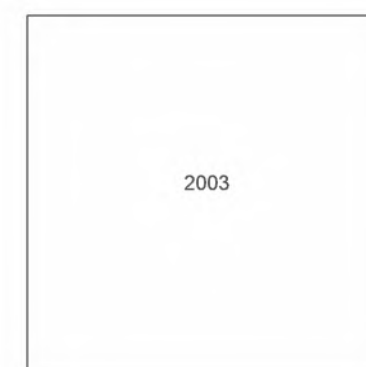
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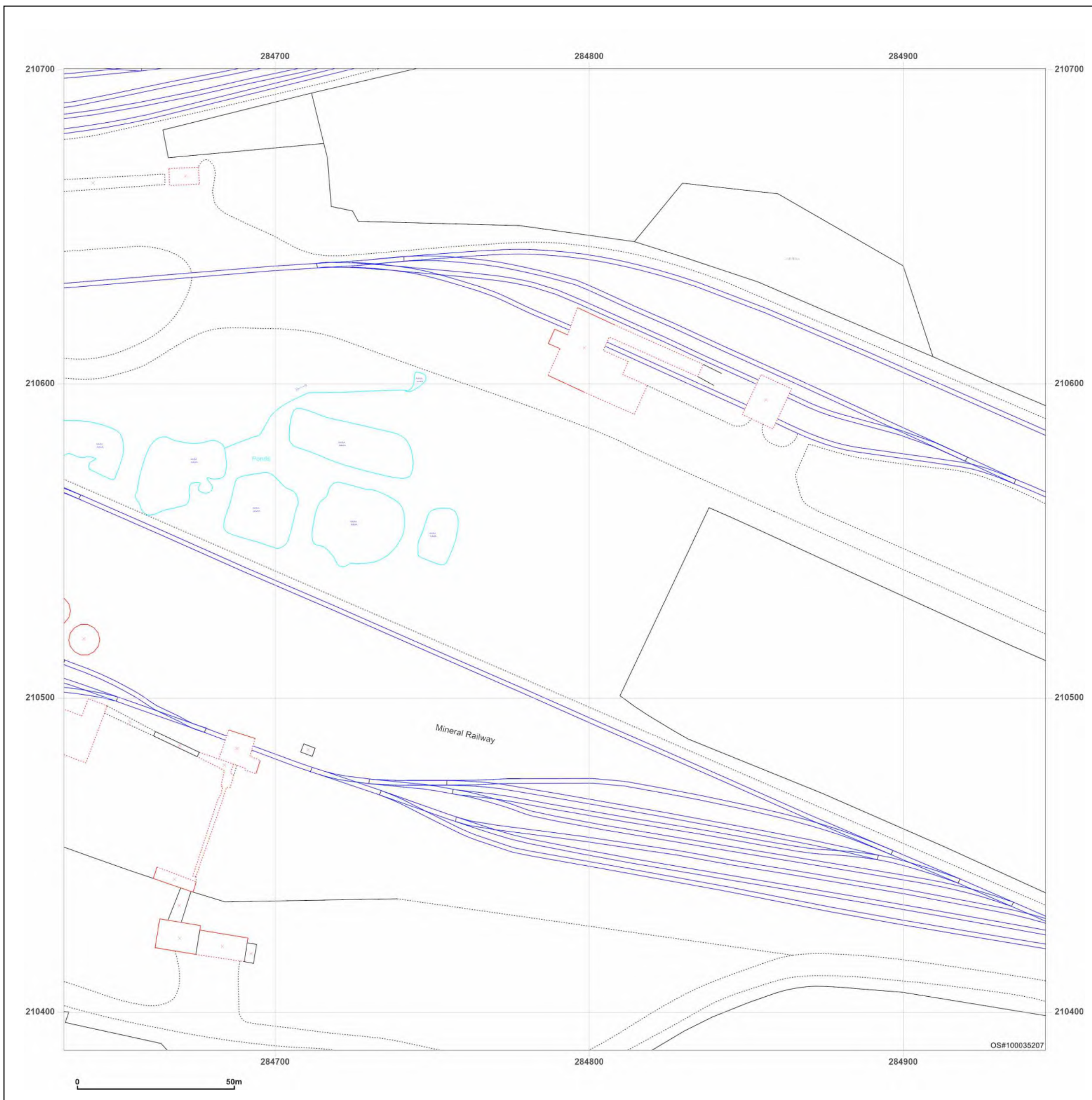


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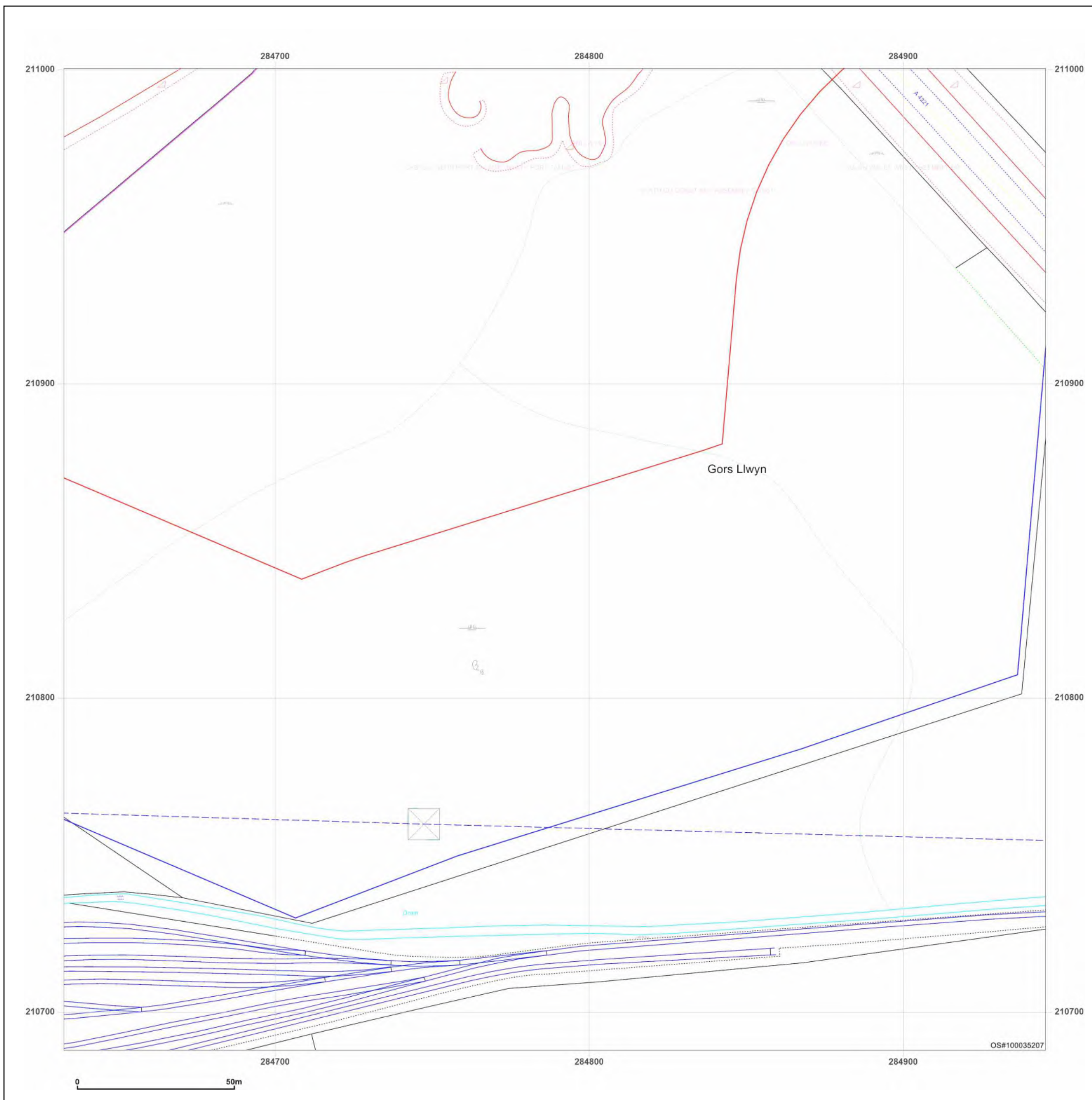


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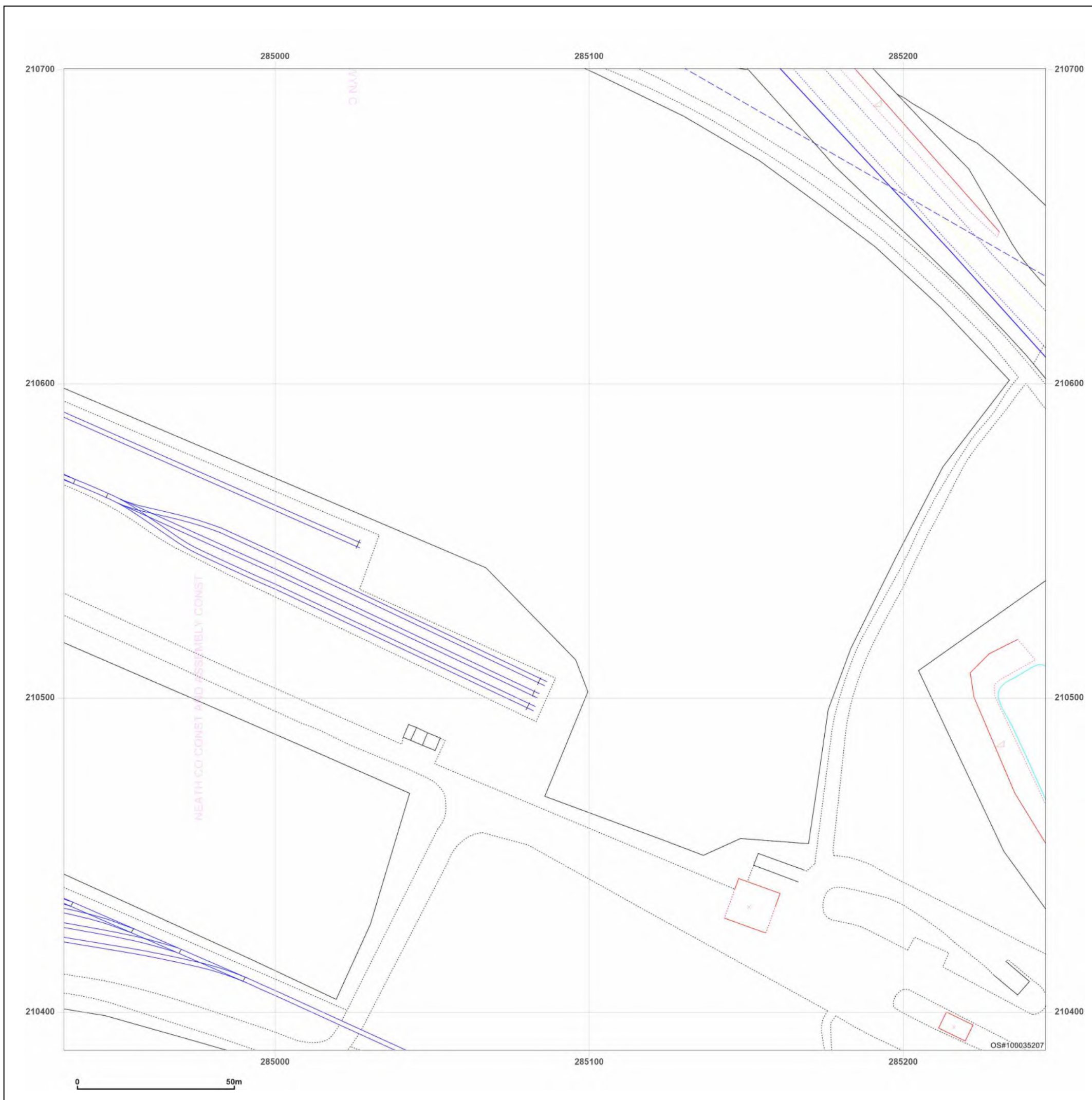


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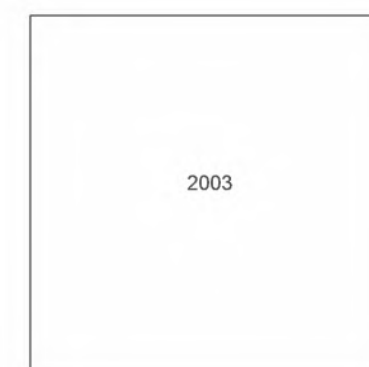
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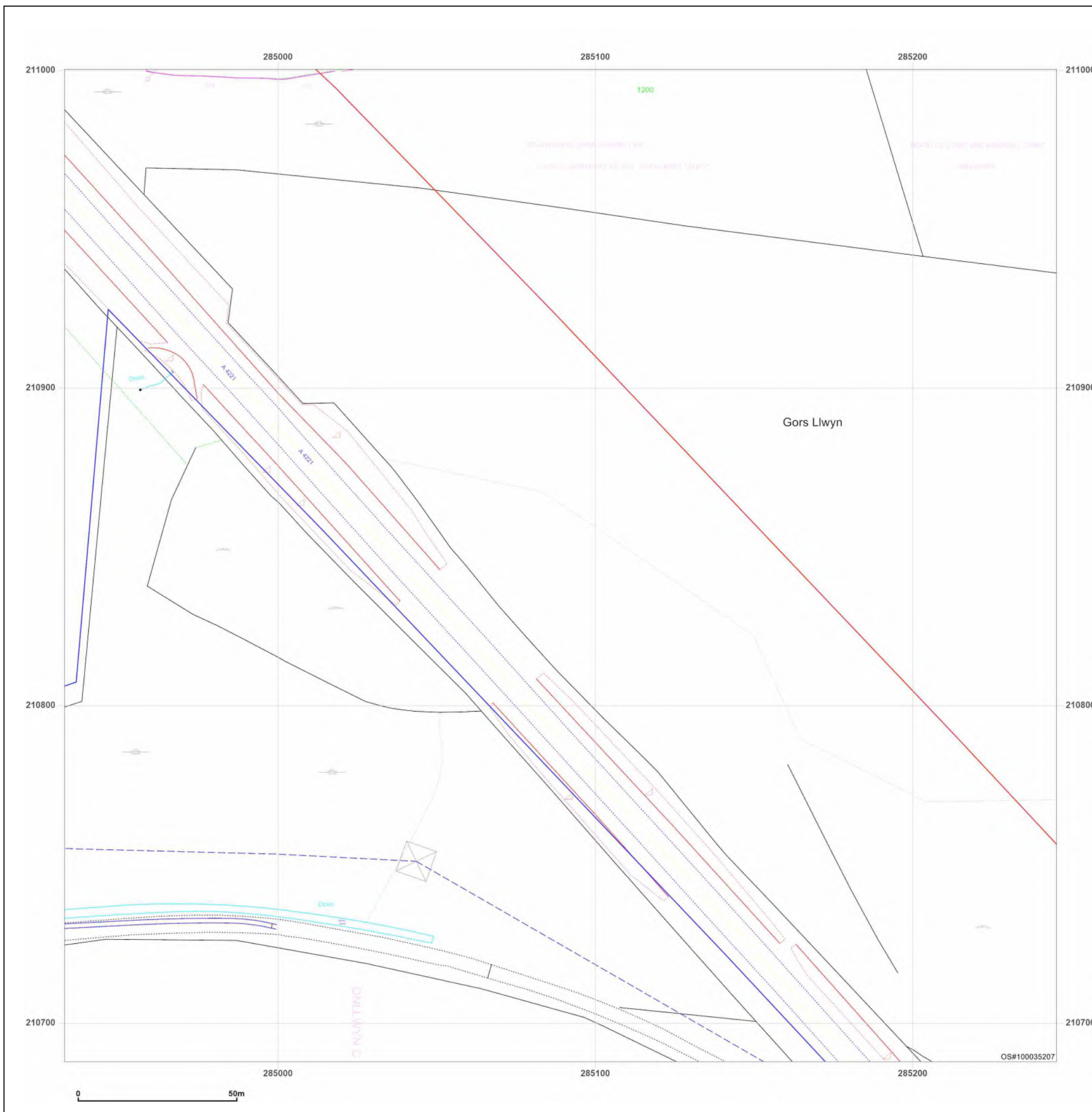


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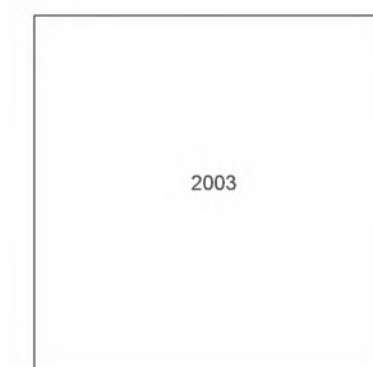
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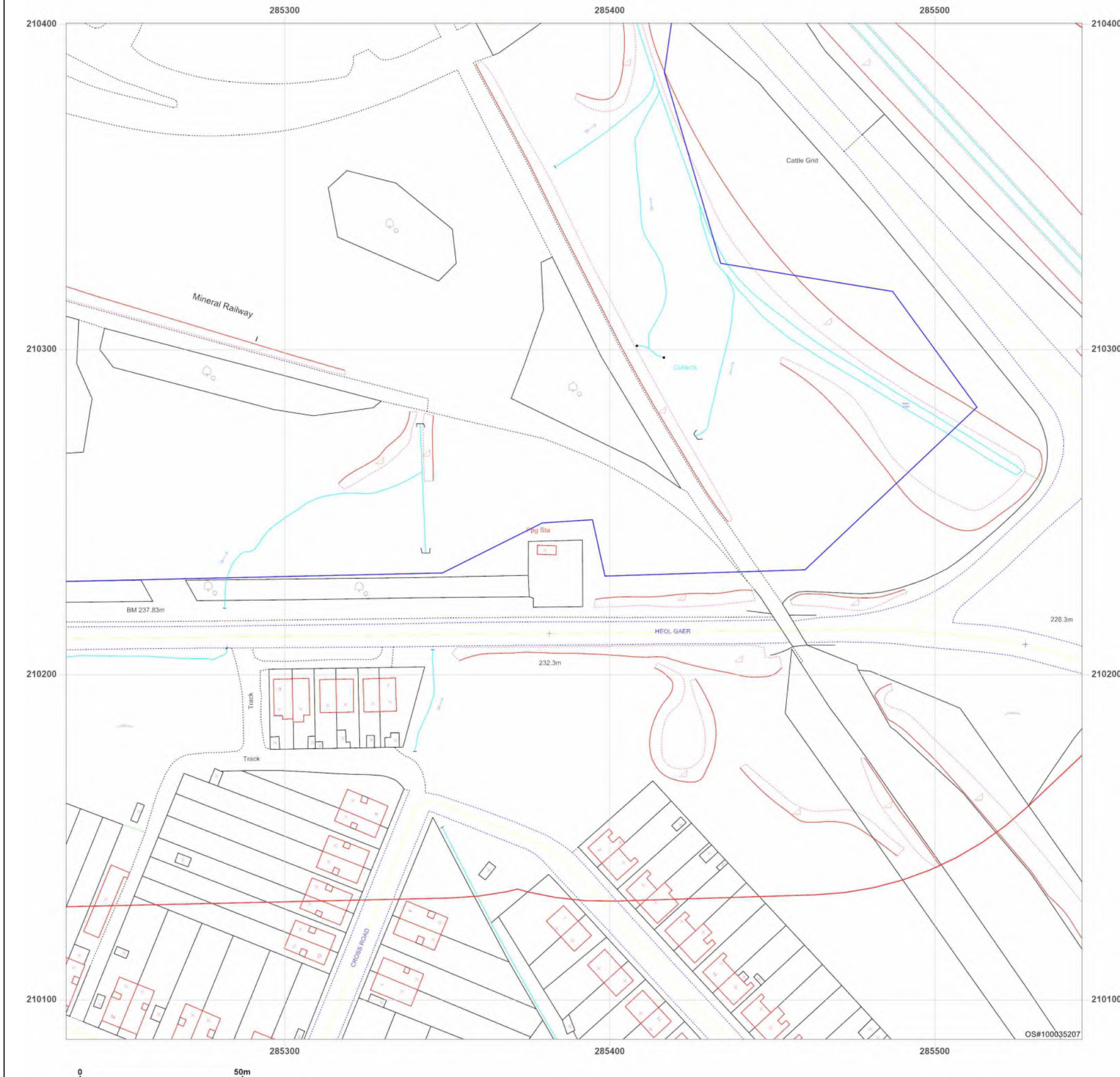


