MONA OFFSHORE WIND PROJECT

Hydrogeological risk assessment for Tan-y-Mynydd Trout Fishery

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Image of an offshore wind farm

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EXECUTIVE SUMMARY

A hydrogeological risk assessment has been undertaken to evaluate the risk that onshore construction activities for Mona Offshore Wind Project represent to the spring fed lake system at Tan-y Myndydd Trout Fishery in Moelfre.

That risk assessment is based conceptual hydrogeological model developed for the local aquifer system based on a review of available geological and hydrogeological information augmented by the results of an intrusive ground investigation and associated preliminary groundwater monitoring within the Onshore Cable Corridor for the Mona Offshore Wind Project .

The risk assessment has considered the possible effect that cable trenching, the construction of joint bays and link boxes, and trenchless techniques for cabling (i.e. horizontal directional drilling) at crossing points within the Onshore Cable Corridor may have on the spring at the Tan-y Myndydd Trout Fishery in terms of its quality and flow.

The risk assessment concludes that construction activities represent a low risk to the spring in terms of its water quality and flow given:

- The large lateral distance (> 525m) and significant vertical height difference (up to 70m) between the cable route corridor and the fishery, considering that the groundwater pathway is dependent on an interconnected fractures system at shallow depth within a low permeability bedrock
- The small areal extent of the construction area relative to the large size of the groundwater catchment area required to support a perennial spring flow at the fishery and to provide a groundwater pathway that could potentially connect the cable route corridor with the fishery
- The small and temporary nature of most construction effects considered
- The effective implementation of surface water and pollution control management measure during the construction phase.

Given the low risk that construction activities represent to the spring at the fishery, a monitoring strategy has been proposed that will demonstrate that effects of construction activities on the groundwater environment within the Onshore Cable Corridor are, as predicted, small, localised and temporary in nature; and provide reassurance and confidence of the absence of significant change at the fishery itself in terms of spring water quality and spring flow.

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1 INTRODUCTION

1.1 Background

1.1.1.1 An Environmental Impact Assessment (EIA) has been produced for the Mona Offshore Wind Project (a joint venture of bp Alternative Energy Investments Ltd and Energie Baden-Württemberg AG). During the statutory consultation process undertaken as part of the EIA, concerns were raised by the Tan-y Mynydd Trout Fishery (hereinafter referred to as 'the Fishery') regarding the potential impact that onshore elements of the windfarm could have on their spring fed system of lakes at Moelfre. This report therefore presents the Hydrogeological Risk Assessment (HRA) that considers the potential effects that construction activities within the Onshore Cable Corridor could have on the Tan-y Mynydd Trout Fishery.

1.2 Objective and approach

1.2.1.1 The objective of the HRA is to determine the potential risk that construction activities associated with the Onshore Cable Corridor may have on the water dependent features on the Fishery, most notably the spring that feeds the ponds thereon. Based on the severity of perceived risk to the Fishery, risk management measures shall be recommended.

1.2.1.2 The HRA first considers the potential groundwater pathway or pathways (i.e. hydraulic connection) that may exist between the Onshore Cable Corridor and key features water dependant features on the Tan-y Mynydd Trout Fishery, most notably the spring that feeds the series of lakes thereon. The HRA then considers the magnitude of the effects that construction activities may have on those pathways should they be identified and the consequences for the Tan-y Mynydd Trout Fishery. This HRA therefore aims to evaluate the potential risk to that groundwater supply source that feeds the spring(s) supporting the ponds to identify any measures to manage the risk to the Fishery's water supply.

1.2.1.3 The HRA has involved the following specific tasks:

- Initial site walkover, completed in May 2024
- Ground Investigation (GI) within Onshore Cable Corridor (Phase 1 (October 2023) and Phase 2, April to May 2024) that involved the drilling of boreholes and excavation of trial pits(see Appendix A and B for the borehole logs and photographs)
- Baseline monitoring of the new boreholes installed during the GI, that included groundwater levels and groundwater quality. Monitoring was undertaken in July and August 2024 and the results are presented in Appendix C
- Development of a Hydrogeological Conceptual Model (HCM) for the local area that includes the Onshore Cable Corridor and the Tan-y Mynydd Trout Fishery
- Assessment of risk to water dependent features (most notably springs) in the Fishery based on potential linkages identified in the HCM
- Identification other measures required to manage or mitigate those risk given their magnitude.

1.2.1.4 The key aspects of spring hydrogeology that must be considered as part of the assessment include:

- The geological units / aquifers that supply groundwater to the spring
- The groundwater flow mechanisms and flow pathways associated with spring discharge and aquifer(s) including the spring at the Tan-y Mynydd Trout Fishery
- The total groundwater catchment to the spring.

1.2.1.5 Consideration of the level of certainty to each aspect of spring hydrogeology is key, given the limited amount of site-specific data available.

1.2.1.6 The following activities associated with the construction of the Onshore Cable Corridor (as assessed as the maximum design scenario in Volume 1, Chapter 3: Geology, Hydrogeology and Ground Conditions (APP-064)) have been considered within the Hydrogeological Risk Assessment:

- Open cut trenching along the Onshore Cable Corridor
- Construction joint bays and/or link boxes
- Trenchless techniques (Horizontal Directional Drilling or HDD) for the installation of the onshore export cables at crossing obstacles (e.g. roads and surface water courses) as shown on the onshore crossing schedule (REP5-012)).

1.3 Limitations of assessment

1.3.1.1 This HRA remains a largely qualitative assessment given: the limited amount of site-specific data available; large area encompassed in the assessment; and the inherent complexity of fracture flow pathways in bedrock aquifers and uncertainty in the actual behaviour and catchment area of the spring at the Tan-y-Mynydd Trout Fishery. The information regarding the spring provided to date has largely been anecdotal.

1.4 Report Structure

1.4.1.1 The subsequent report structure is as follows:

- Section 2: Tan-y Mynydd Trout Fishery – General description of the setting of the fishery and features of interest to the hydrogeological risk assessment.
- Section 3: Site Setting – Description of key aspects of the site setting including most notably geology and hydrogeological characteristics that are required to develop the Conceptual Hydrogeological Model for the hydrogeological risk assessment.
- Section 4: Hydrogeological Risk Assessment – Describes the approach to be used for the hydrogeological risk assessment and activities under consideration to determine the potential effects on the Fishery given the pathway / hydraulic links identified in the Conceptual Hydrogeological Model. Presents a summary of the findings of the detailed hydrogeological risk assessment provided in Appendix D.
- Section 5: Risk Management Measures – Presents the recommended risk management measures, commensurate with the level of risk identified through the risk assessment.
- Section 6: Conclusion.

2 TAN-Y MYNYDD TROUT FISHERY

2.1 Site description

2.1.1.1 The site setting of the Tan-y-Mynydd Trout Fishery is shown in **Figure 1**.

2.1.1.2 The Tan-y-Mynydd Trout Fishery is in the village of Moelfre, near Abergele in North Wales at National Grid Reference (NGR) SH 95358 74513. The Fishery is located at an elevation of c. 160 meters Above Ordnance Datum (m AOD). Topography rises steeply to the south of the fishery, to the summit of Moelfre Isaf at an altitude of 317m AOD (c. 1145 m to the south). The Onshore Cable Corridor runs from west to east on the northern flank of Moelfre Isaf approximately 525 m south of the Tan-y-Mynydd Trout Fishery at its closest point. At that point the Onshore Cable Corridor has a maximum elevation of 230m AOD, approximately 70 m above the lakes on the Fishery.

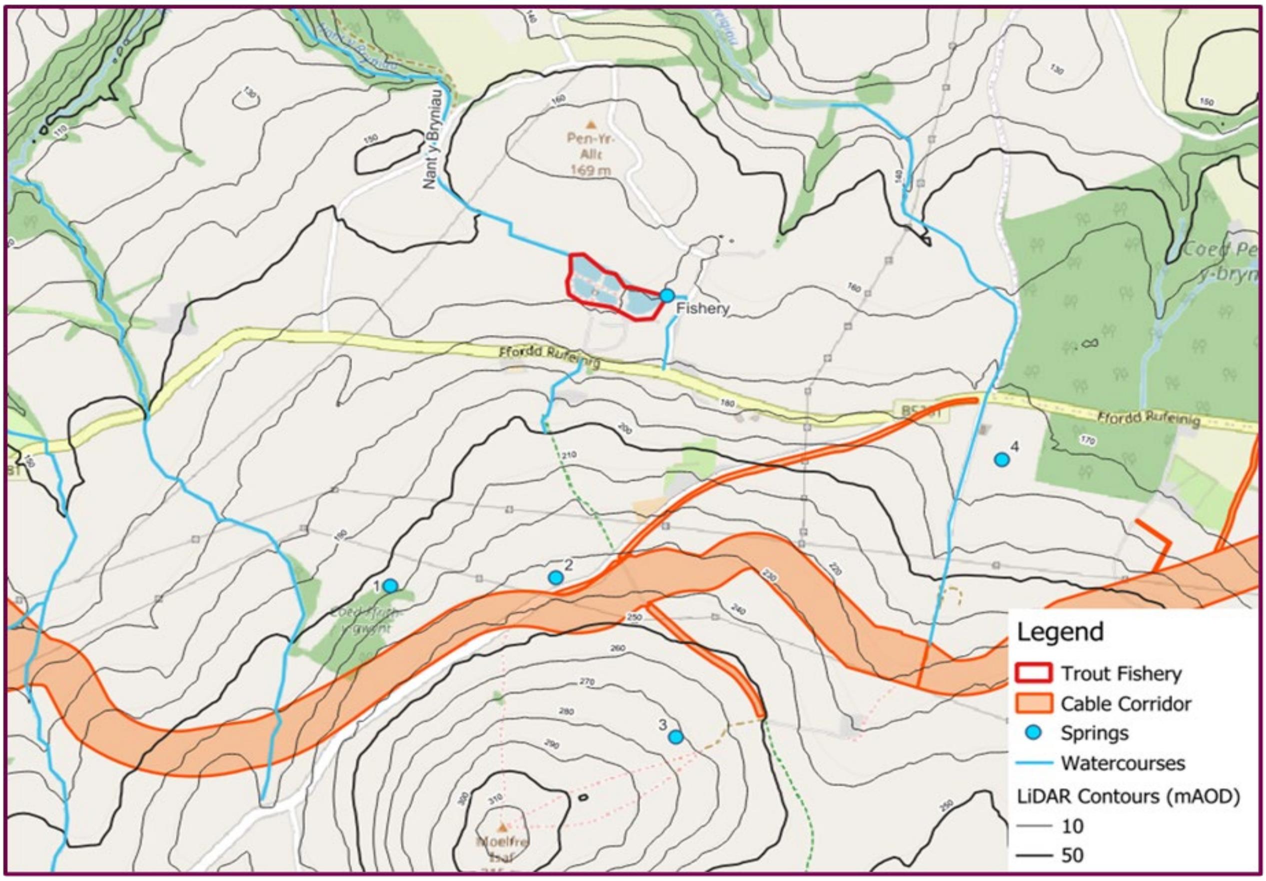

Figure 1: General site setting (blue circles denote springs)

2.2 Site topography, hydrology and hydrogeology

2.2.1.1 A site walkover was conducted in May 2024 and was attended by an experience hydrogeologist from RPS. The results of the walkover and associated conversation with the owners of the Tan-y-Mynydd Trout Fishery are summarised in **Figure 2** and shows the detailed hydrology of the Fishery. Figure 2 includes a detailed map of the ponds that shows their names and approximate depths.

2.2.1.2 All elevations are from the Natural Resources Wales database (Welsh Government, 2023).

2.2.1.3 The ponds at the Tan-y-Mynydd Trout Fishery are fed by a spring that discharges groundwater to the easternmost pond (the Top Pond). That spring is thought to flow perennially and is concealed beneath concrete rings that were emplaced within the pond for its protection during the construction of the Fishery. The location of active spring discharge is therefore at the base of those rings (approximate depth of 7m) and can, in theory, be accessed via a manhole cover on the top of rings. Water flows out of the Top Pond through the piped culvert into the small watercourse that rises behind the Fishery Building in the east and along the northern boundary of the ponds. The water flowing in that small watercourse can be redirected into the other ponds, which are all located at a lower elevation (approximately 3m below the Top Pond).

2.2.1.4 The lower ponds are hydraulically connected by near surface overflow pipes and can also be topped up by diverting surface water from the watercourse to the south and west shown in **Figure 2**. Water is discharged from the pond system into Nant y Bryniau through the overflow on the northwestern pond (i.e. Farm Pond). It is notable that the discharge point from Farm Pond is raised significantly above ground elevation at the receiving watercourse. In contrast, the two southern ponds and Top Pond tie into the natural ground level on the Fishery site. This reflects the construction of the Fishery on ground that is sloping to the north. The headwaters of Nant y Bryniau flow along the northern boundary of the site, with marshy reedy ground immediately north thereof.

2.2.1.5 The Top Pond at the Fishery is dependent on groundwater discharge from the spring to maintain water level and through-flow, particularly at times of low rainfall. In the summer overflow declines although the water level in the Top Pond is reported to be maintained. Top Pond is located at the natural ground level on the site, although **Figure 2** suggests the pond itself may be up to 7 m deep. The spring clearly provides an important component of water throughflow across the system, that will affect the water quality maintained in the system and support water levels therein. The geology of the spring head is not known (See Section 3) although the depth of the pond suggest it is likely to intercept or be close to the underlying bedrock.

2.2.1.6 **Figure 2** also shows location of the watercourse that flows from south to north, through the Fishery site and discharges into Nant y Bryniau. Surface water flow from that stream can be diverted into the southern ponds and used to manage water levels in the system of four lower-level ponds. As shown in **Figure 2**, at the time of the site walkover (13 May 2024) there was reasonable flow in that watercourse across and around the Fishery. However, the watercourse was seen to be essentially dry along much of its course across the northern flank of Moelfre Isaf. A spring is marked on OS maps at the source of that watercourse at an elevation of approximately. 230 mAOD. That spring could not be identified at the time of the site walkover. As shown in **Figure 2**, there is some uncertainty as to the nature and direction of connectivity between that spring and the lower fields where flow was observed.

2.2.1.7 As discussed in Section 3.2, there is an area of locally raised ground immediately to the north of the ponds. That land reaches an elevation of up to between 165 to 170 mAOD. This elevated area is approximately 10m higher in elevation than the Fishery itself, reaching its maximum elevation of 200 m to the north thereof.

Figure 2: Water features at the time of the site walkover in May 2024

3 SITE SETTING

3.1 Hydrology and Topography

3.1.1.1 The hydrological setting of the Tan-y-Mynydd Trout Fishery is shown in **Figure 1**.

3.1.1.2 The area surrounding the Onshore Cable Corridor and the Fishery is crossed by four small watercourses, with an additional two watercourses north of the Fishery. The main river in the area is the River Clwyd, which lies east of the Fishery and flows northwest to the sea. A summary of surface water features is provided in **Table 1**. The distances presented have been measured from the area of the Onshore Cable Corridor closest to the Tan-y-Mynydd Trout Fishery.

Table 1: Summary of surface water features near the Tan-y-Mynydd Trout Fishery

Name	Type	Distance from Onshore Cable Corridor (m)	Direction from Onshore Cable Corridor	Distance from Fishery (m)	Direction from Fishery
Nanty Creigiau	Ordinary Watercourse	936m	North	480	Northeast
River Gele	Main River	525m	North	1,125	East
River Elwy	Main River	1031m	South	1,810	South

3.1.1.3 There are five springs in the search area, including the spring that feeds the Tan-y-Mynydd Trout Fishery. These springs are shown in **Figure 1**. The details of the springs are summarised in **Table 2**, and are located at notably different elevations:

- High elevation springs – Springs 1, 2 and 3 are located on Moelfre Isaf at above 200 mAOD, typically more than 50m above the elevation of the Tan-y-Mynydd Trout Fishery spring. These are likely to represent groundwater discharge points from the shallow fractured bedrock.
- Low elevation springs - Spring 4 and the Tan-y-Mynydd Trout Fishery spring are located at low elevation (160 to 174 mAOD.

3.1.1.4 The spring at the Tan-y-Mynydd Trout Fishery is unusual for the area, given its perennial flow, significant discharge rate and low elevation.

Table 2: Information on springs in the area

Spring Reference	Elevation (m AOD)	Distance from Onshore Cable Corridor (m)	Distance from Fishery (m)
1	208.47	110	720
2	233.60	30	595
3	272.76	270	910
4	173.66	315	742
Tan-y-Mynydd Trout Fishery	160.08	540	0

3.2 Geology

Regional geological setting

3.2.1.1 A summary of the regional geological setting of the area is present in **Table 3**. This has been collated using publicly available geological sources of the British Geological Survey (Lexicon of Named Rock Units (BGS, 2020); the BGS Geological Map (BGS, 1953); and Geoindex onshore (BGS, 2024)). Reference has also been made to Volume 3, Chapter 1: Geology, Hydrogeology and Ground Conditions (APP-064).

Table 3: Geological sequence

Type	Group / Formation	Rock Type	Description
Superficial Deposits	Tidal Flat Deposits		Mud flat and sand flat deposits, consisting of unconsolidated sediment, largely mud and/or sand.
	Glacial Till (Devensian)		Unconsolidated clay, sand, gravel and boulders which vary in size and shape.
	Glaciofluvial Deposits		Unconsolidated boulders, gravel, sand, silt and clay from ice sheets or glaciers.
	Alluvium		Clay, silt, sand and gravel (sorted or semi-sorted).
	Head Deposits		Angular rock debris, clayey hillwash and/or soil creep.
	River Terrace Deposits		Sand and gravel, with lenses of silt, clay and peat.
Bedrock Deposits	Warwickshire Group	Mudstone, siltstone and sandstone	The youngest bedrock in the area is the Warwickshire Group, which comprises Carboniferous red, brown or purple-grey sandstone, siltstone and mudstone.
	Clwyd Limestone Group	Limestone	This is Carboniferous in age and comprises a thick sequence of limestones, which are diverse, with subordinate sandstone and mudstone units.
	Ffernant Formation	Mudstone, siltstone and sandstone	This is Carboniferous in age and comprises a thin sequence of red and purple silty mudstones, siltstone and sandstones.
	Elwy Formation	Sandstone	The oldest bedrock in the region is the Elwy Formation, which comprises a thick sequence of silty mudstones and subordinate sandstones. These rocks are heavily faulted and fractured, and dip to the northeast.
		Mudstone, siltstone and sandstone	

**shaded cells denote bedrock units outside of the local area of the Fishery.*

Superficial deposits

3.2.1.2 The details for the superficial geology in the area are summarised in **Table 3** and presented in **Figure 3**.

3.2.1.3 The area between the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery is almost exclusively covered by a veneer of superficial glacial till termed ‘Devensian Till’ (or Diamicton). Glacial till is shown to be absent around the summit of Moelfre Isaf to the south of the Onshore Cable Corridor .

3.2.1.4 The local high ground to the north and northwest of the Tan-y-Mynydd Trout Fishery is formed by glacial till that is present in the form of drumlins (as shown on **Figure 3**). Drumlins are elongated hills formed of till. In this area, the drumlins are oriented north northwest-south southeast to north northeast-south southern west. Four drumlins lie directly north of the Fishery, with a maximum elevation of 169 mAOD. These form high ground to the north and northeast of the Tan-y-Mynydd Trout Fishery.

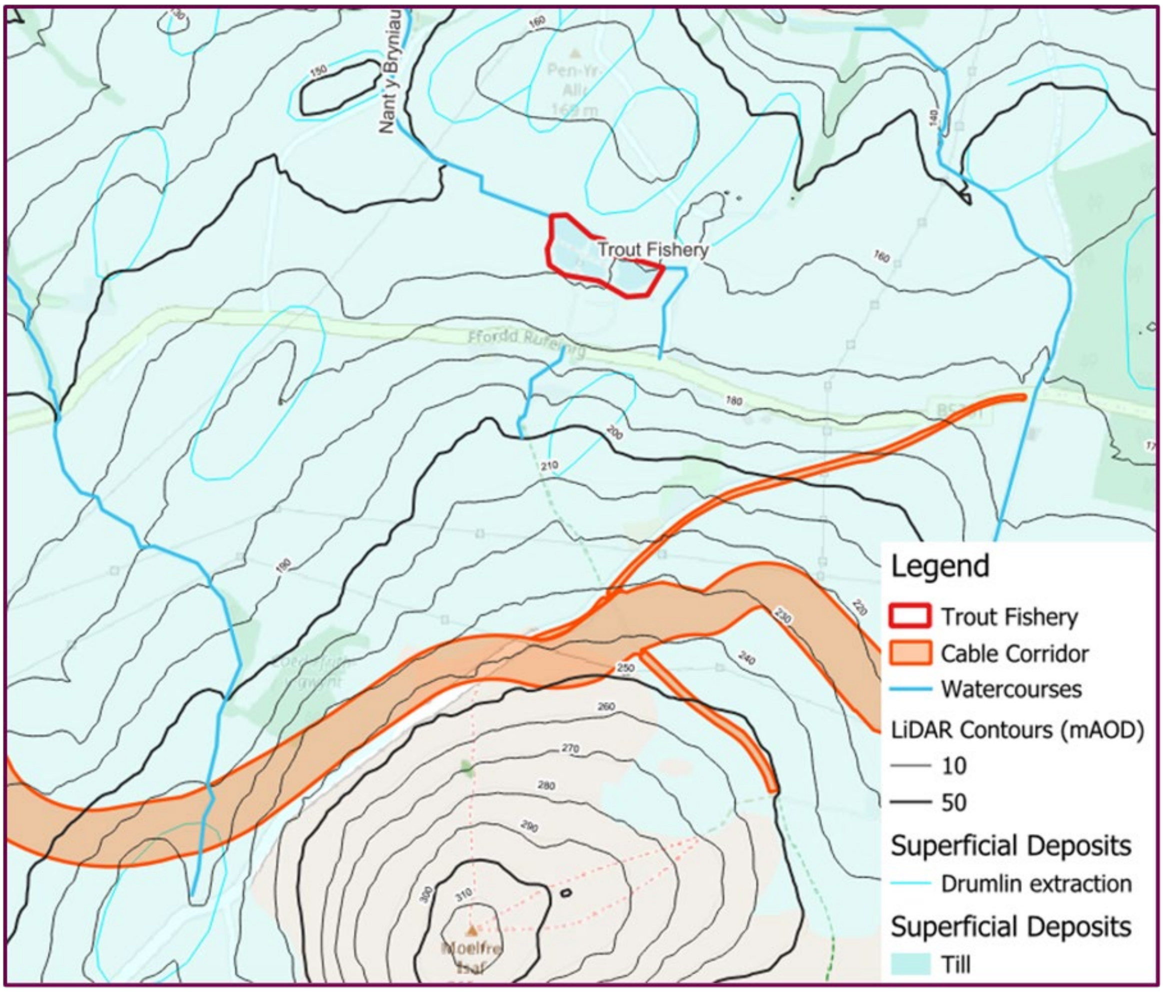

Figure 3: Superficial Geology

Bedrock

3.2.1.5 The published bedrock geology of the local area is shown in **Figure 4**, and is dominated by silty, stripped mudstones of the Elwy Formation. The Elwy Formation includes subordinate sandstone units within the mudstone sequence and such a sandstone is shown to be exposed at the ground surface across the summit of Moelfre Isaf. The BGS mapping suggests the surface exposure of that sandstone is extends southward beneath the Onshore Cable Corridor , although this is not corroborated by the site-specific geology identified from the GI undertaken within the Onshore Cable Corridor (as described in Section 3).

3.2.1.6 The structure of the Elwy Formation is strongly affected by faulting. Several long, regional faults are shown to cut across the local area. The precise location of these major faults is uncertain (being denoted by dashed lines on BGS mapping in **Figure 5**), but typically have a south-southeast to north-northwest orientation. A complex array of minor faults commonly dissects the bedrock between the regional faulting, again with precise locations, strikes and throws uncertain. As a result of this complex faulting the general dip of beds within the Elwy Formation is also complex and variable. However, BGS mapping provides evidence to support a general folding of the Elwy Formation in the local area, with comparatively shallow, southerly orientated dips (of typically less than 20°) to the south of the Onshore Cable Corridor beneath the summit of Moelfre Isaf and steeper, northerly dipping strata (of between 30 and 70°) in the area between the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery and north thereof. This structure would seem to suggest that bedding and any associated bedding parallel fractures are likely to dip more steeply that the ground surface in the area between the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery.

3.2.1.7 As shown in **Figure 5**, the northerly dip of the local bedrock also results in the exposure of progressively younger geological units in that direction, namely the Ffernant Formation and overlying Carboniferous limestones of the Clwyd Limestone Group, to the north of the Tan-y-Mynydd Trout Fishery. The limestones in the local area appear to have a relatively uniform, northeasterly dip of approximately 20° (as highlighted in **Figure 6**).

3.2.1.8 The Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery are both situated above the mudstone bedrock of the Elwy Formation, with a small area of sandstones near the summit of Moelfre Isaf. The Fishery itself, and the spring which feeds the Top Pond, lie on Elwy Formation mudstone, siltstone and sandstone. The bedrock underlying the Onshore Cable Corridor shown to be faulted in this area, particularly to the south beneath exposure on Moelfre Isaf. The BGS do not identify any faulting between the Onshore Cable Corridor and the fishery, but that likely reflects the concealment of the bedrock beneath till.