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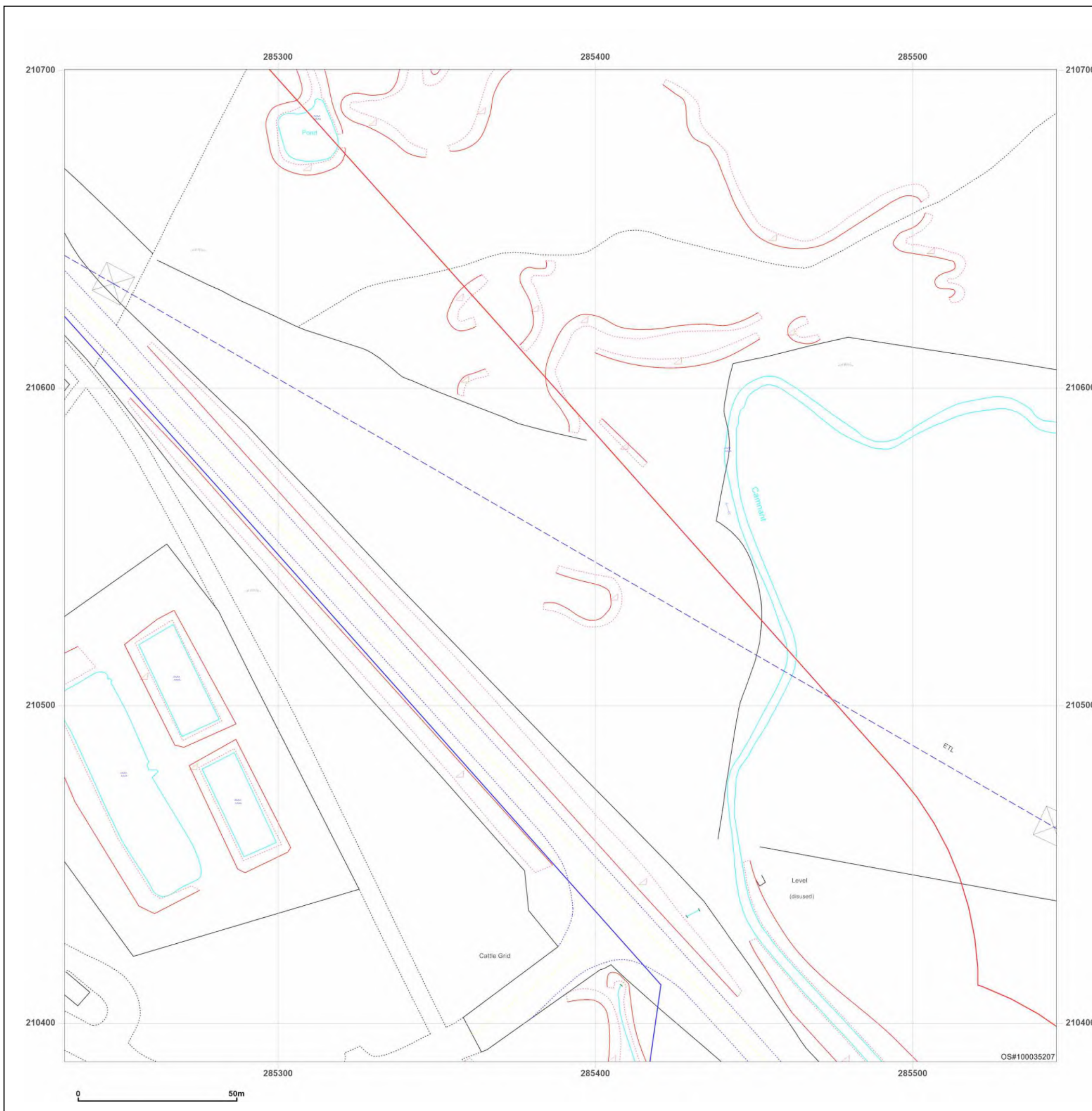


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Appendix F. Factual Report

GLOBAL CENTRE OF RAIL EXCELLENCE

GROUND INVESTIGATION:

Factual Report

Report No. Q0652/FR_01

April 2022

DOCUMENT CONTROL

Contract Name: Global Centre of Rail Excellence

Contract Reference: Q0652

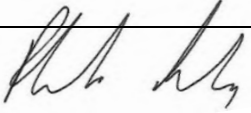
Report Type: Ground Investigation Factual Report

Report Reference: Q0652/FR_01

Date of Report Production: April 2022

Client: Global Centre of Rail Excellence

Client/ Scheme Engineer: ARUP

Version:	Date:	Prepared by:	Checked by:	Approved by:
Draft	07/02/22	P. Darby	R. McDermott	R. McDermott
1	14/03/22			
2	05/04/22			
		Senior Engineering Geologist B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.	Company Manager/ Chartered Engineering Geologist B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.,TechIOSH	Company Manager/ Chartered Engineering Geologist B.Sc.(Hons.),M.Sc., C.Geol., F.G.S., TechIOSH

Disclaimer: Quantum Geotechnic Limited has prepared this report in accordance with the instructions of the above named Client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

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0. FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

0.1 General

Recommendations made and opinions expressed in the report are based on the strata observed in the excavations, together with the results of site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the Exploratory Holes or which occur between Exploratory Holes. Whilst the report may suggest the likely configuration of strata, both between Exploratory Holes and below the maximum depth of investigation, this is only indicative and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

0.2 Investigation Procedures

Cable Percussive Borehole Drilling, Rotary Percussive Borehole Drilling (*dynamic sampled / rotary cored / rotary probed*), Sonic Drilling, Machine Excavated Trial Pits/ Trenches and Geophysical Surveying techniques for ground investigation have been employed on this scheme. All Exploratory Hole operations, sampling and logging of soils, rocks and in-situ testing complies with the recommendations of the British Code of Practice BS 5930:2015+A1:2020, 'Site Investigations', British Code of Practice BS 10175: 2011 + A1:2013, 'Investigation of Potentially Contaminated Sites' and BS 1377: 1990, 'Methods of Test for Soils for Engineering Purposes'. Additional Ground penetrating Radar (GPR) survey of buried utilities was also undertaken.

0.3 Routine Sampling

Representative bulk, undisturbed, disturbed and environmental samples of the different strata are taken during the formation of the exploratory holes and following completion of logging as required and in accordance with Project Specification. These samples are sealed and labelled in clear plastic bags and 2kg plastic tubs. Soil and water samples obtained for environmental testing are sampled and sealed in borosilicate amber jars or in specialist vessels where required. All samples are returned from site to QGL's laboratory for controlled storage within 24 hours of sampling to await test scheduling /requirements.

0.4 In-Situ Testing

- Standard Penetration Testing within Boreholes (SPT)
- Hand Shear Vane Testing in Trenches/ Pits where cohesive soils encountered
- Magnetic Geophysical Survey
- Electromagnetic Geophysical Survey
- Microgravity Geophysical Survey
- Soakaway Testing

0.5 Groundwater

Where possible, or applicable, the depth of entry of any influx of groundwater is recorded during the course of excavation or boring operations. The rate of inflow into the excavation or borehole is monitored during the course of the excavation or during boring procedures. Upon encountering any water strikes, work is temporarily halted and the water levels monitored for a standard twenty minute period recording the change in water level at the end of the twenty minutes.

Groundwater conditions observed in the excavations are those appertaining to the period of investigation. It should be noted, however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions or other causes.

0.6 Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded. Further to notifying the Engineer/ Client with one week's notice all soil and/or rock samples will be discarded 28 days after submission of the approved final report.

1. INTRODUCTION

1.1 General

Upon the instructions of ARUP (Scheme Engineer/ Investigation Supervisor), acting on behalf of the Client, Global Centre of Rail Excellence, Quantum Geotechnic Ltd (QGL) was commissioned to undertake the initial ground investigation for the proposed Global Centre of Rail Excellence, located at the Nant Helen Opencast site, Onllwyn Washery and the adjacent area.

QGL fulfilled the role as Principal Contractors for this scheme.

This report presents a factual account of the fieldwork carried out, including an account of the fieldworks undertaken, descriptions of strata encountered and provision of subsequent laboratory test results. Other available sources of information that have been consulted in the preparation of this Factual Report include the published geological maps for the area and online databases.

General notes on the techniques employed by QGL are described in the Foreword together with the limitations inherent in carrying out site investigation work.

1.2 Purpose of Ground Investigation

The ground investigation is to assist with the design of the proposed development. The proposed main works is the development of a rail testing facility that will include a 7km track, the construction of which will involve the construction of significant cuttings and embankments, a platform environment, train storage facilities, train decommissioning area and an educational facility.

1.3 Scope of Work

The initial scope of works finalised by the Investigation Supervisor / Designer comprised the following:

- 1 no cable percussive with rotary core follow on borehole
- 3 no cable percussive with open hole follow on boreholes
- 3 no cable percussive with rotary coring and open hole follow on boreholes
- 2 no rotary coring boreholes
- 10 no rotary coring with open hole follow on boreholes
- 10 no sonic boreholes
- 33 no trial pits
- Four areas of geophysical testing, including magnetometer, electromagnetic and microgravity surveys

The aim of the exploratory holes is to facilitate:

- Detailed descriptions of the site stratigraphy and the nature and disposition of the superficial soils and rock
- Details of potentially mined coal seams and information to assess subsidence risks associated with these
- Chemical and geotechnical testing of soil and rock samples
- Chemical testing of groundwater samples
- Groundwater and ground gas monitoring from standpipe installations
- In-situ testing, including Standard Penetration Tests, hand vane tests and infiltration tests

2. SITE DETAIL

2.1 Site Description

The site covers an area of approximately 500 hectares and is located between the A4109 to the south and the A4221 to the north-east, at approximate National Grid Reference 282580, 211080.

The majority of the western area of the site is occupied by Celtic Energy as the Nant Helen active open cast coal mine. The western extent is the Nant Helen Extension opencast working. The central and south western portion of the site contains a large overburden storage area whilst the Celtic Energy Nant Helen yard, offices and car parking are located towards the centre of the site. Onllwyn Washery occupies the eastern area of the site and is connected to the Nant Helen site by a series of access roads. The remainder of the site is farmland.

The topography of the site varies significantly and rises inwards to elevations of between 280 and 295m AOD in the central area of the site.

2.2 Statutory Service Information

All service information was provided by the Scheme Engineers and also a separate set of service drawings were obtained by QGL prior to commencement of the intrusive works. A permit to excavate system was implemented by QGL throughout the works for all exploratory holes. Standard QGL procedures for breaking ground were followed and all areas were scanned using a cable avoidance tool. A hand dug trial pit was excavated to 1.2m prior to commencement of borehole drilling. All hand excavation was undertaken using insulated digging tools.

2.3 Published Geology

Details of the geology of the site are provided by British Geological Survey (BGS) Sheet 231 'Merthyr Tydfil', Solid and Drift edition at 1:50,000 scale, and BGS's online tool Geology of Britain Viewer. The maps indicate superficial deposits of Peat to underlie areas of the eastern area of the site, whilst deposits of Glacial Till underlie localised areas below the eastern and central areas of the site.

The solid geology below the site is mapped as the South Wales Coal Measures, typically comprising mudstones, siltstones, sandstones, grits, fireclays, seatearths and coals.

In addition to the geological mapping, the Engineer / Investigation Supervisor provided the following information:

Made Ground material is anticipated beneath the washery site and is likely to comprise a mixture of varied granular backfill material within a cohesive clay matrix. Various gravel inclusions within the Made Ground were noted to be mudstone, sandstone, coal, clinker and wood. The thickness of this material is anticipated to range between 0.25 and 7.0m, although locally thicker deposits could be encountered in the locations of any stockpiles / spoil heaps within the washery site.

Backfilled opencast mining material is anticipated in various areas of the site. The backfill material has derived from the mining of the Middle and Lower Coal Measures. The anticipated depth of backfill between 40 and 150m.

3. FIELDWORK

3.1 General

The fieldwork was carried out between 15th November 2021 and 19th January 2022. Full-time on-site supervision and attendance by an Engineering Geologist from QGL was undertaken on all aspects of the site works.

All works were conducted within safe working practices set out by QGL's Risk Assessed Method Statement including CAT scanning and service inspection hand excavated pits to 1.2mbgl in all borehole locations.

All inductions and regular site briefings were carried out by QGL's Engineering Geologist as well as site specific inductions provided by Celtic Energy. No deviations from the Standards and Procedures adopted for the works were recorded.

Sensitive vegetation clearance was undertaken to access areas of the site where the potential presence of reptiles and amphibians exists, under the supervision of an Ecological Clerk of Works.

Trial Pits and hand excavated service clearance pits outside of the backfilled opencast mines were undertaken under an archaeological watching brief. The scope of the works and supervision was agreed with Glamorgan-Gwent Archaeological Trust and Clwyd-Powys Archaeological Trust prior to commencing work in the areas of interest. The Archaeological report is presented within Appendix VI.

3.2 Exploratory Hole Locations

The exploratory hole locations were set out by QGL in liaison with the Investigation Supervisor. On completion of the ground investigation all exploratory hole positions were surveyed by QGL to National Grid Co-Ordinates and Ordnance Datum (accurate to 0.005m horizontal and 0.01m vertical) using QGL in-house GPS equipment.

An Exploratory Hole Location Plan is presented as Figure 2 in Appendix I, and exploratory hole coordinates and levels are presented on the engineer's log sheets in the corresponding Appendices.

Table 1 presents the National Grid Co-Ordinates and Ordnance Datum for the exploratory holes.

Table 1: Exploratory Hole Co-Ordinates & Levels

Exploratory Hole ID	Easting	Northing	Elevation (mAOD)	Exploratory Hole ID	Easting	Northing	Elevation (mAOD)
BH01	284008.752	210457.288	228.289	TP01	284246.92	210515.985	229.984
BH02	283562.15	210475.288	238.034	TP02	284410.812	210600.045	231.438
BH03	283200	210681	258.30	TP03	284554.783	210496.562	234.921
BH04	282861.715	210545.421	257.69	TP04	284819.634	210502.793	239.164
BH05	282375.778	210348.29	239.39	TP05	284970.622	210390.891	240.574
BH06	281804.05	210415.339	263.08	TP06	285168.401	210396.23	237.139
BH07	281544.876	210721.078	271.278	TP07	285325.242	210402.826	232.565
BH08	282776.077	211918.353	236.309	TP08	284939.196	210661.097	243.459
BH09	283119.525	211903.085	230.86	TP09	285134.983	210589.126	243.465
BH10	283369.5	211901.555	236.953	TP10	283248.015	210699.94	257.767
BH11	283659.495	211793.719	258.786	TP11	283484.765	210766.086	251.088
BH12	283925.43	211066.299	258.21	TP12	285143.133	210543.076	242.244
BH13	283817.797	210965.719	259.335	TP13	285116.027	210469.732	238.825
BH14	283702.056	210915.057	260.008	TP14	285232.47	210442.229	233.459
BH15	283332.648	210758.175	249.628	TP14A	285233.984	210444.909	232.944
BH16	283439.29	211441.069	280.709	TP15	284779.25	210390.75	248.109
BH17	283274.059	211061.09	276.83	TP17	284728	210394	247.22
BH18	283148.397	210982.779	275.032	TP18	283467.81	210253.53	221.201
BH19	281397.517	211205.939	255.047	TP19	282624.076	210468.096	247.39
BH19A	281399.062	211202.028	255.32	TP20	283231.186	211035.804	275.005
BH20	281652.88	211668.6	251.00	TP21	283037.695	211907.981	230.341
BH21	281893.75	211906.21	228.232	TP22	282687.913	210984.945	279.117
BH22	282101.253	212011.3	213.006	TP23	281381.91	211314.37	248.13
BH23	282565.867	211985.864	199.76	TP24	281948.549	211934.417	228.438
BH24	283944.594	211545.584	258.672	TP25	283990.42	211456.97	255.626
BH25	283952.651	211213.21	257.678	TP26	282977.921	210985.136	286.054
BH26	283672.545	211573.995	273.065	TP27	282341.166	210344.218	239.617
BH27	282777.925	210976.889	283.501	TP28	281604.404	211639.767	251.054
BH28	282572.648	210970.189	277.374	TP29	282282.615	212062.103	230.736
BH29	284719.483	210705.393	230.736	TP30	284010.546	211327.163	252.686
BH30	284925.689	210549.408	239.096	TP31	282490.134	211876.52	232.41
BH31	284880.773	210454.806	238.608	TP32	282814.327	211902.586	235.632
BH32	284967.95	210230.008	244.73	TP33	283304.686	211902.413	236.288
BH33	284397.044	210700.878	230.51	TP34	283918.939	211654.186	253.8
BH34	284419.614	210543.602	232.63	TP34A	284641.854	210699.974	230.763
				TP35	285316.156	210289.506	234.766
				TP36	285090.027	210482.138	239.896
				TP37	284931.976	210605.035	239.19
				TP38	284921.927	210557.022	238.95

3.3 Boreholes

A total of thirty-five boreholes were drilled during the site works using a combination of drill rigs and techniques.

The Cable Percussive element of the borehole works were drilled using a Dando 2000 rig utilising 200mm diameter casing and tools.

The dynamic sampling, rotary coring and rotary probing element of the borehole works were undertaken using two Commachio 600 multi-purpose drill rigs, using 101mm diameter dynamic sample barrel for soil sampling and 412F coring barrel for bedrock. A combined air/mist flush was used to clear the hole of returns and debris during the drilling process. 115mm diameter ODEX overburden drill system was used by the Commachio drill rig to maintain the borehole open through the superficial deposits.

Three sonic boreholes were undertaken across the site using a Mito XL140 drill rig operated by Borehole Solutions Limited. Due to ground conditions, which comprised an extensive number of boulders and the continued loss of drill flush, it was not possible to progress the drill casing to the required depths and therefore the scheduled depths were not achieved. The remaining boreholes scheduled as sonic boreholes were undertaken using rotary percussive methods to the maximum depths considered achievable with the available equipment and the ground conditions encountered.

The recovered rock sample liners were split and logged in accordance with BS5930: (2015); BS EN ISO 14688-1:2002; BS EN ISO 14688-2:2005 and BS EN ISO 14689-1:2003, including fracture spacing, by a QGL Engineering Geologist. All retrieved core is stored in wooden lockable boxes and was logged and photographed on site prior to being transported back to QGL premises for storage.

In-situ Standard Penetration Testing (SPT) was carried out in all boreholes (see section 3.5.1.).

Upon completion, selected boreholes were installed with 50mm Internal Diameter combined HDPE landgas and groundwater pipes for subsequent monitoring. Further details are listed in Section 3.7. Boreholes not subject to standpipe installations were backfilled with a Cement and Bentonite grout mix, tremmied to the base of the boreholes, with surfacing reinstated like-for-like.

Details of all Boreholes including final depths are provided below in Table 2.