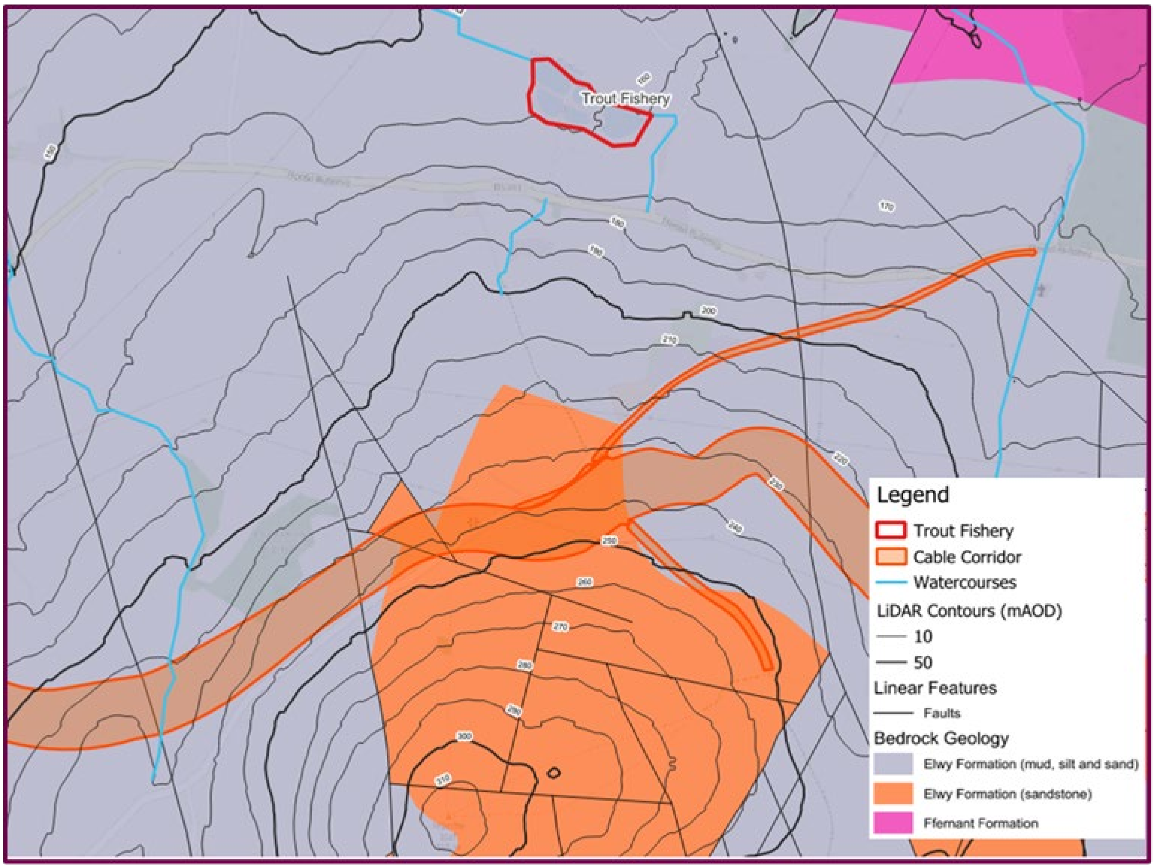

Figure 4: Bedrock Geology

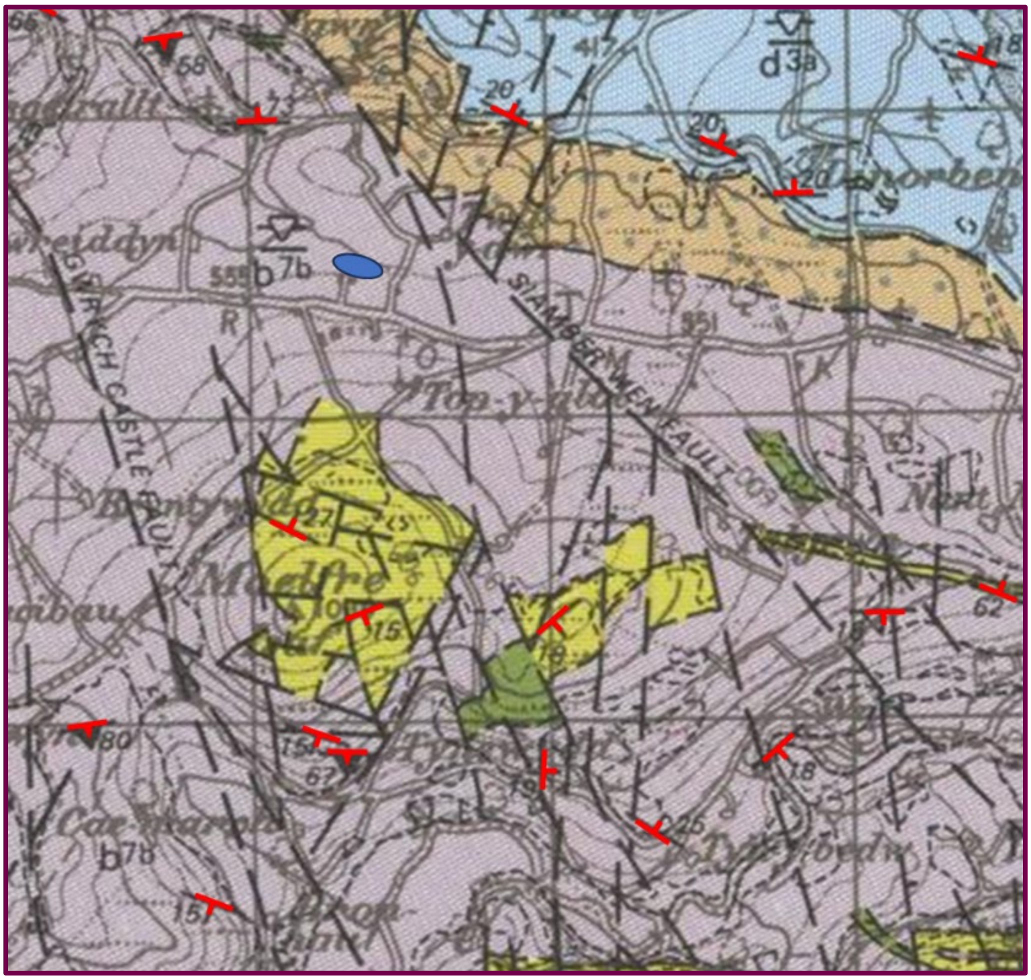

Figure 5: Bedrock geology (detailed structure taken from BGS mapping)

Conceptual geological cross section

3.2.1.9 Based on the BGS mapping a cross section showing the expected geology is provided in **Figure 6**. The cross section runs from south to north, through the Onshore Cable Corridor and to the Tan-y-Mynydd Trout Fishery and associated spring. The geological cross section clearly demonstrates:

- Large horizontal (lateral) and vertical separation between the Tan-y-Mynydd Trout Fishery and the Onshore Cable Corridor
- The bedrock geology of area is dominated by mudstones of the Elwy Formation.
- The localised presence of sandstone units in the Elwy Formation, as mapped at the summit of Moelfre Isaf
- The folded nature of the Elwy Formation, which dips to the north in the direction of the Tan-y-Mynydd Trout Fishery on the northern side of Moelfre Isaf.
- Variety of low angle (bedding parallel) factures and high angle fracture sets albeit limited fracture sets.

- The presence of a thin veneer of glacial till at lower elevations on Moelfre Isaf, that conceals the spring on the Tan-y-Mynydd Trout Fishery, which thickens immediately north of the Fishery as it forms a Drumlins.

3.2.1.10 The cross section does not give any impression of large-scale regional faulting seen on the BGS mapping, because those faults / fault zones extend south-southeast to north-northwest and therefore occur outside of the cross section.

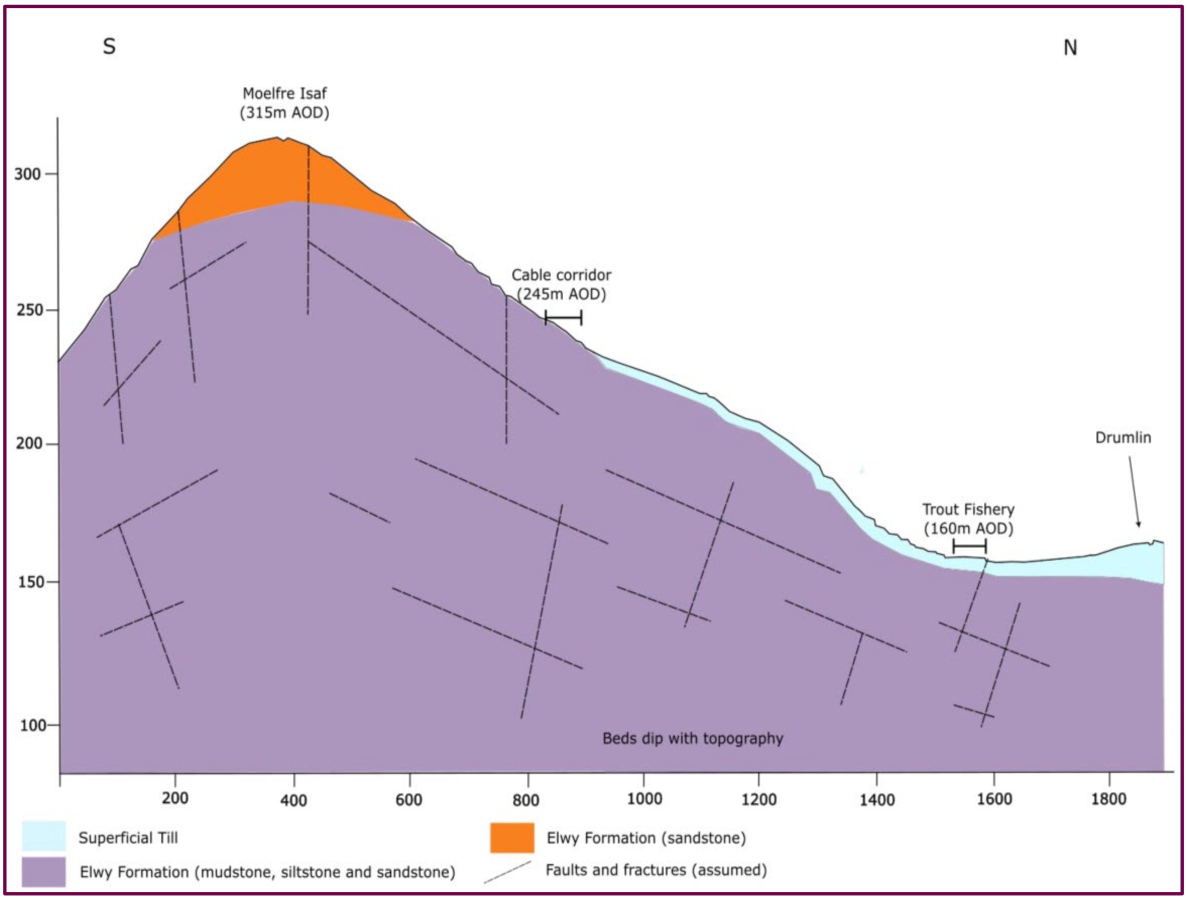

Figure 6: Geological cross section

Site specific geology

3.2.1.11 As shown in **Figure 1**, the Onshore Cable Corridor traverses northern flank of Moelfre Isaf at high elevation. The CRC rises from 220 mAOD on the western flank of Moelfre Isaf (at the crossing of the tributary of the River Gele) to a maximum of 250 m directly south of the Fishery. The elevation then declines on the eastern flank of Moelfre Isaf to approximately. 230 mAOD at the crossing of small watercourse that flows past Glandyfyr (that is presumed to a headwater stream of Nant y Creigiau shown in **Figure 1**).

3.2.1.12 A site-specific investigation was carried out by CJ Associates in April 2024 within the Onshore Cable Corridor and included logging and photographing 32 boreholes along the length of the Onshore Cable Corridor . The location of key intrusive investigation boreholes within the Onshore Cable Corridor near the Fishery and on the flank of Moelfre Isaf are shown in **Figure 7**. Those boreholes were drilled at the location of potential areas of trenchless Horizontal Direction Drilling (HDD) and are therefore deep enough to characterise geological and hydrogeological conditions over the likely maximum depth of construction activities within the Onshore Cable Corridor .

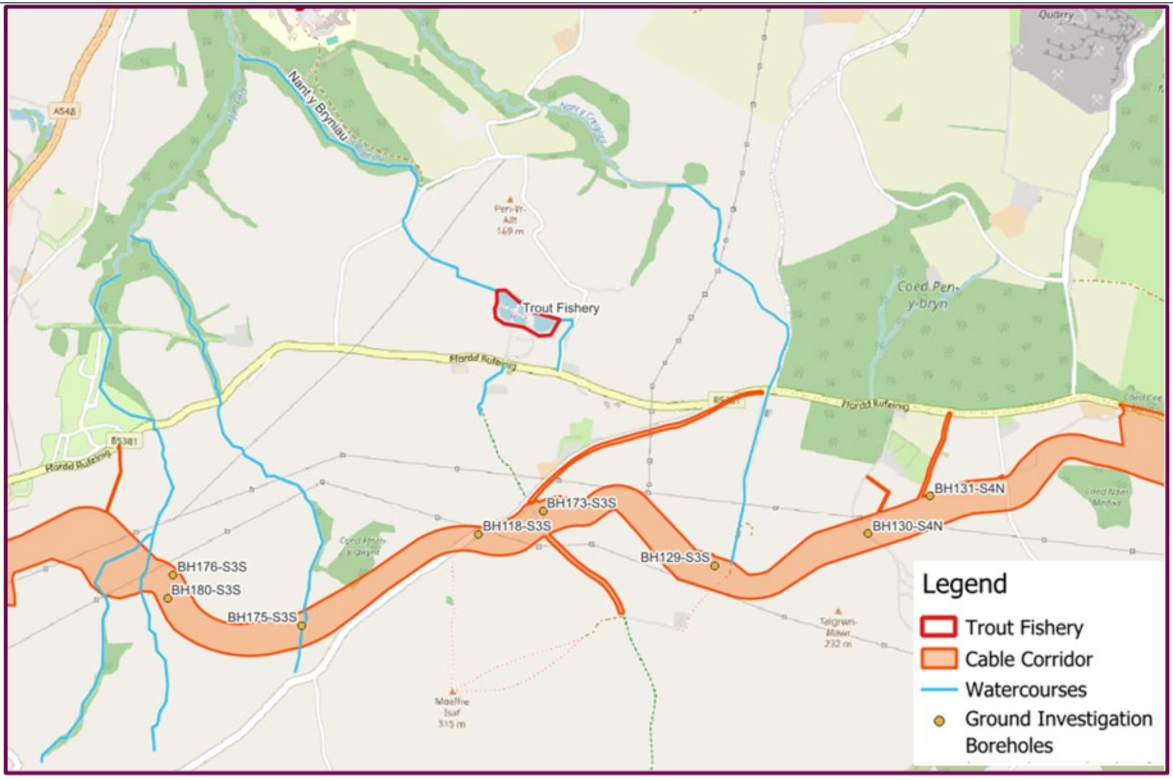

Figure 7: Site-specific investigation locations in the Onshore Cable Corridor

3.2.1.13 The key geological and hydrogeological observations from boreholes situated in the Onshore Cable Corridor closest to the Tan-y-Mynydd Trout Fishery and spring are summarised, from west to east, in **Table 4**. This information has been taken from the borehole logs (Appendix A) and photographs of drilling cores (Appendix B) produced as part of the Phase 2 of the Ground Investigation and dialogue with the contractor who managed the ground investigation.

3.2.1.14 The borehole records from across the Onshore Cable Corridor reflect the expected geology across Moelfre. The key findings from the ground investigation are as follows:

- Shallow geology within the Onshore Cable Corridor on the western flank of Moelfre Isaf and to the south of the Tan-y-Mynydd Trout Fishery (BH180 to BH173 inclusive) is dominated by what is interpreted as a 'disturbed mudstone' (comprising irregular clasts of bedrock in a cohesive matrix) or more massive mudstone exhibiting limited non-drilling inducted fracturing. These boreholes are located at a significantly higher elevation than the Fishery (55 m to 75 m higher). This section of the Onshore Cable Corridor is termed the Western/Central section.
- Shallow geology with the CRC on the eastern flank of Moelfre Isaf (BH129 to BH131 inclusive) is dominated by highly fractured sandstones and mudstones of the Elwy Formation, often including high angle fracture sets and bedding parallel fractures. These boreholes are located a greater lateral distance from the Trout Fishery (greater than 875 m) but generally located lower elevation, between 13 m and 57 m above the Fishery. The vertical height difference declining with greater distance from the Fishery. This section of the Onshore Cable Corridor is termed the Eastern section.
- Limited conclusive occurrence of glacial till.

Table 4: Summary of Ground Investigation Boreholes (from west to east)

**Shaded cells denote intrusive investigation located outside the theoretical groundwater catchment area for spring at the Fishery, hence are considered less critical to the HRA*

Direction from Fishery	Borehole reference	Ground Elevation (m AOD)	Distance from Fishery (m)	Depth to base (m)	Logged rock/soil type	Average depth to groundwater (m bgl)	Hydrogeological Observations	Presumed Unit	Groundwater Data in R1, R2, R3 Depth to GW (m bgl) GW Level (mAOD) Height of GW column (m)
West of Fishery	BH180	178.23	1320 to SW	20 Slotted 12m – 20m	**Gravel** to 17.50m bgl, then **breccia** to base.	1.67	Yellowy till at surface Till transitions into an apparently 'disturbed mudstone' [presumed Elwy Formation]. There are no fractures in the disturbed mudstone. The bedrock becomes more competent with depth, with breccia identified at 17.5m bgl. The breccia contains some horizontal fractures.	Till Elwy Fm mudstone (disturbed)	1.52, 1.80, 1.70 176.71, 176.43, 176.53 18.48, 18.2, 18.3
	BH176	179.83	1260 to SW	9 Slotted 1m – 9m	**Gravel**, **clay** and **silt**	4.50	Possible till which becomes grey, 'disturbed' mudstone at approximately 5 mbgl [presumed Elwy Formation].	Till Elwy Fm mudstone (disturbed)	4.57, 4.45, 4.47 175.25, 175.37, 175.36 4.43, 4.55, 4.43
	BH175	214.84	1135 to SW	10 Slotted 0.9m – 10m	Interbedded **gravel**, **clay**, **sand,** and **silt**	3.00	Although logs describe a 'gravel' core photos show what appears to be a grey, 'disturbed mudstone' comprising often large bedrock clasts in cohesive (silty) matrix. The concentration of clasts increases with depth. Given lithology, no evidence of significant groundwater pathways.	Presumed Elwy Fm mudstone (disturbed)	2.95, 3.01, 3.00 211.53, 211.83, 211.84 7.05, 6.99, 7.00
South of Fishery	BH118	242.72	660 to S	16 Slotted 1m – 16m	**Gravel** to 0.5m bgl, then **mudstone** and **siltstone**	2.89	Thin surface weathered horizon overlying a consolidated mudstone, with only limited fracturing. Fractures are mostly in the shallow depths and become **less common** with depth. Some fractures are high angle relative to bedding. Limited fracturing indicates limited pathways for groundwater.	Elwy Fm mudstone (limited fracturing)	Not sampled, 2.88, 2.90 N/A, 239.84, 239.82 N/A, 13.12, 13.10
	BH173	236.64	565 to S	8	**Gravel** to 0.7m bgl, then **clay** and **silt**	1.84	Dominated by dark grey clay containing bedrock fragments of variable size (often large). Clast sizes increase with depth. This could be a till but, as seen at BH175, is considered more likely to be a	Presumed Elwy Fm mudstone (disturbed)	1.98, 1.77, 1.77 234.66, 234.87, 234.87 6.02, 6.23, 6.23

Direction from Fishery	Borehole reference	Ground Elevation (m AOD)	Distance from Fishery (m)	Depth to base (m)	Logged rock/soil type	Average depth to groundwater (m bgl)	Hydrogeological Observations	Presumed Unit	Groundwater Data in R1, R2, R3 Depth to GW (m bgl) GW Level (mAOD) Height of GW column (m)
				Slotted 0.9m – 8m			"disturbed mudstone". Given lithology, no evidence of significant groundwater pathways. Possible some till at the surface given yellowish colour but does seem gradational with underlying units.	Possible till	
Southeast / East of Fishery	BH129	216.94	875 to SE	10 Slotted 4m – 10m	**Clay** and **gravel** to 5m bgl, then **sandstone** and siltstone	0.44	Generally grey, clay rich surface deposits. Overlies silty sandstone which is heavily fractured, with both shallow and high angle fractures. The slotted section covers the sandstone. Transitional into highly fractured mudstone (often at high angle) Potential groundwater pathways given groundwater levels and fracturing.	Fractured Elwy Fm sandstone and mudstone.	0.50, 0.42, 0.40 216.44, 216.52, 216.54 9.5, 9.58, 9.6
	BH130	207.21	1145 to SE	20 Slotted 1.9m – 20m	**Siltstone, mudstone** and **sandstone** to 8.2m bgl, then **mudstone**	13.75	Fractured sandstone which transitions into highly fractured mudstone at 8.2m bgl. The sandstone is heavily fractured, with shallow and high angle fractures. Assumed fractured sandstones and mudstones of the Elwy Formation. Potential groundwater pathways given groundwater levels and fracturing.	Elwy Fm mudstone and sandstone	12.80, 14.26, 14.20 194.41, 192.95, 193.01 7.2, 5.74, 5.8
	BH131	172.60	1255 to SE	16 Slotted 1m – 16m	**Clay** and **silt** to 6.4mbgl, then **mudstone**	6.00	Mudstone bedrock with high angle laminations and open fractures.	Elwy Fm mudstone	6.41, 5.61, 5.97 166.19, 166.99, 166.63 9.59, 10.39, 10.03

3.3 Local Hydrogeology

Aquifer units and mechanism of groundwater flow

3.3.1.1 The aquifer units present in the local area surrounding the site are summarised in **Table 5**. BGS aquifer descriptions are also provided, except for superficial aquifer units that are not described in the BGS memoir for the area. The aquifer designations have been allocated online (DEFRA, 2024). The following table has also been aided by information from Volume 3, Chapter 1: Geology, Hydrogeology and Ground Conditions (APP-064).

Table 5: Aquifer Designation

Formation	Rock Type	Thickness (m)	Aquifer Unit	BGS Description
Glacial Till	Unconsolidated clay, sand, gravel and boulders.	Variable	Secondary Undifferentiated	None
Elwy Formation	Sandstone	Unknown	Secondary (A)	Low productivity aquifer, with flow almost entirely through fractures.
Elwy Formation	Mudstone, siltstone and sandstone	Over 1,750m	Secondary (B): mudstone, siltstone, sandstone	Low productivity aquifer, with flow almost entirely through fractures. Highly indurated argillaceous rocks with limited groundwater.

3.3.1.2 The key observations are as follows:

- The mudstones that dominate the Elwy Formation form a poor aquifer unit (Secondary B), with groundwater flow restricted to the fracture network resulting in low permeability and poor yields.
- Sandstones units in the Elwy Formation, are also dominated by fracturing and can form more important groundwater bearing aquifer units (Secondary A).
- Glacial till is typically a cohesive material that forms poor aquifers except when dominated by granular material. However, the depth and composition of the till in the area between the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery is not known.

3.3.1.3 Groundwater transport in this Elwy Formation therefore occurs as fracture flow, as the intergranular porosity of this Formation is very low. Bedrock fracturing typically comprises a combination of:

- Shallow, bedding parallel fractures;
- High angle (often sub-vertical) fracture sets; and
- Large scale, laterally extensive, faulting / fault zones.

3.3.1.4 The extent and connectivity of such bedrock fracturing and faulting is dependent on many factors but in the local area is likely to be dominated by bedrock lithology (i.e. sandstone vs mudstone), geological structure (i.e. folding and regional faulting) and depth.

3.3.1.5 Bedding parallel fracturing is common in indurated bedrock including mudstones, although the density of such fracturing and lateral extent is highly variable. Small scale, high angle faulting is also common in such bedrock in the form of joint sets that can provide connection and hydraulic continuity to larger-scale fractures and/or fault zones.

3.3.1.6 The hydraulic behaviour of the large-scale bedrock faulting or fault zones can be highly variable. They can act preferential groundwater flow pathway allowing transport but can also act as barriers to flow if juxtaposing geological units of contrasting properties or the containing a low permeability infill.

3.3.1.7 Fracturing in mudstone bedrock is typically most intense at shallow depth, as fractures close with increasing overburden pressure (i.e. increasing depth). Fracture networks therefore provide highly complex, typically discontinuous pathways through low permeability bedrock. That said spring discharges can be common in such geological terrains and often provide important sources of water albeit small yields in rural areas. The reliability and flow rates achieved from such springs is dependent on the hydraulically connectivity between fractures and thence the catchment area that supports that spring. Typically, such connectivity is limited and catchment areas small, resulting in small discharges that may not be perennial in all years.

3.3.1.8 Glacial till in the area is unsorted clay, sand, silt and gravel, the clasts of which vary in size and shape and is designated a secondary (undifferentiated) aquifer. The till covers the area between the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery, although the thickness and composition of this till is not known. As a result, the hydrogeological behaviour of the till is also unknown. If it is locally thin and/or granular it can yield modest amounts of groundwater and will allow infiltration to the underlying bedrock (i.e. groundwater recharge). If it is thick and/or cohesive, it does not form a viable aquifer unit, it would promote surface water runoff and prevent recharge of the underlying bedrock.

Groundwater occurrence, levels and quality

3.3.1.9 The boreholes summarised in **Table 4** all identify the presence of shallow groundwater. The average depth to groundwater in the Elwy Formation was 4.39mbgl, ranging from 0.5mbgl to 14.3mbgl.

3.3.1.10 Groundwater levels within the boreholes in the western/central of the Onshore Cable Corridor (i.e. BH180 to BH173 inclusive) were relatively consistent ranging from 1.5mbgl to 4.8mbgl but typically being greater than 1.80mbgl in boreholes directly south of the Tan-y-Mynydd Trout Fishery. Although groundwater was present in those boreholes, the boreholes were not characterised by significant fracturing. There is no evidence of presence of important groundwater pathways or hydraulic continuity thereof along the western/central section of the Onshore Cable Corridor .

3.3.1.11 Groundwater levels in boreholes on the eastern flank of Moelfre Isaf (BH129 to BH131) were more variable, ranging between 0.5mbgl to 14.3mbgl. Those boreholes in the eastern section of the Onshore Cable Corridor were also characterised by significant fracturing (shallow and high angle). This is indicative of the presence of more groundwater pathways and the possibility of hydraulic continuity between fractures sets.

3.3.1.12 There was no firm evidence of regional faulting/fault zones in any of the boreholes in either section of the Onshore Cable Corridor.

3.3.1.13 Where present, the glacial till was generally thin and groundwater levels typically at depths below the base of the till.

3.3.1.14 Laboratory results from samples taken in July 2024 showed that groundwater in these units had a neutral or slightly acidic pH and low conductivity with low in metal concentrations. pH in all boreholes was around 7 and EC varied from 257 to 564 µS/cm. Some nitrate, sulphate and barium were present across all boreholes. This chemistry is entirely consistent with unevolved, rainfall dependent groundwater at shallow depth in a rural fractured hard rock aquifer with little calcareous content.

3.3.1.15 Full results of the chemical tests for boreholes considered in this report can be seen in Appendix C.

Groundwater recharge, continuity and catchment areas

3.3.1.16 Groundwater recharge to the fracture systems will be derived principally from either:

1. Infiltration of direct rainfall to shallow soils / weathered bedrock of the Elwy Formation mudstone or sandstone units and migration into discrete fractures where the bedrock is unconfined; or
2. Leakage from the overlying glacial till into the fracture network of underlying bedrock, especially where the till is granular and/or thin.

Groundwater receptors

3.3.1.17 The main receptor being considered in this report is the spring at Tan-y Mynydd Fishery. Other receptors include the Nant y Bryniau and the River Gele. Since the Fishery feeds the Nant y Bryniau, which is in turn a tributary of the River Gele, changes to the outflow of the spring could impact the levels in these rivers.

3.3.1.18 The other springs shown in **Figure 1** are also possible groundwater receptors, of which three are located at high elevations and one at a similar elevation to the Fishery. During the site walkover, the Spring 2 was not observed to be flowing. This is characteristic of high elevation shallow springs in this geological setting.

3.4 Hydrogeology of the Tan-y Mynydd Trout Fishery Spring

3.4.1 Spring discharge

3.4.1.1 The spring at the Tan-y Mynydd Trout Fishery is reported to be perennial. Although there is no flow data for the spring discharge, it is our understanding that the overflow from the Top Pond declines during the summer months and may even cease for a short period. The fact the that the spring discharge appears to respond quickly to normal seasonality, shows that despite the presence of concealing till across much of the catchment area, the system feeding the spring is still behaving like a shallow, unconfined aquifer.

3.4.1.2 The cessation of overflow from the Top Pond does not necessarily mean a cessation of discharge from the spring if water levels are maintained. The simplified water balance of the top pond can be described as follows:

Spring Discharge + Direct Precipitation + Direct Surface Runoff + Shallow Throughflow

=

Open-water evaporation + Abstraction + Overflow ± Change in Storage

3.4.1.3 During summer months when there is no overflow, if it is assumed that lake levels are maintained (with no direct rainfall, or abstraction, or runoff, or throughflow) the water balance simplifies to the following:

Spring Discharge = *Open-water evaporation*

3.4.1.4 The rate of open water evaporation is complex, relating to many factors to water and air temperatures, humidity, windspeed and cloud cover. Given the complexity of this relationship, the uncertainty of the calculation of open water evaporation and uncertainty of the behaviour of the pond (i.e. level variability), an estimate of minimum groundwater spring flow rates for summer months has not been provided at this stage.

3.4.2 Source of groundwater spring flow

3.4.2.1 The occurrence of a significant, potentially perennial spring discharge at such low elevation, in area that is concealed beneath glacial till is unusual and is uncommon such a geological setting.

3.4.2.2 The depth of the Top Pond (approximately 7m) strongly suggests that it is the fractured bedrock of the Elwy Formation is the source of groundwater discharged from the spring. It is considered most likely that the spring is fed from either fracturing and faulting of the mudstone bedrock of Elwy Formation or fracturing and natural permeability within the Elwy Formation sandstone.

3.4.2.3 To sustain a perennial flow from a fractured bedrock aquifer requires recharge across a sufficiently large catchment area of interconnected fractures within that bedrock. The fracture network must be sufficiently interconnected over a wide enough area to provide sufficient storage to sustain a perennial flow. Furthermore, that network must be sufficiently interconnected to provide a continuous pathway over large vertical and lateral distances. Given the Fishery is significantly lower in elevation relative to the Onshore Cable Corridor (typically between 45m and 70m), it is considered unlikely that the observed spring flow could be supported by shallow bedding parallel faulting alone and a complex three-dimensional fracture network appears to be required. Consideration must also be given to the potential that an alternative ‘high storage’ aquifer unit that could support the discharge.

3.4.2.4 Given the observed geological and hydrogeological setting, only a few possible mechanisms seem to have the potential to maintain the observed spring flows at the Tan-y-Mynydd Trout Fishery:

3. Regional faulting or fault zone that acts as a long groundwater pathway that drains an extensive and interconnected fracture network; or

4. Discharge from laterally extensive, more intensely fractured bedrock unit most notably the fractured sandstone or mudstone of the Elwy Formation; or
5. Granular glacial till or other granular superficial deposits nearer the Fishery itself providing significant recharge to bedrock fracture network, or directly supporting spring flow.

3.4.2.5 For the construction works proposed within the Onshore Cable Corridor to affect the spring discharge at the Tan-y-Mynydd Trout Fishery, those three mechanisms must provide a hydraulic pathway that connects the Onshore Cable Corridor with the Fishery.

Groundwater transport by regional faulting / fault zone and associated interconnected fracture network

3.4.2.6 It is possible that the spring at the Tan-y-Mynydd Trout Fishery represents the point of discharge from a regional scale, high-angle fault or fault zone. That type of faulting is shown on geological mapping although there the uncertainty in their location. That fault or fault zone must intercept sufficiently extensive system of fracture sets (i.e. high-angle and bedding-parallel), principally at shallow depth, to capture sufficient groundwater to sustain a perennial spring discharge even at times of extended low rainfall. That catchment area may include areas of unconfined exposed bedrock to the south and leakage to the confined / concealed bedrock from the overlying till. Given that topography falls northwards, that catchment area would likely extend southward from the Tan-y-Mynydd Trout Fishery in-line with regional faults that are orientated south-southeast to north-northwest.

Groundwater transport through highly fractured sandstone or mudstone units in the Elwy Formation

3.4.2.7 Groundwater could flow through the fracture network in the higher permeability sandstone units and./or more intensely fractured mudstone. It is possible that the Fishery is also underlain by these sandstones and is therefore being fed by groundwater from this unit. Since the Elwy Formation sandstones are more permeable than the Elwy Formation mudstones they are more able to transport the sufficient water required to sustain this perennial spring.

3.4.2.8 Sandstones were observed in BH129 and BH130 along the eastern section of the Onshore Cable Corridor. These boreholes are located a significant distance from the Fishery (greater than 875m) and at a significantly higher elevation. The sandstone was noted as being fractured in borehole records and is designated a Secondary (A) aquifer. This bedrock is also more permeable than the associated mudstones of the Elwy Formation. Given these observations this mechanism is considered more likely to support spring flow at the Tan-y-Mynydd Trout Fishery.

Groundwater from granular / high storage superficial aquifer units

3.4.2.9 In contrast to fractured bedrock, unconsolidated granular deposits (i.e. sands and gravels) are characterised by a high storage that can support perennial springs flows. Although fractured bedrock is the likely source of groundwater discharged at the spring, it cannot be entirely discounted that the spring is fed by granular superficial deposits. Most notably the drumlins to the north and northeast of the fishery, could support spring flow should they be granular in nature. In the absence of geological and hydrogeological data for the area north of the ponds this cannot be verified, however, given the Onshore Cable Corridor is located more than 500 m south of the ponds there is no way construction activities could affect the hydrogeology of those features. The possibility of the source of the spring being granular deposits to the north of the ponds has not therefore been considered further.

3.4.2.10 Given the extent of glacial till in the area between the fishery and the Onshore Cable Corridor it is possible that leakage through those deposits could contribute recharge to fractured bedrock if it is sufficiently granular.

3.4.3 Potential groundwater catchment area

3.4.3.1 It is not straightforward to determine groundwater catchment areas in fractured bedrock systems, especially if that aquifer system is concealed beneath glacial till. However, given the steep topography in this area the catchment area for the Tan-y-Mynydd Trout Fishery can be approximately by extending it to the unconfined outcrop around Moelfre Isaf where it has an elevation greater than the fishery and limiting its lateral extent to the course of key watercourses that rise on its flanks.

3.4.3.2 A schematic groundwater catchment area that includes the Tan-y-Mynydd Trout Fishery and Onshore Cable Corridor as shown in **Figure 8**. The catchment area also extends to the north, given the locally elevated topography relative to the fishery in that direction. The total potential catchment area shown in **Figure 8** exceeds 1.4 km^2 and includes exposed bedrock and bedrock shown to be concealed beneath glacial till. However, it is likely that the actual catchment area supporting spring flow at the Tan-y-Mynydd Trout Fishery, will be a smaller subset of this total catchment area, possibly of the order of 1km^2.

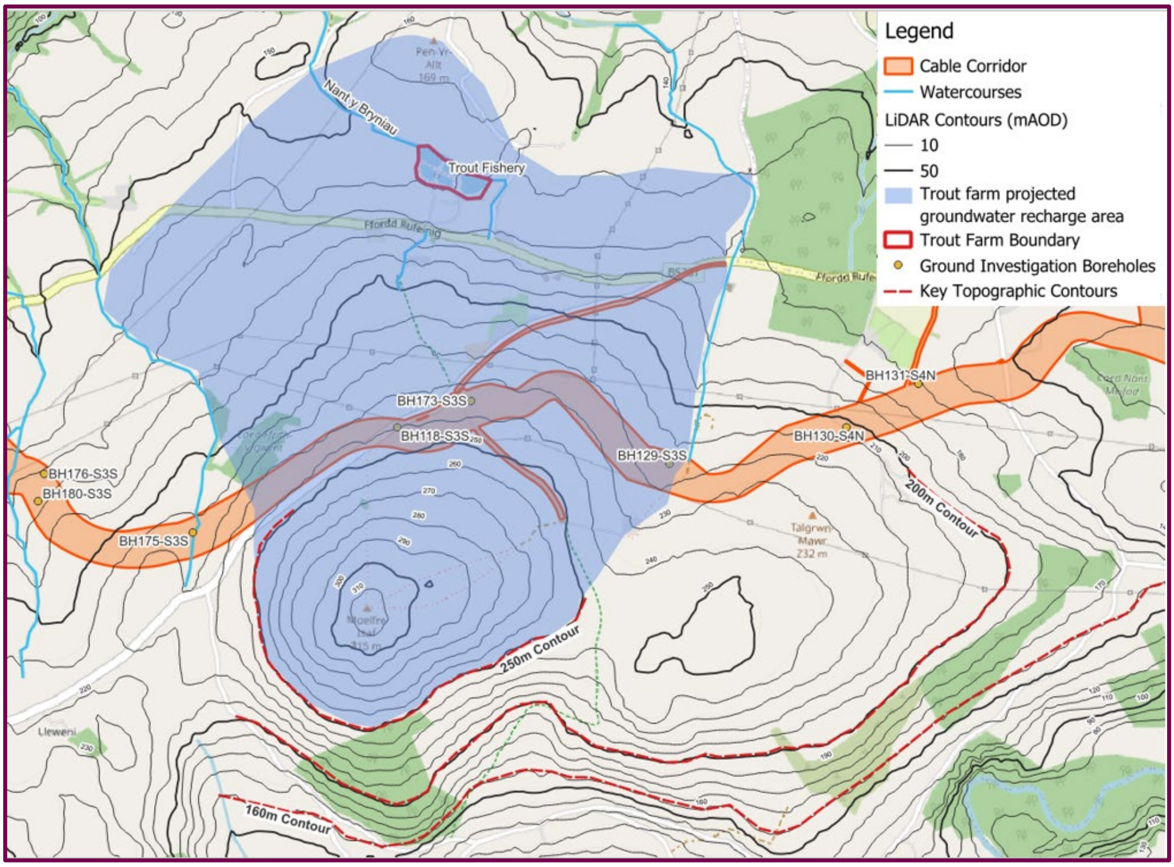

Figure 8: Schematic groundwater recharge catchment area, showing the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery

3.4.3.3 Given the extent of glacial till mapped in the area, it seems highly unlikely that bedrock does not receive some recharge through that unit.

3.5 Conceptual Hydrogeological Model

3.5.1.1 Based on the review of geology and hydrogeology a Conceptual Hydrogeological Conceptual (CHM) for the area including the Onshore Cable Corridor and the Tan-y-Mynydd Trout Fishery and has been developed. The two end member models introduced in **Section 3.4** models are presented in **Figure 9** and **Figure 10**.

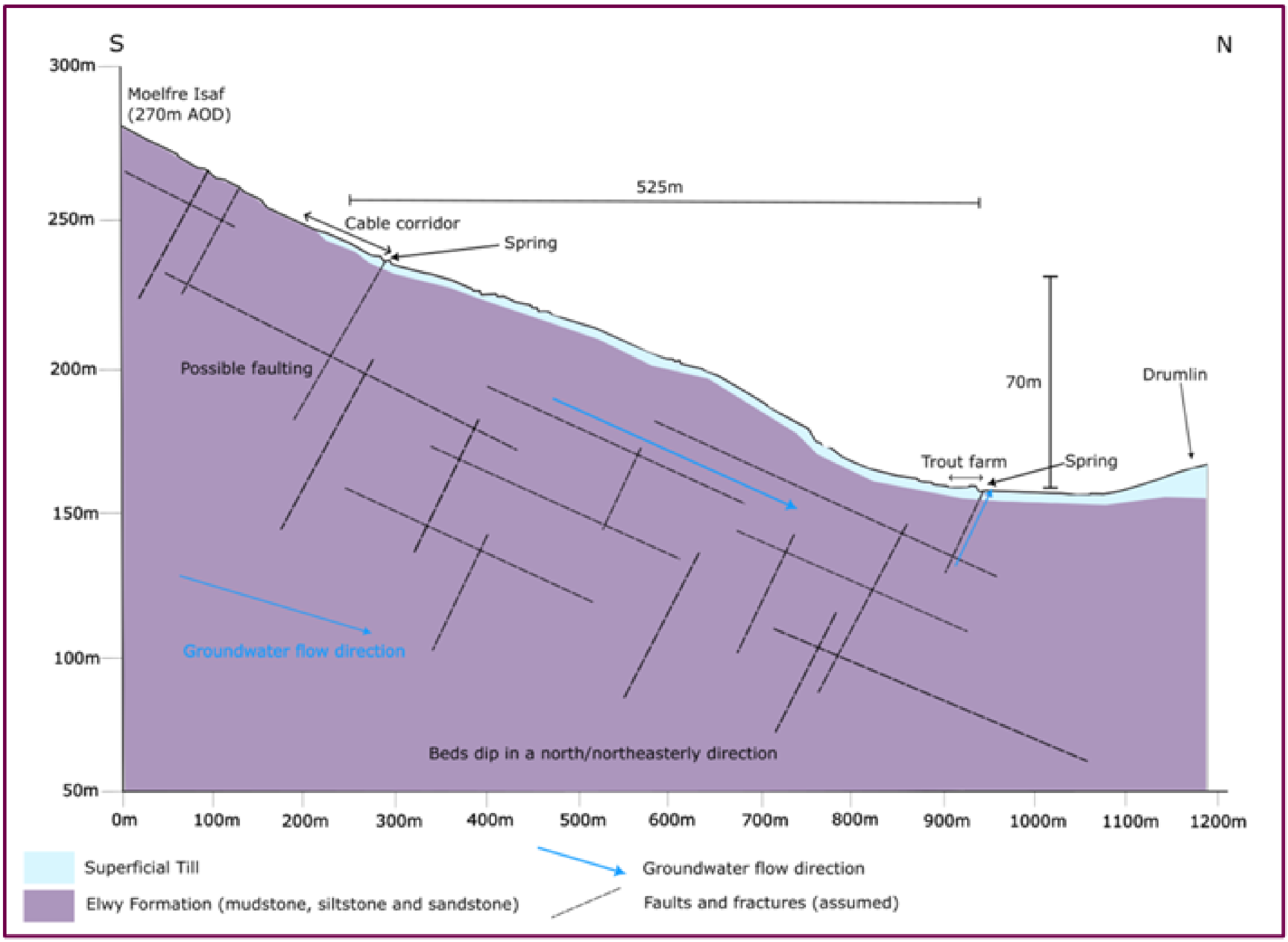

Figure 9: Conceptual Hydrogeological Model 1 – Regional Fault / Fault Zone

3.5.1.2 CHM 1 shown in **Figure 9** presents the regional faulting/fault zone and the associated interconnected fracture network. As with the geological conceptual model provided in **Figure 6**, the cross section does not give an impression of the large-scale regional faulting because those faults/fault zones extend from south to north in the plane of the cross section.

3.5.1.3 The results of the ground investigation undertaken within the Onshore Cable Corridor to the south of the Tan-y-Mynydd Trout Fishery provides no direct evidence for the presence of such large-scale major faulting. Although a potential mechanism that could explain the spring and provide a possible pathway to the Onshore Cable Corridor it seems improbable given the need for it to intercept a sufficiently dense fracture network to provide a perennial flow at the spring and sufficient interconnectivity to facilitate vertical transfer of water by up to 70 m.

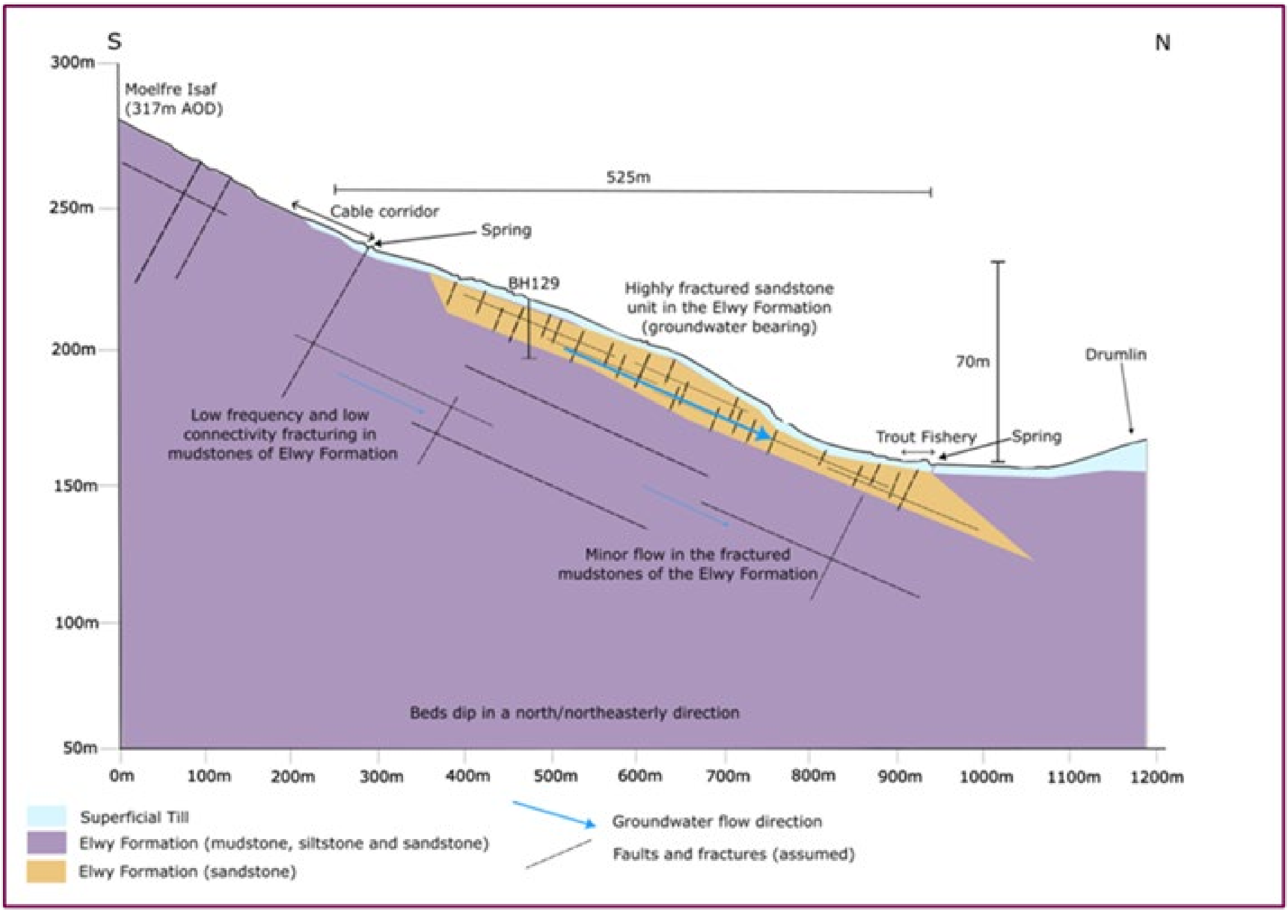

Figure 10: Conceptual Hydrogeological Model 2 – highly fractured sandstone or mudstone units in the Elwy Formation

3.5.1.4 CHM 2 presents a conceptual model for the presence of highly fractured sandstone and mudstones at shallow depth with Elwy Formation. That highly fractured unit is shown to be concealed beneath glacial till but could extend to areas where it is unconfined. This model seems to be more plausible than CHM1 given the following observations:

- The identification of intensely fractured sandstones and mudstones in boreholes within the eastern section of the Onshore Cable Corridor on the eastern side of Moelfre Isaf.
- The apparent lower elevation of these highly fractured units.
- The presence of groundwater in these highly fractured units, with the potential for significant groundwater flow compared to the mudstones in the Onshore Cable Corridor further to the west.
- These units could be recharged by infiltration through the glacial till.

3.5.1.5 Given the absence of evidence for CHM1, it seems more likely that the spring at the Fishery is fed by groundwater from a such a system. That in turn means that catchment area for the spring at the Tan-y-Mynydd Trout Fishery would extend more eastward, rather than directly southward from the Fishery.

4 HYDROGEOLOGICAL RISK ASSESSMENT

4.1 Proposed construction activities to be assessed

4.1.1.1 This risk assessment considers the potential effect that construction activities undertaken within the cable route corridor may have on the spring at the trout fishery, given the conceptual hydrogeological understanding of the system. The length area of the cable route corridor under consideration extends approximately. 2 km from BH175 to BH130 shown in **Figure 7**.

4.1.1.2 The construction activities to be undertaken within the Onshore Cable Corridor and their respective Maximum Design Scenario is summarised below and form the basis of this assessment. The Maximum Design Scenario is defined in Table 1.14 of Volume 3, Chapter 1: Geology, Hydrogeology and Ground Conditions (APP-064) summarised below and form the basis of this assessment.

- **Shallow cable trenching**
  - Up to four cable circuits to be trenched within the Onshore Cable Corridor
  - Cable trenches will be a maximum of 1.5 m wide at their base and 2.5 m wide at the surface
  - Trenches will be excavated to a depth of approximately 1.8 m
  - Dry excavations are required for cable emplacement so any groundwater ingress into the trenches will be pumped out and discharge to the local surface water drainage system
  - Trenches to be reinstated with the excavated material.
- **Joint Bays (JBs) and Link Boxes (LBs)**
  - Joint Bays (JBs) and Link Boxes (LBs) to installed in dry pits at intervals along the Onshore Cable Corridor.
  - JBs to be emplaced in excavations with a maximum depth of 2.0 m and surface area of 200 m^2 (equivalent to 14 m x 14 m).
  - LBs to be emplaced in excavations with a maximum depth of 1.0 m and surface area of 6m^2.
  - Dry excavations are required for JBs and LBs, so any groundwater ingress into the excavations will be pumped out and discharge to the local surface water drainage system.
  - Given the LBs are shallower and of smaller extent that the cable trenches themselves, only the JBs have been considered in the risk assessment.
  - JBs and LBs to be installed at 750 m to 1,750 m along the Onshore Cable Corridor . This implies no more the two will be installed within the approximate 2 km length of Onshore Cable Corridor under consideration.
  - Excavations to be reinstated with the excavated material.

- **Trenchless drilling techniques (Horizontal Directional Drilling or HDD) at crossings**
  - Duration of drilling approximately1 day
  - Drilling at a diameter of 1.4 m
  - Installation of ducting for cable circuits, with a bentonite / cement seal against bedrock.

4.1.1.3 Onshore export cables will be installed using open cut trenching will occur along the majority of the Onshore Cable Corridor except where trenchless techniques are proposed. The locations where trenchless techniques will be used to cross obstacles along the Onshore Cable Corridor are identified in Volume 5, Annex 5.3: Onshore Crossing Schedule (REP5-012). Six groups of crossings are located within the vicinity of the Tan-y-Mynydd Trout Fishery within a section of approximately 2km. These crossings are shown in **Figure 11** (Crossing Group C1 to C6) and correspond with the location of Phase 2 intrusive investigation boreholes installed within the Onshore Cable Corridor that are shown in **Figure 7**.

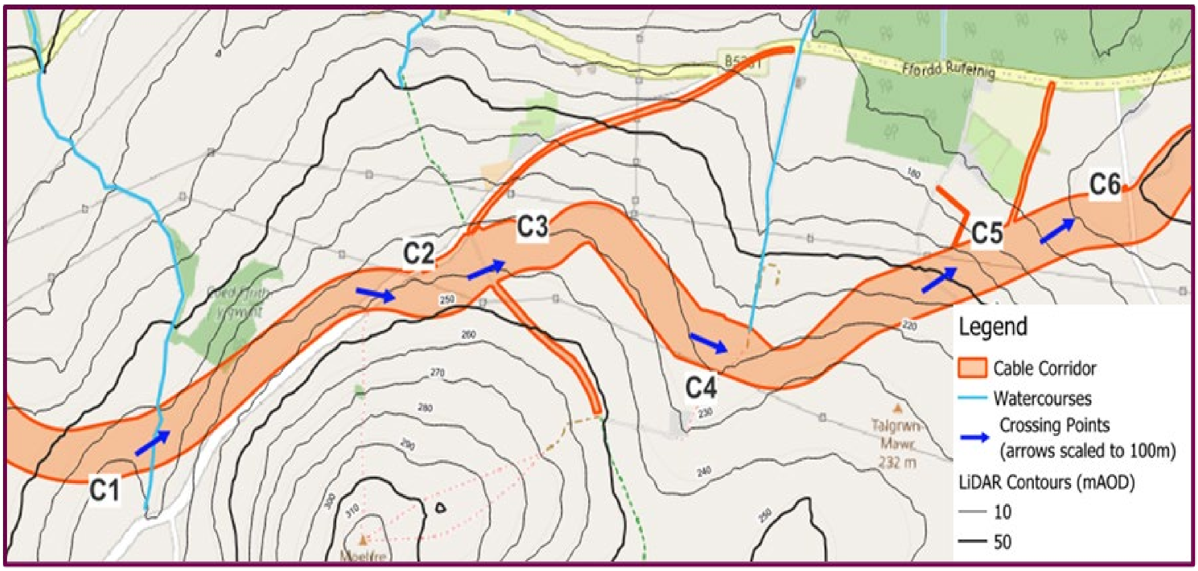

Figure 11: Groups of Crossing Points investigated for suitability of trenchless techniques

4.1.1.4 The groups of crossings identified in Figure 11 comprise the following crossing locations as shown in Volume 5, Annex 5.3: Onshore Crossing Schedule (REP5-012):

- Crossing Group 1:
  - 119
  - 120
  - 121
- Crossing Group 2:

  - 122
  - 123
  - 127
  - 128
  - 129
- Crossing Group 3:
  - 130
  - 131
- Crossing Group 4:
  - 99139
  - 100
  - 102
  - 103
- Crossing Group 5:
  - 137
  - 138
  - 139
  - 142
  - 167
  - 168
  - 169
- Crossing Group 6:
  - 147

4.1.1.5 The location of JBs and LBs will not be known until detailed design.

4.2 Potential effects to be assessed

4.2.1.1 The ass13essment has considered the potential risk to groundwater quality and spring discharge rate (i.e. flow) at the fishery that is posed by the proposed construction activities. The potential effects that have been considered with respect each of the activities listed above, are as follows:

- **Cable trenching**
  - Short-term reduction of groundwater flow due to temporary dewatering of trenches.
  - Effect on groundwater quality through accidental releasee / emissions of polluting materials.

  - Effect on groundwater quality through the ingress to surface water runoff from with the construction area.

- **Joint Bays (JBs) and Link Boxes (LBs)**
  - As for cable trenching.
  - Given LBs are shallower and of smaller extent that the cable trenches themselves, only the JBs have been considered in the risk assessment.
- **Trenchless drilling techniques (Horizontal Directional Drilling or HDD) at crossings**
  - Short term reduction in groundwater flow due to during drilling.
  - Long term reduction in groundwater flow due to completion installation of permanent ducting.
  - Effect on groundwater quality through accidental release / emissions of polluting material.

4.3 General approach for risk assessment

4.3.1.1 The risk assessment provides a largely qualitative assessment of risk to groundwater flow and groundwater spring at the Tan-y-Mynydd Trout Fishery, based on a conceptual hydrogeological model developed for the site. The qualitative assessment has been augmented by the results of the ground investigation and preliminary monitoring completed to date.

4.3.1.2 The risk assessment considers the likelihood of a pathway existing that could provide a hydraulic connection between the fishery and construction activities in the cable route corridor, based on the two endmember HCMs and observations within the cable route corridor. The likelihood a connection exists are as follows:

- No Pathway
- Unlikely
- Possible
- Highly Likely

4.3.1.3 The risk assessment then considers the likely severity that each effect may have on groundwater quality and groundwater spring flow at the fishery in terms of utility for its current purpose (i.e. to support of a trout fishery). The severity of consequence at the fishery used for the assessment are summarised in **Table 6**.

Table 6: Severity of consequence

Spring Characteristic	Description of Effect	Duration of Effect	Severity of Consequence if Pathway Exists
Discharge rate/flow	No change	-	Negligible
	Measurable flow reduction	Short term (construction phase)	Mild

Spring Characteristic	Description of Effect	Duration of Effect	Severity of Consequence if Pathway Exists
		Seasonal	Mild-moderate
		Permanent	Moderate
	Cessation of flow	Short term (construction phase)	Moderate-Severe
		Seasonal	Severe
		Permanent	Extreme
Quality	No change/ Not Measurable	-	Negligible
	Measurable change ins quality but still suitable for Trout Fishery	Short term (construction phase)	Mild
		Seasonal	Mild-moderate
		Permanent	Moderate
	Change in quality. No longer fit to support Trout Fishery	Short term (construction phase)	Moderate-Severe
		Seasonal	Severe
		Permanent	Extreme

4.3.1.4 The consideration of severity of outcome at the fishery is primarily based a consideration nature of the effects that can be expected in the immediate vicinity of the construction activity being considered. Based on those localised effects on groundwater the effect to the Fishery is evaluated, through consideration of the characteristics of the hydrogeological pathway connecting the fishery and construction area (i.e. CHM1 and CHM2). The incorporated mitigation measures implemented to control risk are included in the assessment and include the management plans and emergency response plans have been drafted and any additional measures that are identified through the risk assessment process.

4.3.1.5 The risk matrix provided **Table 7** in is then used to determine the overall risk classification for each of the activity evaluated.

Table 7: Matrix for determine risk classification for construction activities

		Severity of Consequences if Pathway Exists				
		Extreme	***Severe***	***Moderate***	***Mild***	***Negligible***
Probability that the Hydrological Pathway Exists	*Highly Likely*	Extreme Risk	Extreme Risk	Very High Risk	High Risk	**Moderate Risk**
	Likely	Extreme Risk	Very High Risk	High Risk	Moderate Risk	**Low Risk**
	Possible	Very High Risk	High Risk	Moderate Risk	Low Risk	**Very Low Risk**
	Unlikely	High Risk	Moderate Risk	Low Risk	Very Low Risk	**Very Low Risk**
	No Pathway	**Moderate Risk**	**Low Risk**	**Very Low Risk**	**Very Low Risk**	**No Risk**

4.3.1.6 The risk matrix, pathway criteria and consequence criteria presented above have been developed specifically for this hydrogeological risk assessment to reflect the receptor being considered. The matrix approach is based on the methodology set out in Volume 1 Chapter 5: Environmental Impact Assessment Methodology (APP-052) and guidance set out in Design Manual for Roads and Bridges (DMRB) LA104 (Highways England et al., 2020).

4.4 Result of the Risk Assessment

4.4.1.1 The detailed hydrogeological risk assessment is tabulated in Appendix D and summarised below.

Pathway

4.4.1.2 Along the western / central section of the Onshore Cable Corridor, the geological data for boreholes BH180 to BH173 provide no evidence of highly fractured sandstones or mudstones in the Elwy Formation (i.e. HCM2) and no evidence of regional scale faults or faults zones within the zone that construction activities will occur. Furthermore, the borehole information does not provide any indication of a dense fracture network and/or high interconnectivity of fractures in the more competent mudstones of the Elwy Formation where present. Given those observation the likelihood of a continuous pathway from the Onshore Cable Corridor to the spring on the fishery is considered unlikely.

4.4.1.3 Along the eastern section of the Onshore Cable Corridor the geological data for BH129 to BH131 does provide evidence of more highly fractured sandstone and mudstones of the Elwy Formation that is saturated with groundwater. Those units are located at shallow depth and lower topographic elevation relative to the western/central section, but at a significantly greater lateral distance from the Tan-y-Mynydd Trout Fishery. Given those observation the likelihood of a continuous pathway from the Onshore Cable Corridor to the spring on the Fishery is considered possible.

Severity of consequence and risk

Cable trenching – impact on spring flow at the Tan-y-Mynydd Trout Fishery

4.4.1.4 The groundwater level monitoring data shows that much of the cable trenching will occur above the water table in the bedrock and will require limited dewatering, especially in the western/central section of the Onshore Cable Corridor. The dewatering that is required will have a short-term temporary effect on local groundwater levels and recover once pumping has ceased and trenches will be reinstated with excavated material.