Table 2: Borehole Detail

Exploratory Hole ID	Borehole Type	Completed Depth (mbgl)	SPT Hammer Ref	Terminating Strata	Backfill Details	Notes/Reason for Termination
BH01	Rotary Probe Borehole	30.0		Sandstone Bedrock	Grout Backfill	Scheduled Depth
BH02	Rotary Probe Borehole	30.0		Hard Drill (Loss of	Grout Backfill	Scheduled Depth

Exploratory Hole ID	Borehole Type	Completed Depth (mbgl)	SPT Hammer Ref	Terminating Strata	Backfill Details	Notes/Reason for Termination
				Flush)		
BH03	Rotary Cored & Probed Boreholes	32.7	Q2 AR830	Mudstone Bedrock	Grout Backfill	Upon Engineer Instruction
BH04	Rotary Cored & Probed Boreholes	30.0	Q2 AR830	Mudstone Bedrock	Grout Backfill	Scheduled Depth
BH05	Dynamic Sampled with Rotary Core follow-on	30.7	Q5	Mudstone Bedrock	Grout Backfill	Scheduled Depth
BH06	Rotary Cored & Probed Boreholes	30.0	Q5	Mudstone and Sandstone Bedrock	Grout Backfill	Scheduled Depth
BH07	Rotary Cored & Probed Boreholes	35.0	Q5	Mudstone and Sandstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH08	Rotary Probe Borehole	42.0		Mudstone and Sandstone Bedrock	Grout Backfill	Upon Engineer Instruction
BH09	Rotary Probe Borehole	30.0		Siltstone Bedrock	Grout Backfill	Scheduled Depth
BH10	Rotary Probe Borehole	30.0		Sandstone Bedrock	Grout Backfill	Scheduled Depth
BH11	Rotary Cored & Probed Boreholes	30.0	Q2 AR830	Mudstone and Sandstone Bedrock	Grout Backfill	Scheduled Depth
BH12	Rotary Cored & Probed Boreholes	30.0	Q2 AR830	Mudstone Bedrock	Grout Backfill	Scheduled Depth
BH13	Rotary Cored Boreholes	30.0	Q5	Mudstone Bedrock	Grout Backfill	Scheduled Depth
BH14	Rotary Cored & Probed Boreholes	30.0	Q5	Mudstone and Sandstone Bedrock	Grout Backfill	Scheduled Depth
BH15	Rotary Cored & Probed Boreholes	30.0	Q5	Mudstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH16	Rotary Cored Boreholes	40.2	Q2 AR830	Mudstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH17	Rotary Cored & Probed Boreholes	30.0	Q2 AR830	Mudstone Bedrock	Grout Backfill	Scheduled Depth
BH18	Rotary Cored & Probed Boreholes	45.2	Q2 AR830	Mudstone Bedrock	Grout Backfill	Upon Engineer Instruction
BH19	Rotary Probe Borehole	19.2	Q2 AR830	Made Ground – Opencast Backfill	Grout Backfill	Unable to progress borehole
BH19A	Rotary Probe Borehole	28.2	Q2 AR830	Made Ground – Opencast Backfill	Land Gas & Ground Water Installation	Unable to progress borehole
BH20	Rotary Probe Borehole	40.2	Q2 AR830	Made Ground – Opencast Backfill	Grout Backfill	Unable to progress borehole
BH21	Sonic Borehole	33.0	XL140	Made Ground – Opencast Backfill	Grout Backfill	Unable to progress borehole
BH22	Sonic Borehole	32.0	XL140	Possible Bedrock	Grout Backfill	Unable to progress borehole
BH22A	Rotary Probe Borehole	34.0		Possible Bedrock	Land Gas & Ground Water Installation	Unable to progress borehole
BH23	Rotary Cored & Probed Boreholes	30.0	Q2 AR830	Mudstone Bedrock	Grout Backfill	Scheduled Depth
BH24	Rotary Probe Borehole	50.7	Q2 AR830	Made Ground – Opencast Backfill	Land Gas & Ground Water Installation	Unable to progress borehole
BH25	Rotary Probe Borehole	50.7	Q2 AR830	Made Ground – Opencast Backfill	Land Gas & Ground Water Installation	Unable to progress borehole

Exploratory Hole ID	Borehole Type	Completed Depth (mbgl)	SPT Hammer Ref	Terminating Strata	Backfill Details	Notes/Reason for Termination
BH26	Rotary Cored & Probed Boreholes	40.2	Q2 AR830	Mudstone Bedrock	Grout Backfill	Upon Engineer Instruction
BH27	Sonic Borehole	61.5	XL140	Made Ground – Opencast Backfill	Grout Backfill	Unable to progress borehole
BH28	Rotary Probe Borehole	49.2	Q2 AR830	Made Ground – Opencast Backfill	Land Gas & Ground Water Installation	Unable to progress borehole
BH29	Cable Percussive Borehole with Rotary Probe 'follow on'	35.0	SAM1	Mudstone / Siltstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH30	Cable Percussive Borehole with Rotary Cored and Probe 'follow on'	35.0	SAM1	Mudstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH31	Cable Percussive Borehole with Rotary Probe 'follow on'	35.0	SAM1	Mudstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH32	Cable Percussive Borehole with Rotary Cored and Probe 'follow on'	35.0	SAM1	Mudstone / Siltstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH33	Cable Percussive Borehole with Rotary Cored and Probe 'follow on'	35.0	SAM1	Mudstone / Siltstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth
BH34	Cable Percussive Borehole with Rotary Probe 'follow on'	30.0	SAM1	Mudstone Bedrock	Land Gas & Ground Water Installation	Scheduled Depth

A complete set of borehole logs are presented in Appendix II along with SPT Hammer calibration certificates for both the Cable Percussive and the Commachio drill rigs for reference purposes.

3.4 Machine Excavated Trial Pits and Trenches

A total of forty pits and trenches were excavated using 360 tracked excavators, either 9 Tonne or 13 Tonne, depending on depth requirement and access/ working area constraints.

Trial Pits TP12 – TP17 and TP35 – TP38 were excavated to investigate possible mining related anomalies identified from the Geophysical survey undertaken.

Soil infiltration tests were scheduled within Trial Pits TP01 – TP02, TP04 and TP18 – TP21 (see Section 3.5.2).

The trial pitting method of investigation allows direct sampling of the near surface deposits for identification purposes, locating of buried services, as well as assessment of any salient features and Made Ground or disturbed ground. The trial pits were logged in accordance with BS5930:2015+A1:2020; BS EN ISO 14688-1:2002 and BS EN ISO 14688-2:2004, and supervised at all times by an Engineering Geologist from QGL.

A graticule was used to assist with the field description of grading for material within Trial Pits TP22 – TP33. The graticule records are included as Appendix V.

All machine excavated trial pits and trenches were backfilled with compacted layers of arisings upon completion.

Geotechnical and Environmental samples were taken within the superficial deposits for laboratory testing purposes.

Details of the Machine Excavated Trial Trenches and Pits are provided in Table 3 below;

Table 3: Machine Excavated Trial Trench and Trial Pit Detail

Exploratory Hole ID	Completed Depth (mbgl)	Notes/Reason for Termination	Exploratory Hole ID	Completed Depth (mbgl)	Notes/Reason for Termination
TP01	2.8	Sides unstable and collapsing. Unable to undertake soakaway test due to high ground water encountered	TP21	4	Scheduled Depth
TP02	2.3	Sides unstable and collapsing. Unable to undertake soakaway test due to high ground water encountered	TP22	4.3	Sides collapsing, pit unstable.
TP03	3.3	Sides unstable and collapsing no progress being made	TP23	4	Scheduled Depth
TP04	3.6	Unable to proceed past cobbles/boulders at base of pit	TP24	4.5	Scheduled Depth
TP05	3	Sides unstable and collapsing no progress being made	TP25	4.5	Scheduled Depth
TP06	2.8	Unable to proceed past cobbles/boulders at base of pit	TP26	3.8	Sides collapsing, pit unstable.
TP07	4	Scheduled Depth	TP27	4.5	Scheduled Depth
TP08	3	Sides unstable and collapsing no progress being made	TP28	4	Scheduled Depth
TP09	4	Scheduled Depth	TP29	4.5	Scheduled Depth
TP10	2.6	Sides collapsing, pit unstable.	TP30	4.5	Scheduled Depth
TP11	2.7	Sides collapsing due to fast groundwater ingress.	TP31	4.5	Scheduled Depth
TP12	4.5	Scheduled Depth	TP32	4.5	Scheduled Depth
TP13	4	On natural strata	TP33	4.5	Scheduled Depth
TP14	3.5	Sides unstable and collapsing	TP34	4.5	Scheduled Depth
TP14A	3.5	Sides unstable and collapsing	TP34A	2.5	Sides unstable and collapsing. Unable to undertake soakaway test due to high ground water encountered
TP15	4.5	Scheduled Depth	TP35	4	Scheduled Depth
TP17	4	Scheduled Depth	TP36	4	Scheduled Depth
TP18	3	Significant Instability	TP37	4.5	Scheduled Depth
TP19	4	Scheduled Depth	TP37A	2	Encountered possible service

Exploratory Hole ID	Completed Depth (mbgl)	Notes/Reason for Termination	Exploratory Hole ID	Completed Depth (mbgl)	Notes/Reason for Termination
TP20	4	Scheduled Depth	TP38	4	Scheduled Depth

A full set of machine excavated trial trench and trial pit logs are presented in Appendix III.

The graticule results are provided in Appendix V.

3.5 In-Situ Testing

3.5.1 Standard Penetration Testing

Standard penetration tests (SPTs) were undertaken in all boreholes through the superficial deposits and weak bedrock at intervals shown on the engineer's logs, typically 1m intervals to 5m depth and 1.5m thereafter.

This dynamic in-situ test measures the density of soil or rock and is described in BS1377:1990 (part 9), partially superseded by BS EN ISO 22476-3 (2005). Within fine grained or cohesive soils, the test incorporates a small diameter tube (650mm length, 50mm external diameter and 35mm internal diameter) with a cutting shoe known as the 'split barrel sampler'. The sampler is forced into the soil dynamically using blows from a 63.5kg hammer dropped through 760mm. The sampler is initially advanced 150mm into the soil with seating blows, then the number of blows required to advance the sampler each 75mm increment up to a depth of 300mm is recorded. This cumulative total number of blows over the 300mm test is referred to as the "N" value. For coarse gravels and bedrock, the split barrel is replaced by a 60° cone.

SPT results can be found on the corresponding borehole logs in Appendix II.

3.5.2 Soakaway Testing

Soakaway testing was undertaken in accordance with BRE365 within selected Trial Pits. The test involved pumping clean water into a Trial Pit and measuring the time taken for the water level to fall. Where permeability allows, the test is repeated three times.

The soakaway test results are included within Appendix IV.

3.5.3 Geophysical Survey

A Geophysical Survey was undertaken by Terradat in four zones in and around Onllwyn Washery to identify areas containing possible mining related features. A Magnetic Survey was undertaken to map distortions in the Earth's magnetic field due to the presence of buried ferrous material that may be related to mine workings. An Electromagnetic Survey was undertaken to map variations in the near surface ground conductivity and in-phase response associated with different shallow materials / structures. A Microgravity survey was undertaken

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.

The Geophysical survey report is presented in Appendix IX.

3.6 Sampling - General

Sampling of soils, rocks and waters were undertaken as instructed by the Client in accordance with the specification. Bulk, disturbed and undisturbed samples were taken where required within the superficial deposits for strata identification and laboratory testing purposes.

Geotechnical samples were returned from site to QGL's offsite controlled storage to await test scheduling/requirements. The environmental samples were transported within 24hrs to QGL's specialist chemical testing laboratory sub-contractor premises, Eurofins Chemtest Ltd to await test scheduling/requirements. Sample type depth are recorded on the corresponding exploratory hole logs found within Appendices II and III. For specific details of laboratory testing see Section 4.

3.7 Groundwater & Landgas Standpipe Installations

Thirteen boreholes were installed with either 50mm Ø HDPE or both 50mm and 19mm Ø HDPE combined land gas and groundwater monitoring standpipe to permit post-fieldwork landgas and groundwater monitoring visits.

Groundwater and landgas monitoring standpipes consist of plastic pipework set in filter aggregate (pea gravel) forming a well. The filter is sealed at one or both ends by use of bentonite grout. Parts of the pipe itself are slotted, allowing the infiltration of groundwater which can then be accessed through the pipe from ground level. Slotted sections are covered by 'geo-sock' to reduce the intrusion of silt into the standpipes and the range of depths at which the groundwater is intercepted is known as the 'response zone'.

Standpipes were installed using 1m lengths of pipework (threaded at either end) fitted together and lowered into the borehole. The boreholes were then filled with either pea gravel or bentonite (depending on which zone or level) and cemented in place at ground level with a steel flush cover. Table 5 details the installation undertaken.

Table 5: Borehole Installation Detail

Exploratory Hole ID	Installation Standpipe Internal Diameter (mm)	Installation Depth (m.bgl)	Installation Response Zone (m.bgl)
BH07	50	10.0	8.0-10.0
BH15	50	5.0	1.0-5.0
BH16	50	10.0	8.0-10.0

BH19A	50	28.2	25.2 – 28.2
BH22	50	34.0	29.0 – 34.0
BH25	50	49.2	39.2 – 49.2
BH28	50	49.2	39.2 – 49.2
BH29	50	15.0	12.0 – 15.0
BH30	50	4.0	3.0 – 4.0
BH31	50	5.0	1.0 – 5.0
	50	21.0	16.0 – 21.0
BH32	50	17.5	12.5 – 17.5
BH33	50	20.0	15.0 – 20.0
BH34	50	3.3	1.0 – 3.3
	50	13.0	11.0 – 13.0

3.8 Post-Fieldwork Monitoring

The standpipe installations were scheduled for two post-fieldwork monitoring visits with two rounds of groundwater sampling from selected boreholes to be undertaken. Each post-fieldwork monitoring visit included the measurement of the following parameters:

- O₂ (% v/v)
- CH₄ (% v/v)
- H₂S (ppm)
- CO₂ (% v/v)
- Flow Rate (l/hr)
- Atmospheric Pressure (mb)
- Groundwater Level (m.bgl/ mAOD)
- CO (% v/v)

The results of the scheduled post-fieldwork monitoring visits are undertaken to date are presented in Appendix X.

4. LABORATORY TESTING

The laboratory testing was scheduled by the Scheme Engineer and comprised a number of geotechnical and geo-environmental tests on soil, water and rock samples recovered from this ground investigation phase.

4.1 Geotechnical Laboratory Testing

Geotechnical tests undertaken on selected soil and rock samples are detailed in Table 6. All the geotechnical soil testing work was carried out in accordance with the procedures stipulated in the various sections of BS 1377:1990 "Methods of test for soils for civil engineering purposes" and to UKAS accreditation where applicable.

Table 6: *Geotechnical Laboratory Tests*

Test	Number of Tests
Moisture Content of Soil	23
4 Point Liquid & Plastic Limit	24
Particle Size Distribution (PSD) Wet Sieve	51
PSD: Sedimentation by Pipette	20
Undrained strength of a single 100mm diameter specimen in triaxial compression without the measurement of pore pressure	4
One-dimensional consolidation properties, test period 5days	4
Dry density/moisture content relationship using 2.5kg rammer	4
Moisture Condition Value/moisture content relationship	11
5 point compaction test using 4.5kg rammer in CBR mould	7
Loss on Ignition	5
Organic Matter	7
BRE SD1 Suite B	31
BRE SD1 Suite D	10
Point load Index (Rock)	47
Unconfined Compressive Strength (UCS – Rock)	1
LA coefficient	6
Freeze Thaw	6
Soundness by magnesium sulphate	6
Slake Durability	6

Available geotechnical laboratory test certificates are provided within Appendix VII.

4.2 Geo-Environmental Laboratory Testing

Geo-environmental testing was carried out on selected soil and water samples gained from the ground investigation as summarised in Table 7.

Table 7: Geo-Environmental Laboratory Tests

Test/ Suite	Number of Tests
Specification Suite E1 – Soils Samples General Suite	28
Specification Suite E2 – Asbestos Suite	26
Specification Suite E3 – TPH CWG Suite	21
Specification Suite E4 – PAH & BTEX Suite	28
Specification Suite E5 – VOC & SVOC	1
Specification Suite E9 – Hex Chromium	7
Specification Suite E16 – Loss on Ignition	7
Specification Suite F1 – Water Samples General Suite	9
Specification Suite F2 – TPH CWG Suite	9
Specification Suite F3 – PAH & BTEX Suite	9
Specification Suite F5 – PCB's	9
Specification Suite H – Waste Acceptance Total Solids	7
Specification Suite I – Waste Acceptance Leachability	7
Specification Suite J1 – Soil Leachability general	9
Specification Suite J2 – Soil leachability PAH	1

A full set of geo-environmental laboratory test certificates are provided within Appendix VIII.

5. REFERENCES

British Geological Survey (BGS)

- BGS online maps and lexicon database – www.bgs.co.uk
- BGS Sheet 261 'Merthyr Tydfil' Solid and Drift edition at 1:50,000 scale.