4.4.1.5 Given the small drawdown that will be required to reduce groundwater level and the temporary nature of this effect on local groundwater levels, trench dewatering is considered unlikely to have any effect on spring flow at the fishery in along the wester/central section and non-measurable effect on spring flow as a result of trenching the eastern section (severity of consequences is negligible). This gives dewatering for cable trenching a risk ranking of **very low risk** with respect the spring flow at the Tan-y-Mynydd Trout Fishery.

Cable trenching – impact on spring water quality at the Tan-y-Mynydd Trout Fishery

4.4.1.6 The accidental release of polluting substances to ground within the cable route corridor (most notably hydrocarbons used for fuel for construction equipment) could affect local groundwater quality, particularly if lost directly to excavations. Only a small proportion of any product lost to ground will have the potential to enter the dissolved phase and be transported through hydraulically continuous fracture network in the underlying bedrock aquifer. Most of the product lost to ground will either be retained within shallow soils or trapped within minor fractures in the shallow bedrock that have little hydraulic connectivity. The volume of hydrocarbons and other polluting substances potentially lost to groundwater will be minimised through the implementation of agreed management plans that control where the highest risky activities are undertaken (i.e. refuelling and storage) and define the necessary emergency response to any such release.

4.4.1.7 Given the size of the catchment area that is required to contribute flow to the springs at the Tan-y-Mynydd Trout Fishery and length and complexity of the connecting groundwater pathway, significant attenuation of pollutant concentrations will occur through dilution, dispersion, and dilution during groundwater flow through the bedrock. Although hydrocarbon fuel does contain some hazardous substances and non-hazardous pollutants that are eco-toxic, no measurable impact is expected at the spring at the fishery. The severity of consequence is therefore considered to be negligible. This indicates that accidental releases / emissions within both the western/central section and the eastern section of the cable route corridor represent a **very low risk** to the water quality at the spring at the Tan-y-Mynydd Trout Fishery.

4.4.1.8 Similarly, the uncontrolled loss of surface runoff from the construction areas into excavations could result introduce silt laden waters, that potentially contain low concentrations of metals and or hydrocarbons associated with construction vehicles, into the shallow fractured bedrock. This short-term temporary effect would be minimised through implementation of effective surface water management during construction. As with accidental releases this polluting substance, the potential for significant attenuation along the long and complex pathway, indicate that surface runoff within both the western/central and the eastern section of the cable route corridor has a severity of consequence is therefore considered to be negligible and therefore represent a **very low risk** to the quality at the spring at the Tan-y-Mynydd Trout Fishery.

Joint Bays (JBs) and Link Boxes (LBs) – impact on spring flow at the Tan-y-Mynydd Trout Fishery

4.4.1.9 Given the excavations required for LBs are shallower and of smaller extent that excavations for cable trenching, their potential effect on the spring flow at the fishery is incorporated with the assessment of cable trenching.

4.4.1.10 The JBs are to be placed in excavations that are marginally deeper than the cable trenches (2.0m vs 1.8m) and covering an area of approximately 200 m^2 (equivalent to 14m x 14m). Although the location of JBs is not yet defined, they are likely to be installed at two locations with the stretch of cable route corridor under consideration given their separation of between 750m and 1,750m. Given their small size and similar depth to cable trenching their impact during construction (i.e. dewatering) is considered to be effectively the same as for cable trenching. As such their installation in either the western/central section or eastern section is considered to have a severity of consequence that is negligible, and therefore representing a **very low risk** to spring flow at the Fishery.

4.4.1.11 Given the JBs could be permanent structures they do, in theory, have the potential to limit vertical recharge to underlying fracture network and locally reduce shallow lateral groundwater flow if significant, saturated and hydraulically connected fractures are intercepted/crossed. However, JBs cover a very small proportion of the total catchment area (<0.1%) and small proportion of the aquifer face perpendicular to possible groundwater flow (<1.4%). Given the size of the groundwater catchment area and the complexity of the fractured aquifer pathway (should it be present) their long-term effect on groundwater flow to the spring is considered have a severity of consequence that is negligible and therefore represent a **very low risk** to spring flow in at the Fishery in both the western/central and eastern section of the cable route corridor.

Joint Bays and Link Boxes – impact on spring water quality at the Tan-y-Mynydd Trout Fishery

4.4.1.12 Given the excavations required for LBs are shallower and of smaller extent that excavations for cable trenching, their potential effect on the spring water quality at the fishery is incorporated with the assessment of cable trenching.

4.4.1.13 Given the similarity in the nature of effect on local groundwater conditions, JBs and LBs are considered to represent the same risk as cable trenching with respect to contamination by accidental emission and surface runoff with thin the construction area. Within both the western/central and the eastern section of the cable route corridor the construction of JBs and LBs represent have negligible severity of consequence and therefore represent a **very low risk** to the water quality at the spring at the Tan-y-Mynydd Trout Fishery.

Trenchless techniques (HDD) for cable route – impact of spring flow at the Tan-y-Mynydd Trout Fishery

Short-term effects

4.4.1.14 Short-term groundwater dewatering within the fractured bedrock aquifer during HDD is considered likely to have a severity of consequence that is negligible in the eastern and western/central section of the Onshore cable Corridor. This primarily reflects the small and narrow length of sub water table HDD sections within the Onshore Cable Corridor , the short-term nature of the drilling effect (c. 2-days), the length and complexity of the groundwater flow pathway, and the large catchment area that is required to contribute to flow at the spring. Given these observations no measurable effect on spring flow is anticipated, giving a severity of consequence that is negligible. This indicates that in the eastern and western/central section of the Onshore Cable Corridor the overall risk to the spring flow at the Tan-y-Mynydd Trout Fishery is **very low**.

Long-term effects

4.4.1.15 Cable ducting installed during drilling will be permanently grouted in place during HDD. The emplacement of permanent sub water table cable ducts does have the to affect shallow lateral groundwater flow (typically < 5m) if significant, saturated, and hydraulically connected fractures be intercepted / crossed across the narrow (1.4m high) corridor of the ducting. In the absence of evidence of significant interconnected fracturing in the western/central section of the Onshore Cable Corridor and extensive, deep and complex fracture network required to be present, no impact at the spring at the Tan-y-Mynydd Trout Fishery is expected. The severity of consequence to spring flow is therefore negligible and the risk to Fishery considered to be **very low**.

4.4.1.16 Evidence of significant fracturing has been identified in the eastern section of the cable route corridor. It is noted at any pathway connecting the HDD sites and the Fishery is long and highly complex and the groundwater catchment area likely to large. Given that fracturing will only be affected over short, narrow corridors of sub water table bedrock, no measurable impact on spring flow is predicted and the risk to the Tan-y-Mynydd Trout Fishery is considered to be **very low**.

Trenchless techniques (HDD) for cable route – impacts of spring quality at the Tan-y-Mynydd Trout Fishery

4.4.1.17 The loss of grout or drilling fluids during HDD could affect local groundwater quality. The loss of such materials will be controlled through monitoring and mitigation actions that will defined in the method statement for HDD. Given the length and complexity of the fracture network required to provide and connection between the cable route corridor and the Fisher and the large size of the groundwater catchment area that is also required, no measurable effect is anticipated at the spring. The severity of consequence is therefore considered to be **negligible** and the risk to spring flow at the Fishery conceded very low in the eastern and western/central section of the Onshore Cable Corridor.

5 RISK MANAGEMENT MEASURES

5.1.1.1 Based on the conceptual understanding of the hydrogeological site setting, the HRA has concluded that construction activities for the onshore transmission assets for the Mona Offshore Wind Project represent a low risk to the interests of the Fishery. Commensurate with this perceived level of risk, a monitoring strategy is recommended for the construction phase. That monitoring strategy has the following objectives:

- Demonstrate that effects of construction activities on the groundwater environment within the Onshore Cable Corridor are, as predicted, small, localised and temporary in nature; and
- Provide reassurance and confidence of the absence of significant change at the fishery itself in terms of spring water quality and spring flow.

5.1.1.2 Although the scope of the monitoring strategy will be finalised and agreed following detailed design it is expected to include:

- Monitoring of boreholes (levels and quality) situated near (immediately downgradient of) construction activities within the Onshore Cable Corridor
- Monitoring of spring water quality on the Tan-y-Mynydd Trout Fishery through sampling of the spring chamber
- Demonstration of continued overflow, hence groundwater discharge, from the top pond.

5.1.1.3 A period of baseline data collection will be required in advance of the construction phase commencing. That baseline period should capture the seasonal range of groundwater conditions, most notably the summer and autumn conditions when groundwater recharge is low, evaporation from the ponds can be high and groundwater spring flow typically at its lowest. The final duration of monitoring shall also be defined and agreed following detailed design.

6 SUMMARY

6.1.1.1 The construction of onshore elements of the Mona Offshore Wind Project have the potential to affect groundwater in terms of its quality, water levels, and groundwater throughflow. These activities therefore have the potential to affect groundwater dependent receptors that are situated in a down gradient position from those construction activities if they are within their groundwater catchment area. The significance of those effects is largely dependent on the magnitude and duration of the construction effects on groundwater; the presence and nature of a groundwater pathway that connects the construction area with the receptor; and the total size of the groundwater catchment area that supports the receptor.

6.1.1.2 The risk posed by construction activities to the spring fed lake system at the Tan-y Mynydd Trout Fishery has therefore been assessed. The risk assessment was based on a review of available geological and hydrogeological information augmented by the results of an intrusive ground investigation and associated preliminary groundwater monitoring within the Mona Onshore Cable Corridor. Those works have included the drilling and logging of eight boreholes within the Onshore Cable Corridor up-gradient from the fishery and results of three preliminary rounds of groundwater monitoring that included the measurement of groundwater levels and groundwater quality.

6.1.1.3 The ponds at the fishery are fed by a single spring that discharges groundwater into the easternmost ‘top pond’. A significant perennial discharge from that spring is reported, which sustains water levels and presumed water quality in the top pond. There is an overflow from the top pond into the small watercourse running along the northern side of the ponds. That water can be diverted into the other ponds which are located at a notably lower significantly elevation. The series of ponds at the fishery ultimately discharge into Nant y Bryniau through the overflow on the northwestern pond.

6.1.1.4 The fractured bedrock of the Elwy Formation that underlies the entire area is considered the most likely source of groundwater discharged at the spring on the Fishery. That fractured aquifer will be recharged by infiltration through the overlying glacial till and infiltration across the unconfined outcrop of the bedrock. This implies a large catchment area is required for the spring, possibly in excess of 1km^2.

6.1.1.5 It is theoretically possible that the local area of high ground situated immediately to the north and northwest of the fishery could support a perennial spring flow if composed of granular glacial material. However, this possible source of groundwater has not been considered given it is located to the north of fishery and is therefore unaffected by proposed construction activities.

6.1.1.6 Although a significant flow of groundwater, over long distances, is unusual for fractured mudstone aquifers in this geological setting, two end-member mechanisms have been identified that could potentially provide a groundwater pathway linking the construction areas in the Onshore Cable Corridor with the spring at the Tan-y-Mynydd Trout Fishery:

- Groundwater transport through a large-scale regional fault / fault zone and an associated interconnected fracture network in the mudstones Elwy Formation.
- Groundwater transport in a shallow, more highly fractured and locally extensive sandstone or mudstone unit(s) in the Elwy Formation.

6.1.1.7 Given the nature of fractured bedrock aquifer these pathways (especially the former) are extremely difficult to demonstrate conclusively or map.

6.1.1.8 The results of the intrusive ground investigation have shown little or no evidence of major faults / fault zones, although that is not entirely unsurprising giving the limited lateral extent of such high angle systems. The ground investigation has shown to the western and central sections of Onshore Cable Corridor (to the south and southwest of the Tan-y-Mynydd Trout Fishery) the presence of either a presumed 'disturbed mudstone' or mudstone exhibiting limited fracturing. Both units are considered to be of the Elwy Formation and imply little fracturing and little fracture connectivity in that area across the depth that construction activities will occur. The presence of more highly fractured, groundwater bearing, sandstones and mudstones of the Elwy Formation have however been identified at lower elevation on the eastern flank of the Moelfre Isaf. Those fractured units are situated at shallow depth and at an elevation that is closer to the elevation of the Fishery, albeit still 47 m to 57 m above ground level thereon. If laterally extensive, these units fractured units are considered a more likely pathway that could provide a source of groundwater that could support spring flow at the Tan-y-Mynydd Trout Fishery. This network fracture network would have to be extensive and would likely receive some recharge through the glacial till that is shown to overlie it over large areas.

6.1.1.9 The risk assessment has considered the possible effect that cable trenching, the construction of joint bays and link boxes, and trenchless techniques for cabling (i.e. horizontal directional drilling) at crossing points within the cable route corridor may have on the spring at the Tan-y-Mynydd Trout Fishery in terms of its quality and flow. The risk assessment has also considered possible construction effects on the watercourse that flows northwards off the steep side of Moelfre Isaf and passes around the southern and western boundary of the fishery. Flow in that watercourse can diverted to top up the southern ponds at the fishery.

6.1.1.10 Possible construction effects considered therefore include: temporary lowering of groundwater levels and reduction of infiltration to groundwater in dewatered excavations; the ingress of contaminated water to ground through accidental releases and/or uncontrolled surface water runoff into excavation trenches or to surface watercourses; the reduction in flow in surface watercourses due to dewatering activities; and longer term dewatering effects and/or barriers to groundwater lateral flow caused by subsurface horizontal directional drilling techniques and cable installation.

6.1.1.11 The risk assessment considers that construction effects represent a low risk to the spring in terms of its water quality and flow given the following observations:

- The large lateral distance (greater than 525m) and significant vertical height difference (up to 70m) between the Onshore Cable Corridor and the

Fishery, considering that the groundwater pathway is dependent on an interconnected fractures system at shallow depth within a low permeability bedrock

- The small areal extent of construction the area relative to the large size of the groundwater catchment area required to support a perennial spring flow at the Fishery and to provide a groundwater pathway that could potentially connect the cable route corridor with the fishery
- The small and temporary nature of most construction effects considered
- The effective implementation of surface water and pollution control management measure during the construction phase.

6.1.1.12 Given the low risk that construction activities represent to the spring at the Tan-y-Mynydd Trout Fishery, a monitoring strategy has been proposed for the construction phase. The objective of that monitoring strategy is twofold: to demonstrate that the local impact of construction activities on the groundwater environment within the Onshore Cable Corridor is, as predicted, small and temporary; and to confirm the absence of significant change at the Tan-y-Mynydd Trout Fishery itself.

6.1.1.13 Although the scope of the monitoring strategy is to be finalised following detailed design it is expected to include:

- Monitoring of boreholes (levels and quality) situated near (immediately downgradient of) construction activities within the Onshore Cable Corridor.
- Monitoring of spring water quality on the fishery through sampling of the spring chamber; and
- Demonstration of continued overflow, hence groundwater discharge, from the top pond.

6.1.1.14 A period of baseline data collection will be required in advance of the construction phase commencing. That baseline period should capture the seasonal range of groundwater conditions, most notably the summer and autumn conditions when groundwater recharge is low, evaporation from the ponds can be high and groundwater spring flow typically at its lowest. The final duration of monitoring shall also be defined and agreed following detailed design.

6.1.1.15 The commitments to undertake groundwater monitoring is captured in the Outline Construction Surface Water and Drainage Management Plan (J26.6 F03) and the design of the monitoring strategy will be provided in the final Construction Surface Water and Drainage Management Plan that will be agreed with the relevant planning authority.

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A.1. APPENDIX A: BOREHOLE LOGS (GROUND INVESTIGATION REPORT)

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Start Date:	18/04/2024	Checked:	AH
End Date:	24/04/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 1.20	Inspection Pit	Hand Tools
1.20 - 2.00	Dynamic Sampling	Geo 205
2.00 - 12.00	Rotary Coring	Geo 205

Location ID

BH106-S2

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**292907.12**	Northing:	**374903.05**
Elevation:	**138.49mAOD**	Final Depth:	**12.00m**
Logged By:	**MC**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)
Light brown to greyish brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL of mudstone and limestone with low cobble content. Sand is fine to coarse. Cobbles are subrounded of limestone.	(0.60) 0.60	137.89
Medium dense light brown and greyish brown slightly clayey very sandy subrounded fine to coarse mudstone and limestone GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded limestone.	(1.20) 1.20	137.29
Medium dense light yellowish brown and greyish brown very sandy angular to subangular fine to coarse GRAVEL of mudstone and limestone with low to medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular mudstone.	(0.80) 2.00	136.49
Medium dense becoming dense yellowish brown clayey very sandy subangular medium to coarse GRAVEL of mudstone and limestone with low to medium cobble content. Sand is fine to coarse. Cobbles are subangular mudstone and limestone. *From 2.00m to 4.90m, Limited recovery.*	(2.00) 4.00	134.49
Medium dense becoming dense yellowish brown slightly sandy subangular fine to coarse GRAVEL of mudstone and limestone with high cobble content. Sand is fine to coarse. Cobbles are subangular mudstone and limestone.	(0.90) 4.90	133.59
Medium strong to strong thickly laminated to thickly bedded dark grey moderately weathered MUDSTONE. Discontinuities are 1) Subvertical 80-90 Deg closely to medium spaced undulating rough open with occasional silty clay infill. 2) Subhorizontal 40-45 Deg extremely closely to medium spaced planar rough to undulating tight to partly open. *From 5.00m to 5.20m, Non-intact core.*	(1.10) 6.00	132.49
Medium strong thickly laminated to thickly bedded dark grey moderately weathered MUDSTONE. Non-intact core recovered as angular to rounded fine to coarse GRAVEL.	(0.75) 6.75	131.74
Medium strong thickly laminated to thickly bedded dark grey moderately weathered MUDSTONE. Discontinuities are 1) Subvertical 80-90 Deg closely to widely spaced undulating rough open with occasional silty clay infill. 2) Subhorizontal 40-45 Deg extremely closely to widely spaced planar rough to undulating tight to partly open.	(0.75) 7.50	130.99
Medium strong locally weak thickly laminated to thickly bedded dark grey slightly weathered MUDSTONE. Discontinuities are 40-45 Deg undulating rough partly open to open with frequent clay infill. *From 8.12m to 8.25m, Joint fracture 30 Deg undulating rough partly open with brown staining and light silty film infill.* *From 9.18m to 9.31m, Joint fracture 50-60 Deg planar rough partly open with dark grey staining and clay infill.* *9.20-9.40m: Strong.*	(4.50)	

Hole Ø (mm) / Depth (m):
Casing Ø (mm) / Depth (m): 143 / 6.50

Coring, Samples & Testing

Core Run	TCR	SCR	RQD
2.00 3.00	40	0	0
3.00 4.00	40	0	0
4.00 5.00	30	0	0
5.00 6.00	85	38	32
6.00 7.50	86	31	20
7.50 9.00	98	76	47
9.00 10.00	96	79	50

If: 2; NI; 4; NI; 14

Depth (m)	Ref	Test Results
0.00 - 0.30	1 B	
0.10	1 ES	
0.10	2 ES	
0.10	ES1 ES	
0.60	2 ES	
0.60	3 ES	
0.60	ES2 ES	
1.00 - 1.20	2 B	
1.10	3 ES	
1.20 - 1.30	4 D	SPT(S) 1.20m, N=10 (1,1/2,2,3,3)
1.30 - 1.90	5 B	
1.90 - 2.00	3 D	
2.00 - 2.90	6 B	SPT(S) 2.00m, N=30 (6,6/7,7,8,8)
2.65	ES1 EW	
2.90 - 3.00	5 D	
2.90 - 3.00	5 ES	SPT(C) 3.00m, N=33 (7,8/7,8,10,8)
3.00 - 3.80	8 B	
3.90 - 4.00	7 D	
4.00 - 4.80	10 B	SPT(S) 4.00m, N=22 (3,3/4,6,6,6)
4.90 - 5.00	9 D	
4.90 - 5.00	9 ES	
5.26 - 5.48	11 C	
7.50 - 7.76	12 C	
9.20 - 9.40	13 C	
9.60 - 9.70	14 C	

Continued on Next Page

Observations / Remarks

1) PAS survey cleared on 09.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
18/04	06:00	0.00	-	Dry
18/04	16:00	0.60	-	Dry
22/04	04:30	0.60	-	Dry
22/04	16:30	4.00	3.00	2.50
23/04	07:00	4.00	3.00	2.70
23/04	17:00	10.00	6.50	Dry
24/04	08:00	10.00	6.50	Dry
24/04	12:00	12.00	6.50	Dry

Backfill

From (m)	To (m)	Material
0.00	0.50	Bentonite
0.50	5.00	Gravel
5.00	12.00	Bentonite

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	0.50 - 5.00	5.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
2.00 - 3.00	Water	Light Brown	100
3.00 - 4.00	Water	Light Brown	75
4.00 - 5.00	Water	Yellow	75

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Start Date:	18/04/2024	Checked:	AH
End Date:	24/04/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 1.20	Inspection Pit	Hand Tools
1.20 - 2.00	Dynamic Sampling	Geo 205
2.00 - 12.00	Rotary Coring	Geo 205

Location ID

BH106-S2

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 2 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**292907.12**	Northing:	**374903.05**
Elevation:	**138.49mAOD**	Final Depth:	**12.00m**
Logged By:	**MC**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Legend	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)	Installation / Backfill
Medium strong locally weak thickly laminated to thickly bedded dark grey slightly weathered MUDSTONE. Discontinuities are 40-45 Deg undulating rough partly open to open with frequent clay infill. *From 10.56m to 10.60m, Joint fracture 130-140 Deg planar smooth open with clay infill.* *From 10.71m to 10.93m, 2 No. joint fractures 120-130 Deg undulating rough with occasional clay infill.* *At 11.20m, Slump folded texture showing light grey silty inclusions.* *From 11.30m to 11.44m, Joint fracture 50-60 Deg undulating rough with brown surface staining and silty infill.* *From 11.47m to 11.53m, Non-intact core.* *From 11.67m to 11.97m, Closed to tight part fractured core with vertical fracture 70-80 Deg undulating rough with brown staining and clayey silt infill.* *From 11.67m to 12.00m, Relict mineralised fractures <1mm*	▤	12.00	126.49	121 12.00			■
EOH at 12.00m - Scheduled Depth							

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If	Depth (m)	Ref	Test Results
10.00 11.00	85	66	20				
					11.10 - 11.21	15 C	
11.00 12.00	100	70	39	NI	11.40 - 11.50	16 C	
				2			

Observations / Remarks

1) PAS survey cleared on 09.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
18/04	06:00	0.00	-	Dry
18/04	16:00	0.60	-	Dry
22/04	04:30	0.60	-	Dry
22/04	16:30	4.00	3.00	2.50
23/04	07:00	4.00	3.00	2.70
23/04	17:00	10.00	6.50	Dry
24/04	08:00	10.00	6.50	Dry
24/04	12:00	12.00	6.50	Dry

Backfill

From (m)	To (m)	Material
0.00	0.50	Bentonite
0.50	5.00	Gravel
5.00	12.00	Bentonite

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	0.50 - 5.00	5.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
2.00 - 3.00	Water	Light Brown	100
3.00 - 4.00	Water	Light Brown	75
4.00 - 5.00	Water	Yellow	75

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Start Date:	21/05/2024	Checked:	AH
End Date:	28/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.50	Inspection Pit	Hand Tools
0.50 - 1.00	Dynamic Sampling	Geo 205
1.00 - 16.00	Rotary Coring	Geo 205

Location ID

BH118-S3S

DRAFT

Log Type

Rotary Coring

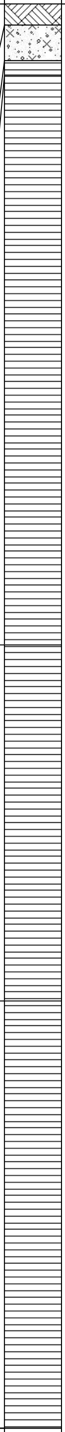
Scale: 1:50

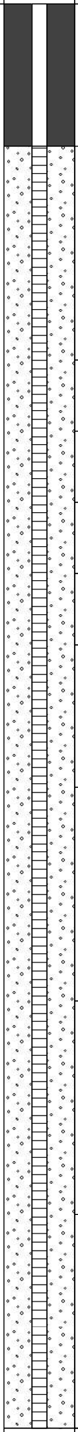
Sheet 1 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**295211.29**	Northing:	**373832.31**
Elevation:	**242.72mAOD**	Final Depth:	**16.00m**
Logged By:	**IS+MB**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**





Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)
Grass over soft brown slightly gravelly slightly clayey sandy SILT with frequent rootlets. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of mudstone. [TOPSOIL]	(0.15) 0.15	242.57			
Orangish brown silty very sandy angular to subrounded fine to coarse GRAVEL of mudstone and limestone. Sand is fine to coarse.	(0.25) 0.40	242.32			
Very weak grey MUDSTONE recovered as angular fine to coarse GRAVEL of mudstone.	(0.10) 0.50	242.22			
Very weak very thickly bedded dark greenish grey MUDSTONE & SILTSTONE. *From 0.50m to 4.50m, Recovery shows highly weathered non-intact fragments which show dark brown discolouration on surfaces. ~Fragments show planar smooth joint fracture surfaces. Recovery occasionally shows a light yellowish brown clay.* *From 3.00m to 3.50m, Residual soil with recovery as silty sandy gravel.* *From 3.50m to 4.00m, Non-intact core.* *From 4.00m to 4.50m, Non-intact, recovered as cobbles.*	(4.00) 4.50	238.22		143 3.00	
Very weak to weak very thickly bedded dark greenish grey MUDSTONE & SILTSTONE. Discontinuities are 1) 40-50 Deg widely spaced undulating rough to planar smooth open with brown surface staining. 2) Subvertical 70-90 Deg very closely to closely spaced undulating rough to planar smooth open with clay infill. *From 4.90m to 5.10m, Non-intact highly fractured zone.* *From 6.75m to 6.85m, Non-intact, recovered as gravel with brown staining.*	(2.50) 7.00	235.72			
Weak to moderately weak very thickly bedded dark greenish grey MUDSTONE & SILTSTONE. Discontinuities are 1) 50-70 Deg very closely to closely spaced planar smooth open with dark brown surface staining and occasional clay infill. 2) 40-50 Deg closely to medium spaced planar rough open with brown surface staining and occasional clay infill. *From 9.04m to 9.64m, Non-intact, recovered as gravel with brown staining along fracture surfaces.*					

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If
1.00 2.50	73	9	0	NI
2.50 3.00	10	0	0	
3.00 3.50	70	10	0	
3.50 4.00	100	0	0	
4.00 4.50	60	0	0	
4.50 5.50	100	60	0	1
5.50 7.00	73	55	0	
7.00 8.50	100	85	33	
8.50 10.00	100	85	11	

Depth (m)	Ref	Test Results
0.00 - 0.10	1 B	
0.10	1 ES	
0.10	ES1 ES	
0.20 - 0.40	2 B	
0.30	2 ES	
0.30	ES2 ES	SPT(C) 0.50m, 50 (25 for 75mm/50 for 75mm)
0.50 - 0.60	8 D	
0.50 - 0.60	8 ES	
4.00 - 4.50	9 D	
4.00 - 4.50	9 ES	
4.12	ES1 EW	
7.10 - 7.40	5 C	
9.80 - 10.00	6 C	
10.00 - 10.20	10 D	

Continued on Next Page

Observations / Remarks

PAS survey cleared on 10/04/24

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
21/05	08:00	0.00	-	Dry
21/05	16:00	1.00	-	Dry
22/05	08:00	1.00	-	Dry
22/05	16:00	5.50	3.00	Dry
23/05	08:00	5.50	3.00	Dry
23/05	16:00	13.00	3.00	Dry
24/05	08:00	13.00	3.00	Dry
24/05	16:00	16.00	3.00	Dry

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	16.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 16.00	16.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
1.00 - 2.50	Water	Brown	80
2.50 - 3.00	Water	Brown	100
3.00 - 3.50	Water	Brown	100

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Start Date:	21/05/2024	Checked:	AH
End Date:	28/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.50	Inspection Pit	Hand Tools
0.50 - 1.00	Dynamic Sampling	Geo 205
1.00 - 16.00	Rotary Coring	Geo 205

Location ID

BH118-S3S

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 2 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**295211.29**	Northing:	**373832.31**
Elevation:	**242.72mAOD**	Final Depth:	**16.00m**
Logged By:	**IS+MB**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Legend	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)	Installation / Backfill	Core Run	TCR	SCR	RQD	If	Depth (m)	Ref	Test Results
Weak to moderately weak very thickly bedded dark greenish grey MUDSTONE & SILTSTONE. Discontinuities are 1) 50-70 Deg very closely to closely spaced planar smooth open with dark brown surface staining and occasional clay infill. 2) 40-50 Deg closely to medium spaced planar rough open with brown surface staining and occasional clay infill.								10.00 11.50	96	87	35				
		(9.00)													
								11.50 13.00	100	87	36		11.80 - 12.10	12 C	
												12			
								13.00 14.50	100	80	25		13.95 - 14.20	13 C	
From 15.25m to 15.48m, 2 No. closed to tight fractures - 50-70 Deg joint set.								14.50 16.00	100	70	27		15.60 15.70 - 16.00	11 D 14 C	
EOH at 16.00m - Scheduled Depth		16.00	226.72	121 16.00											

Observations / Remarks

PAS survey cleared on 10/04/24

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
21/05	08:00	0.00	-	Dry
21/05	16:00	1.00	-	Dry
22/05	08:00	1.00	-	Dry
22/05	16:00	5.50	3.00	Dry
23/05	08:00	5.50	3.00	Dry
23/05	16:00	13.00	3.00	Dry
24/05	08:00	13.00	3.00	Dry
24/05	16:00	16.00	3.00	Dry

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	16.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 16.00	16.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
1.00 - 2.50	Water	Brown	80
2.50 - 3.00	Water	Brown	100
3.00 - 3.50	Water	Brown	100

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Start Date:	04/06/2024	Checked:	AH
End Date:	05/06/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.50	Inspection Pit	Hand Tools
0.50 - 3.00	Dynamic Sampling	Geo 205
3.00 - 10.00	Rotary Coring	Geo 205

Location ID

BH129-S3N/S

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 1

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**295932.96**	Northing:	**373736.19**
Elevation:	**216.94mAOD**	Final Depth:	**10.00m**
Logged By:	**MB+IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)
Grass over soft brown slightly gravelly silty CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. [TOPSOIL]	(0.25) 0.25	216.69
Firm becoming stiff grey occasionally mottled brown slightly gravelly silty CLAY. Gravel is angular to subangular fine to coarse of mudstone.	(0.25) 0.50	216.44
Firm to stiff light yellowish brown mottled light grey slightly sandy slightly gravelly clayey SILT. Gravel is angular fine to coarse of mudstone.	(0.95) 1.45	215.49
Soft to firm grey CLAY. *From 1.50m to 1.55m, Light yellowish brown silty clay.*	(0.25) 1.70	215.24
Firm light brown and grey slightly gravelly slightly sandy clayey SILT. Sand is fine. Gravel is angular to rounded fine to coarse of mudstone. *From 1.80m to 1.90m, Brown sandy slightly gravelly silt.*	(1.15) 2.85	214.09
Dark brownish grey very silty angular to well rounded fine to coarse GRAVEL of mudstone with low cobble content. Cobbles are angular to subrounded of mudstone.	(1.35) 4.20	212.74
Stiff light brown slightly sandy gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles are angular to subangular of siltstone, sandstone and mudstone.	(0.80) 5.00	211.94
Weak thickly bedded dark yellowish brown SANDSTONE & SILTSTONE. Discontinuities are 1) Subvertical 70-90 Deg closely spaced planar smooth open to moderately wide with oxidised staining and frequent yellowish brown clay infill. 2) 40-50 Deg very closely to closely spaced planar smooth open to moderately wide with oxidised staining and clay infill. 3) 30-40 Deg medium spaced planar smooth wide with quartz infill. *From 5.35m to 5.80m, Non-intact core recovered as silty subangular to subrounded fine to coarse GRAVEL of mudstone.* *From 6.30m to 6.40m, Mineralised fracture (20mm)* *From 6.60m to 6.70m, Mineralised fracture (40mm)* *From 7.00m to 7.85m, No recovery.* *From 7.85m to 8.00m, Non-intact core.* *From 8.40m to 8.50m, Non-intact core.* *From 8.50m to 8.70m, No recovery.* *From 8.70m to 9.30m, Non-intact core.* *From 9.50m to 9.60m, Non-intact core.*	(5.00) 10.00	206.94
EOH at 10.00m - Scheduled Depth		

Hole Ø (mm) / Depth (m): 121 / 10.00

Casing Ø (mm) / Depth (m): 143 / 4.50

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If
3.00 4.50	60	0	0	NA
4.50 5.00	100	0	0	NA
5.00 6.50	90	63	0	18
6.50 7.00	80	68	0	
7.00 8.50	43	31	0	NR NI 23 NI
8.50 10.00	87	87	0	NR NI 30 NI 30

Depth (m)	Ref	Test Results
0.10	1 ES	
0.10	ES1 ES	
0.30 - 0.50	1 B	
0.45	2 ES	
0.50	ES1 EW	SPT(S) 0.50m, N=25 (5,5/7,7,6,5)
1.10 - 1.35	7 B	
1.35 - 1.45	8 D	
1.45 - 1.70	9 B	
1.70 - 1.80	10 D	
1.80 - 1.90	11 D	
1.90 - 2.25	12 B	
		SPT(S) 2.10m, N=20 (2,3/3,5,5,7)
2.85 - 2.95	13 D	
2.95 - 3.00	14 D	
3.00 - 4.20	15 B	
4.20 - 4.30	16 D	
4.20 - 4.30	16 ES	
5.00	17 D	
10.00	18 D	

Observations / Remarks

PAS survey cleared on 15.04.24

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
04/06	08:00	0.00	-	Dry
04/06	16:00	4.50	4.50	Dry
05/06	08:00	4.50	4.50	Dry
05/06	16:00	10.00	4.50	Dry

Backfill

From (m)	To (m)	Material
0.00	4.00	Bentonite
4.00	10.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	4.00 - 10.00	10.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
3.00 - 4.50	Water	Grey	100
4.50 - 5.00	Water	Grey	100
5.00 - 6.50	Water	Grey	100

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Start Date:	04/06/2024	Checked:	AH
End Date:	06/06/2024	Approved:	MA

Location ID

BH130-S4N

DRAFT

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.50	Inspection Pit	Hand Tools
0.50 - 20.00	Rotary Coring	Geo 205

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 2

Project No: **2072214**

Name: **Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**

Location: **North Wales**

Client: **bpEnBW**

Location Details

Easting:	**296401.95**	Northing:	**373837.97**
Elevation:	**207.21mAOD**	Final Depth:	**20.00m**
Logged By:	**IS+MB**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)
Grass over soft brown sandy clayey SILT with occasional rootlets. Sand is fine to coarse. [TOPSOIL]	(0.20) 0.20	207.01			
Brown occasionally mottled orangish brown slightly gravelly slightly clayey fine to coarse SAND. Gravel is angular to subrounded fine to coarse of mudstone and limestone.	(0.30) 0.50	206.71			
Very stiff dark orangish brown and grey slightly sandy gravelly clayey SILT with low to medium cobble content. Sand is fine to coarse. Gravel is subangular to well rounded fine to coarse of mudstone, sandstone, siltstone and quartz. Cobbles are subangular to well rounded of mudstone.	(2.60) 3.10	204.11			
Weak thickly laminated greenish brownish grey banded SILTSTONE, MUDSTONE & SANDSTONE. Highly weathered, recovered as angular fine to coarse gravel.	(1.50) 4.60	202.61			
Weak thickly laminated greenish brown grey banded SILTSTONE, MUDSTONE & SANDSTONE. Discontinuities are 1) 30-50 Deg very closely to closely spaced planar rough open with heavy oxidation and yellowish brown clay infill. 2) 60-80 Deg extremely closely to closely spaced planar smooth very tight with heavy oxidised staining and yellowish brown clay infill. *From 5.50m to 5.85m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.* *From 7.40m to 7.45m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.*	(3.60) 8.20	199.01		143 6.00	
Weak locally medium strong thinly bedded grey MUDSTONE. Discontinuities are 1) 30-40 Deg very closely to closely spaced planar smooth partly open to open with heavy staining. 2) 60-80 Deg closely spaced planar smooth tight to closed with zones of partly open to open. 3) 70 Deg closely to medium spaced planar smooth open to tight. *From 8.70m to 8.85m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.* *From 9.30m to 9.70m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.*					

Continued on Next Page

Installation / Backfill

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If	Depth (m)	Ref	Test Results
					0.10	1 ES	
					0.10	ES1 ES	
					0.40	2 ES	
					0.50 - 1.80	7 B	SPT(C) 0.50m, 50 (13,10/50 for 247mm)
0.50 2.00	27	0	0	NA	1.80 - 1.90	8 D	
					1.90 - 2.00	9 D	
					1.90 - 2.00	9 ES	
2.00 2.50	80	0	0		2.00 - 2.50	10 B	
2.50 4.00	80	15	0		2.50 - 3.10	12 B	SPT(C) 2.50m, 50 (25 for 87mm/50 for 161mm)
				0	3.10 - 3.20	13 D	
					3.90 - 4.00	11 D	
4.00 5.50	93	53	0	NI			
				23	5.10 - 5.20	14 D	
					5.10 - 5.20	14 ES	
5.50 7.00	100	70	23	NI			
				12	6.68 - 6.84	15 C	
7.00 8.50	87	81	7	NI			
				24	8.20 - 8.40	16 C	
					8.40 - 8.50	17 D	
8.50 10.00	92	81	23	NR			
				NI			
				13			
				NI			
				17			

Observations / Remarks

1) PAS survey cleared on 29.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
04/06	08:00	0.00	-	Dry
04/06	16:00	5.50	4.00	3.80
05/06	08:00	5.50	4.00	3.30
05/06	16:00	13.00	6.00	4.40
06/06	08:00	13.00	6.00	7.90
06/06	16:00	20.00	6.00	13.90

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	20.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 20.00	20.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
0.50 - 2.00	Water	Brown	30
2.00 - 2.50	Water	Brown	30
2.50 - 4.00	Water	Brown	40

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Start Date:	04/06/2024	Checked:	AH
End Date:	06/06/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.50	Inspection Pit	Hand Tools
0.50 - 20.00	Rotary Coring	Geo 205

Location ID

BH130-S4N

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 2 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**296401.95**	Northing:	**373837.97**
Elevation:	**207.21mAOD**	Final Depth:	**20.00m**
Logged By:	**IS+MB**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Legend	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)	Installation / Backfill
Weak locally medium strong thinly bedded grey MUDSTONE. Discontinuities are 1) 30-40 Deg very closely to closely spaced planar smooth partly open to open with heavy staining. 2) 60-80 Deg closely spaced planar smooth tight to closed with zones of partly open to open. 3) 70 Deg closely to medium spaced planar smooth open to tight. *From 10.00m to 10.30m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.* *From 10.30m to 10.95m, Bedding fracture zone with joint discontinuities showing increased weathered due to open bedding fracture.* *From 10.60m to 10.70m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.* *From 13.30m to 13.55m, 3No very closely spaced 70 Deg joint discontinuities. Planar smooth apertures are open with surface staining.* *From 13.80m to 14.20m, 2 No closely spaced 70 Deg joint discontinuities. Planar smooth apertures are open with surface staining* *From 14.50m to 15.15m, 1 No 70 Deg joint discontinuity planar smooth apertures are open with surface staining.* *From 16.00m to 16.60m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.* *From 17.00m to 17.30m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.* *From 17.90m to 18.50m, 80-90 Deg fractures very closely spaced planar smooth open with heavy staining.* *From 18.80m to 18.90m, Non-intact core recovered as angular to subrounded fine to coarse GRAVEL.*		(11.80) 20.00	187.21	121 20.00			
EOH at 20.00m - Scheduled Depth							

Coring, Samples & Testing

Core Run	TCR	SCR	RQD
10.00 11.50	100	73	7
11.50 13.00	100	93	7
13.00 14.50	100	90	0
14.50 16.00	100	87	7
16.00 17.00	80	36	0
17.00 18.50	97	77	0
18.50 20.00	80	63	0

If
NI
17
NI
7
NI
16
NI
2
NI
17
NR
NI
19

Depth (m)	Ref	Test Results
11.90 - 12.05	18 C	
13.00 - 13.10	19 D	
16.00 - 16.60	20 D	
17.64 - 17.74	21 C	
19.25 - 19.40	23 C	
19.80 - 20.00	22 D	

Observations / Remarks

1) PAS survey cleared on 29.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
04/06	08:00	0.00	-	Dry
04/06	16:00	5.50	4.00	3.80
05/06	08:00	5.50	4.00	3.30
05/06	16:00	13.00	6.00	4.40
06/06	08:00	13.00	6.00	7.90
06/06	16:00	20.00	6.00	13.90

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	20.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 20.00	20.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
0.50 - 2.00	Water	Brown	30
2.00 - 2.50	Water	Brown	30
2.50 - 4.00	Water	Brown	40

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Start Date:	29/05/2024	Checked:	AH
End Date:	31/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 1.20	Inspection Pit	Hand Tools
1.20 - 1.70	Dynamic Sampling	Geo 205
1.70 - 16.00	Rotary Coring	Geo 205

Location ID

BH131-S4N

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**296590.98**	Northing:	**373952.14**
Elevation:	**172.60mAOD**	Final Depth:	**16.00m**
Logged By:	**IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)
Grass over soft greyish brown slightly gravelly slightly sandy silty CLAY with frequent rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone. [TOPSOIL]	(0.30) 0.30	172.30
Soft to firm light brown locally grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mudstone and sandstone. Cobbles are subangular of mudstone.	(0.70) 1.00	171.60
Firm yellowish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mudstone.	(0.20) 1.20	171.40
Very stiff locally firm to stiff light yellowish brown mottled light grey and dark brown slightly sandy gravelly clayey SILT with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mudstone. Cobbles are subangular of mudstone.	(1.00) 2.20	170.40
Very stiff light yellowish brown and greenish grey slightly sandy gravelly CLAY with high cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mudstone. Cobbles and boulders are subangular of mudstone. *From 4.20m to 4.50m, Bed of silty gravel. Gravel is angular fine of mudstone.* *From 4.50m to 5.20m, Limited recovery.* *From 6.00m to 6.20m, No recovery.* *From 6.20m to 6.40m, Non-intact core.*	(4.20) 6.40	166.20
Weak to medium strong very thinly bedded dark grey mottled light grey MUDSTONE. Discontinuities are 1) 50 Deg very closely spaced planar smooth open with heavy brown surface staining. 2) 130 Deg medium spaced undulating rough open with heavy brown surface staining. *From 9.00m to 9.35m, Non-intact core.*	(3.00) 9.40	163.20
Moderately weak very thinly bedded dark grey mottled light grey MUDSTONE. Discontinuities are 50 Deg closely to medium spaced planar smooth open to moderately wide with heavy		

Continued on Next Page

Hole Ø (mm) Depth (m):

Casing Ø (mm) Depth (m): 143
6.00

Water Level (m):

Coring, Samples & Testing

Core Run	TCR	SCR	RQD
1.70 2.20	100	0	0
2.20 3.00	77	0	0
3.00 4.50	60	0	0
4.50 6.00	53	0	0
6.00 7.50	90	0	0
7.50 9.00	100	87	0
9.00 10.50	100	78	0

If: NA; 20; NI; 20

Depth (m)	Ref	Test Results
0.00 - 0.30	1 B	
0.10	1 ES	
0.10	ES1 ES	
0.50 - 0.80	2 B	
0.60	2 ES	
0.60	ES2 ES	
1.00 - 1.20	3 B	
1.20 - 1.30	7 D	SPT(S) 1.20m, N=46 (4,6/6,8,15,17)
1.30 - 1.40	8 D	
1.40 - 1.70	9 B	
1.70 - 2.20	11 B	
2.20 - 2.80	12 B	
2.80 - 2.90	13 D	
2.90 - 3.00	10 D	
3.00 - 4.00	14 B	SPT(C) 3.00m, N=65 (6,9/14,11,19,21)
4.00 - 4.10	15 D	
4.20 - 4.50	16 D	
5.20 - 5.90	18 B	
5.90 - 6.00	17 D	
5.90 - 6.00	17 ES	
6.30 - 6.40	19 D	
7.30 - 7.45	20 C	
8.10 - 8.20	21 C	
9.50 - 9.65	22 C	

Observations / Remarks

1) PAS survey cleared on 29.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
29/05	08:00	0.00	-	Dry
29/05	16:00	4.50	4.50	Dry
30/05	08:00	4.50	4.50	Dry
30/05	16:00	16.00	6.00	Dry

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	16.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 16.00	16.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
1.70 - 2.20	Water	Brown	100
2.20 - 3.00	Water	Brown	80
3.00 - 4.50	Water	Brown	55

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Start Date:	29/05/2024	Checked:	AH
End Date:	31/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 1.20	Inspection Pit	Hand Tools
1.20 - 1.70	Dynamic Sampling	Geo 205
1.70 - 16.00	Rotary Coring	Geo 205

Location ID

BH131-S4N

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 2 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**296590.98**	Northing:	**373952.14**
Elevation:	**172.60mAOD**	Final Depth:	**16.00m**
Logged By:	**IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)
Moderately weak very thinly bedded dark grey mottled light grey MUDSTONE. Discontinuities are 50 Deg closely to medium spaced planar smooth open to moderately wide with heavy brown surface staining and frequent clay and gravel infill. *From 10.00m to 10.30m, Non-intact core.* *From 10.50m to 10.65m, Non-intact core.* *From 13.35m to 13.50m, Non-intact core.* *From 13.76m to 13.82m, Non-intact core.*	(6.60) 16.00	156.60	121 16.00		
EOH at 16.00m - Scheduled Depth					

Coring, Samples & Testing

Core Run	TCR	SCR	RQD
10.50 12.00	100	80	11
12.00 13.50	100	87	0
13.50 15.00	100	85	7
15.00 16.00	100	77	12

If
NI
20
NI
8
NI
20
NI
26

Depth (m)	Ref	Test Results
11.40 - 11.60	23 C	
13.40 - 13.50	24 D	
13.80 - 13.95	25 C	
15.45 - 15.60	26 C	

Observations / Remarks

1) PAS survey cleared on 29.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
29/05	08:00	0.00	-	Dry
29/05	16:00	4.50	4.50	Dry
30/05	08:00	4.50	4.50	Dry
30/05	16:00	16.00	6.00	Dry

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	16.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 16.00	16.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
1.70 - 2.20	Water	Brown	100
2.20 - 3.00	Water	Brown	80
3.00 - 4.50	Water	Brown	55

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Start Date:	01/05/2024	Checked:	AH
End Date:	03/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.70	Inspection Pit	Hand Tools
0.70 - 1.20	Dynamic Sampling	Geo 205
1.20 - 8.00	Rotary Coring	Geo 205

Location ID

BH173-S3S

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 1

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**295409.80**	Northing:	**373908.40**
Elevation:	**236.64mAOD**	Final Depth:	**8.00m**
Logged By:	**IS+MC**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Legend	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)	Installation / Backfill
Soft brown slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of limestone. [TOPSOIL]		(0.15) 0.15	236.49				
Grey to brownish grey very clayey very sandy angular to subangular fine to coarse GRAVEL of mudstone.		(0.55) 0.70	235.94				
Very stiff light grey mottled orangish brown slightly sandy gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular to subrounded of mudstone.		(1.50) 2.20	234.44		143 2.00		
Stiff yellowish brown slightly sandy gravelly clayey SILT with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mudstone. Cobbles are subangular to subrounded of mudstone.		(1.60) 3.80	232.84				
Very stiff dark brownish grey slightly sandy gravelly silty CLAY with low to medium cobble content. Gravel is angular to rounded fine to coarse of mudstone, quartz, siltstone and sandstone. Cobbles are angular of mudstone.		(4.20) 8.00	228.64	121 8.00			
EOH at 8.00m - Scheduled Depth							

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If	Depth (m)	Ref	Test Results
					0.00 - 0.15 0.10 0.10 0.15 - 0.40 0.30	1 B 1 ES ES1 ES 2 B 2 ES	
					0.70 - 0.80 0.70 - 1.20 0.80 - 0.90	5 B 7 B 6 D	
1.20 2.00	94	0	0	NA	1.20 - 2.00	8 B	SPT(C) 1.20m, N=46 (25 for 114mm/16,10,7,13)
2.00 2.50	80	0	0		2.00 - 2.50	9 B	SPT(C) 2.00m, 50 (25 for 111mm/50 for 114mm)
2.50 4.00	100	0	0	NA	3.00 - 3.10 3.10 - 3.20 3.20 - 3.80	10 D 11 D 12 B	
4.00 5.50	80	0	0		4.00 - 5.30	15 B	SPT(C) 4.00m, 50 (25 for 96mm/50 for 174mm)
					5.30 - 5.40 5.40 - 5.50 5.50 - 6.90	14 D 13 D 17 B	SPT(C) 5.50m, N=44 (10,11/10,11,10,13)
5.50 7.00	83	0	0	NA			
7.00 8.00	80	0	0		6.90 - 7.00 7.00 - 8.00	16 D 18 B	SPT(C) 7.00m, N=46 (9,11/11,10,12,13)

Observations / Remarks

1) PAS survey cleared on 22.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
01/05	14:00	0.00	-	Dry
01/05	16:00	8.00	2.00	4.50

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	8.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 8.00	8.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
1.20 - 2.00	Water	Grey	50
2.00 - 2.50	Water	Grey	60
2.50 - 4.00	Water	Grey	60

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Start Date:	13/05/2024	Checked:	AH
End Date:	14/05/2024	Approved:	MA

Location ID

BH175-S3S

DRAFT

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 1.20	Inspection Pit	Hand Tools
1.20 - 3.50	Dynamic Sampling	Geo 205
3.50 - 10.00	Rotary Coring	Geo 205

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 1

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**294671.47**	Northing:	**373561.49**
Elevation:	**214.84mAOD**	Final Depth:	**10.00m**
Logged By:	**IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)
Soft light brown slightly gravelly slightly sandy silty CLAY with frequent rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. [TOPSOIL]	(0.30) 0.30	214.54			
Soft to firm yellowish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mudstone, limestone and sandstone.	(0.90) 1.20	213.64			
Medium dense becoming very dense light grey mottled dark orangish brown and yellowish brown very sandy silty subangular fine to coarse GRAVEL of mudstone. Sand is fine to coarse.	(1.90) 3.10	211.74			
Dark brownish grey very sandy subangular to rounded fine to medium GRAVEL of mudstone. Sand is fine to coarse.	(0.20) 3.30	211.54			
Dark grey slightly silty very gravelly fine to coarse SAND. Gravel is subangular to rounded fine of mudstone.	(0.20) 3.50	211.34			
Dark grey slightly silty slightly sandy angular to subrounded medium to coarse GRAVEL of mudstone with high cobble content. Sand is fine to coarse. Cobbles are angular of mudstone.	(0.50) 4.00	210.84			
Stiff yellowish brown mottled orangish brown slightly sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mudstone.	(0.20) 4.20	210.64			
Very stiff dark brownish grey slightly sandy gravelly silty CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mudstone. Cobbles are angular to subrounded of mudstone.	(0.60) 4.80	210.04			
Light brownish grey slightly sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mudstone with low to medium cobble content. Sand is fine to coarse. Cobbles are subangular of mudstone.	(0.85) 5.65	209.19			
Stiff dark grey gravelly SILT. Gravel is subrounded to rounded fine to coarse of mudstone.	(0.50) 6.15	208.69			
Very dense dark grey sandy subrounded to rounded fine GRAVEL of mudstone. Sand is fine to coarse.	(0.20) 6.35	208.49			
Very dense dark brownish grey sandy very silty subangular to rounded fine to coarse GRAVEL of mudstone and quartz with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded of mudstone.	(3.65) 10.00	204.84	121 10.00	143 9.00	
EOH at 10.00m - Scheduled Depth					

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If	Depth (m)	Ref	Test Results
					0.00 - 0.30	1 B	
					0.15	1 ES	
					0.15	ES1 ES	
					0.90	2 ES	
					0.90	ES2 ES	
					0.90 - 1.20	2 B	
					1.20 - 3.10	9 B	SPT(S) 1.20m, N=17 (3,6/4,4,4,5)
					1.80 - 1.90	7 D	
					1.90 - 2.00	8 D	
					2.20 - 2.50	UT	100% Recovery
							SPT(C) 2.50m, N=56 (13,12/16,15,12,13)
					3.10 - 3.20	10 D	
					3.10 - 3.20	11 D	
					3.20 - 3.70	13 B	
					3.40 - 3.50	12 D	
					3.50 - 4.00	14 B	
3.50 4.50	90	0	0	NA			
				NA	4.00 - 4.20	15 D	
					4.20 - 4.50	16 B	
				NA			SPT(S) 4.50m, N=54 (5,7/7,13,15,19)
					4.80 - 4.90	17 D	
					4.90 - 5.00	18 D	
					5.00 - 5.60	19 B	
4.50 6.00	60	0	0	NA			
					5.60 - 6.00	20 B	
				NA			SPT(S) 6.00m, N=65 (4,6/9,20,17,19)
				NA	6.15 - 6.30	21 B	
					6.40 - 6.50	22 D	
					6.50 - 6.60	23 D	
					6.60 - 7.50	24 B	
6.00 7.50	87	0	0				
					7.50 - 8.90	26 B	SPT(C) 7.50m, 110 (21,4/110 for 220mm)
7.50 9.00	83	0	0	NA			
					8.90 - 9.00	25 D	
							SPT(C) 9.00m, N=87 (7,6/8,23,27,29)
					9.10 - 9.20	27 D	
					9.20 - 10.00	28 B	
9.00 10.00	100	0	0				

Observations / Remarks

PAS survey cleared on 10.04.24

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
13/05	08:00	0.00	-	Dry
13/05	16:00	4.50	3.00	Dry
14/05	08:00	4.50	3.00	Dry
14/05	16:00	10.00	9.00	Dry

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	10.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 10.00	10.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
3.50 - 4.50	Water	Brown	100
4.50 - 6.00	Water	Brown	100
6.00 - 7.50	Water	Brown	80

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Start Date:	15/05/2024	Checked:	AH
End Date:	21/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.60	Inspection Pit	Hand Tools
0.60 - 3.50	Dynamic Sampling	Geo 205
3.50 - 9.00	Rotary Coring	Geo 205

Location ID

BH176-S3S

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 1

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**294325.07**	Northing:	**373704.75**
Elevation:	**179.83mAOD**	Final Depth:	**9.00m**
Logged By:	**MC+IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)
Soft light brown slightly gravelly slightly sandy CLAY with frequent rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. [TOPSOIL]	(0.20) 0.20	179.63			
Soft to firm yellowish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mudstone and sandstone.	(0.40) 0.60	179.23			
Dense to very dense dark yellowish brown clayey silty sandy angular to rounded fine to coarse GRAVEL of mudstone with medium cobble content. Sand is fine to coarse. Cobbles are angular to rounded of mudstone.	(2.55) 3.15	176.68			
Dense to very dense dark brownish grey very sandy subangular to rounded fine GRAVEL of mudstone. Sand is fine to coarse. *From 3.40m to 3.50m, Dense dark blackish grey gravelly fine to coarse SAND. Gravel is subangular to rounded fine of mudstone.*	(0.35) 3.50	176.33			
Stiff to very stiff dark grey and light yellowish brown slightly gravelly silty CLAY with high cobble content. Gravel is angular to rounded fine of mudstone. Cobbles are angular to subangular of mudstone.	(0.50) 4.00	175.83			
Very stiff yellowish brown mottled orangish brown and grey slightly sandy gravelly clayey SILT with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mudstone. Cobbles are angular of mudstone.	(2.50) 6.50	173.33			
Very dense dark grey slightly sandy clayey angular to rounded fine to coarse GRAVEL of mudstone with medium to high cobble content. Sand is fine to coarse. Cobbles are angular to rounded of mudstone.	(2.50) 9.00	170.83	121 9.00	143 9.00	
EOH at 9.00m - Scheduled Depth					

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If
3.50 5.00	60	0	0	NA
5.00 6.00	90	0	0	
6.00 7.50	67	0	0	
7.50 9.00	60	0	0	

Depth (m)	Ref	Test Results
0.00 - 0.20	1 B	
0.10	1 ES	
0.10	ES1 ES	
0.40 - 0.60	2 B	
0.50	2 ES	
0.60 - 1.00	8 B	
1.00 - 1.10	9 D	
1.10 - 1.20	10 D	
1.20 - 2.00	11 B	SPT(S) 1.20m, N=42 (6,11/9,9,11,13)
2.00 - 2.90	12 B	SPT(S) 2.00m, N=42 (8,14/13,10,9,10)
2.90 - 3.00	13 D	
		SPT(S) 3.00m, N=50 (12,12/14,11,10,15)
3.20 - 3.40	14 D	
3.40 - 3.50	15 D	
3.50 - 4.00	16 B	
4.00 - 4.80	17 B	SPT(S) 4.00m, 50 (16,9/50 for 150mm)
4.57	ES1 EW	
4.80 - 4.90	18 D	
4.90 - 5.00	19 D	
5.00 - 5.30	20 B	SPT(C) 5.00m, N=94 (8,12/15,21,31,27)
5.30 - 6.00	21 B	
6.00 - 7.40	22 B	SPT(C) 6.00m, N=106 (7,11/17,14,34,41)
7.40 - 7.50	23 D	
7.50 - 8.80	24 B	
8.80 - 8.90	25 D	