British Standards

- British Code of Practice BS 5930:2015+A1:2020 '*Code of Practice for Site Investigations*'
- British Code of Practice BS 1377:1990 '*Methods of test for soils for civil engineering purposes*'.
- British Code of Practice BS EN ISO 14688-1:2002+A2:2013 '*Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description*'
- British Code of Practice BS EN ISO 14688-2:2004+A2:2013 '*Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification*'
- British Code of Practice BS EN ISO 22475-1:2006 '*Geotechnical investigation and testing – Sampling methods and groundwater measurements*'

Institution of Civil Engineers (ICE)

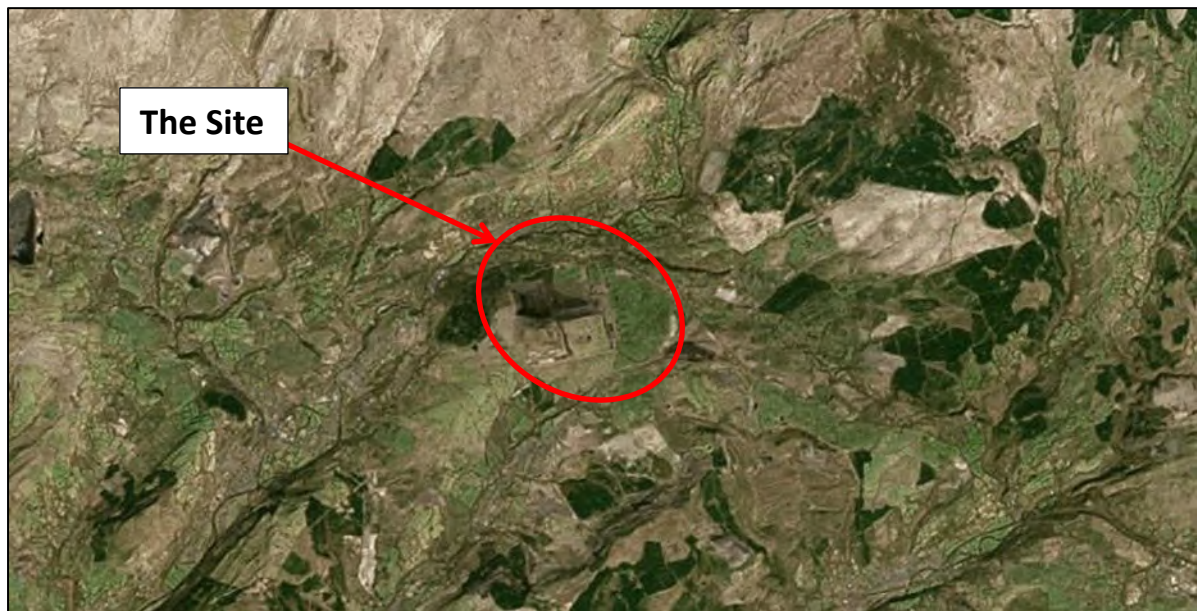
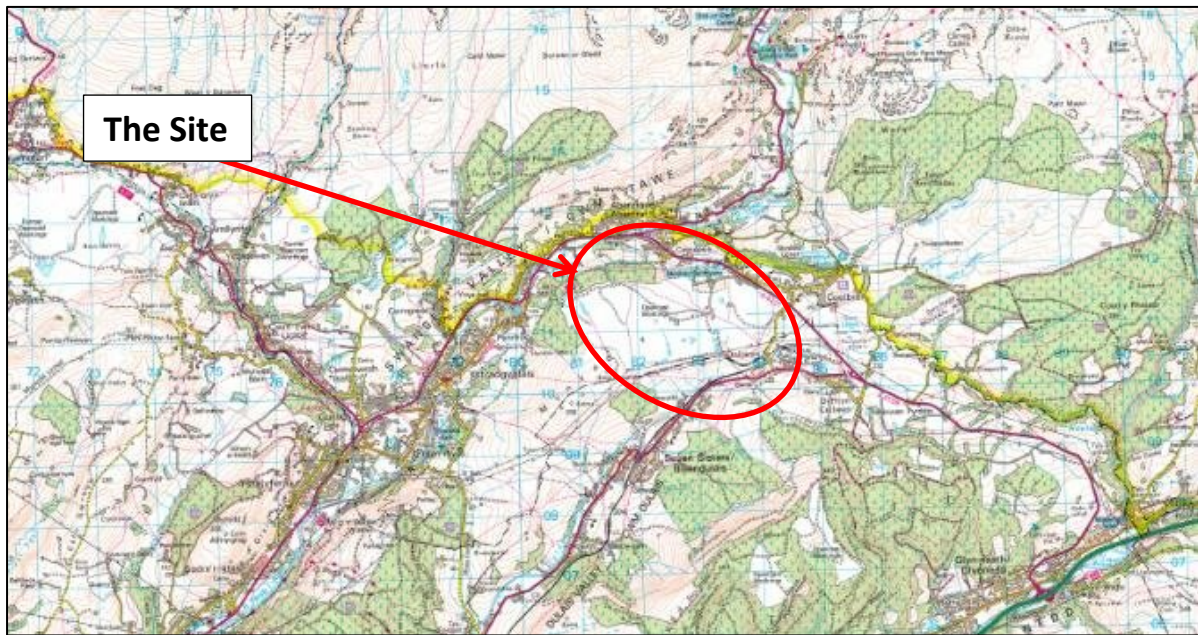
- UK Specification for Ground Investigation, Second Edition (2012)

Specialist Publications

- Health and Safety Executive Guidance Note EH40/90

APPENDIX I – SITE PLANS AND FIGURES

- **Figure 1: *Location Plan***
- **Figure 2: *Exploratory Hole Location Plan***



Source: www.bing.com/maps

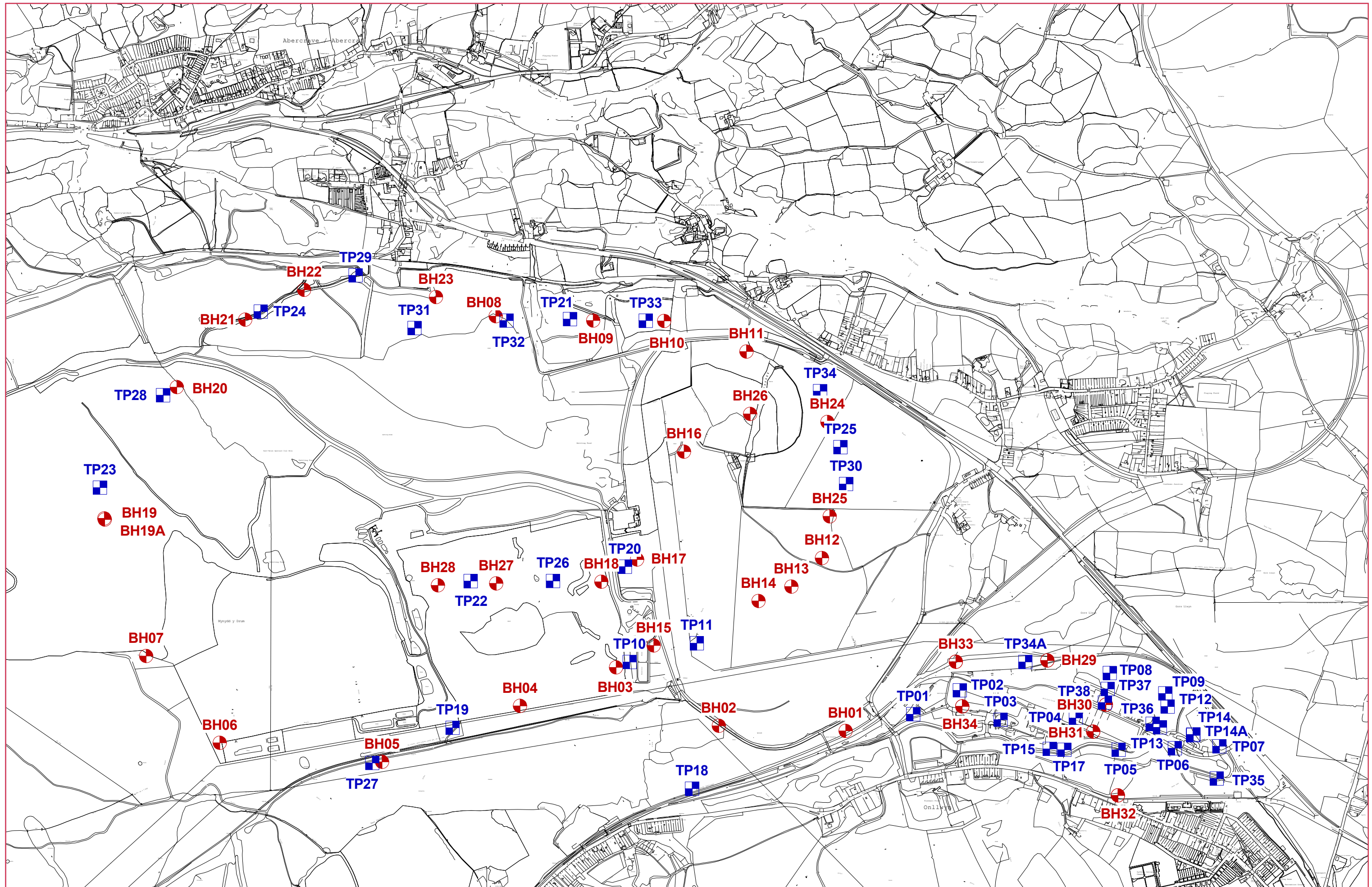


FIGURE 1

Project: Global Centre of Rail Excellence

Job No: Q0652

Drawing Title: Site Location Plan



KEY

 Borehole

 Trial Pit

 Dynamic Probe

 In-situ Test

 Window Sample

 Sampling Point

 Historical Borehole

PROJECT
GLOBAL CENTRE OF RAIL
EXCELLENCE

DRAWING TITLE:
EXPLORATORY HOLE
LOCATION PLAN

JOB NO.
Q0652
DATE
07/02/22

FIGURE NO.
2
SCALE
1:12000

APPENDIX II – ENGINEER’S BOREHOLE LOGS

Contract : Global Centre of Rail Excellence											Borehole No. BH01	
Client : Global Centre of Rail Excellence												
Dates : 30/11/21 - 20/11/21					Job Number : Q0652					Ground Level : 228.29 m A.O.D. Level to Ordnance Datum		
Location :					Engineer : ARUP					Coordinates: 284008.75 E 210457.29 N Co-ordinates to National Grid		

m B.G.L.	Run Details				Fractures		Samples		Strata				Water
	Core Run	TCR %	SCR %	RQD %	Min Avg Max	FI	Depth	Type No. Blows	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	
0										Clay and Colliery Spoil (Drillers Description)			
1													
2													
3													
4													
5									5.00	Weathered Mudstone (Drillers Description)		223.29	
6									(2.20)				
7													
8									7.20	Mudstone with Sandstone Bands (Drillers Description)		221.09	
9													
10													
11													
12													
13									13.20	Weak Coal (Drillers Description)		215.09	
14									(1.70)				
15									14.90	Mudstone (Drillers Description)		213.39	
16													
17													
18													
19													
20													
21													
22													
23									22.50	Sandstone (Drillers Description)		205.79	
24													
25													
26													
27													
28													
29													
30													
31									30.00	Terminated at 30.0mbgl (Scheduled Depth)		198.29	
32													
33													
34													

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns
				7.20	115.00	5.00 13.70	0.00 0.00	Rapid Groundwater Inflow. Rose to 0.5magl Rapid Groundwater Inflow. Rose to 0.5magl		0.00 - 30.00	Mist	100

Plant: Commachio 600
Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-7.2mbgl, Rotary 'open hole' 7.2-30.0mbgl

	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	1 Of 1	35		

Form Name: ROTARY. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence											Borehole No. BH02	
Client : Global Centre of Rail Excellence												
Dates : 29/11/21 - 29/11/21					Job Number : Q0652					Ground Level : 238.03 m A.O.D. Level to Ordnance Datum		
Location :					Engineer : ARUP					Coordinates: 283562.15 E 210475.29 N Co-ordinates to National Grid		

m B.G.L.	Run Details				Fractures		Samples		Strata					Water
	Core Run	TCR %	SCR %	RQD %	Min Avg Max	FI	Depth	Type No. Blows	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.		
0														
1									(1.20)	Colliery Spoil (Drillers Description)				
2									1.20	Brown Clay (Drillers Description)		236.83		
3									(0.80)	Clay and Boulders (Drillers Description)		236.03		
4									2.00					
5									(1.90)					
6									3.90	Weathered Mudstone (Drillers Description)		234.13		
7									(1.80)					
8									5.70	Mudstone (Drillers Description)		232.33		
9									(3.10)					
10									8.80	Sandstone (Drillers Description)		229.23		
11									(4.30)					
12														
13									13.10	Mudstone (Drillers Description)		224.93		
14														
15														
16														
17									(6.60)					
18														
19														
20									19.70	Cavity (Drillers Description)		218.33		
21									(0.70)	Hard Drill - Loss of Returns (Drillers Description)		217.63		
22									20.40					
23														
24														
25														
26									(9.60)					
27														
28														
29														
30									30.00	Terminated at 30.0mbgl (Scheduled Depth)		208.03		
31														
32														
33														
34														

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns
				4.20	115.00					0.00 - 19.70	Mist	100
										19.70 - 30.00	Mist	0

Plant: Commachio 600

Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Encountered. ODEX GL-4.2mbgl, Rotary 'open hole' 4.2-30.0mbgl

	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	1 Of 1	35		

Form Name: ROTARY. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 18/11/21 - 22/11/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 258.30 m A.O.D.
Level to Ordnance Datum

Coordinates: 283200.00 E
210681.00 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No.
BH03

0 m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
0	1.20 - 2.70								1.20 - 2.70	D1	1.2	SPT (C) 50/60mm (25/10mm-75/50mm----)	(1.20)	MADE GROUND - Grey clayey slightly sandy GRAVEL. Gravel is fine to coarse angular mudstone.										
1		20	10	0									1.20	Colliery Spoil (Drillers Description) Arisings are grey clayey Gravel. Gravel is fine to medium angular mudstone		257.10								
2																								
3									2.70 - 3.70	D2	2.7	SPT (C) 50/90mm (12-13/5mm-41-9/15mm--)												
4	4.20 - 5.70								4.20 - 5.70	D3	4.2	SPT (C) 50/30mm (25/5mm-75/25mm----)		 between 3.7 and 4.2mbgl mudstone boulder										
5		37	27	15																				
6									5.70 - 7.20	D4	5.7	SPT (C) 50/65mm (25/10mm-75/55mm----)												
7																								
8									7.20 - 8.70	D5	7.2	SPT (C) 75/120mm (12-13/8mm-39-36/45mm--)												
9									8.70 - 10.20	D6	8.7	SPT (C) 50/110mm (25/45mm-75/65mm----)												
10									10.20 - 11.70	D7	10.2	SPT (C) 75/190mm (10-15/60mm-25-30-20/40mm-)												

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Encountered. ODEX GL-22.2mbgl, Rotary coring 22.2-32.7mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	
										0.00 - 13.20	Mist	100		

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
1 Of 3

m Per Page
11

All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 18/11/21 - 22/11/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 258.30 m A.O.D.

Level to Ordnance Datum

Coordinates: 283200.00 E

210681.00 N

Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH03

11m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water	
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description				
									11.70 - 13.20	D8	11.7	SPT (C) 66 (10-10-15-15-15-21)	(20.60)												
									13.20 - 14.70	D9	13.2	SPT (C) 92/285mm (5-3-7-14-31-40/60mm)													
									14.70 - 16.20	D10	14.7	SPT (C) 92/260mm (6-2-8-13-30-41/35mm)													
									16.20 - 17.70	D11	16.2	SPT (C) 50/80mm (25/50mm-75/30mm----)													
									17.70 - 19.20	D12	17.7	SPT (C) 75/155mm (18-7/0mm-27-31-17/5mm-)													
									19.20 - 20.70	D13	19.2	SPT (C) 50/115mm (25/50mm-75/65mm----)													
									20.70 - 21.80	D14	20.7	SPT (C) 75/80mm (21-4/0mm-61-14/5mm--)													
Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Encountered. ODEX GL-22.2mbgl, Rotary coring 22.2-32.7mbgl											
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour												
19/11/2021 07:00	11.70	11.70									13.20 - 21.80 21.80 - 32.70	Mist Mist	50 100												
Operator: QGL										Logged By: P Darby		Logged Date:		Equipment Used: Rig: Commachio 600.				Sheet No. 2 Of 3		m Per Page 11		All measurements in metres unless otherwise stated		AGS	



Quantum Geotech

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

Operator: QGL

Logged By: P Darby

Logged Date:

Equipment Used: Rig: Commachio 600.

Sheet No. 2 Of 3

m Per Page 11

All measurements in metres unless otherwise stated



Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates : 18/11/21 - 22/11/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 258.30 m A.O.D.
Level to Ordnance Datum

Coordinates: 283200.00 E
210681.00 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No.
BH03

23m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
	22.20 - 23.70								22.20	C1	22.2	SPT (C) 50/20mm (25/10mm-75/10mm----)	(0.40) 22.20	Weak to medium strong grey MUDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES)		236.10	22.20				Sub-horizontal to 15 degree discontinuity set (bedding) extremely close to closely spaced, rough planar, partly open, locally with orange surface staining. sub-vertical to 70 degree discontinuity set (joints) smooth planar locally undulating, partly open, locally with orange surface staining.. Between 22.7 and 23.2mbgl sub-horizontal discontinuity surfaces highly weathered up to 50mm penetration with reduction in strength to very weak and weathered to fine angular gravel.			
	23.70 - 25.20	97	43	10	20	100	200	13													Between 24.04 and 24.34mbgl sub-vertical discontinuity.			
	25.20 - 26.70								23.70	C2											Below 25.2mbgl sub-horizontal discontinuities close to medium spaced. between 25.2 and 25.7mbgl sub-vertical discontinuity. Between 25.4 and 25.6mbgl sub-horizontal discontinuities extrmeley closely spaced and highly weathered to coarse angular gravel up to 50mm penetration. At 25.8mbgl 45 degree discontinuity smooth undulating, partly open, clean / fresh.			
	26.70 - 28.20	87	60	30	20	80	180	15																
	28.20 - 29.70								27.20 - 27.40	C3			(10.50)											
	29.70 - 31.20	100	90	69	50	166	400	8																
	31.20 - 32.70	99	80	23	20	87	270	16													At 31.1mbgl 45 degree discontinuity smooth planar, open, clean / fresh.			
	32.7								32.60 - 32.70	C6			32.70	Terminated at 32.7mbgl (Investigation Supervisors Instruction)		225.60								

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Encountered. ODEX GL-22.2mbgl, Rotary coring 22.2-32.7mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	
				22.20	115.00									

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

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All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH03

Dates : 18/11/21 - 22/11/21

Job Number : Q0652

Ground Level : 258.30 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283200.00 E
210681.00 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
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Page
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH03

Dates : 18/11/21 - 22/11/21

Job Number : Q0652

Ground Level : 258.30 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283200.00E
210681.00 N
Co-ordinates to National Grid



Plas Newydd
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Operator:
QGL

Logged By:
P Darby

Sheet No.
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All measurements in
metres unless
otherwise stated



Form Name: ROTARY A3 Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 22/11/21 - 23/11/21

Location :

Job Number : Q0652

Engineer : ARUP

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

Coordinates: 282861.72 E
210545.42 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No.
BH04

11m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
		73	0	0				NI									11.70							
	11.70 - 13.20													 Between 11.7 and 14.7mbgl non-intact, recovered as fine to coarse angular Gravel and angular Cobbles										
		57	3	0				NI																
	13.20 - 14.70								13.20	C5			(8.30)											
		53	6	0				NI																
	14.70 - 16.20								14.70	C6				 Between 14.7 and 15.0mbgl completely weathered to a clayey sandy fine to coarse angular Gravel										
		100	42	25				NI																
	16.20 - 17.70								16.20	C7				 Between 16.2 and 17.1mbgl non-intact, recovered as coarse angular Gravel										
	99	40	24																					
				30	120	230	4	17.45 - 17.70	C8				17.00 (0.15) Weak black COAL. Highly weathered to fine to medium angular Gravel. (SOUTH WALES COAL MEASURES)		240.69									
													17.15 (0.55) Between 17.1 and 17.3mbgl completely weathered to soft to firm gravelly Clay		240.54									
													17.70 Medium strong MUDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)		239.99									
													Mudstone (Drillers Description)											
Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Encountered. ODEX GL-4.2mbgl, Rotary coring 4.2-17.8mbgl, Rotary 'open hole' 17.8-30.0mbgl										
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour											

Quantum Geotech

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
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m Per Page
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All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH04

Dates : 22/11/21 - 23/11/21

Job Number : Q0652

Ground Level : 257.69 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 282861.72E
210545.42 N
Co-ordinates to National Grid



Plas Newydd
Swansea
Tel: 01554744880
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Operator:
QGL

Logged By:
P Darby

Sheet No.
1 Of 2

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2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH04

Dates : 22/11/21 - 23/11/21

Job Number : Q0652

Ground Level : 257.69 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 282861.72E
210545.42 N
Co-ordinates to Nation Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
2 Of 2

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 1/12/21 - 3/12/21

Location :

Job Number : Q0652

Engineer : ARUP

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

Coordinates: 282375.78 E
210348.29 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No.
BH05

1 m B.G.L.

11.00 - 12.00

100

97

88

40

200

300

4

11.60 - 11.85

C1

11.00

Medium strong to strong grey thinly to thickly interlaminated MUDSTONE and SANDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)

228.39

11.00

Sub-horizontal to 15 degree discontinuity set closely spaced, smooth to rough planar, partly open to open, clean / fresh.
At 11.3mbgl sub-angular coarse gravel infill.

12.00 - 13.50

100

100

83

10

167

380

8

12.20 - 12.60

C2

(2.20)

2.20

13.50 - 15.00

100

95

64

60

115

200

12

13.85 - 14.00

C3

13.20

Medium strong grey MUDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)

226.19

13.20

Sub-horizontal to 15 degree discontinuity set closely spaced, smooth to rough planar, partly open to open, clean / fresh.