Observations / Remarks

PAS survey cleared on 10.04.24

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
15/05	08:00	0.00	-	Dry
15/05	16:00	3.00	-	Dry
16/05	08:00	3.00	-	Dry
16/05	16:00	6.00	-	Dry
17/05	08:00	6.00	-	Dry
17/05	16:00	6.00	6.00	Dry
20/05	08:00	6.00	6.00	Dry
20/05	16:00	7.50	7.50	Dry
21/05	08:00	7.50	7.50	Dry
21/05	16:00	9.00	9.00	Dry

Backfill

From (m)	To (m)	Material
0.00	1.00	Bentonite
1.00	9.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	1.00 - 9.00	9.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
3.50 - 5.00	Water	Brown	100
5.00 - 6.00	Water	Brown	100
6.00 - 7.50	Water	Brown	90

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Start Date:	07/05/2024	Checked:	AH
End Date:	10/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.60	Inspection Pit	Hand Tools
0.60 - 20.00	Rotary Coring	Geo 205

Location ID

BH180-S3S

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 1 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**294262.96**	Northing:	**373641.12**
Elevation:	**178.23mAOD**	Final Depth:	**20.00m**
Logged By:	**IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)
Grass over soft brown slightly sandy slightly gravelly silty CLAY with frequent rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. [TOPSOIL]	(0.20) 0.20	178.03			
Soft to firm light brown grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fin e to medium of mudstone and sandstone.	(0.30) 0.50	177.73			
Soft light brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mudstone.	(0.10) 0.60	177.63			
Light brown clayey silty sandy angular to sub-angular fine to coarse GRAVEL of mudstone and sandstone. Sand is fine to coarse.	(0.60) 1.20	177.03			
Stiff high strength light yellowish brown dark brown and grey gravelly slightly sandy clayey SILT with low cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of sandstone, siltstone, limestone and mudstone. Cobbles are angular of mudstone.	(1.60) 2.80	175.43			
Firm to stiff light yellowish brown and grey slightly sandy gravelly silty CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mudstone. Cobbles are angular of mudstone.	(0.50) 3.30	174.93			
Very dense dark grey and yellowish brown sandy silty angular to subrounded fine to coarse GRAVEL of mudstone and siltstone with low to medium cobble content. Sand is fine to coarse. Cobbles are angular to rounded of mudstone.	(1.10) 4.40	173.83			
Dense to very dense dark brownish grey clayey silty sandy angular to rounded fine to coarse GRAVEL of mudstone and siltstone with high cobble content. Sand is fine to coarse. Cobbles are angular to rounded of mudstone.	(4.00) 8.40	169.83			
Stiff medium to high strength brownish grey slightly gravelly silty CLAY. Gravel is angular to rounded fine to coarse of mudstone and siltstone.	(0.40) 8.80	169.43			
Very dense dark grey clayey very sandy angular to rounded fine to medium GRAVEL of mudstone with low cobble content. Sand is fine to coarse. Cobbles are subangular to rounded of mudstone.	(1.10) 9.90	168.33			

Continued on Next Page

Installation / Backfill

Coring, Samples & Testing

Core Run	TCR	SCR	RQD
0.60 1.20	100	0	0
1.80 3.30	37	0	0
3.30 4.50	42	0	0
4.50 6.00	20	0	0
6.00 7.50	13	0	0
7.50 9.00	53	0	0
9.00 10.50	67	0	0

If
NA
NA
NA
NA
NA
NA

Depth (m)	Ref	Test Results
0.00 - 0.15	1 B	
0.10	1 ES	
0.10	ES1 ES	
0.30 - 0.50	2 B	
0.40	2 ES	
0.40	ES2 ES	
0.50 - 0.60	3 B	SPT(S) 0.60m, N=29 (5,6/6,7,7,9)
0.55	3 ES	
0.55	ES3 ES	
0.60 - 1.00	4 B	
1.00 - 1.10	5 D	
1.10 - 1.20	6 D	
1.20 - 1.65	UT	100% Recovery
1.52	ES1 EW	
2.80 - 3.00	7 D	
3.00 - 3.20	8 D	
3.30 - 4.40	9 B	SPT(S) 3.30m, N=66 (5,12/10,14,17,25)
4.40 - 4.50	10 D	SPT(C) 4.50m, N=58 (8,10/9,12,14,23)
5.50 - 5.60	11 D	
5.60 - 6.00	12 B	
6.00 - 7.50	13 B	SPT(C) 6.00m, N=44 (7,7/9,10,11,14)
7.50 - 8.40	14 B	SPT(S) 7.50m, N=46 (7,6/7,10,14,15)
8.40 - 8.50	15 D	
8.50 - 8.60	16 D	
8.60 - 8.80	17 B	
		SPT(S) 9.00m, 100 (10,15/100 for 149mm)
9.70 - 9.80	18 D	
9.80 - 9.90	19 D	
10.00 - 10.10	20 D	

Observations / Remarks

1) PAS survey cleared on 10.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
07/05	08:00	0.00	-	-
07/05	16:00	4.50	3.30	-
08/05	08:00	4.50	3.30	-
08/05	16:00	10.50	9.00	-
09/05	08:00	10.50	9.00	-
09/05	16:00	18.00	10.50	-
10/05	08:00	18.00	10.50	-
10/05	16:00	20.00	10.50	-

Backfill

From (m)	To (m)	Material
0.00	12.00	Bentonite
12.00	20.00	Gravel

Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	12.00 - 20.00	20.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
0.60 - 1.20	Water	Brown	100
1.80 - 3.30	Water	Brown	100
3.30 - 4.50	Water	Brown	100

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CJ Associates Geotechnical Ltd
Portview Road, Avonmouth
Bristol, BS11 9JE
+44(0)117 9821 473
www.cjageo.co.uk

Start Date:	07/05/2024	Checked:	AH
End Date:	10/05/2024	Approved:	MA

Methodology & Plant

Depth (m)	Method	Plant Used
0.00 - 0.60	Inspection Pit	Hand Tools
0.60 - 20.00	Rotary Coring	Geo 205

Location ID

BH180-S3S

DRAFT

Log Type

Rotary Coring

Scale: 1:50

Sheet 2 of 2

Project No:	**2072214**
Name:	**Onshore Ground and Site Investigation Surveys: Mona Offshore Wind Farm**
Location:	**North Wales**
Client:	**bpEnBW**

Location Details

Easting:	**294262.96**	Northing:	**373641.12**
Elevation:	**178.23mAOD**	Final Depth:	**20.00m**
Logged By:	**IS**	Grid System:	**OSGB**
Orientation:	**N/A**	Inclination:	**90°**

Strata Description	Legend	Depth (m) (Stratum Thickness)	Reduced Level (mAOD)	Hole Ø (mm) Depth (m)	Casing Ø (mm) Depth (m)	Water Level (m)	Installation / Backfill
Dark grey very gravelly silty coarse SAND. Gravel is subangular to rounded fine of mudstone.		(0.50) 10.40	167.83		143 10.50		
Very dense dark grey very sandy silty angular to subangular fine to coarse GRAVEL of mudstone with low to medium cobble content. Sand is fine to coarse. Cobbles are angular of mudstone.		(7.10) 17.50	160.73				
Very weak to weak dark grey BRECCIA. Grey silt matrix. Clasts are angular fine to coarse gravel sized occasionally cobble sized of sandstone.		(2.50) 20.00	158.23	121 20.00			
EOH at 20.00m - Scheduled Depth							

Coring, Samples & Testing

Core Run	TCR	SCR	RQD	If
10.50 12.00	80	0	0	NA
12.00 13.50	100	0	0	NA
13.50 15.00	67	0	0	
15.00 16.50	73	0	0	
16.50 18.00	100	0	0	
18.00 19.50	100	0	0	NA
19.50 20.00	33	0	0	

Depth (m)	Ref	Test Results
10.10 - 10.40	21 B	
		SPT(C) 10.50m, N=50 (4,4/9,12,17,12)
11.80 - 11.90	22 D	
11.90 - 12.00	23 D	
13.90 - 14.00	24 D	
15.75 - 15.90	25 D	
17.60 - 17.80	29 C	
17.80 - 17.90	26 D	
17.90 - 18.00	27 D	
18.35 - 18.55	30 C	
19.70 - 19.90	31 C	
19.90 - 20.00	28 D	

Observations / Remarks

1) PAS survey cleared on 10.04.24 2) Borehole cleared by UXO engineer using downhole magnetometer.

Misc.

No Groundwater Encountered
Casing Used
Monitoring Point/s Installed
Hammer Ref & Energy Ratio (%)
AR4009 (75 (%)

Shift Information

Date	Time	Depth (m)	Casing (m)	Water (m)
07/05	08:00	0.00	-	-
07/05	16:00	4.50	3.30	-
08/05	08:00	4.50	3.30	-
08/05	16:00	10.50	9.00	-
09/05	08:00	10.50	9.00	-
09/05	16:00	18.00	10.50	-
10/05	08:00	18.00	10.50	-
10/05	16:00	20.00	10.50	-

Backfill

From (m)	To (m)	Material
0.00	12.00	Bentonite
12.00	20.00	Gravel

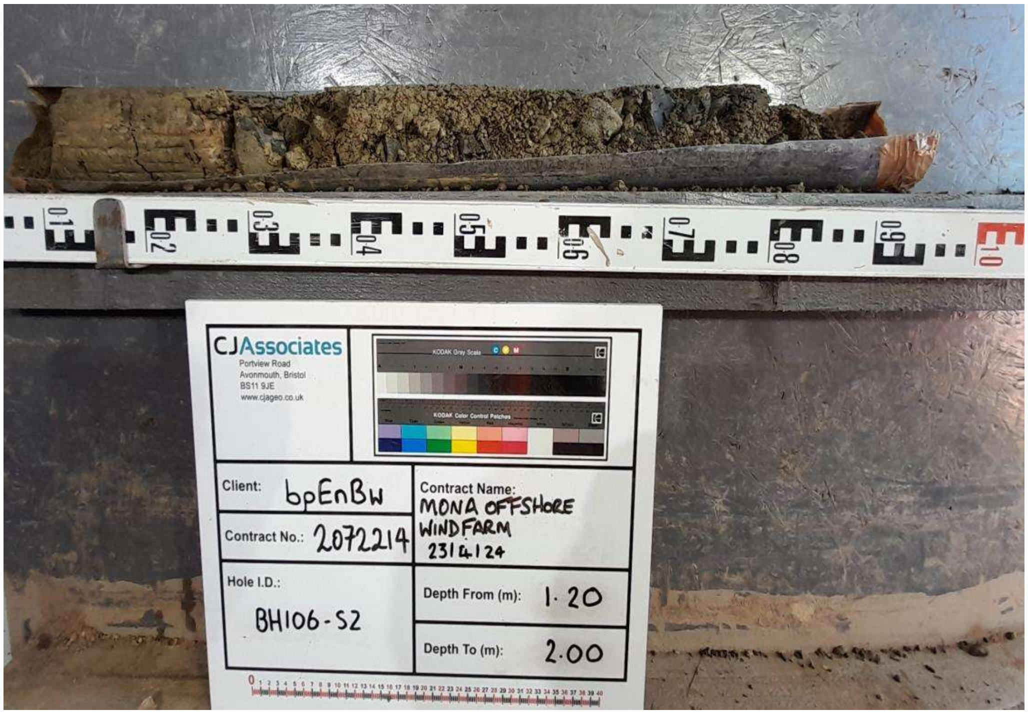
Installations

Instrument Details	Resp. Zone	Depth (m)	Diameter
Standpipe	12.00 - 20.00	20.00	

Drilling Fluid

Depth (m)	Type	Colour	Return %
0.60 - 1.20	Water	Brown	100
1.80 - 3.30	Water	Brown	100
3.30 - 4.50	Water	Brown	100

A.2. APPENDIX B: CORE PHOTOGRAPHS (GROUND INVESTIGATION REPORT)



CJAssociates
Portview Road
Avonmouth, Bristol
BS11 9JE
www.cjageo.co.uk

Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WINDFARM 23|4|24
Hole I.D.: BH106-S2
Depth From (m): 1.20
Depth To (m): 2.00

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Avonmouth, Bristol
BS11 9JE
www.cjageo.co.uk

Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WINDFARM 23|4|24
Hole I.D.: BH106-S2
Depth From (m): 2.00
Depth To (m): 3.00

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Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH106-S2

Client
bpEnBW

Project No.
2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project

Mona Offshore Wind Project
Ground Investigation

Drawing Title

BH106-S2

Client

bpEnBW

Project No.

2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH106-S2

Client
bpEnBW

Project No.
2072214

CJAssociates	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH106-S2**
Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Client bpEnBW	Project No. 2072214

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Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH106-S2

Client
bpEnBW

Project No.
2072214

Client: bpEnBW
Contract Name: MONA OFFSHORE WIND FARM 23/5/24
Contract No.: 2072214
Hole I.D.: BH 118-S3S
Depth From (m): 3.50
Depth To (m): 4.50

Client: bpEnBW
Contract Name: MONA OFFSHORE WIND FARM 23/5/24
Contract No.: 2072214
Hole I.D.: BH 118-S3S
Depth From (m): 4.50
Depth To (m): 5.50

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Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH118-S3S**
Client bpEnBW	Project No. 2072214

CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH118-S3S**
	Client bpEnBW	Project No. 2072214

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Project
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Ground Investigation

Drawing Title
BH118-S3S

Client
bpEnBW

Project No.
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Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH118-S3S**
Client bpEnBW	Project No. 2072214

CJAssociates
Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WIND FARM 24/5/24
Hole I.D.: BH 118 - S3S
Depth From (m): 11.50
Depth To (m): 13.00

CJAssociates
Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WIND FARM 24/5/24
Hole I.D.: BH 118 - S3S
Depth From (m): 13.00
Depth To (m): 14.50

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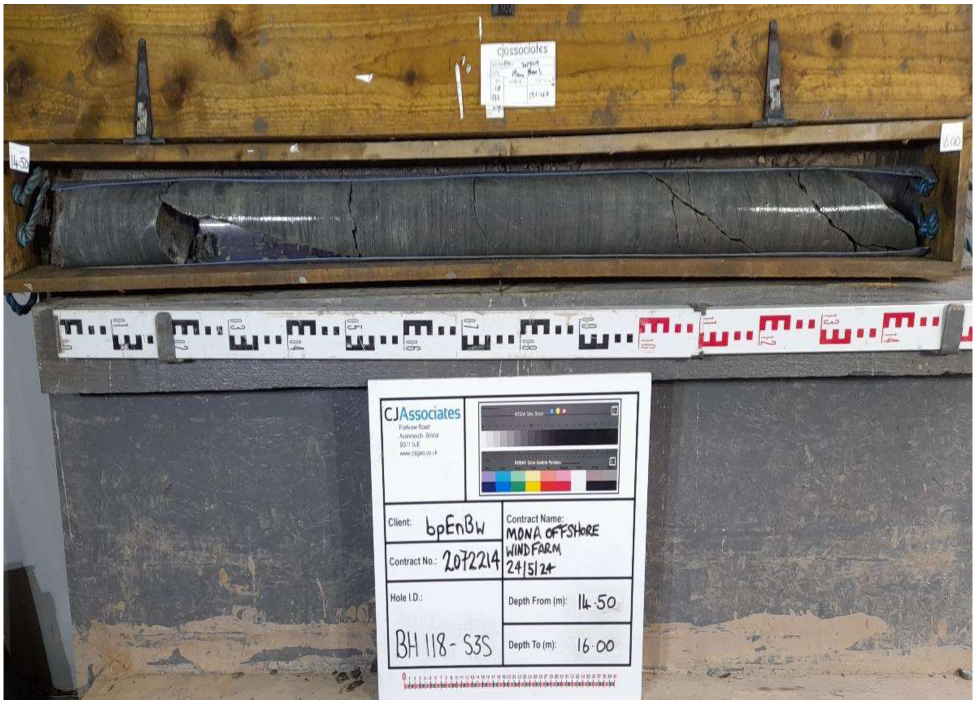
Project: Mona Offshore Wind Project Ground Investigation

Drawing Title: **BH118-S3S**

Client: bpEnBW

Project No.: 2072214



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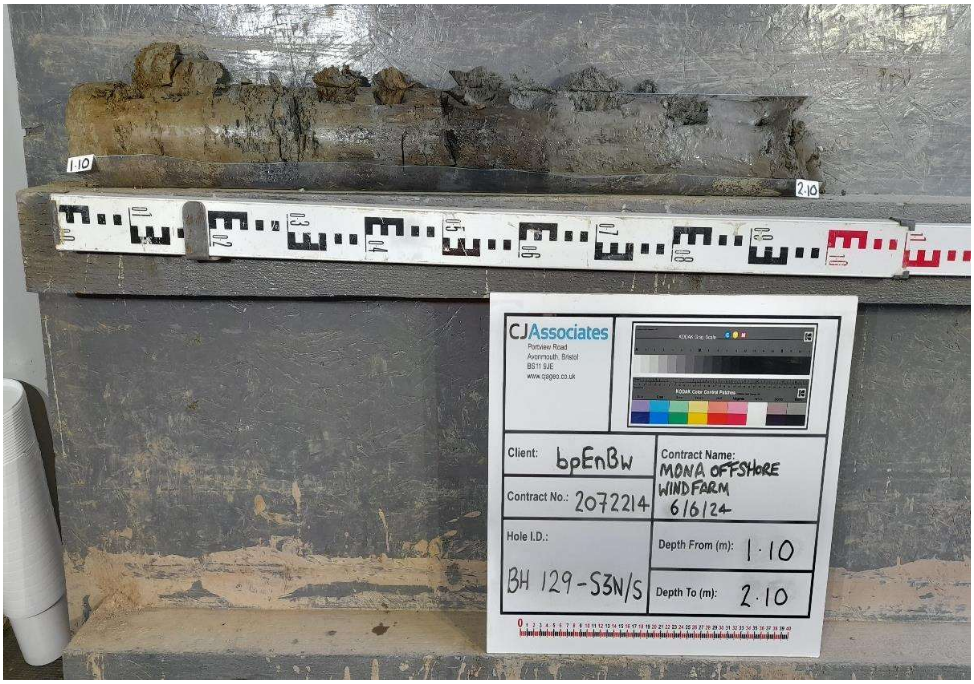
Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH118-S3S**
Client bpEnBW	Project No. 2072214



CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH129-S3N/S**
	Client bpEnBW	Project No. 2072214

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Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH129-S3N/S

Client
bpEnBW

Project No.
2072214

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Bridgend, CF31 2DA

Project

Mona Offshore Wind Project
Ground Investigation

Drawing Title

BH129-S3N/S

Client

bpEnBW

Project No.

2072214

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Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WIND FARM 6/6/24

Hole I.D.: BH 129-S3N/S

Depth From (m): 8.50

Depth To (m): 10.00

CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH129-S3N/S**
	Client bpEnBW	Project No. 2072214

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Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH130-S4N**
Client bpEnBW	Project No. 2072214

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Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH130-S4N

Client
bpEnBW

Project No.
2072214

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	Client bpEnBW	Project No. 2072214

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BS11 9JE
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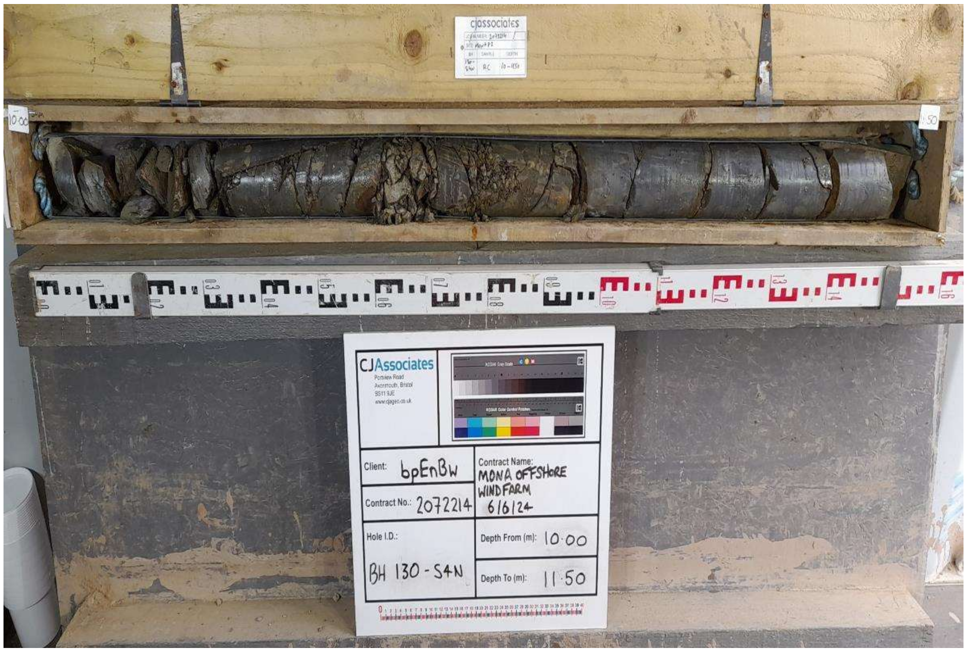
Client: bpEnBw
Contract Name: MONA OFFSHORE WIND FARM 6/6/24
Contract No.: 2072214
Hole I.D.: BH 130-S4N
Depth From (m): 8.50
Depth To (m): 10.00



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Client: bpEnBw
Contract Name: MONA OFFSHORE WIND FARM 6/6/24
Contract No.: 2072214
Hole I.D.: BH 130-S4N
Depth From (m): 10.00
Depth To (m): 11.50

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Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH130-S4N

Client
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Project No.
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	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH130-S4N**
	Client bpEnBW	Project No. 2072214

Client: bpEnBw

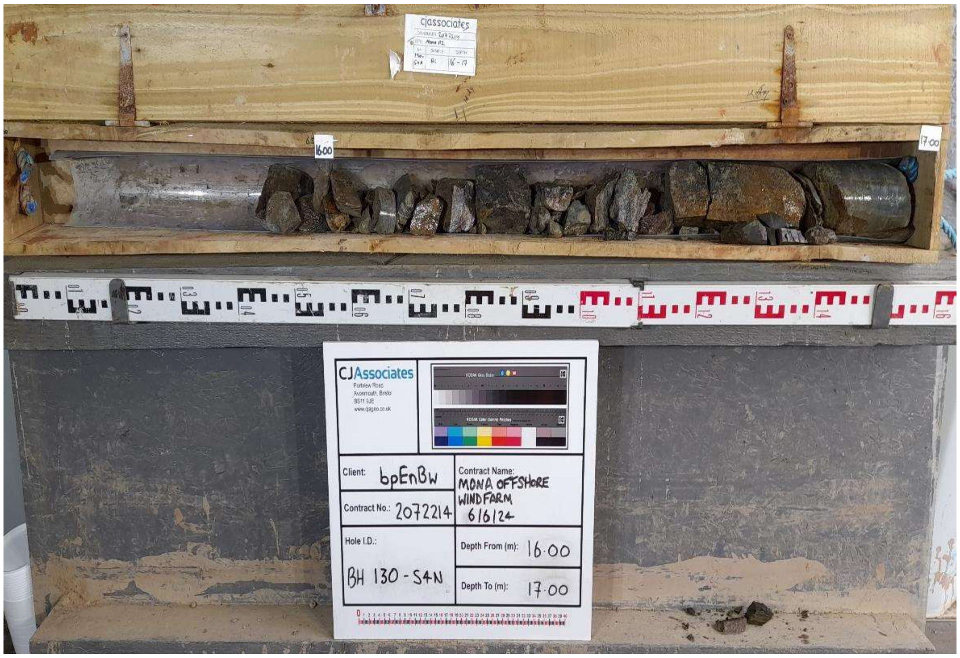
Contract No.: 2072214

Contract Name: MONA OFFSHORE WIND FARM 6/6/24

Hole I.D.: BH 130 - S4N

Depth From (m): 14.50

Depth To (m): 16.00



Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WIND FARM 6/6/24

Hole I.D.: BH 130 - S4N

Depth From (m): 16.00

Depth To (m): 17.00

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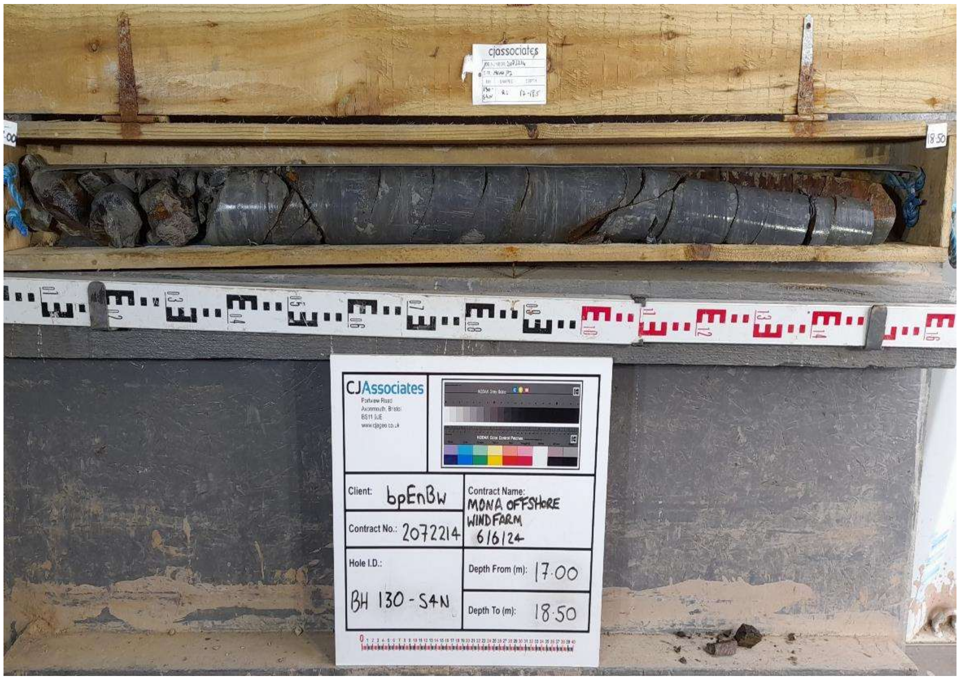
Bridgend, CF31 2DA

Project: Mona Offshore Wind Project Ground Investigation

Drawing Title: **BH130-S4N**

Client: bpEnBW

Project No.: 2072214



Client: bpEnBW

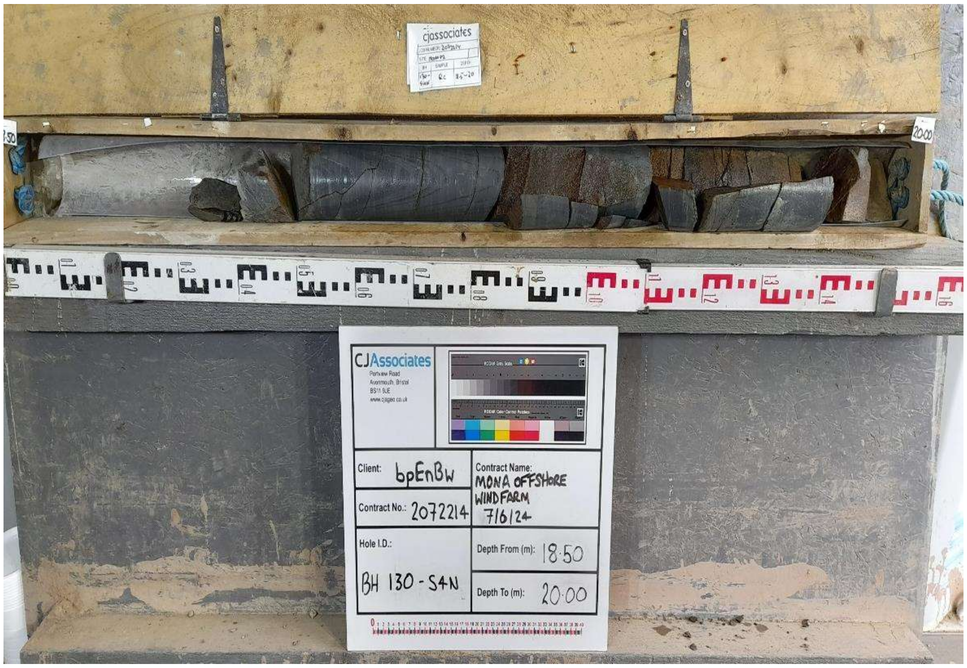
Contract Name: MONA OFFSHORE WINDFARM 6/6/24

Contract No.: 2072214

Hole I.D.: BH 130 - S4N

Depth From (m): 17.00

Depth To (m): 18.50



Client: bpEnBW

Contract Name: MONA OFFSHORE WINDFARM 7/6/24

Contract No.: 2072214

Hole I.D.: BH 130 - S4N

Depth From (m): 18.50

Depth To (m): 20.00

Unit 3, Block 6
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Brackla Industrial Estate
Bridgend, CF31 2DA

Project

Mona Offshore Wind Project Ground Investigation

Drawing Title

BH130-S4N

Client

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Project No.