15.00 - 16.00

100

87

56

20

111

260

8

..... between 15.2 and 15.3mbgl highly weathered to sandy fine to coarse angular Gravel

16.00 - 17.50

100

98

52

60

150

280

10

15.90 - 16.00

C4

(6.90)

6.90

Below 16.0mbgl sub-horizontal discontinuities extremely close to closely spaced and loclly with silt surface coating.

17.50 - 19.00

98

90

45

40

113

160

12

17.20 - 17.35

C5

At 17.67mbgl sub-horizontal discontinuity highly weathered to fine to coarse angular gravel up to 60mm penetration.
Between 17.8 and 17.9mbgl sub-vertical discontinuity smooth undulating, partly open with silt surface coating.

19.00 - 20.50

97

78

7

20

51

100

27

18.65 - 18.75

C6

20.50 - 22.00

NI

19.90

C7

20.10

Weak to medium strong black COAL with one discontinuity set. (SOUTH WALES COAL MEASURES)
..... between 20.5 and 20.67mbgl highly weathered to fine to coarse angular Gravel

219.29

20.10

Sub-horizontal discontinuity set extremely closely spaced, smooth and rough planar, partly open, locally highly weathered to fine to medium angular gravel upto 10mm penetration.

100

85

62

40

120

140

10

21.40 - 21.70

C8

20.70

Strong grey SILTSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)

218.69

20.70

Sub-horizontal to 15 degree discontinuity set (bedding) extremely close to medium spaced, rough planar to undulating, open, generally clean / fresh locally with silt surface coating.
Between 20.9 and 21.2mbgl and 21.6 and 22.0mbgl 70 degree discontinuities rough planar, undlating, partly open with silt surface coating.

Hole Progress / Water Obs

Date / Time

H. Depth

C. Depth

Water

Casing

Depth

Diam.

Groundwater

Struck

Rose To

Behaviour

Sealed

Flush

Depth

Type

Returns

Colour

Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken.
ODEX GL-7.2mbgl, Rotary coring 7.2-30.7mbgl

Quantum Geotech

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
2 Of 3

m Per Page
11

All measurements in metres unless otherwise stated

AGS

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Form Name: ROTARY A3 Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH05

Dates : 1/12/21 - 3/12/21

Job Number : Q0652

Ground Level : 239.39 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 282375.78E
210348.29 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
1 Of 4

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH05

Dates : 1/12/21 - 3/12/21

Job Number : Q0652

Ground Level : 239.39 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 282375.78E
210348.29 N
Co-ordinates to National
Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
2 Of 4

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH05

Dates : 1/12/21 - 3/12/21

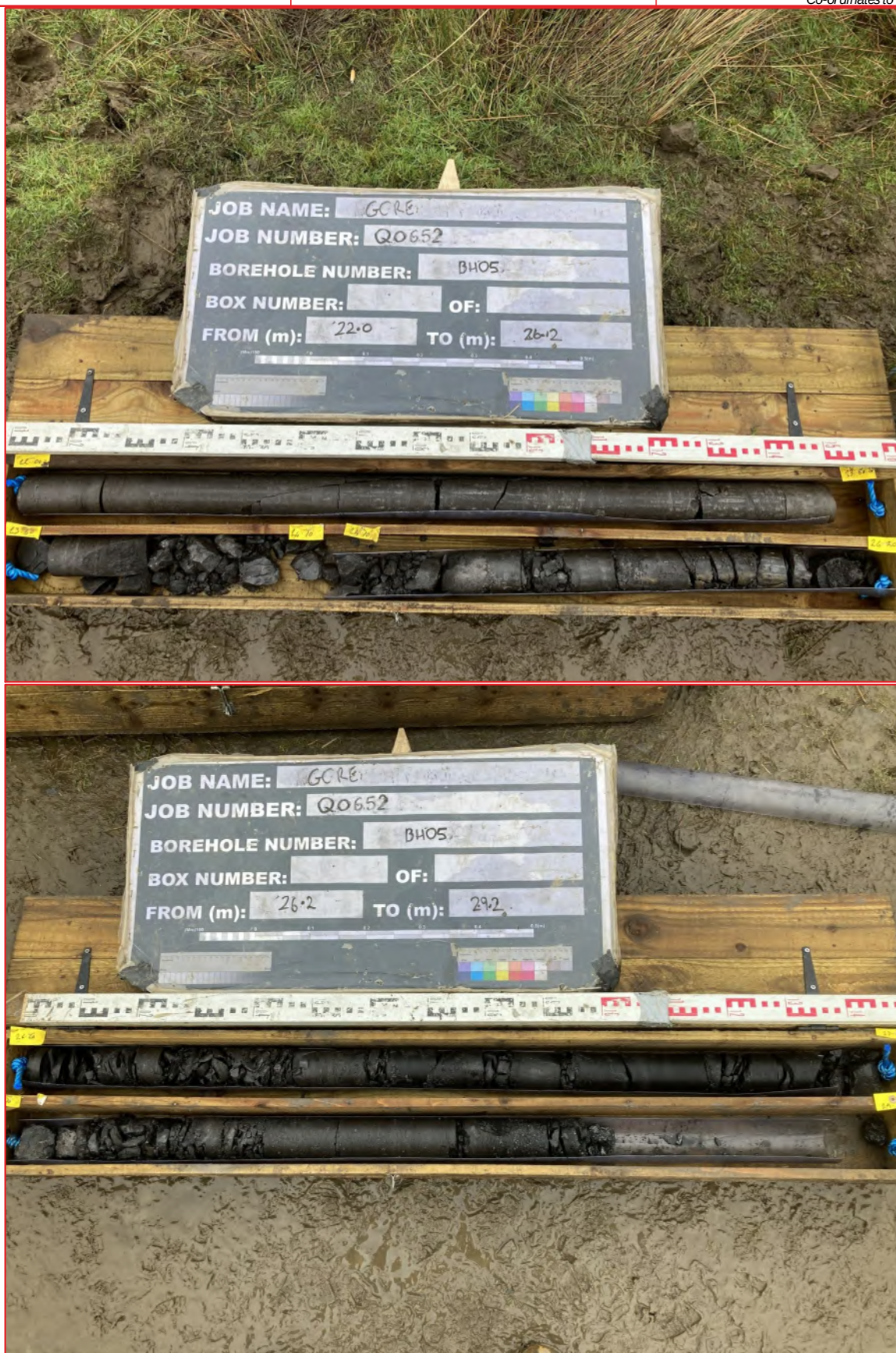
Job Number : Q0652

Ground Level : 239.39 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 282375.78E
210348.29 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

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Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH05

Dates : 1/12/21 - 3/12/21

Job Number : Q0652

Ground Level : 239.39 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 282375.78E
210348.29 N
Co-ordinates to National Grid



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

Operator:
QGL

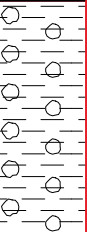
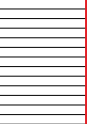
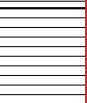
Logged By:
P Darby

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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence																				Borehole No. BH06						
Dates : 24/11/21 - 26/11/21								Job Number : Q0652					Ground Level : 263.08 m A.O.D. Level to Ordnance Datum				Coordinates: 281804.05 E 210415.34 N Co-ordinates to National Grid				Orientation & Inclination: Orientation: N/A Inclination: N/A					
Location :								Engineer : ARUP																		
0 1 2 3 4 5 6 7 8 9 10	Run Details				Fracture Details				Samples		Insitu Tests		Strata						Discontinuities						Water	
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description					
									1.20 - 2.70	D1	1.2	SPT (S) 23 (3-3-4-5-7-7)	(2.00)	Clay and Cobbles (Drillers Description) sample between 1.2 and 2.7mbgl CLAY												
													2.00	Weathered Mudstone (Drillers Description)		261.08										
	2.70 - 3.70										2.7	SPT (S) 50/189mm (5-10-15-15-20/39mm-)	(1.70)													
	3.70 - 5.20							NI	4.00	C8	3.7	SPT (S) 50/167mm (5-7-12-17-21/17mm-)	3.70	Medium strong grey MUDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES) Between 3.7 and 4.3mbgl completely weathered to fine to coarse angular Gravel		259.38	3.70				Sub-horizontal to 10 degree discontinuity set (bedding) closely spaced, smooth to rough planar locally planar to undulating, open, clean / fresh locally with silt surface coating sub-vertical discontinuity set (joint) rough planar to undulating, partly open, clean / fresh locally completely weathered to fine angular gravel up to 10mm penetration.					
		93	44	13		60	100	100	7	4.70 - 4.78	C1															
	5.20 - 6.70																									
		97	75	18	20	69	140	20		6.00 - 6.05	C2										Between 6.05 and 6.8mbgl sub-vertical discontinuity.					
	6.70 - 7.70																									
		90	64	33	10	75	120	11																		
	7.70 - 8.70																									
	99	99	33	25	76	120	12		7.70 - 7.80	C3										Between 8.2 and 8.35mbgl sub-vertical to 80 degree discontinuity. possibly drilling induced.						
8.70 - 10.20																										
	95	67	31	5	55	130	25		8.75 - 8.90	C4										Between 9.65 and 9.97mbgl sub-vertical discontinuity between 9.65 and 9.97mbgl sub-horizontal discontinuities extremely closely spaced.						
10.20 - 10.90																										
	100	89	33	15	79	130	10		10.25 - 10.40	C5										Between 10.67 and 10.9mbgl sub-vertical discontinuity.						
10.90 -																										
Hole Progress / Water Obs					Casing		Groundwater					Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-2.7mbgl, Rotary coring 2.7-13.9mbgl, Rotary 'open hole' 13.9-30.0mbgl										
Date / Time		H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour												
26/11/2021 07:00		6.00	3.70	5.75	3.70	115.00						0.00 - 30.00	Mist	100												
 Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk										Operator: QGL		Logged By: P Darby		Logged Date:		Equipment Used: Rig: Commachio 600.				Sheet No. 1 Of 3		m Per Page 11		All measurements in metres unless otherwise stated		

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 24/11/21 - 26/11/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 263.08 m A.O.D.
Level to Ordnance Datum

Coordinates: 281804.05 E
210415.34 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH06

11 m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water		
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description					
	12.40	100	62	9	15	83	130	17	11.35 - 11.50	C6				 between 12.4 and 12.7mbgl weak dark grey to black carbonaceous MUDSTONE with thin coal bands Below 12.7mbgl weak to medium strong grey and light grey thinly laminated MUDSTONE							Between 12.1 and 12.4mbgl sub-vertical discontinuity. Below 12.4mbgl sub-horizontal discontinuities extremely closely spaced and locally completely weathered to fine angular gravel and reduction in strength to weak upto 50mm penetration.					
12	12.40 - 13.90				10	27	40	10	13.20 - 13.40	C7						249.18										
13					15	85	160	13																		
14	13.9												13.90	Mudstone (Drillers Description)												
15																										
16																										
17																										
18																										
19																										
20																										
21													(13.10)													
Hole Progress / Water Obs					Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-2.7mbgl, Rotary coring 2.7-13.9mbgl, Rotary 'open hole' 13.9-30.0mbgl											
Date / Time		H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour												
Quantum Geotech Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk										Operator: QGL		Logged By: P Darby		Logged Date:		Equipment Used: Rig: Commachio 600.				Sheet No. 2 Of 3		m Per Page 11		All measurements in metres unless otherwise stated		AGS

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH06

Dates : 24/11/21 - 26/11/21

Job Number : Q0652

Ground Level : 263.08 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 281804.05E
210415.34 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH06

Dates : 24/11/21 - 26/11/21

Job Number : Q0652

Ground Level : 263.08 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 281804.05E
210415.34 N
Co-ordinates to National Grid



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

Operator:
QGL

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P Darby

Sheet No.
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates : 29/11/21 - 30/11/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 271.28 m A.O.D.
Level to Ordnance Datum

Coordinates: 281544.88 E
210721.08 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH07

0 m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water	Install/ Backfill
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description				
													(0.30)	MADE GROUND - Grey clayey GRAVEL. Gravel is fine to coarse angular mudstone.		270.98									
												SPT (S) 6 (2-1-2-1-1-2)	(1.70)	Soft grey and light brown slightly gravelly CLAY. Gravel is fine to coarse sub-rounded to angular mudstone. (Description from SPT sample).											
													2.00	Clay and Sandstone Boulders (Drillers Description). Arisings are grey gravelly Clay. Gravel is fine to medium angular mudstone		269.28									
												SPT (S) 45/97mm (3-22-6-39/22mm--)	(2.20)												
	4.20 - 5.70								4.40	C1		SPT (S) 50/73mm (25/31mm-100/42mm----)	4.20	Weak to medium strong grey SILTSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)		267.08	4.20				Sub-horizontal to 10 degree discontinuity set (bedding) extremely close to closely spaced, rough planar, partly open to open, locally with brown silt coating and highly weathered to fine to medium angular gravel up to 20mm penetration.				
		47	26	0	20	50	50	13					(1.50)				1.50								
	5.70 - 7.20							NI	5.90	C2			5.70	Medium strong dark grey MUDSTONE with one discontinuity set (SOUTH WALES COAL MEASURES) Between 5.7 and 5.95mbgl highly to completely weathered to fine to coarse angular Gravel		265.58	5.70				Sub-horizontal to 10 degree discontinuity set (bedding) extremely close to closely spaced, smooth to rough planar, partly open, generally clean / fresh locally with yellowish brown clay surface coating..				
		44	22	7	20	59	110	6																	
7.20 - 8.70								7.40	C3												Between 7.35 and 8.2mbgl sub-vertical to 80 degree discontinuity smooth planar, partly open, with yellowish brown clay surface coating.				
	95	90	37	30	84	130	16																		
8.70 - 10.20								8.90	C4												Between 8.8 and 8.95mbgl sub-vertical discontinuity smooth undulating to stepped, tight, clean / fresh. possibly drilling induced. Between 9.23 and 9.95mbgl sub-vertical to 80 degree discontinuity smooth planar, partly open, locally with orange surface staining and yellowish brown clay surface coating. At 9.4mbgl sub-horizontal discontinuity highly weathered to coarse angular gravel upto 50mm penetration. Between 9.75 and 10.1mbgl sub-vertical to 80 degree discontinuity smooth planr, tightto partly open, clean / fresh.				
	100	85	10	50	79	150	18																		
10.20 - 11.70														 between 10.2 and 10.6mbgl thinly to thickly laminated with strong light grey Sandstone laminae.			9.40								
	97	79	47	40	91	120	15																		

Hole Progress / Water Obs

Casing

Groundwater

Flush

Date / Time

H. Depth

C. Depth

Water

Depth

Diam.

Struck

Rose To

Behaviour

Sealed

Depth

Type

Returns

Colour

7.20

115.00

Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-4.2mbgl, Rotary coring 4.2-16.2mbgl, Rotary 'open hole' 16.2-35.0mbgl

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

Operator:

QGL

Logged By:

P Darby

Logged Date:

Equipment Used:

Rig: Commachio 600.

Sheet No.

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All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 29/11/21 - 30/11/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 271.28 m A.O.D.
Level to Ordnance Datum

Coordinates: 281544.88 E
210721.08 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No. BH07

11 m B.G.L.

11

12

13

14

15

16

17

18

19

20

21

Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities						Water	Install/ Backfill
Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
11.70 - 13.20	97	79	47	40	91	120	15	11.00	C5			(10.50)									Between 11.07 and 11.5mbgl closely spaced sub-vertical rough undulating, tight, clean / fresh. possibly drilling induced.		
	100	80	16	20	88	120	16	12.50	C6														
13.20 - 14.70													 between 13.8 and 14.8mbgl weak								Between 13.8 and 14.8mbgl sub-horizontal discontinuities locally with slickend surfaces.		
	100	73	20	50	167	150	8	14.00	C7														
14.70 - 16.20													 below 15.1mbgl weak dark grey carbonaceous Mudstone			15.10					Sub-horizontal discontinuity set extremely closely spaced, rough planar, open locally highly weathered to fine to coarse angular gravel up to 70mm penetration.		
	100	53	7	15	68	110	21	14.70	C8							1.10							
16.2												16.20	Mudstone with Sandstone bands (Drillers Description)		255.08								
												(5.80)											

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-4.2mbgl, Rotary coring 4.2-16.2mbgl, Rotary 'open hole' 16.2-35.0mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	

Quantum Geotech

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

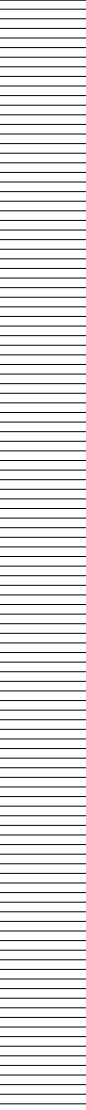
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All measurements in metres unless otherwise stated



Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence																			Borehole No. BH07										
Client : Global Centre of Rail Excellence										Job Number : Q0652					Ground Level : 271.28 m A.O.D. Level to Ordnance Datum				Coordinates: 281544.88 E 210721.08 N Co-ordinates to National Grid				Orientation & Inclination: Orientation: N/A Inclination: N/A						
Dates: 29/11/21 - 30/11/21										Location :																			
22m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities							Water	Install/ Backfill			
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description								
22													22.00	Coal (Drillers Description)		249.28													
23													(1.50)																
24													23.50	Mudstone with Sandstone bands (Drillers Description)		247.78													
25																													
26																													
27																													
28																													
29																													
30																													
31																													
32																													
Hole Progress / Water Obs					Casing		Groundwater					Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-4.2mbgl, Rotary coring 4.2-16.2mbgl, Rotary 'open hole' 16.2-35.0mbgl													
Date / Time		H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour		Sealed	Depth	Type	Returns	Colour														
							28.00	21.00	Fast groundwater inflow																				
Operator: QGL										Logged By: P Darby		Logged Date:		Equipment Used: Rig: Commachio 600.					Sheet No. 3 Of 4		m Per Page 11		All measurements in metres unless otherwise stated						

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 29/11/21 - 30/11/21

Location :

Job Number : Q0652

Engineer : ARUP

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

Coordinates: 281544.88 E
210721.08 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation:
N/A

Inclination:
N/A

Borehole No.
BH07

33m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities							Water	Install/ Backfill
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description				
33																									
34																									
35													35.00	Terminated at 35.0mbgl (Investigation Supervisors Instruction)		236.28									
36																									
37																									
38																									
39																									
40																									
41																									
42																									
43																									

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-4.2mbgl, Rotary coring 4.2-16.2mbgl, Rotary 'open hole' 16.2-35.0mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	
30/11/2021 14:00	35.00	7.20	21.00											



Plas Newydd
Swansea
Tel: 01554744880
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Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
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All measurements in metres unless otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH07

Dates : 29/11/21 - 30/11/21

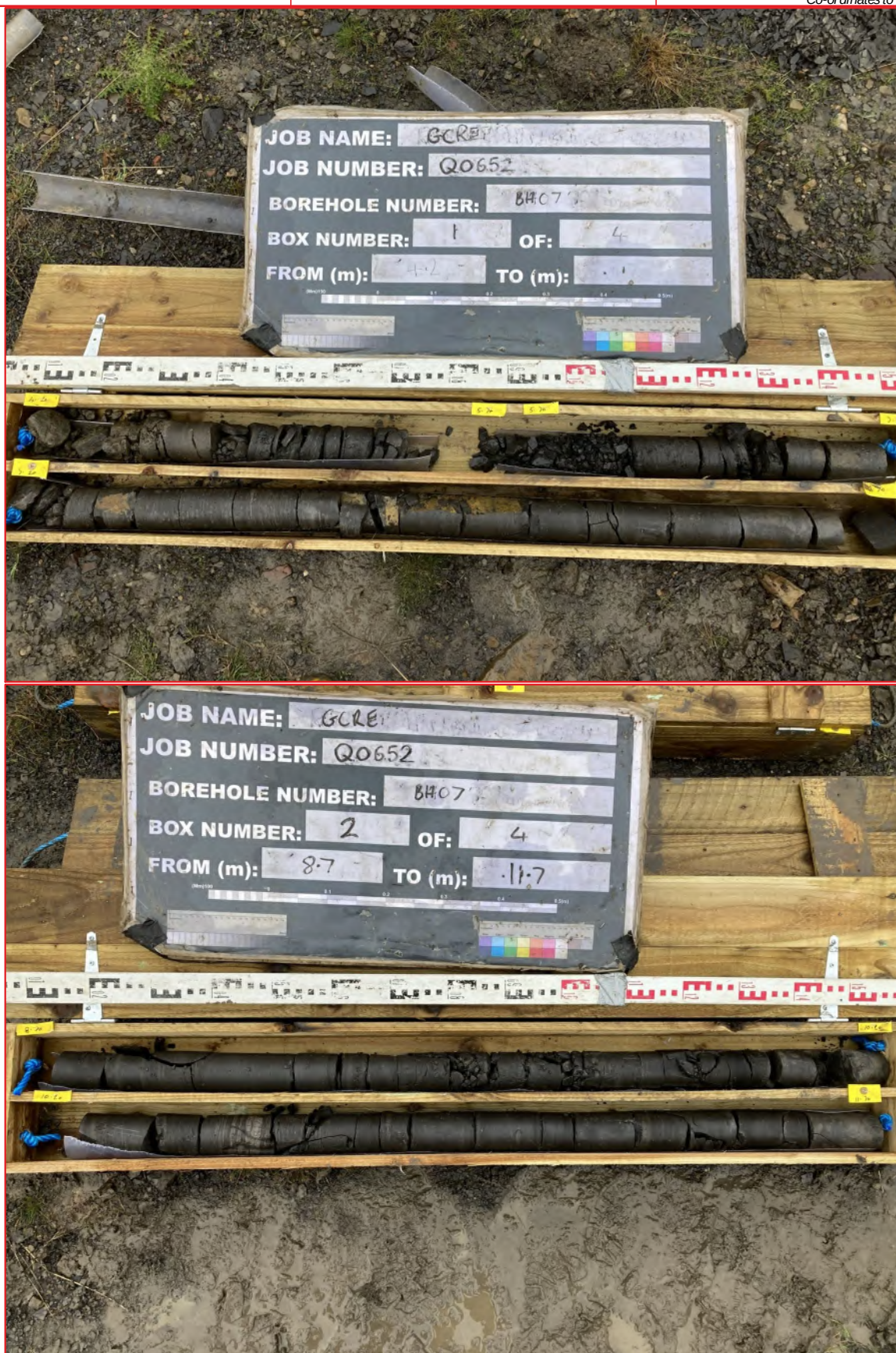
Job Number : Q0652

Ground Level : 271.28 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 281544.88E
210721.08 N
Co-ordinates to National Grid



Plas Newydd
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Operator:
QGL

Logged By:
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Page
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH07

Dates : 29/11/21 - 30/11/21

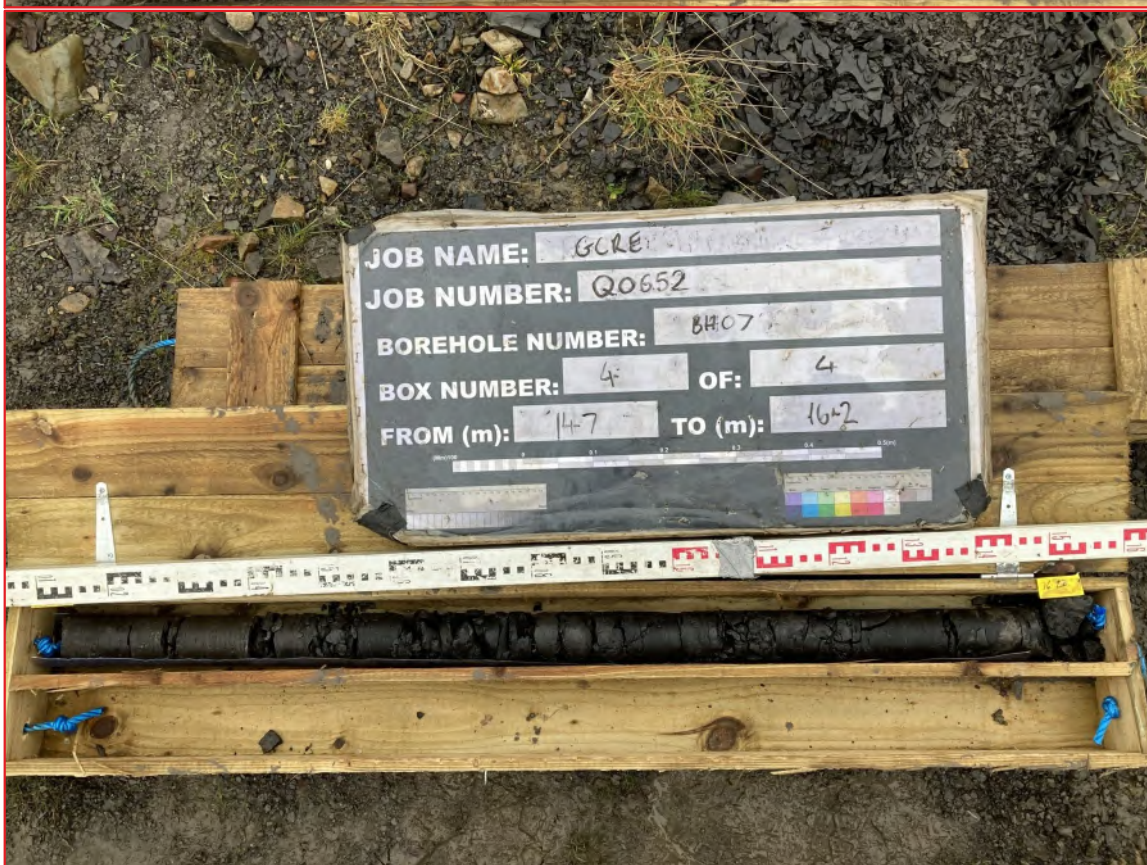
Job Number : Q0652

Ground Level : 271.28 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 281544.88E
210721.08 N
Co-ordinates to NationalGrid



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Operator:
QGL

Logged By:
P Darby

Sheet No.
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m Per Page
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence											Borehole No. BH08		
Client : Global Centre of Rail Excellence													
Dates : 7/12/21 - 8/12/21					Job Number : Q0652					Ground Level : 236.31 m A.O.D. Level to Ordnance Datum			
Location :					Engineer : ARUP					Coordinates: 282776.08 E 211918.35 N Co-ordinates to National Grid			

m B.G.L.	Run Details				Fractures		Samples		Strata					Water
	Core Run	TCR %	SCR %	RQD %	Min Avg Max	FI	Depth	Type No. Blows	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.		
0														
1										Colliery Spoil (Drillers Description)				
2														
3														
4														
5														
6									(12.00)					
7														
8														
9														
10														
11														
12									12.00	Clay (Drillers Description)		224.31		
13									(1.50)					
14									13.50	Clay with quartz cobbles (Drillers Description)		222.81		
15														
16														
17									(6.50)					
18														
19														
20									20.00	Black silty Clay (Drillers Description)		216.31		
21									(2.00)					
22									22.00	Mudstone with Sandstone bands (Drillers Description)		214.31		
23														
24														
25														
26														
27														
28														
29														
30														
31														
32									(20.00)					
33														
34														
35														
36														
37														
38														
39														
40														
41														
42									42.00	Terminated at 42.0mgl (Investigation SUPervisors Instruction)		194.31		
43														
44														

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns
08/12/2021 16:00	42.00	20.50	23.00	20.50	115.00	9.00	8.75	Seepage between 9.0 and 13.5mbgl	13.50	0.00 - 42.00	Mist	100

Plant: Commachio 600
Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-20.5mbgl, Rotary 'open hole' 20.5-42.0mbgl

	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	1 Of 1	45		

Form Name: ROTARY. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence											Borehole No.		
Client : Global Centre of Rail Excellence											BH10		
Dates : 13/12/21 - 13/12/21					Job Number : Q0652				Ground Level : 236.95 m A.O.D. Level to Ordnance Datum				
Location :					Engineer : ARUP				Coordinates: 283369.50 E 211901.56 N Co-ordinates to National Grid				

m B.G.L.	Run Details				Fractures		Samples		Strata					Water
	Core Run	TCR %	SCR %	RQD %	Min Avg Max	FI	Depth	Type No. Blows	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.		
0									(0.70)	Topsoil (Drillers Description)		236.25		
1									0.70	Mudstone (Drillers Description)				
2														
3														
4														
5														
6														
7														
8														
9														
10														
11									(19.30)					
12														
13														
14														
15														
16														
17														
18														
19														
20									20.00	Mudstone with Sandstone Bands		216.95		
21									(4.00)					
22														
23														
24									24.00	Coal (Drillers Description)		212.95		
25									(1.20)					
26									25.20	Sandstone (Drillers Description)		211.75		
27														
28									(4.80)					
29														
30									30.00	Terminated at 30.0mbgl (Scheduled Depth)		206.95		
31														
32														
33														
34														
35														
36														
37														
38														
39														

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns
13/12/2021 14:30	30.00	9.25	9.25	7.50	115.00	7.75	4.20					

Plant: Commachio 600
Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-7.2mbgl, Rotary 'open hole' 7.2-30.0mbgl

	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	1 Of 1	40		

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 16/12/21 - 17/12/21

Location: Around washery area

Job Number : Q0652

Engineer : ARUP

Ground Level : 258.79 m A.O.D.
Level to Ordnance Datum

Coordinates: 283659.50 E
211793.72 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH11

0m B.G.L. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description		
											1.2	SPT (C) 50/35mm (25/15mm-50/35mm--)		Grass over brown grey Sandstone boulders with clay bands (Drillers Description)									
											2.7	SPT (C) 50/140mm (11-16/50mm-31-19/65mm--)	(5.40)										
											4.2	SPT (C) 50/60mm (10-15/45mm-50/60mm--)											
	5.20 - 7.20										5.7	SPT (C) 50/65mm (25/20mm-50/65mm--)	5.40 (0.30) 5.70	Grey weathered MUDSTONE (Drillers Description) Weak to strong dark grey MUDSTONE with one discontinuity set (SOUTH WALES COAL MEASURES)		253.39 253.09	5.70			1	Bedding fracture set, undulating smooth, matt, clay, fresh, horizontal, partly open.		
	7.20 - 8.70	75	75	0	3	5	14	26															
	8.70 - 10.20	100	100	0	2	4	13	23					(4.95)										
	10.20 - 11.70							10															
		100	97	27				NI						10.65 (0.55) 11.20	Weak black COAL (SOUTH WALES COAL MEASURES) Strong grey SILTSTONE (SOUTH WALES COAL MEASURES)		248.14 247.59	11.20			2		
	11.70 - 13.20				4	12	15	14															
13.20 - 14.70							0 NI																
	100	87	23	3	17	20	7					(5.00)											
14.70 - 16.20							NI																
	100	67	0	2	6	18	15																

Hole Progress / Water Obs

Date / Time

H. Depth

C. Depth

Water

Casing

Depth

Diam.

Groundwater

Struck

Rose To

Behaviour

Sealed

Flush

Depth

Type

Returns

Colour

Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-5.7mbgl, Rotary coring 5.7-16.2mbgl, Rotary 'open hole' 16.2-30.0mbgl

16/12/2021 16:30	8.70	5.70		5.70	115.00	14.70	11.90	Medium ground water strike at 14.70mbgl		0.00 - 30.00	Air Mist	100	Grey brown
17/12/2021 07:30	8.70	5.70											

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

Operator:
G Blades

Logged By:
S Picton

Logged Date:

Equipment Used:
Rig: Commachio MC600.

Sheet No.
1 Of 2

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All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates : 16/12/21 - 17/12/21

Location : Around washery area

Job Number : Q0652

Engineer : ARUP

Ground Level : 258.79 m A.O.D.

Level to Ordnance Datum

Coordinates: 283659.50 E

211793.72 N

Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH11

m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities					Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description		
16	16.2							NI 3					16.20	Grey MUDSTONE with Sandstone bands (Drillers Description)	x x x x	242.59							
17																							
18																							
19																							
20																							
21																							
22																							
23													(13.80)										
24																							
25																							
26																							
27																							
28																							
29																							
30													30.00	Terminated at 30.00mbgl (Scheduled Depth)		228.79							
31																							

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-5.7mbgl, Rotary coring 5.7-16.2mbgl, Rotary 'open hole' 16.2-30.0mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	

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

Operator:
G Blades

Logged By:
S Picton

Logged Date:

Equipment Used:
Rig: Commachio MC600.

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m Per Page
16

All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH11

Dates : 16/12/21 - 17/12/21

Job Number : Q0652

Ground Level : 258.79 m A.O.D.
Level to Ordnance Datum

Location : Around washery area

Engineer : ARUP

Coordinates: 283659.50E
211793.72 N
Co-ordinates to National Grid



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

Operator:
G Blades

Logged By:
S Picton

Sheet No.
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m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH11

Dates: 16/12/21 - 17/12/21

Job Number : Q0652

Ground Level : 258.79 m A.O.D.
Level to Ordnance Datum

Location : Around washery area

Engineer : ARUP

Coordinates: 283659.50E
211793.72 N
Co-ordinates to National Grid



Plas Newydd
Swansea
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Operator:
G Blades

Logged By:
S Picton

Sheet No.
2 Of 2

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2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 14/12/21 - 15/12/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 258.21 m A.O.D.
Level to Ordnance Datum

Coordinates: 283925.43 E
211066.30 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH12

0m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
														Topsoil (Drillers Description)										
														Brown Clay (Drillers Description)		257.71								
									1.20	SPTLS1	1.2	SPT (S) 42 (4-7-12-10-10-10)		Weathered Mudstone (Drillers Description) - SPT sample Firm dark grey Clay		257.01								
	2.70 - 4.20								2.70 2.80	SPTLS2 C7 C1	2.7	SPT (S) 50/41mm (10-15/12mm-50/41mm---)		Weak to medium strong grey MUDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)		255.51	2.70				10 to 30 degree discontinuity set (bedding) extremely closely spaced, smooth and rough planar, partly open to open, slightly weathered with orange surface staining. locally with clayey fine to medium sub-angular to angular infill..			
	4.20 - 5.70	53	18	0	10	53	70	14						 between 4.2 and 5.7mbgl locally highly to completely weathered to fine to coarse angular Gravel										
	5.70 - 6.70													Actual Zone of Core Loss no recovery between 5.7 and 6.7mbgl. SPT sample grey gravelly Clay. Gravel is fine angular weak Mudstone		252.51	6.30							
	6.70 - 8.20													Weak to medium strong grey MUDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES) between 6.7 and 7.35mbgl highly weathered to medium to coarse sub-angular to angular Gravel and Cobbles below 7.35mbgl thinly laminated		251.51					Below 7.35mbgl discontinuities closely spaced and clean..			
	8.20 - 9.70	80	38	19	10	69	150	7						Actual Zone of Core Loss		250.31								
														Weak to medium strong grey MUDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)		250.01					Between 8.2 and 8.52mbgl discontinuities extremely closely spaced and sub-vertical discontinuity smooth planar to undulating, clean.			
9.70 - 11.20	99	73	41	15	98	280	12						Medium strong to strong light grey SILTSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES)		249.21	9.00				Sub-horizontal to 15 degree discontinuity set (bedding) closely spaced, smooth to rough planar, partly open to open, clean.				
																				Between 10.5 and 10.7mbgl sub-vertical discontinuity smooth planar, tight, clean.				

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-2.7mbgl, Rotary coring 2.7-12.7mbgl, Rotary 'open hole' 12.7-30.0mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	
				5.70	115.00					0.00 - 30.00	Mist	100		

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
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m Per Page
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All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence																				Borehole No. BH12							
Client : Global Centre of Rail Excellence										Job Number : Q0652					Ground Level : 258.21 m A.O.D. Level to Ordnance Datum			Coordinates: 283925.43 E 211066.30 N Co-ordinates to National Grid				Orientation & Inclination: Orientation: N/A Inclination: N/A					
Dates: 14/12/21 - 15/12/21					Location :					Engineer : ARUP																	
22m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata							Discontinuities							Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description						
22																											
23													(13.75)														
24																											
25																											
26																											
27																											
28																											
29																											
30													30.00	Terminated at 30.0mbgl (Scheduled Depth)		228.21											
31																											
32																											
Hole Progress / Water Obs					Casing		Groundwater					Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-2.7mbgl, Rotary coring 2.7-12.7mbgl, Rotary 'open hole' 12.7-30.0mbgl											
Date / Time		H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour													
Operator: QGL										Logged By: P Darby		Logged Date:		Equipment Used: Rig: Commachio 600.							Sheet No. 3 Of 3		m Per Page 11	All measurements in metres unless otherwise stated		AGS	

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH12

Dates : 14/12/21 - 15/12/21

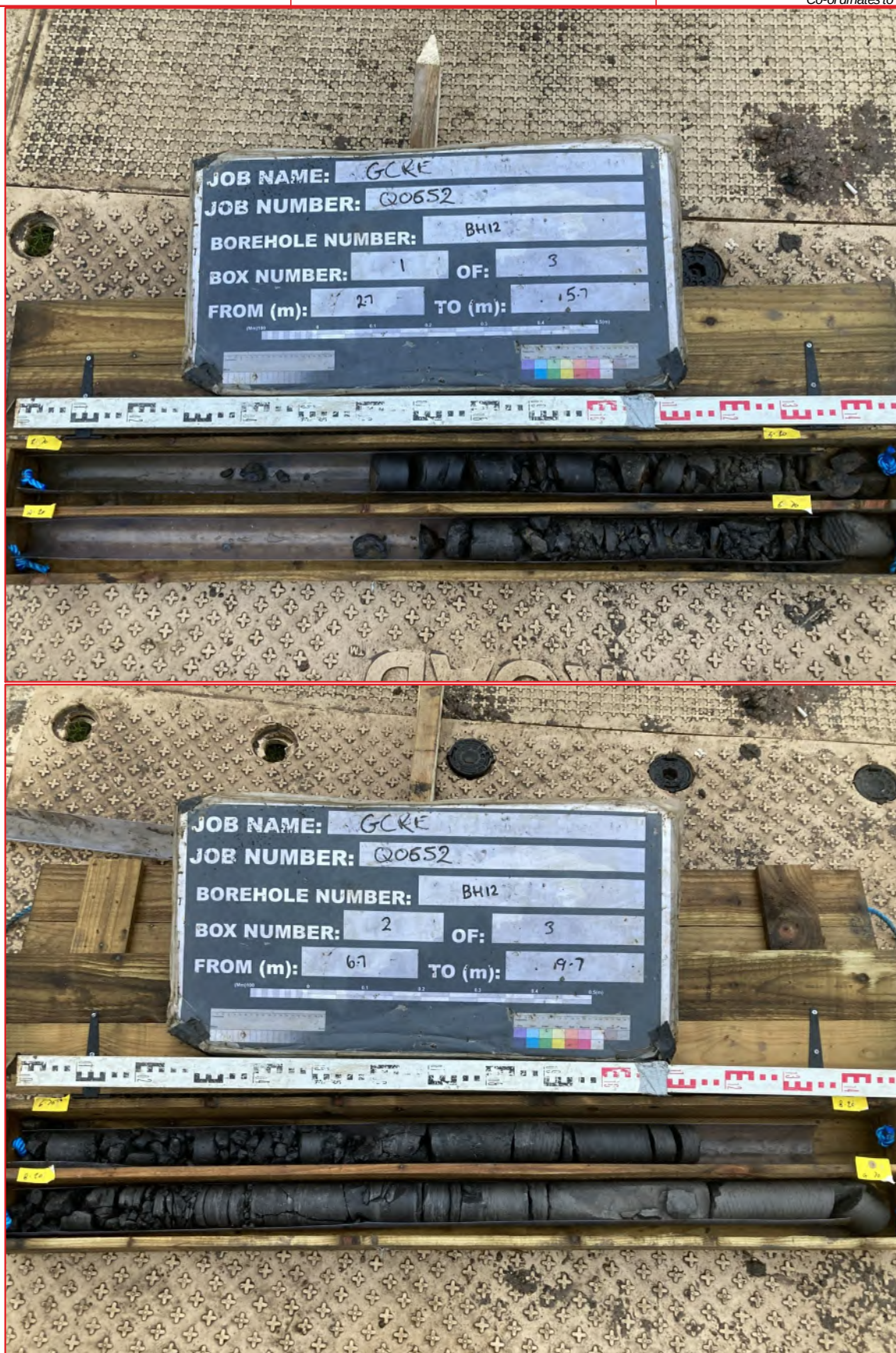
Job Number : Q0652

Ground Level : 258.21 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283925.43E
211066.30 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
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m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH12