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Client: bpEnBw
Contract Name: MONA OFFSHORE WINDFARM 3/6/24
Contract No.: 2072214
Hole I.D.: BH 131-S4N
Depth From (m): 1·20
Depth To (m): 1·70

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Client: bpEnBw
Contract Name: MONA OFFSHORE WINDFARM 3/6/24
Contract No.: 2072214
Hole I.D.: BH 131-S4N
Depth From (m): 1·70
Depth To (m): 3·00

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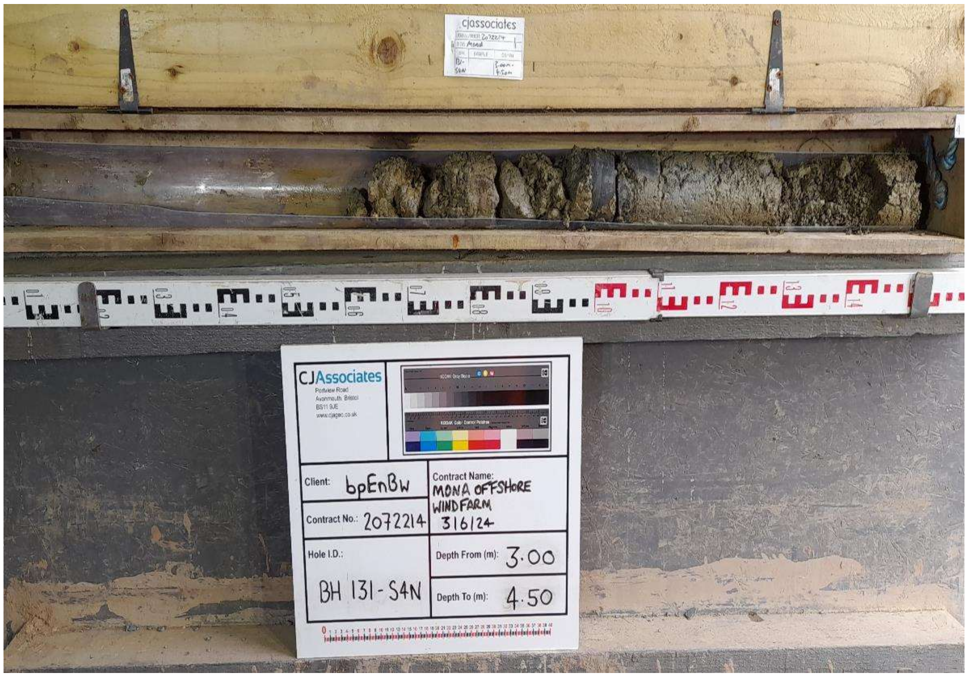
Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH131-S4N

Client
bpEnBW

Project No.
2072214



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Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WINDFARM 3/6/24
Hole I.D.: BH 131-S4N
Depth From (m): 3.00
Depth To (m): 4.50

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Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WINDFARM 3/6/24
Hole I.D.: BH 131-S4N
Depth From (m): 4.50
Depth To (m): 6.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH131-S4N

Client
bpEnBW

Project No.
2072214

Client: bpEnBw

Contract Name: MONA OFFSHORE WIND FARM 3/6/24

Contract No.: 2072214

Hole I.D.: BH 131-S4N

Depth From (m): 6.00

Depth To (m): 7.50

Client: bpEnBw

Contract Name: MONA OFFSHORE WIND FARM 3/6/24

Contract No.: 2072214

Hole I.D.: BH 131-S4N

Depth From (m): 7.50

Depth To (m): 9.00

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Unit 3, Block 6
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Bridgend, CF31 2DA

Project

Mona Offshore Wind Project
Ground Investigation

Drawing Title

BH131-S4N

Client

bpEnBW

Project No.

2072214

CJAssociates

Client: BP EnBW

Contract No.: 2072214

Contract Name: Mona Phase 2

Hole I.D.: BH131 -S4N

Depth From (m): 9.00m

Depth To (m): 10.50m

CJAssociates

Client: bpEnBW

Contract No.: 2072214

Contract Name: MONA OFFSHORE WINDFARM 3/6/24

Hole I.D.: BH 131-S4N

Depth From (m): 10.50

Depth To (m): 12.00

CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH131-S4N**
	Client bpEnBW	Project No. 2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH131-S4N

Client
bpEnBW

Project No.
2072214

CJAssociates

Client: bpEnBw

Contract Name: MONA OFFSHORE WINDFARM 3/6/24

Contract No.: 2072214

Hole I.D.: BH 131-S4N

Depth From (m): 15.00

Depth To (m): 16.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project

Mona Offshore Wind Project
Ground Investigation

Drawing Title

BH131-S4N

Client

bpEnBW

Project No.

2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH173-S3S**
Client bpEnBW	Project No. 2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH173-S3S**
Client bpEnBW	Project No. 2072214

Client: bpEnBw

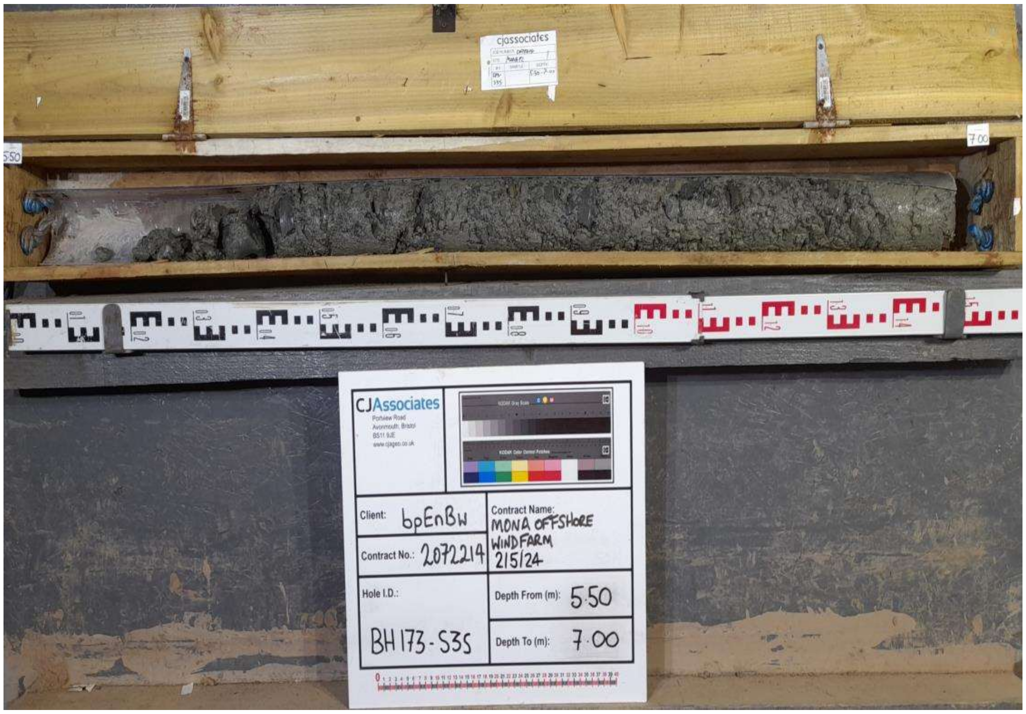
Contract Name: MONA OFFSHORE WINDFARM 215/24

Contract No.: 2072214

Hole I.D.: BH173-S3S

Depth From (m): 4.00

Depth To (m): 5.50



Client: bpEnBw

Contract Name: MONA OFFSHORE WINDFARM 215/24

Contract No.: 2072214

Hole I.D.: BH173-S3S

Depth From (m): 5.50

Depth To (m): 7.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project

Mona Offshore Wind Project
Ground Investigation

Drawing Title

BH173-S3S

Client

bpEnBW

Project No.

2072214

Client: bpEnBW

Contract Name: MONA OFFSHORE WINDFARM 21/5/24

Contract No.: 2072214

Hole I.D.: BH173-S3S

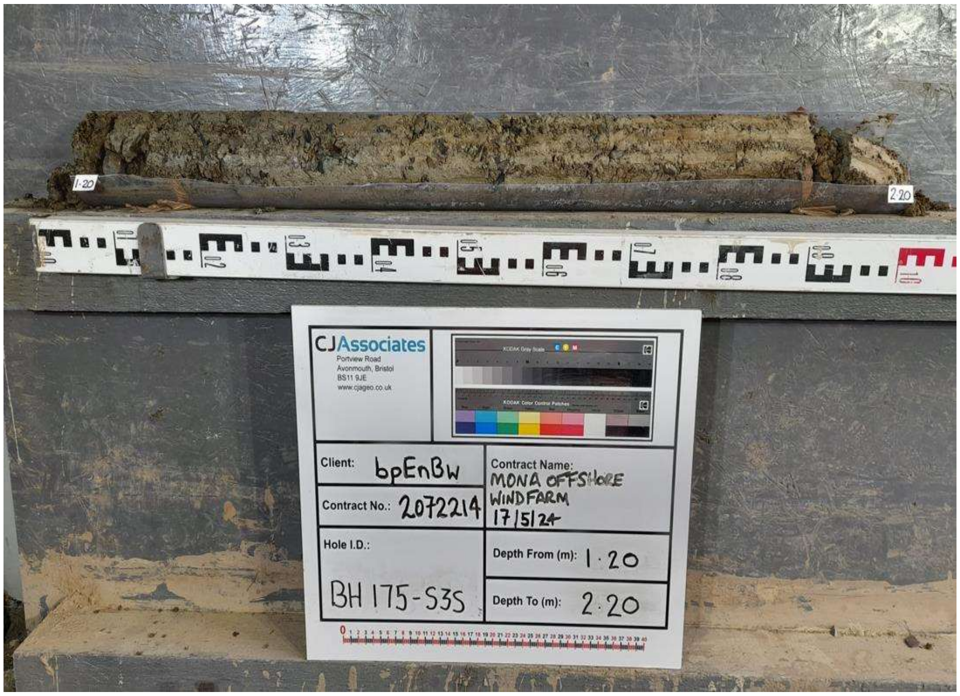
Depth From (m): 7.00

Depth To (m): 8.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH173-S3S**
Client bpEnBW	Project No. 2072214



Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH175-S3S

Client
bpEnBW

Project No.
2072214

Client: bpEnBw
Contract Name: MONA OFFSHORE WIND FARM 17/5/24
Contract No.: 2072214
Hole I.D.: BH175-S3S
Depth From (m): 3.50
Depth To (m): 4.50

Client: bpEnBw
Contract Name: MONA OFFSHORE WIND FARM 17/5/24
Contract No.: 2072214
Hole I.D.: BH175-S3S
Depth From (m): 4.50
Depth To (m): 6.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH175-S3S

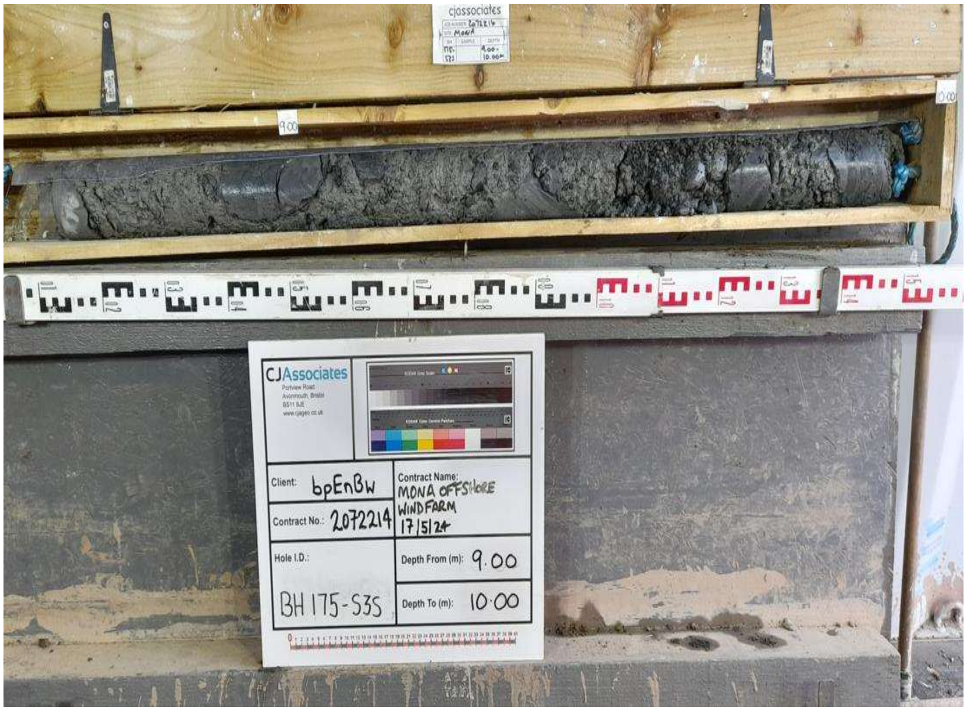
Client
bpEnBW

Project No.
2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH175-S3S**
Client bpEnBW	Project No. 2072214



CJAssociates
Portview Road
Avonmouth, Bristol
BS11 9JE
www.cjageo.co.uk

Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WINDFARM 17/5/24

Hole I.D.: BH 175-S3S

Depth From (m): 9.00

Depth To (m): 10·00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH175-S3S

Client
bpEnBW

Project No.
2072214

CJAssociates
Portview Road
Avonmouth, Bristol
BS11 9JE
www.cjageo.co.uk

Client: bpEnBW
Contract No.: 2072214
Contract Name: MONA OFFSHORE WINDFARM 20/5/24
Hole I.D.: BH 176A-S3S
Depth From (m): 0·60
Depth To (m): 1·20

CJAssociates
Portview Road
Avonmouth, Bristol
BS11 9JE
www.cjageo.co.uk

Client: bpEnBW
Contract No.: 2072214
Contract Name: MONA OFFSHORE WINDFARM 20/5/24
Hole I.D.: BH 176A-S3S
Depth From (m): 1·20
Depth To (m): 2·00

CJAssociates

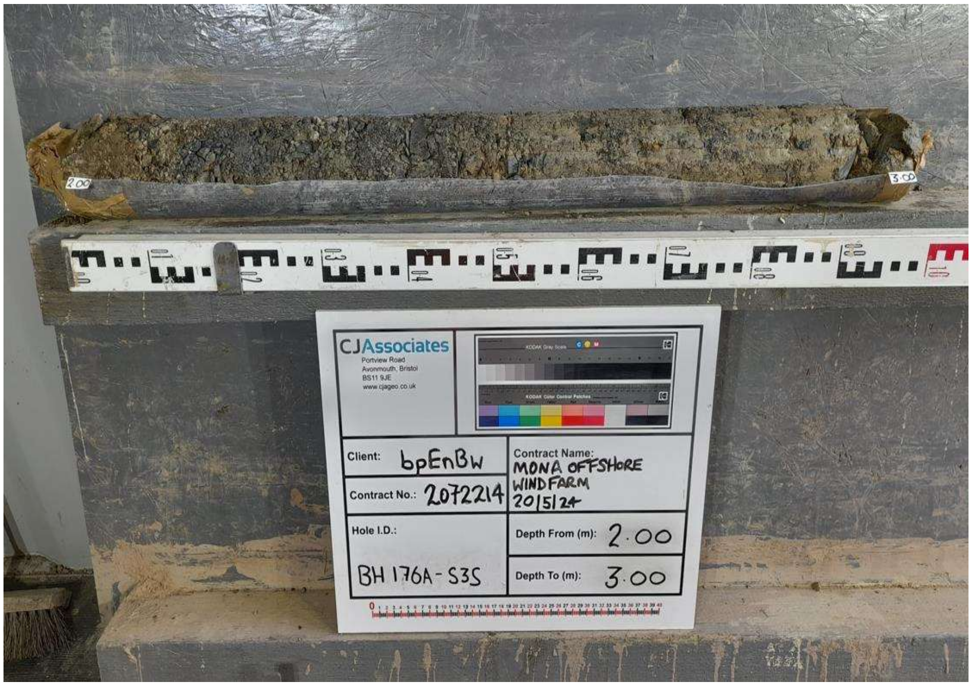
Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH176-S3S

Client
bpEnBW

Project No.
2072214



Client: bpEnBW

Contract No.: 2072214

Contract Name: MONA OFFSHORE WINDFARM 20/5/24

Hole I.D.: BH 176A-S3S

Depth From (m): 2.00

Depth To (m): 3.00

Client: bpEnBW

Contract No.: 2072214

Contract Name: MONA OFFSHORE WINDFARM 20/5/24

Hole I.D.: BH 176A-S3S

Depth From (m): 3.00

Depth To (m): 3.50

CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH176-S3S**
	Client bpEnBW	Project No. 2072214

CJAssociates

Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WIND FARM 20/5/24

Hole I.D.: BH 176A-S3S

Depth From (m): 3.50

Depth To (m): 5.00

CJAssociates

Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WIND FARM 20/5/24

Hole I.D.: BH 176A-S3S

Depth From (m): 5.00

Depth To (m): 6.00

	Project	Drawing Title
CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Mona Offshore Wind Project Ground Investigation	**BH176-S3S**
	Client bpEnBW	Project No. 2072214

Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WIND FARM 22/5/24
Hole I.D.: BH 176A-S3S
Depth From (m): 6.00
Depth To (m): 7.50

Client: bpEnBw
Contract No.: 2072214
Contract Name: MONA OFFSHORE WIND FARM 22/5/24
Hole I.D.: BH 176A-S3S
Depth From (m): 7.50
Depth To (m): 9.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project	Drawing Title
Mona Offshore Wind Project Ground Investigation	**BH176-S3S**
Client bpEnBW	Project No. 2072214

Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WINDFARM 9/5/24

Hole I.D.: BH 180-S3S

Depth From (m): 0·60

Depth To (m): 1·20

Client: bpEnBw

Contract No.: 2072214

Contract Name: MONA OFFSHORE WINDFARM 9/5/24

Hole I.D.: BH 180-S3S

Depth From (m): 1·80

Depth To (m): 3·30

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project
Ground Investigation

Drawing Title
BH180-S3S

Client
bpEnBW

Project No.
2072214

CJAssociates

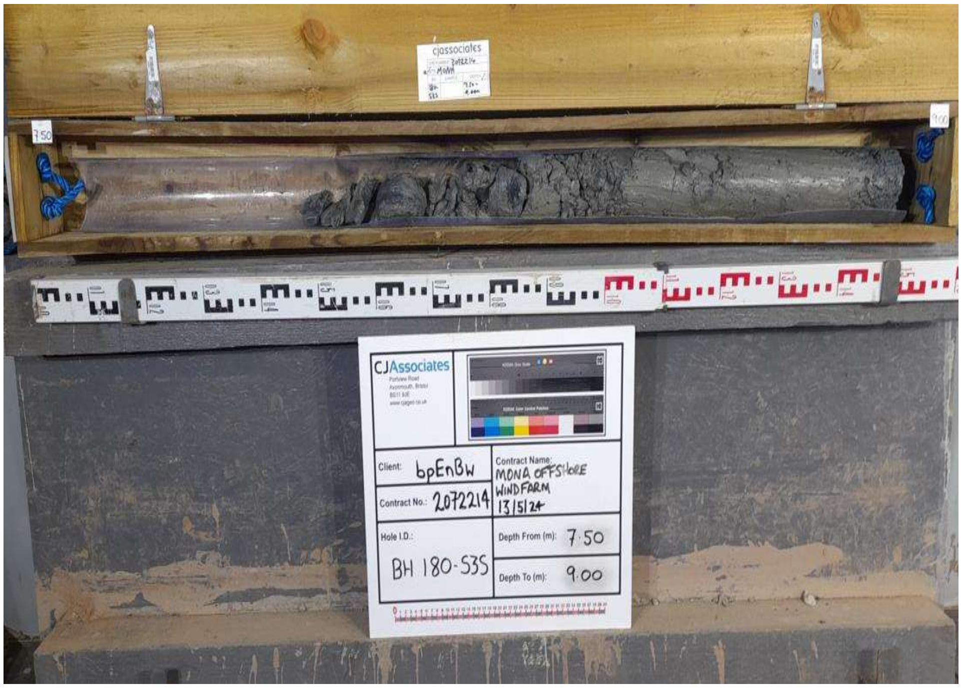
Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project
Mona Offshore Wind Project Ground Investigation

Drawing Title
BH180-S3S

Client
bpEnBW

Project No.
2072214



CJAssociates Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH180-S3S**
	Client bpEnBW	Project No. 2072214

CJAssociates

Client: bpEnBw

Contract Name: MONA OFFSHORE WIND FARM 13/5/24

Contract No.: 2072214

Hole I.D.: BH 180-S3S

Depth From (m): 9.00

Depth To (m): 10.50

CJAssociates

Client: bpEnBw

Contract Name: MONA OFFSHORE WIND FARM 13/5/24

Contract No.: 2072214

Hole I.D.: BH 180-S3S

Depth From (m): 10.50

Depth To (m): 12.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project

Mona Offshore Wind Project
Ground Investigation

Drawing Title

BH180-S3S

Client

bpEnBW

Project No.

2072214

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH180-S3S**
Client bpEnBW	Project No. 2072214

Unit 3, Block 6 Newlands Avenue Brackla Industrial Estate Bridgend, CF31 2DA	Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH180-S3S**
	Client bpEnBW	Project No. 2072214

Client: bpEnBw

Contract Name: MONA OFFSHORE WIND FARM 13/5/24

Contract No.: 2072214

Hole I.D.: BH 180-S3S

Depth From (m): 18.00

Depth To (m): 19.50

Client: bpEnBw

Contract Name: MONA OFFSHORE WIND FARM 13/5/24

Contract No.: 2072214

Hole I.D.: BH 180-S3S

Depth From (m): 19.50

Depth To (m): 20.00

CJAssociates

Unit 3, Block 6
Newlands Avenue
Brackla Industrial Estate
Bridgend, CF31 2DA

Project Mona Offshore Wind Project Ground Investigation	Drawing Title **BH180-S3S**
Client bpEnBW	Project No. 2072214

A.3. APPENDIX C: MONITORING DATA

Envirolab Job Number: 24/06858

Client Project Name: Onshore Ground & Site Investigation Surveys: Mona Offshore Wind Farm

Client Project Ref: 2072214 - L17001 - S10655

Lab Sample ID	24/06858/1	24/06858/2	24/06858/3	24/06858/4	24/06858/5	24/06858/6	24/06858/7	Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1	ES1	ES1			
Client Sample ID	BH106-S2	BH111-S3N/S	BH118-S3S	BH129-S3N/S	BH130-S4N	BH131-S4N	BH173-S3S			
Depth to Top	2.65	2.54	4.12	0.50	12.80	6.41	1.98			
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24			
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW			
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
pH (w)$_{A}^{\#}$	6.47	7.73	7.33	7.01	7.01	6.96	7.42	pH	0.01	A-T-031w
Electrical conductivity @ 20degC (w)$_{A}^{\#}$	564	534	257	506	500	290	290	µs/cm	10	A-T-037w
Alkalinity by titration (bicarbonate) (w)$_{A}$	220	275	145	300	320	125	160	mg/l Ca CO3	15	Titration w
Hardness Total$_{A}^{\#}$	270	98	125	323	322	93	130	mg/l Ca CO3	4	A-T-049w
Total Dissolved Solids (w)$_{A}^{\#}$	692	524	359	506	526	319	236	mg/l	20	A-T-035w
Total Suspended Solids (w)$_{A}^{\#}$	4947	167	12443	68017	90553	2237	5313	mg/l	10	A-T-036w
Ammonium / Ammoniacal nitrogen as NH4 (w)$_{A}^{\#}$	0.094	0.477	0.197	0.182	0.144	0.573	0.146	mg/l	0.065	A-T-033w
Chloride (w)$_{A}^{\#}$	39	25	16	10	10	11	17	mg/l	1	A-T-026w
Fluoride (w)$_{A}^{\#}$	0.11	1.12	0.49	0.26	0.19	0.14	0.49	mg/l	0.1	A-T-026w (F)
Nitrate (w)$_{A}^{\#}$	16.4	<0.1	0.2	16.5	16.0	39.0	0.7	mg/l	0.1	A-T-026w (N)
Sulphate (w)$_{A}^{\#}$	75	44	15	56	57	35	16	mg/l	1	A-T-026w
Cyanide (free) (w)$_{A}^{\#}$	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	0.005	A-T-042wFCN
Cyanide (total) (w)$_{A}^{\#}$	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	0.005	A-T-042wTCN
Phenols - Total by HPLC (w)$_{A}$	<0.01	<0.05	<0.20	<0.02	<0.01	<0.20	<0.01	mg/l	0.01	A-T-050w
Antimony (dissolved)$_{A}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-025w
Arsenic (dissolved)$_{A}^{\#}$	<1	1	<1	<1	<1	<1	<1	µg/l	1	A-T-025w
Boron (dissolved)$_{A}^{\#}$	19	16	16	18	17	15	15	µg/l	10	A-T-025w
Barium (dissolved)$_{A}^{\#}$	58	50	33	91	91	7	32	µg/l	1	A-T-025w
Beryllium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-025w
Cadmium (dissolved)$_{A}^{\#}$	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	µg/l	0.2	A-T-025w
Calcium (dissolved)$_{A}^{\#}$	76	24	31	101	101	22	32	mg/l	1	A-T-049w
Copper (dissolved)$_{A}^{\#}$	<4	<4	<4	<4	<4	4	<4	µg/l	4	A-T-025w
Chromium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-025w
Chromium (hexavalent) (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	0.01	A-T-040w
Lead (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	5	µg/l	1	A-T-025w
Magnesium (dissolved)$_{A}^{\#}$	19	9	11	17	17	9	12	mg/l	1	A-T-049w
Mercury (dissolved)$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	µg/l	0.1	A-T-025w
Nickel (dissolved)$_{A}^{\#}$	<2	3	<2	4	4	14	<2	µg/l	2	A-T-025w
Potassium (dissolved)$_{A}^{\#}$	14	6	<1	3	3	2	<1	mg/l	1.2	A-T-049w
Selenium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-025w
Sodium (dissolved)$_{A}^{\#}$	19	104	17	15	15	9	17	mg/l	1	A-T-049w

Lab Sample ID	24/06858/1	24/06858/2	24/06858/3	24/06858/4	24/06858/5	24/06858/6	24/06858/7	Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1	ES1	ES1			
Client Sample ID	BH106-S2	BH111-S3N/S	BH118-S3S	BH129-S3N/S	BH130-S4N	BH131-S4N	BH173-S3S			
Depth to Top	2.65	2.54	4.12	0.50	12.80	6.41	1.98			
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24			
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW			
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Sulphur, Total (dissolved)$_{A}$	27	16	6	17	17	12	6	mg/l	1	A-T-072w
Vanadium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-025w
Zinc (dissolved)$_{A}^{\#}$	11	16	28	19	22	57	30	µg/l	2	A-T-025w

Envirolab Job Number: 24/06858

Client Project Name: Onshore Ground & Site Investigation Surveys: Mona Offshore Wind Farm

Client Project Ref: 2072214 - L17001 - S10655

Lab Sample ID	24/06858/1	24/06858/2	24/06858/3	24/06858/4	24/06858/5	24/06858/6	24/06858/7	Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1	ES1	ES1			
Client Sample ID	BH106-S2	BH111-S3N/S	BH118-S3S	BH129-S3N/S	BH130-S4N	BH131-S4N	BH173-S3S			
Depth to Top	2.65	2.54	4.12	0.50	12.80	6.41	1.98			
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24			
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW			
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
PAH 16MS (w)										
Acenaphthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Acenaphthylene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Anthracene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Benzo(a)anthracene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Benzo(a)pyrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Chrysene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Fluoranthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Fluorene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Naphthalene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Phenanthrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Pyrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w
Total PAH 16MS (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	µg/l	0.01	A-T-019w

Envirolab Job Number: 24/06858

Client Project Name: Onshore Ground & Site Investigation Surveys: Mona Offshore Wind Farm