Dates : 14/12/21 - 15/12/21

Job Number : Q0652

Ground Level : 258.21 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283925.43E
211066.30 N
Co-ordinates to National Grid



Plas Newydd
Swansea
Tel: 01554744880
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Operator:
QGL

Logged By:
P Darby

Sheet No.
2 Of 2

**m Per
Page**
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 16/12/21 - 4/1/22

Location :

Job Number : Q0652

Engineer : ARUP

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

Coordinates: 283817.80 E
210965.72 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No.
BH13

0 m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities					Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description		
									1.20	SPTLS1	1.2	SPT (S) 16 (2-2-4-4-4-4)	(0.50)	Topsoil (Drillers Description)									
													0.50	MADE GROUND - Mudstone Fill (Drillers Description)		258.84							
													1.00	Clay (Drillers Description). SPT sample firm brown and grey slightly gravelly silty CLAY. Gravel is fine to medium sub-rounded mudstone		258.34							
													(1.70)										
									2.70 - 4.20 2.70	D1 SPTLS2	2.7	SPT (S) 5 (4-2-2-1-1-1)	2.70	Cobbles, Boulders and Clay (Drillers Description)		256.64							
													(2.50)										
									4.20 - 5.70	D2	4.2	SPT (C) 50/150mm (10-10/19mm-17-33--)											
													5.20	Weathered Mudstone (Drillers Description)		254.14							
											5.7	SPT (C) 50/18mm (17-8/14mm-50/18mm--)	5.70	Fractured Mudstone (Drillers Description)		253.64							
													(1.00)										
6.70 - 7.20	100	0	0				NI					6.70	Weak to medium strong grey MUDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES)		252.64	6.70				Sub-horizontal to 10 degree discontinuity set (bedding) extremely closely spaced, rough planar, partly open, locally with clay surface coating and weathered to medium gravel up to 20mm penetration sub-vertical discontinuity set (joints) rough planar, partly open, clean.			
7.20 - 8.70							NI																
8	83	41	0	10	59	80	18	8.20 - 8.29	C1														
8.70 - 10.00	92	27	8	10	64	100	11	9.55 - 9.60	C2											Between 9.3 and 10.0mbgl sub-vertical discontinuity.			
10.00 - 10.30	67	0	0				NI																
10.30 - 11.60	92	81	8	30	65	100	19																

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-5.7mbgl, Rotary coring 5.7-29.7mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	
16/12/2021 07:30	10.20	5.70		5.70	115.00					0.00 - 30.00	Mist	100		



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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
1 Of 3

m Per Page
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All measurements in metres unless otherwise stated



Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates : 16/12/21 - 4/1/22

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 259.34 m A.O.D.

Level to Ordnance Datum

Coordinates: 283817.80 E

210965.72 N

Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH13

11m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
	11.60 - 13.10	92	81	8	30	65	100	19	11.15 - 11.25	C3				 between 11.6 and 11.9mbgl highly weathered to fine to coarse angular Gravel										
								NI																
		90	51	0	10	55	80	21	12.40 - 12.48	C4				 between 11.6 and 13.1mbgl thinly laminated										
	13.10 - 13.80	100	0	0				NI	13.50	C5				 between 13.1 and 13.8mbgl highly weathered to fine to coarse angular Gravel							Between 12.8 and 13.1mbgl sub-vertical discontinuity locally with silt surface coating.			
								NI																
	13.80 - 15.30	100	53	7	10	71	110	11	14.80 - 14.90	C6				 between 14.1 and 14.35mbgl highly weathered to fine to coarse angular Gravel							Between 13.8 and 14.1mbgl sub-vertical discontinuity.			
	15.30 - 16.70							NI					(17.50)								Between 15.3 and 15.94mbgl sub-vertical discontinuity.			
16.70 - 18.20	100	53	0	30	58	70	12	16.30	C7				 below 16.7mbgl medium strong, locally weak							Between 16.7 and 19.7mbgl sub-horizontal to 10 degree discontinuities closely spaced.				
							NI																	
	93	80	8	10	81	120	17	17.98 - 18.10	C8															
18.20 - 19.70	93	87	19	20	79	150	18	19.30 - 19.42	C9											Between 18.9 and 19.05mbgl sub-vertical discontinuity and smooth.				
							NI																	
19.70 - 21.20	90	43	11	50	64	150	14	20.35 - 20.50	C10											Between 19.7 and 21.3mbgl sub-horizontal discontinuities locally with clay surface coating. At 20.28mbgl 30 degree discontinuity smooth planar, open, clean.				
21.20 - 22.70							NI																	
	93	60	45	40	250	300	5	21.80 -	C11											Between 21.35 and 22.05mbgl sub-horizontal to 10 degree discontinuities close to medium spaced.				

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-5.7mbgl, Rotary coring 5.7-29.7mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	



Quantum Geotech

Plas Newydd

Swansea

Tel: 01554744880

email: enquiries@quantumgeotechnic.co.uk

Operator:

QGL

Logged By:

P Darby

Logged Date:

Equipment Used:

Rig: Commachio 600.

Sheet No.

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All measurements in metres unless otherwise stated

AGS

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 16/12/21 - 4/1/22

Location :

Job Number : Q0652

Engineer : ARUP

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

Coordinates: 283817.80 E
210965.72 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No.
BH13

23m B.G.L.

22

23

24

25

26

27

28

29

30

31

32

Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities						Water
Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description		
22.70 - 24.20	93	60	45	40	250	300	5	22.10	C12				 between 22.25 and 22.7mbgl highly weathered to fine to coarse angular Gravel							Between 22.2 and 22.3mbgl sub-vertical discontinuity smooth planar, slight and localised orange surface staining.		
	NI																					
24.20 - 25.70	50	40	7	20	75	100	9	23.10 - 23.18	C13				24.20 Weak black COAL. Highly weathered to fine to coarse angular Gravel and Cobbles (SOUTH WALES COAL MEASURES)		235.14	24.50				Sub-horizontal to 10 degree discontinuity set (bedding) extremely close to closely spaced, smooth and rough planar, partly open, locally with clay surface coating. 45 degree discontinuity set widely spaced, smooth planar, open, with clay surface coating.		
	NI						24.50 Medium strong grey MUDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES) between 25.0 and 25.3mbgl occasional Calcite nodules	234.84														
25.70 - 26.70	100	85	30	20	100	160	9	24.85 - 25.03	C14				 between 26.0 and 26.2mbgl sub-vertical calcite veins (healed sub-vertical discontinuities)							At 25.7mbgl 45 degree discontinuity open with soft clay infill.		
26.70 - 28.20	80	78	28	20	75	180	15	26.05 - 26.13	C15			(5.50)				5.50						
28.20 - 29.70	100	93	39	20	71	200	20	27.30 - 27.45	C16													
29.7								28.80 - 28.90														
								30.00					Terminated at 30.0mbgl (Scheduled Depth)		229.34							

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-5.7mbgl, Rotary coring 5.7-29.7mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	



Quantum Geotech

Plas Newydd
Swansea
Tel: 01554744880
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Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

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All measurements in metres unless otherwise stated



Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH13

Dates : 16/12/21 - 4/1/22

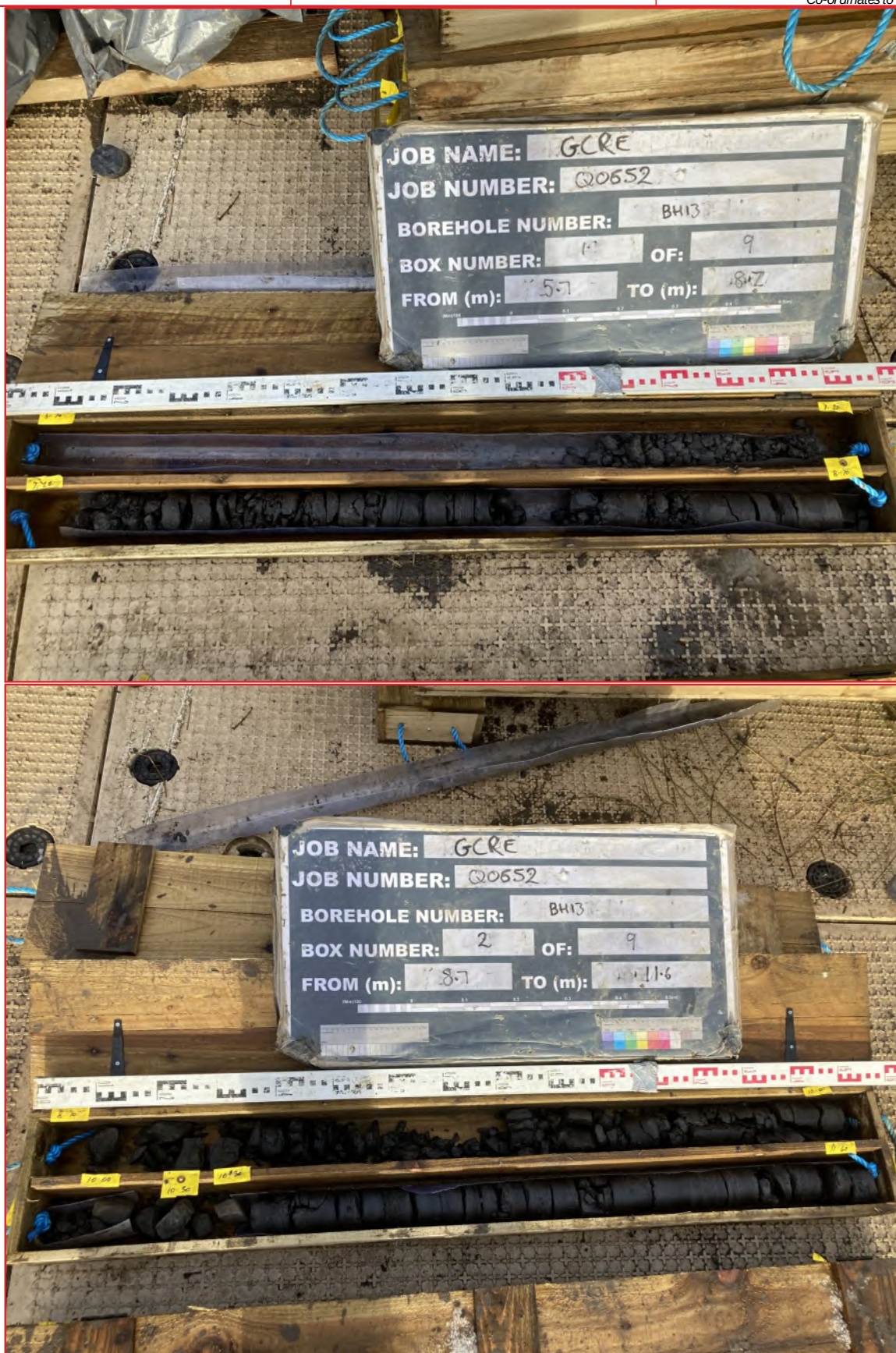
Job Number : Q0652

Ground Level : 259.34 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283817.80E
210965.72 N
Co-ordinates to National Grid



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH13

Dates : 16/12/21 - 4/1/22

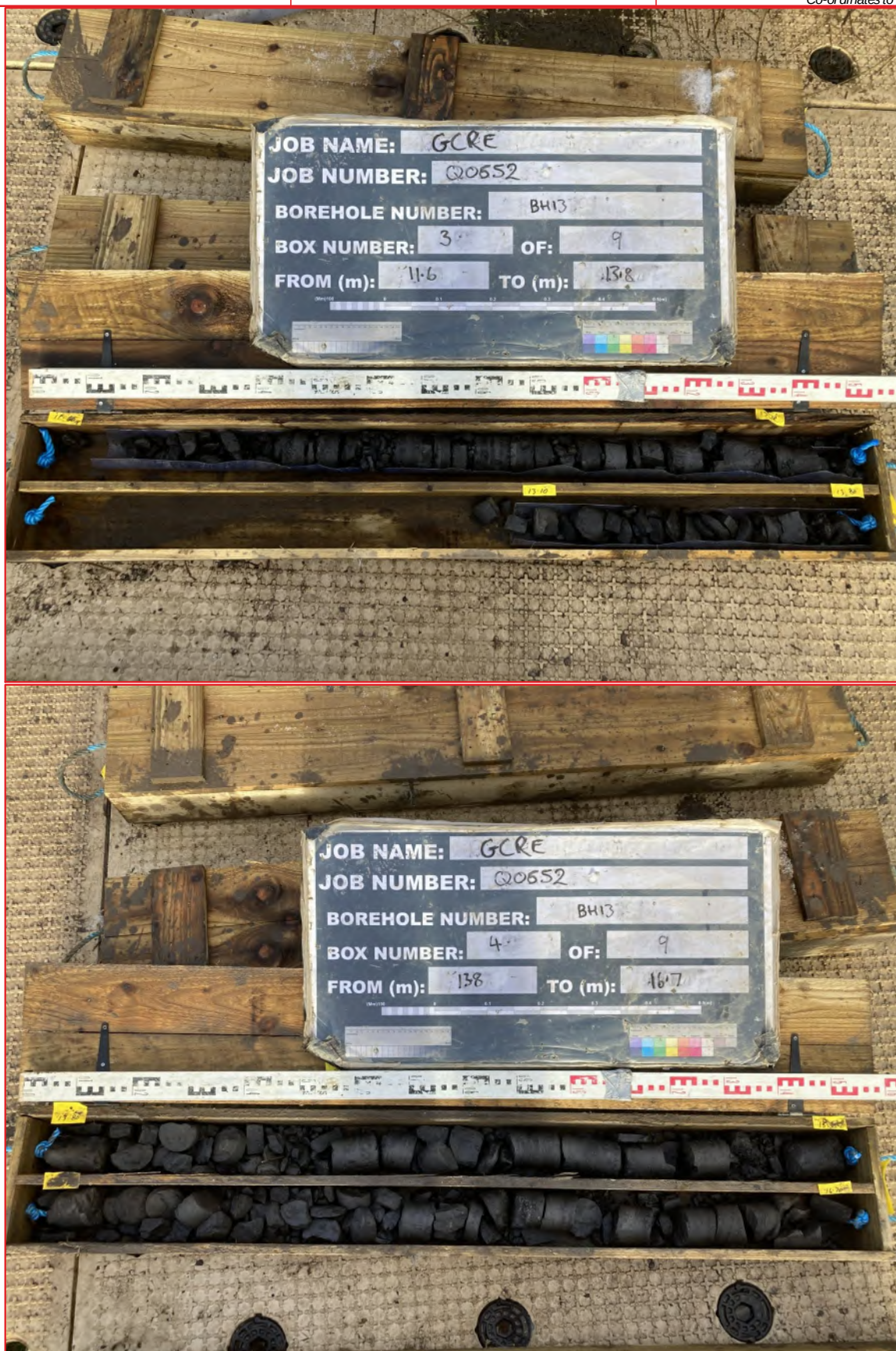
Job Number : Q0652

Ground Level : 259.34 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283817.80E
210965.72 N
Co-ordinates to National Grid



Plas Newydd
Swansea
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Operator:
QGL

Logged By:
P Darby

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All measurements in
metres unless
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Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH13

Dates : 16/12/21 - 4/1/22

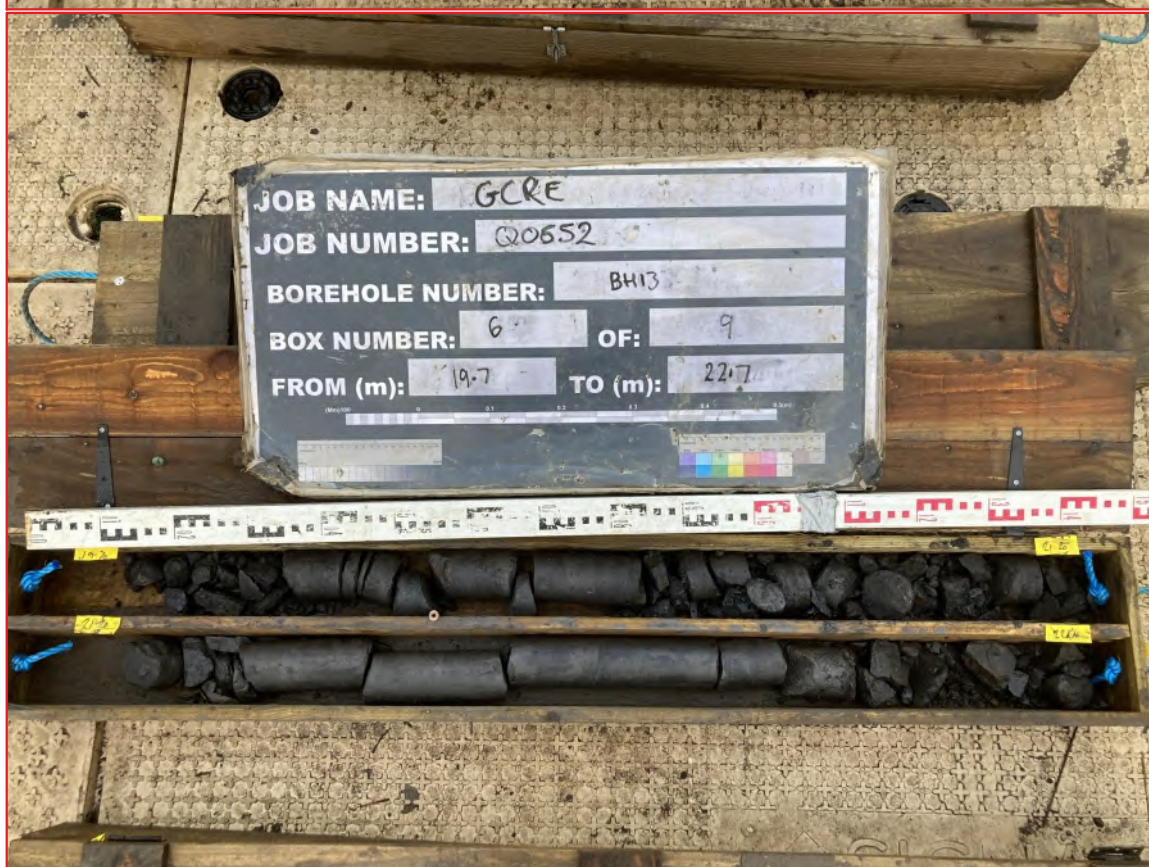
Job Number : Q0652

Ground Level : 259.34 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283817.80E
210965.72 N
Co-ordinates to Naional Grid



Plas Newydd
Swansea
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All measurements in
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Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH13

Dates : 16/12/21 - 4/1/22

Job Number : Q0652

Ground Level : 259.34 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283817.80E
210965.72 N
Co-ordinates to National Grid



Plas Newydd
Swansea
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All measurements in
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otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH13

Dates : 16/12/21 - 4/1/22

Job Number : Q0652

Ground Level : 259.34 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283817.80E
210965.72 N
Co-ordinates to National Grid



Plas Newydd
Swansea
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All measurements in
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Form Name: ROTARY A3 Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 15/12/21 - 16/12/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 260.01 m A.O.D.
Level to Ordnance Datum

Coordinates: 283702.06 E
210915.06 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH14

1m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata					Discontinuities						Water
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	Depth (Thickness)	Dip	Direction	Fracture Set	Discontinuity Description			
													(10.60)				10.60				open.			
	12.20 - 13.70	100	93	27	40	89	150	16	11.60 - 11.75	C5				 between 12.1 and 12.2mbgl weak black Coal highly weathered to coarse angular Gravel										
		100	93	27	10	88	200	16	13.10 - 13.25	C6				 weak below 13.0mbgl							Between 12.6 and 12.8mbgl 80 degree discontinuity smooth to rough planar, partly open, clean and fresh. At 13.0mbgl 30 degree discontinuity rough planar, tight, with silt surface coating. At 13.3mbgl sub-horizontal discontinuity open with silt / sand infill.			
	13.70 - 14.80	100	73	21	30	85	130	12	14.40 - 14.50	C7											Between 13.7 and 14.8mbgl discontinuities locally highly weatherd to fine to medium angular gravel upto 70mm penetration and locally with calcite deposits on discontinuity surfaces.			
	14.80 - 16.30				20	63	70	7																
		87	40	19				NI						 between 15.3 and 15.7mbgl highly weathered to fine to coarse angular Gravel										
					60	100	150	3	15.90 - 16.05	C8														
	16.3												16.30	Mudstone and Sandstone bands (Drillers Description)		243.71								
Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. No Groundwater Strike Observed. ODEX GL-5.7mbgl, Rotary coring 5.7-16.3mbgl, Rotary 'open hole' 16.3-30.0mbgl										
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour											
16/12/2021 07:30	14.80	5.70	5.25																					
Plas Newydd Swansea Tel: 01554744880 email: enquiries@quantumgeotechnic.co.uk Operator: QGL Logged By: P Darby Logged Date: Equipment Used: Rig: Commachio 600.										Sheet No. 2 Of 3	m Per Page 11	All measurements in metres unless otherwise stated												

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH14

Dates : 15/12/21 - 16/12/21

Job Number : Q0652

Ground Level : 260.01 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283702.06 E
210915.06 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

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Page
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH14

Dates : 15/12/21 - 16/12/21

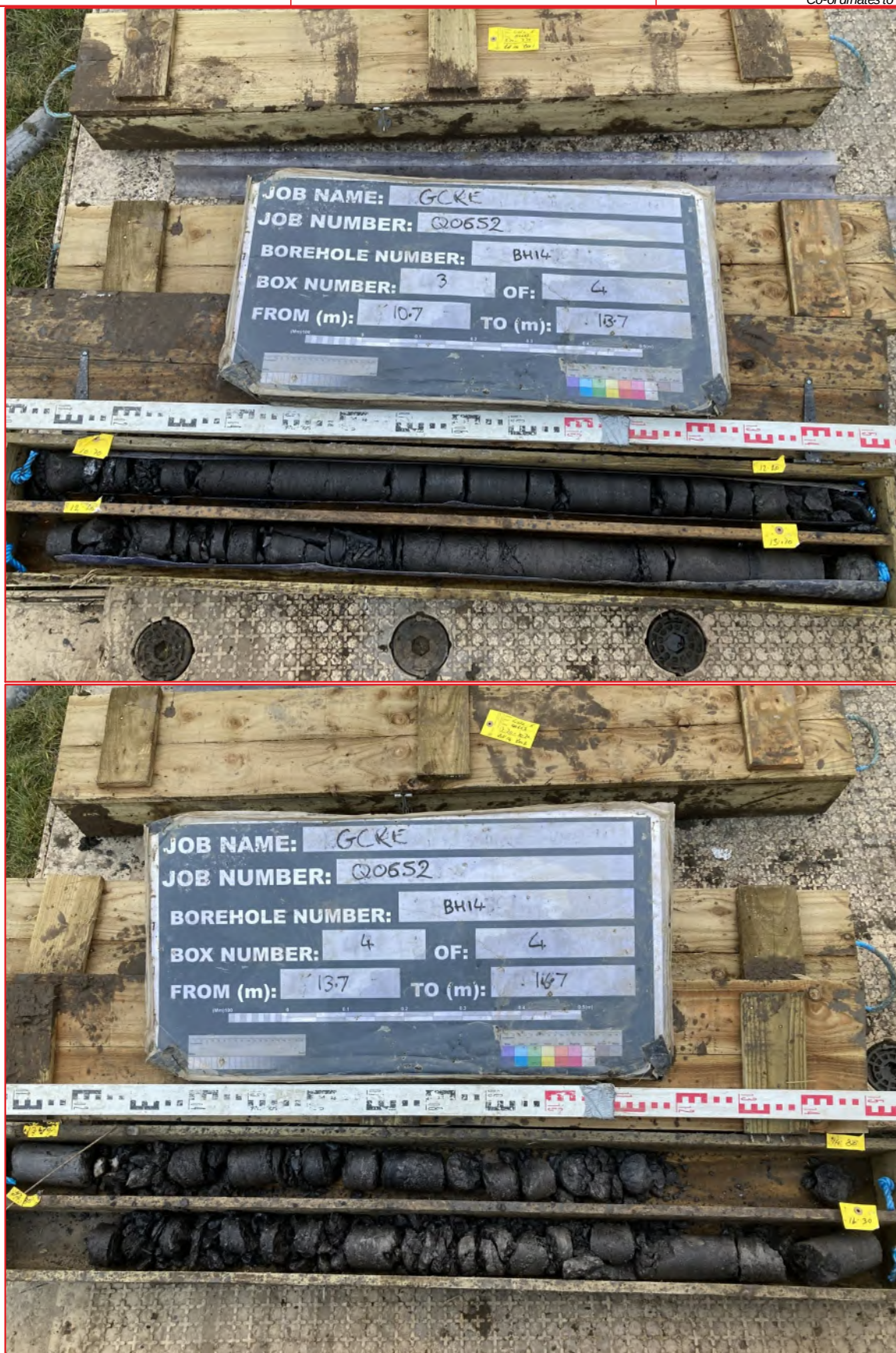
Job Number : Q0652

Ground Level : 260.01 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283702.06 E
210915.06 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
2 Of 2

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 5/12/21 - 6/12/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 249.63 m A.O.D.
Level to Ordnance Datum

Coordinates: 283332.65 E
210758.18 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No. BH15

0m B.G.L.

1

2

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Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities						Water	Install/ Backfill
Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
2.70 - 4.20	80	40	0	20	57	80	12	2.70	C8	2.7	SPT (S) 50/100mm (10-10-25-25/25mm-)	(1.75)	Made Ground - Mudstone Fill (Drillers Description)										
												1.75	Clay (Drillers Description). SPT sample is firm slightly gravelly CLAY. Gravel is fine to medium sub-rounded to angular mudstone		247.88								
												(0.95)											
												2.70	Medium strong grey MUDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES) between 2.7 and 3.15mbgl highly weathered to medium to coarse angular Gravel.		246.93	2.70				Sub-horizontal to 15 degree discontinuity set (bedding) extremely closely spaced, smooth and rough planar, partly open, slightly weathered with orange surface staining and locally with fine angular gravel infill. 45 to 55 degree discontinuity set (joint) medium spaced, smooth planar, tight to partly open, clean /fresh. Between 3.3 and 3.4mbgl sub-vertical discontinuity rough planar to undulating, partly open, slightly weathered with orange surface staining.			
												3.45 - 3.55	C1	(1.20)									
												3.90	Actual Zone of Core Loss		245.73								
												4.20	Medium strong grey MUDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES)		245.43								
												5.02 - 5.14	C2										
												6.08 - 6.20	C3										
												6.70 - 8.20	C4										
8.20 - 9.70	C5																						
9.70 - 11.20	C6																						
10.40 - 10.50																							

Hole Progress / Water Obs				Casing		Groundwater				Flush				Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-2.7mbgl, Rotary coring 2.7-12.7mbgl, Rotary 'open hole' 12.7-30.0mbgl
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour	
06/12/2021 07:30	6.70	2.70	3.25	2.70	115.00	0.75	0.20	Medium groundwater inflow	1.75	0.00 - 13.00	Mist	100		

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

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All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH15

Dates : 5/12/21 - 6/12/21

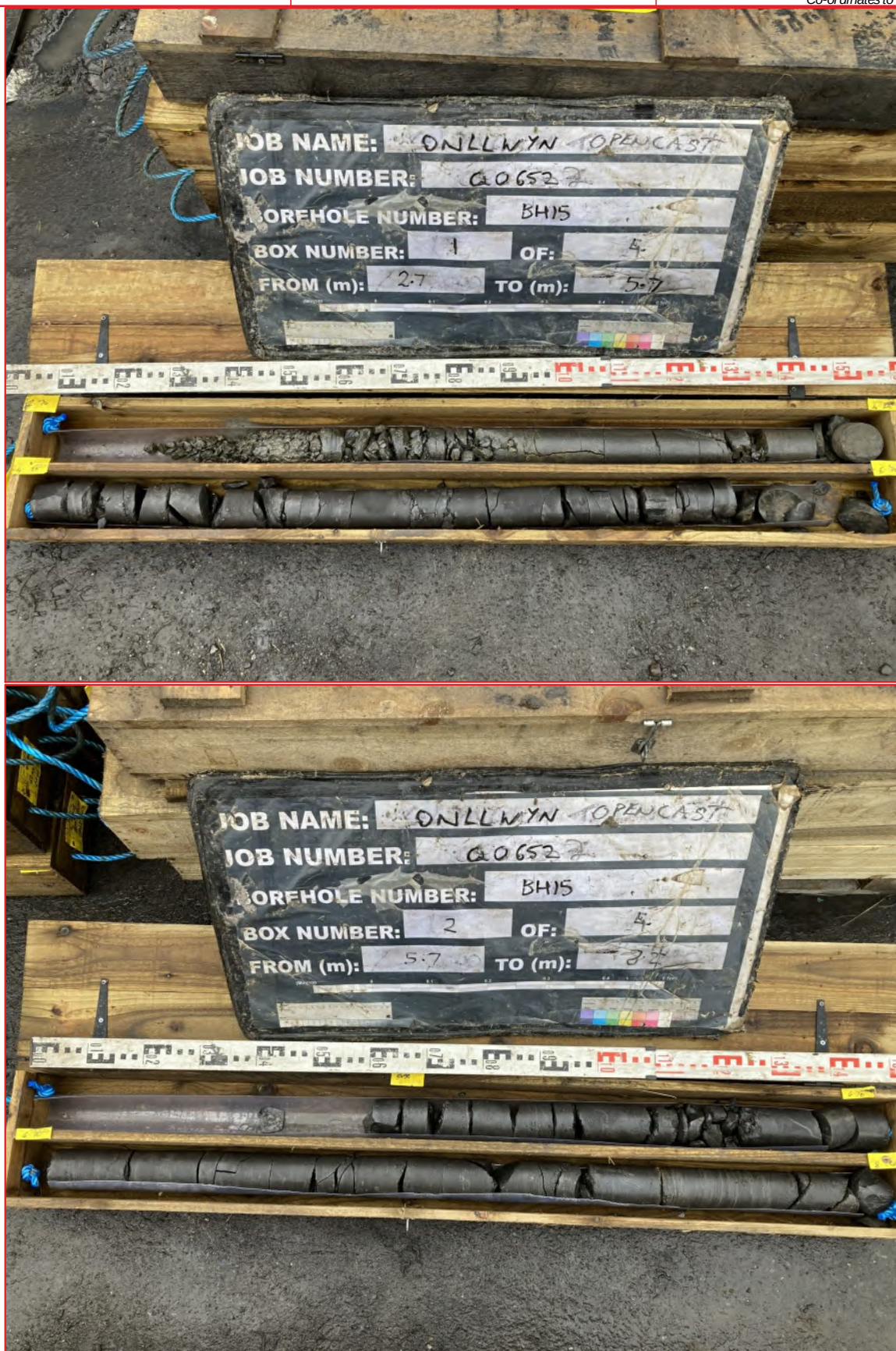
Job Number : Q0652

Ground Level : 249.63 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283332.65E
210758.18 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
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m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH15

Dates : 5/12/21 - 6/12/21

Job Number : Q0652

Ground Level : 249.63 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283332.65E
210758.18 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
2 Of 2

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Page
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All measurements in
metres unless
otherwise stated



Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 14/12/21 - 16/12/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 280.71 m A.O.D.
Level to Ordnance Datum

Coordinates: 283439.29 E
211441.07 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No.
BH16

0 m B.G.L.

1

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Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities						Water	Install/ Backfill
Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description			
													Clay and Gravel (Drillers Description)										
										1.2	SPT (S) 11 (3-3-3-2-3-3)	(2.70)											
										2.7	SPT (C) 50/35mm (25/60mm-50/35mm---)	2.70	Clay and Boulders (Drillers Description)		278.01								
										4.2	SPT (C) 50/10mm (25/30mm-50/10mm---)	4.00 (0.20) 4.20 (0.70)	Weathered Mudstone (Drillers Description) Strong light grey SANDSTONE with two discontinuity sets. (SOUTH WALES COAL MEASURES)		276.71 276.51	4.20 0.70				30 degree discontinuity set closely spaced, rough planar, open with black surface staining and locally highly weathered to sandy fine to coarse angular gravel. 60 to 70 degree discontinuity set closely spaced, rough planar, open with black surface staining and locally highly weathered to sandy fine to coarse angular gravel..			
5.70 - 7.20	44	0	0				NI						Weak to medium strong grey MUDSTONE with one discontinuity set. (SOUTH WALES COAL MEASURES) between 4.9 and 5.2mbgl highly weathered to fine to coarse angular Gravel between 5.2 and 5.6mbgl completely weathered to silty Sand		275.81								
7.20 - 8.70	73	21	0				NI	7.70	C2							7.20				Sub-horizontal to 10 degree discontinuity set (bediing) extremely closely spaced, smooth planar locally undulating, open, clean, highly weathered to fine to medium angular gravel up to 20mm penetration.. Below 7.9mbgl locally highly weathered at 7.9mbgl discontinuity with possible slickened surface between 7.9 and 8.3mbgl sub-horizontal discontinuities rough undulating to stepped, tight to partly open, clean, locally highly weathered to fine to medium angular gravel up to 5mm penetration..			
8.70 - 10.20	100	29	20				NI	9.20	C3														
				20	81	150	8									4.90				Below 9.55mbgl discontinuities extremely close to closely spaced.			
10.20 - 11.70	73	44	20	20	69	180	15	10.70	C4														

Hole Progress / Water Obs

Casing

Groundwater

Flush

Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour
15/12/2021 07:30	7.20	4.20	3.60	4.20	115.00	4.20	3.90	Medium groundwater inflow		0.00 - 40.20	Mist	100	

Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-4.2mbgl, Rotary coring 4.2-40.2mbgl

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
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11

All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 14/12/21 - 16/12/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 280.71 m A.O.D.
Level to Ordnance Datum

Coordinates: 283439.29 E
211441.07 N
Co-ordinates to National Grid

Orientation & Inclination:
Orientation: N/A
Inclination: N/A

Borehole No.
BH16

11 m B.G.L.

12

13

14

15

16

17

18

19

20

21

Run Details				Fracture Details				Samples		Insitu Tests		Strata				Discontinuities							
Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description	Water	Install/ Backfill	
11.70 - 13.20	73	44	20	20	69	180	15	12.65 - 12.75	C5				Weak black COAL. Highly weathered to fine to coarse angular Gravel. (SOUTH WALES COAL MEASURES)		268.61								
	99	63	27	15	57	120	6																NI
30				79	160	6																	
13.20 - 14.70	88	41	9	30	79	120	6	14.10 - 14.25	C6			14.00 (0.28)	Weak to medium strong black COAL. (SOUTH WALES COAL MEASURES)		266.71	14.28							
				20	57	60	6																
14.70 - 16.20	77	77	67	50	130	200	8	15.20 - 15.50	C7														
16.20 - 17.70	93	77	31	20	107	230	12	16.90 - 17.00	C8														
17.70 - 19.20	97	87	11	40	112	180	12	18.00 - 18.20	C9														
19.20 - 20.70	99	72	35	10	64	280	22	19.70 - 19.88	C10														
20.70 - 22.20	92	88	35	20	69	160	19	21.70 - 21.80	C11				 between 20.7 and 28.2mbgl fossiliferous between 21.1 and 21.7mbgl dark grey carbonaceous Mudstone										

Hole Progress / Water Obs

Casing

Groundwater

Flush

Remarks: BH set out by QGL in liaison with ARUP. Services checked, area CAT scanned and hand dug pit to 1.20mbgl undertaken. ODEX GL-4.2mbgl, Rotary coring 4.2-40.2mbgl

Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns	Colour

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

Operator:
QGL

Logged By:
P Darby

Logged Date:

Equipment Used:
Rig: Commachio 600.

Sheet No.
2 Of 4

m Per Page
11

All measurements in metres unless otherwise stated

Form Name: ROTARY A3. Version 2.11.000, 22/05/15 Output By: Phil Darby. Library File: C:\USERS\PHIL DARBY\ONEDRIVE - QUANTUM GEOTECHNIC LTD\QUANTUM 4.GLB.

Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Dates: 14/12/21 - 16/12/21

Location :

Job Number : Q0652

Engineer : ARUP

Ground Level : 280.71 m A.O.D.
Level to Ordnance Datum

Coordinates: 283439.29 E
211441.07 N
Co-ordinates to National Grid

Orientation & Inclination:

Orientation: N/A

Inclination: N/A

Borehole No. BH16

23m B.G.L.	Run Details				Fracture Details				Samples		Insitu Tests		Strata										Discontinuities										Water	Install/ Backfill																																											
	Core Run	TCR %	SCR %	RQD %	Min	Avg	Max	FI	Depth	Type No. Blows	Depth	Test Results	Depth (Thick-ness)	Description	Legend	Red. Level A.O.D.	Depth (Thick-ness)	Dip	Direction	Fracture Set	Discontinuity Description																																																								
	22.20 - 23.70	92	88	35	20	69	160	19	23.05 - 23.20	C12												At 23.7mbgl 45 degree discontinuity rough undulating, open, clean.																																																							
	23.70 - 25.20																						24.50 - 24.65	C13																																																					
	25.20 - 26.70																																						25.90 - 26.00	C14																																					
	26.70 - 28.20																																																				27.40 - 27.45	C15																							
28.20 - 29.70								29.20 - 29.45																									C16																																												
29.70 - 31.20									30.50 - 30.65	C17																																																																			
31.20 - 32.70																							31.00 - 31.05	C18																																																					
32.70 - 34.20																																							29.20 - 29.45	C16																																					
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Contract : Global Centre of Rail Excellence

Client : Global Centre of Rail Excellence

Borehole No.

BH16

Dates : 14/12/21 - 16/12/21

Job Number : Q0652

Ground Level : 280.71 m A.O.D.
Level to Ordnance Datum

Location :

Engineer : ARUP

Coordinates: 283439.29 E
211441.07 N
Co-ordinates to National Grid



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

Operator:
QGL

Logged By:
P Darby

Sheet No.
1 Of 7

m Per
Page
2

All measurements in
metres unless
otherwise stated



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