Client Project Ref: 2072214 - L17001 - S10655

Lab Sample ID	24/06858/1	24/06858/2	24/06858/3	24/06858/4	24/06858/5	24/06858/6	24/06858/7	Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1	ES1	ES1			
Client Sample ID	BH106-S2	BH111-S3N/S	BH118-S3S	BH129-S3N/S	BH130-S4N	BH131-S4N	BH173-S3S			
Depth to Top	2.65	2.54	4.12	0.50	12.80	6.41	1.98			
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24			
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW			
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
TPH CWG (w) with Clean Up										
Ali >C5-C6 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
Ali >C6-C8 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
Ali >C8-C10 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Ali >C10-C12 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Ali >C12-C16 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Ali >C16-C21 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Ali >C21-C35 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Total Aliphatics (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	Calc-As Recd
Aro >C5-C7 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
Aro >C7-C8 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
Aro >C8-C10 (w)$_{A}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Aro >C10-C12 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Aro >C12-C16 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Aro >C16-C21 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5	<5	<5	µg/l	5	A-T-055w
Aro >C21-C35 (w)$_{A}^{\#}$	<10	<10	<10	<10	<10	<10	<10	µg/l	10	A-T-055w
Total Aromatics (w)$_{A}^{\#}$	<10	<10	<10	<10	<10	<10	<10	µg/l	10	Calc-As Recd
TPH (Ali & Aro >C5-C35) (w)$_{A}$	<10	<10	<10	<10	<10	<10	<10	µg/l	10	Calc-As Recd
BTEX - Benzene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
BTEX - Toluene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
BTEX - Ethyl Benzene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
BTEX - m & p Xylene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
BTEX - o Xylene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w
MTBE (w)$_{A}^{\#}$	<1	<1	<1	<1	<1	<1	<1	µg/l	1	A-T-022w

Envirolab Job Number: 24/06858

Client Project Name: Onshore Ground & Site Investigation Surveys: Mona Offshore Wind Farm

Client Project Ref: 2072214 - L17001 - S10655

Lab Sample ID	24/06858/8	24/06858/9	24/06858/10	24/06858/11	24/06858/12			Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1					
Client Sample ID	BH175-S3S	BH176-S3S	BH177-S4N	BH180-S3S	BH181-S4N					
Depth to Top	2.95	4.57	0.01	1.52	4.98					
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24					
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW					
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A					
pH (w)$_{A}^{\#}$	7.84	7.28	6.58	7.34	7.17			pH	0.01	A-T-031w
Electrical conductivity @ 20degC (w)$_{A}^{\#}$	533	544	449	550	353			µs/cm	10	A-T-037w
Alkalinity by titration (bicarbonate) (w)$_{A}$	330	365	230	290	135			mg/l Ca CO3	15	Titration w
Hardness Total$_{A}^{\#}$	97	264	94	261	93			mg/l Ca CO3	4	A-T-049w
Total Dissolved Solids (w)$_{A}^{\#}$	420	279	326	362	266			mg/l	20	A-T-035w
Total Suspended Solids (w)$_{A}^{\#}$	78	4780	13037	19503	4093			mg/l	10	A-T-036w
Ammonium / Ammoniacal nitrogen as NH4 (w)$_{A}^{\#}$	0.666	2.011	0.112	2.002	0.153			mg/l	0.065	A-T-033w
Chloride (w)$_{A}^{\#}$	25	14	11	14	11			mg/l	1	A-T-026w
Fluoride (w)$_{A}^{\#}$	1.12	0.41	0.12	0.46	0.10			mg/l	0.1	A-T-026w (F)
Nitrate (w)$_{A}^{\#}$	<0.1	<0.1	38.9	0.2	39.4			mg/l	0.1	A-T-026w (N)
Sulphate (w)$_{A}^{\#}$	47	24	38	24	41			mg/l	1	A-T-026w
Cyanide (free) (w)$_{A}^{\#}$	<0.005	<0.005	<0.005	<0.005	<0.005			mg/l	0.005	A-T-042wFCN
Cyanide (total) (w)$_{A}^{\#}$	<0.005	<0.005	0.006	<0.005	0.007			mg/l	0.005	A-T-042wTCN
Phenols - Total by HPLC (w)$_{A}$	<0.05	<0.02	<0.20	<0.02	<0.20			mg/l	0.01	A-T-050w
Antimony (dissolved)$_{A}$	<1	<1	<1	<1	<1			µg/l	1	A-T-025w
Arsenic (dissolved)$_{A}^{\#}$	1	<1	<1	1	<1			µg/l	1	A-T-025w
Boron (dissolved)$_{A}^{\#}$	15	34	16	37	17			µg/l	10	A-T-025w
Barium (dissolved)$_{A}^{\#}$	49	139	8	140	7			µg/l	1	A-T-025w
Beryllium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-025w
Cadmium (dissolved)$_{A}^{\#}$	<0.2	<0.2	<0.2	<0.2	<0.2			µg/l	0.2	A-T-025w
Calcium (dissolved)$_{A}^{\#}$	24	72	22	71	22			mg/l	1	A-T-049w
Copper (dissolved)$_{A}^{\#}$	<4	<4	5	<4	<4			µg/l	4	A-T-025w
Chromium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-025w
Chromium (hexavalent) (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/l	0.01	A-T-040w
Lead (dissolved)$_{A}^{\#}$	<1	2	<1	<1	<1			µg/l	1	A-T-025w
Magnesium (dissolved)$_{A}^{\#}$	9	20	10	20	9			mg/l	1	A-T-049w
Mercury (dissolved)$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1			µg/l	0.1	A-T-025w
Nickel (dissolved)$_{A}^{\#}$	3	5	14	5	14			µg/l	2	A-T-025w
Potassium (dissolved)$_{A}^{\#}$	6	7	2	7	2			mg/l	1.2	A-T-049w
Selenium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-025w
Sodium (dissolved)$_{A}^{\#}$	103	43	11	42	9			mg/l	1	A-T-049w

Envirolab Job Number: 24/06858

Client Project Name: Onshore Ground & Site Investigation
Surveys: Mona Offshore Wind Farm

Client Project Ref: 2072214 - L17001 - S10655

Lab Sample ID	24/06858/8	24/06858/9	24/06858/10	24/06858/11	24/06858/12			Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1					
Client Sample ID	BH175-S3S	BH176-S3S	BH177-S4N	BH180-S3S	BH181-S4N					
Depth to Top	2.95	4.57	0.01	1.52	4.98					
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24					
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW					
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A					
Sulphur, Total (dissolved)$_{A}$	16	11	12	10	12			mg/l	1	A-T-072w
Vanadium (dissolved)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-025w
Zinc (dissolved)$_{A}^{\#}$	19	11	63	16	49			µg/l	2	A-T-025w

Lab Sample ID	24/06858/8	24/06858/9	24/06858/10	24/06858/11	24/06858/12			Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1					
Client Sample ID	BH175-S3S	BH176-S3S	BH177-S4N	BH180-S3S	BH181-S4N					
Depth to Top	2.95	4.57	0.01	1.52	4.98					
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24					
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW					
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A					
PAH 16MS (w)										
Acenaphthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	0.01	<0.01			µg/l	0.01	A-T-019w
Acenaphthylene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Anthracene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Benzo(a)anthracene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Benzo(a)pyrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Chrysene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Fluoranthene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Fluorene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Naphthalene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Phenanthrene (w)$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	0.01	A-T-019w
Pyrene (w)$_{A}^{\#}$	0.01	<0.01	<0.01	<0.01	0.02			µg/l	0.01	A-T-019w
Total PAH 16MS (w)$_{A}^{\#}$	0.01	<0.01	<0.01	0.01	0.02			µg/l	0.01	A-T-019w

Lab Sample ID	24/06858/8	24/06858/9	24/06858/10	24/06858/11	24/06858/12			Units	Limit of Detection	Method ref
Client Sample No	ES1	ES1	ES1	ES1	ES1					
Client Sample ID	BH175-S3S	BH176-S3S	BH177-S4N	BH180-S3S	BH181-S4N					
Depth to Top	2.95	4.57	0.01	1.52	4.98					
Depth To Bottom										
Date Sampled	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24	11-Jul-24					
Sample Type	WATER - EW	WATER - EW	WATER - EW	WATER - EW	WATER - EW					
Sample Matrix Code	N/A	N/A	N/A	N/A	N/A					
TPH CWG (w) with Clean Up										
Ali >C5-C6 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
Ali >C6-C8 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
Ali >C8-C10 (w)$_{A}^{\#}$	<5	<5	<5	<5	<5			µg/l	5	A-T-055w
Ali >C10-C12 (w)$_{A}^{\#}$	<5	<5	<5	9	<5			µg/l	5	A-T-055w
Ali >C12-C16 (w)$_{A}^{\#}$	75	303	<5	1301	<5			µg/l	5	A-T-055w
Ali >C16-C21 (w)$_{A}^{\#}$	<5	<5	<5	16	<5			µg/l	5	A-T-055w
Ali >C21-C35 (w)$_{A}^{\#}$	<5	92	<5	99	<5			µg/l	5	A-T-055w
Total Aliphatics (w)$_{A}^{\#}$	75	395	<5	1430	<5			µg/l	5	Calc-As Recd
Aro >C5-C7 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
Aro >C7-C8 (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
Aro >C8-C10 (w)$_{A}$	<5	6	<5	7	<5			µg/l	5	A-T-055w
Aro >C10-C12 (w)$_{A}^{\#}$	<5	15	<5	31	<5			µg/l	5	A-T-055w
Aro >C12-C16 (w)$_{A}^{\#}$	20	126	<5	335	<5			µg/l	5	A-T-055w
Aro >C16-C21 (w)$_{A}^{\#}$	13	18	<5	20	<5			µg/l	5	A-T-055w
Aro >C21-C35 (w)$_{A}^{\#}$	<10	11	<10	12	<10			µg/l	10	A-T-055w
Total Aromatics (w)$_{A}^{\#}$	33	176	<10	405	<10			µg/l	10	Calc-As Recd
TPH (Ali & Aro >C5-C35) (w)$_{A}$	108	571	<10	1830	<10			µg/l	10	Calc-As Recd
BTEX - Benzene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
BTEX - Toluene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
BTEX - Ethyl Benzene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
BTEX - m & p Xylene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
BTEX - o Xylene (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w
MTBE (w)$_{A}^{\#}$	<1	<1	<1	<1	<1			µg/l	1	A-T-022w

GAS AND GROUNDWATER MONITORING RESULTS

CJAssociates

Project: Mona Offshore Wind Farm, Phase 2 - Landfall & Cable Route

Job no: 2072214

Date: 08-11/07/24

Time of start of visit: 08:00

Time of end of visit: 16:00

Barometric pressure start of visit (mb):

Barometric pressure end of visit (mb):

Visit no.: 1

Barometric pressure in preceding 24hrs (mb):

Remarks: Groundwater dip only. All measurements taken from the current ground level.

Weather conditions: Mostly Dry

Ground conditions: Dry / Damp

Monitoring Point		Methane (% vol) CH_4	Carbon Dioxide (% vol) CO_2	Hydrogen Sulphide (ppm) H_2S	Oxygen (% vol) O_2	Carbon Monoxide (ppm) CO	PID (ppm)	Free Phase Product (mm)	Gas flow average (l/hr)	Borehole Pressure (Pa)	Water Depth (mbgl)	Remarks	Base Depths (mbgl)
Ambient:													
BH102-S2	Peak						N/A	N/A	N/A	N/A	5.31	Water Sampled	14.05
	Steady												
BH103-S2A	Peak						N/A	N/A	N/A	N/A	5.10	Water Sampled	6.40
	Steady												
BH103-S2B	Peak						N/A	N/A	N/A	N/A	6.83	Water Sampled	17.79
	Steady												
BH106-S2	Peak						N/A	N/A	N/A	N/A	2.65	Water Sampled	4.07
	Steady												
BH108-S2	Peak						N/A	N/A	N/A	N/A	4.83	Water Sampled	7.74
	Steady												
BH109-S2	Peak						N/A	N/A	N/A	N/A	1.55	Water Sampled	7.72
	Steady												
BH111-S3N/S	Peak						N/A	N/A	N/A	N/A	2.54	Water Sampled	7.31
	Steady												
BH114-S6	Peak						N/A	N/A	N/A	N/A	DRY		9.31
	Steady												
BH111-S3N/S	Peak						N/A	N/A	N/A	N/A	2.54	Water Sampled	7.31
	Steady												
BH129-S4N/S	Peak						N/A	N/A	N/A	N/A	0.50	Water Sampled	8.81
	Steady												
BH130-S4N	Peak						N/A	N/A	N/A	N/A	12.80	Water Sampled	18.58
	Steady												
BH131-S4N	Peak						N/A	N/A	N/A	N/A	6.41	Water Sampled	11.69
	Steady												
BH133-S5N	Peak						N/A	N/A	N/A	N/A	2.99	Water Sampled	10.17
	Steady												
BH140-S5N/S	Peak						N/A	N/A	N/A	N/A	6.09	Water Sampled	8.09
	Steady												

GAS AND GROUNDWATER MONITORING RESULTS

Project: Mona Offshore Wind Farm, Phase 2 - Landfall & Cable Route
Job no: 2072214
Date: 08-11/07/24
Time of start of visit: 08:00
Barometric pressure start of visit (mb):
Visit no.: 1
Time of end of visit: 16:00
Barometric pressure end of visit (mb):

Barometric pressure in preceding 24hrs (mb):

Remarks: Groundwater dip only. All measurements taken from the current ground level.

Weather conditions: Mostly Dry
Ground conditions: Dry / Damp

Monitoring Point		Methane (% vol) CH_4	Carbon Dioxide (% vol) CO_2	Hydrogen Sulphide (ppm) H_2S	Oxygen (% vol) O_2	Carbon Monoxide (ppm) CO	PID (ppm)	Free Phase Product (mm)	Gas flow average (l/hr)	Borehole Pressure (Pa)	Water Depth (mbgl)	Remarks	Base Depths (mbgl)
Ambient:													
BH141-S7N/S	Peak						N/A	N/A	N/A	N/A	DRY		9.85
	Steady												
BH142-S7NS	Peak						N/A	N/A	N/A	N/A	7.40	Water Sampled	18.84
	Steady												
BH143-S7S	Peak						N/A	N/A	N/A	N/A	DRY		16.30
	Steady												
BH144-S7S	Peak						N/A	N/A	N/A	N/A	0.89	Water Sampled	7.95
	Steady												
BH150-S8	Peak						N/A	N/A	N/A	N/A	4.99	Water Sampled	5.68
	Steady												
BH167-S9	Peak						N/A	N/A	N/A	N/A	0.82	Water Sampled	9.77
	Steady												
BH173-S3S	Peak						N/A	N/A	N/A	N/A	1.98	Water Sampled	7.43
	Steady												
BH174-S5N	Peak						N/A	N/A	N/A	N/A	10.16	Water Sampled	15.15
	Steady												
BH175-S3S	Peak						N/A	N/A	N/A	N/A	2.95	Water Sampled	8.29
	Steady												
BH176-S3S	Peak						N/A	N/A	N/A	N/A	4.57	Water Sampled	6.66
	Steady												
BH177-S4N	Peak						N/A	N/A	N/A	N/A	0.01	Water Sampled	7.85
	Steady												
BH178-S7S	Peak						N/A	N/A	N/A	N/A	0.88	Water Sampled	5.49
	Steady												
BH180-S3S	Peak						N/A	N/A	N/A	N/A	1.52	Water Sampled	17.59
	Steady												
BH181-S4N	Peak						N/A	N/A	N/A	N/A	4.98	Water Sampled	8.61
	Steady												
BH209-S2	Peak						N/A	N/A	N/A	N/A	Dry		2.90
	Steady												

GAS AND GROUNDWATER MONITORING RESULTS

CJAssociates

Project: Mona Offshore Wind Farm, Phase 2 - Landfall & Cable Route

Job no: 2072214

Date: 22-24/07/24

Time of start of visit: 08:00

Time of end of visit: 16:00

Barometric pressure start of visit (mb)

Barometric pressure end of visit (mb):

Visit no.: 2

Barometric pressure in preceding 24hrs (mb):

Remarks: Groundwater dip only. All measurements taken from the current ground level.

Weather conditions: Dry

Ground conditions: Dry

Monitoring Point		Methane (% vol) CH_4	Carbon Dioxide (% vol) CO_2	Hydrogen Sulphide (ppm) H_2S	Oxygen (% vol) O_2	Carbon Monoxide (ppm) CO	PID (ppm)	Free Phase Product (mm)	Gas flow average (l/hr)	Borehole Pressure (Pa)	Water Depth (mbgl)	Remarks	Base Depths (mbgl)
Ambient:													
BH102-S2	Peak						N/A	N/A	N/A	N/A	5.48		14.02
	Steady												
BH103-S2A	Peak						N/A	N/A	N/A	N/A	5.15		6.40
	Steady												
BH103-S2B	Peak						N/A	N/A	N/A	N/A	6.94		17.71
	Steady												
BH106-S2	Peak						N/A	N/A	N/A	N/A	2.60		4.06
	Steady												
BH108-S2	Peak						N/A	N/A	N/A	N/A	5.01		7.71
	Steady												
BH109-S2	Peak						N/A	N/A	N/A	N/A	1.06		7.73
	Steady												
BH111-S3N/S	Peak						N/A	N/A	N/A	N/A	2.52		7.31
	Steady												
BH114-S6	Peak						N/A	N/A	N/A	N/A	8.55		9.11
	Steady												
BH129-S4N/S	Peak						N/A	N/A	N/A	N/A	0.42		8.80
	Steady												
BH130-S4N	Peak						N/A	N/A	N/A	N/A	14.26		17.68
	Steady												
BH131-S4N	Peak						N/A	N/A	N/A	N/A	5.61		11.60
	Steady												
BH133-S5N	Peak						N/A	N/A	N/A	N/A	3.08		10.10
	Steady												
BH140-S5N/S	Peak						N/A	N/A	N/A	N/A	5.90		8.12
	Steady												

GAS AND GROUNDWATER MONITORING RESULTS

Project: Mona Offshore Wind Farm, Phase 2 - Landfall & Cable Route
Job no: 2072214
Date: 22-24/07/24

CJAssociates

Time of start of visit: 08:00
Barometric pressure start of visit (mb):
Visit no.: 2
Time of end of visit: 16:00
Barometric pressure end of visit (mb):

Barometric pressure in preceding 24hrs (mb):

Remarks: Groundwater dip only. All measurements taken from the current ground level.

Weather conditions: Dry
Ground conditions: Dry

Monitoring Point		Methane (% vol) CH_4	Carbon Dioxide (% vol) CO_2	Hydrogen Sulphide (ppm) H_2S	Oxygen (% vol) O_2	Carbon Monoxide (ppm) CO	PID (ppm)	Free Phase Product (mm)	Gas flow average (l/hr)	Borehole Pressure (Pa)	Water Depth (mbgl)	Remarks	Base Depths (mbgl)
Ambient:													
BH141-S7N/S	Peak						N/A	N/A	N/A	N/A	DRY		9.85
	Steady												
BH142-S7NS	Peak						N/A	N/A	N/A	N/A	7.22		18.85
	Steady												
BH143-S7S	Peak						N/A	N/A	N/A	N/A	DRY		18.80
	Steady												
BH144-S7S	Peak						N/A	N/A	N/A	N/A	0.80		7.95
	Steady												
BH150-S8	Peak						N/A	N/A	N/A	N/A	5.22		5.49
	Steady												
BH167-S9	Peak						N/A	N/A	N/A	N/A	0.82		9.34
	Steady												
BH173-S3S	Peak						N/A	N/A	N/A	N/A	1.77		7.74
	Steady												
BH174-S5N	Peak						N/A	N/A	N/A	N/A	10.01		15.13
	Steady												
BH175-S3S	Peak						N/A	N/A	N/A	N/A	3.01		8.24
	Steady												
BH176-S3S	Peak						N/A	N/A	N/A	N/A	4.45		6.60
	Steady												
BH177-S4N	Peak						N/A	N/A	N/A	N/A	0.01		7.85
	Steady												
BH178-S7S	Peak						N/A	N/A	N/A	N/A	0.91		5.38
	Steady												
BH180-S3S	Peak						N/A	N/A	N/A	N/A	1.80		17.59
	Steady												
BH181-S4N	Peak						N/A	N/A	N/A	N/A	5.29		8.71
	Steady												
BH209-S2	Peak						N/A	N/A	N/A	N/A	2.89		2.95
	Steady												

GAS AND GROUNDWATER MONITORING RESULTS

Project: Mona Offshore Wind Farm, Phase 2 - Landfall & Cable Route
Job no: 2072214
Date: 05-07/08/24
Time of start of visit: 08:00
Time of end of visit: 16:00
Barometric pressure start of visit (mb)
Barometric pressure end of visit (mb):
Visit no.: 3

Barometric pressure in preceding 24hrs (mb):

Remarks: Groundwater dip only. All measurements taken from the current ground level.

Weather conditions: Overcast
Ground conditions: Dry

Monitoring Point		Methane (% vol) CH_4	Carbon Dioxide (% vol) CO_2	Hydrogen Sulphide (ppm) H_2S	Oxygen (% vol) O_2	Carbon Monoxide (ppm) CO	PID (ppm)	Free Phase Product (mm)	Gas flow average (l/hr)	Borehole Pressure (Pa)	Water Depth (mbgl)	Remarks	Base Depths (mbgl)
Ambient:													
BH102-S2	Peak						N/A	N/A	N/A	N/A	5.40		14.00
	Steady												
BH103-S2A	Peak						N/A	N/A	N/A	N/A	5.18		6.35
	Steady												
BH103-S2B	Peak						N/A	N/A	N/A	N/A	6.95		17.77
	Steady												
BH106-S2	Peak						N/A	N/A	N/A	N/A	2.50		4.00
	Steady												
BH108-S2	Peak						N/A	N/A	N/A	N/A	4.95		7.70
	Steady												
BH109-S2	Peak						N/A	N/A	N/A	N/A	0.99		7.70
	Steady												
BH111-S3N/S	Peak						N/A	N/A	N/A	N/A	2.50		7.31
	Steady												
BH114-S6	Peak						N/A	N/A	N/A	N/A	8.62		9.08
	Steady												
BH118-S6	Peak						N/A	N/A	N/A	N/A	2.90	`	14.14
	Steady												
BH129-S4N/S	Peak						N/A	N/A	N/A	N/A	0.40		8.78
	Steady												
BH130-S4N	Peak						N/A	N/A	N/A	N/A	14.20		17.60
	Steady												
BH131-S4N	Peak						N/A	N/A	N/A	N/A	5.97		11.57
	Steady												
BH133-S5N	Peak						N/A	N/A	N/A	N/A	3.15		10.08
	Steady												
BH140-S5N/S	Peak						N/A	N/A	N/A	N/A	5.87		8.10
	Steady												

GAS AND GROUNDWATER MONITORING RESULTS

CJAssociates

Project: Mona Offshore Wind Farm, Phase 2 - Landfall & Cable Route

Job no: 2072214

Date: 05-07/08/24

Time of start of visit: 08:00

Barometric pressure start of visit (mb):

Visit no.: 3

Time of end of visit: 16:00

Barometric pressure end of visit (mb):

Barometric pressure in preceding 24hrs (mb):

Remarks: Groundwater dip only. All measurements taken from the current ground level.

Weather conditions: Overcast

Ground conditions: Dry

Monitoring Point		Methane (% vol) CH_4	Carbon Dioxide (% vol) CO_2	Hydrogen Sulphide (ppm) H_2S	Oxygen (% vol) O_2	Carbon Monoxide (ppm) CO	PID (ppm)	Free Phase Product (mm)	Gas flow average (l/hr)	Borehole Pressure (Pa)	Water Depth (mbgl)	Remarks	Base Depths (mbgl)
Ambient:													
BH141-S7N/S	Peak						N/A	N/A	N/A	N/A	DRY		9.85
	Steady												
BH142-S7NS	Peak						N/A	N/A	N/A	N/A	7.25		18.83
	Steady												
BH143-S7S	Peak						N/A	N/A	N/A	N/A	DRY		18.77
	Steady												
BH144-S7S	Peak						N/A	N/A	N/A	N/A	0.83		7.93
	Steady												
BH150-S8	Peak						N/A	N/A	N/A	N/A	5.18		5.50
	Steady												
BH167-S9	Peak						N/A	N/A	N/A	N/A	0.88		9.34
	Steady												
BH173-S3S	Peak						N/A	N/A	N/A	N/A	1.77		7.40
	Steady												
BH174-S5N	Peak						N/A	N/A	N/A	N/A	10.00		15.09
	Steady												
BH175-S3S	Peak						N/A	N/A	N/A	N/A	3.00		8.20
	Steady												
BH176-S3S	Peak						N/A	N/A	N/A	N/A	4.47		6.55
	Steady												
BH177-S4N	Peak						N/A	N/A	N/A	N/A	0.01		7.84
	Steady												
BH178-S7S	Peak						N/A	N/A	N/A	N/A	0.91		5.34
	Steady												
BH180-S3S	Peak						N/A	N/A	N/A	N/A	1.70		17.59
	Steady												
BH181-S4N	Peak						N/A	N/A	N/A	N/A	5.29		8.70
	Steady												
BH209-S2	Peak						N/A	N/A	N/A	N/A	2.85		2.90
	Steady												

A.4. APPENDIX D: RISK ASSESSMENT

Mona Offshore Windfarm
Hydrogeological Risk Assessment for Tan-y Myndd Trout Fishery

Construction Activity	Description of Activity	Section of Cable Route Corridor Considered	Potential effects on local groundwater in the cable route corridor	Incorporated Mitigation	Groundwater Pathway Affected	Effect on spring fed Tan-y Mynydd Trout Fishery Considered	Key Risk Notes	Likelihood of Pathway	Severity of Consequence	RISK RANKING	Reference
Shallow open trenching for onshore export cables	Four cable circuits to be trenched in the cable route corridor. Trenches excavated to a depth of 1.8 m. Cable trenches 1.5m wide at their base and 2.5m wide at the surface. Dry excavation are required for cable emplacement so any groundwater ingress into the will be pumped out and discharge to the surface waters drainage system.	Western and central section (BH180 to BH173 inclusive)	*Groundwater Dewatering to maintain dry excavations:* Groundwater levels in boreholes in the western and central section of the CRC have been shown to range between 1.5 mbgl to 4.8 mbgl, but are typically greater than 1.80 mbgl. This suggests limited dewatering in is required in the section to lowered groundwater levels by less than 0.2m.	-	HCM1: Groundwater transport through a large-scale regional fault / fault zone and an associated interconnected fracture network in the mudstones Elwy Formation	Short-term, temporary reduction in groundwater throughflow to the spring at the fishery.	- Shallow trenches, with a small groundwater drawdown required and limited dewatering requirements predicted. - There is little evidence of fractures and/or interconnected a fractured network in boreholes constructed in the western section over the depth of HDD that could provide a connected pathway to the spring. - The western section is located at large lateral distance from the spring (>575m) and at significantly higher elevation (55m to 75m). This requires an extensive, deep and complex fracture network to exist in the bedrock. - Cable trenches cover a very small area that require dewatering relative to the total potential catchment area. - Short-term, temporary dewatering effect that should recover afterward construction phase. **No effect at spring predicted**	Unlikely	Negligible	**Very Low Risk**	1.1.1
			Accidental releases: Accidental release of polluting material into excavation trench and migration into saturated fractures in the bedrock aquifer. Hazardous liquids include fuels (hydrocarbons), hydraulic fluids, oils/grease and include fuels and hydraulic fluids associated with construction vehicles and plant.	Pollution prevention management plan and emergency response plan		Transport of contaminants in dissolved phase to the to the spring at the fishery.	- Small release volumes and risk minimisation expected through implementation of pollution prevention management plan and emergency response plan. - Accidental release rather than continuous release during construction phase. - There is little evidence of fractures and/or interconnected a fractured network in boreholes constructed in the western section over the depth of HDD that could provide a connected pathway to the spring. - The western section is located at large lateral distance from the spring (>575m) and at significantly higher elevation (55m to 75m). This requires an extensive, deep and complex fracture network to exist in the bedrock. - Much of polluting substances lost to ground (i.e. hydrocarbon products) likely to retained in shallow weathered materials (soils) or fractures with limited connectivity, in the vicinity o the spillage. Localised impact. - Cable trenches cover a very small area that requires dewatering relative to the total potential catchment area (Assuming a toral catchment area of 1km^2 , the 4 cable circuits over the 1km length of the western section cover only 1% of the catchment area). - Short term temporary effect on groundwater near area of ingress. **No measurable effect at spring predicted**	Unlikely	Negligible	**Very Low Risk**	1.1.2
			Ingress of silt laden surface runoff: Ingress of silt laden surface runoff from the cable corridor in the excavated trenches and migration into saturated fractures. Runoff may also contain low concentrations of metals and hydrocarbons associated with construction vehicles.	Surface water management plan for cable route corridor		Transport of contaminants in dissolved phase to the to the spring at the fishery.	- Runoff into excavations minimised by control measures defined in the surface water management plan for the construction area. - There is little evidence of fractures and/or interconnected a fractured network in boreholes constructed in the western section over the depth of HDD that could provide a connected pathway to the spring. - The western section is located at large lateral distance from the spring (>575m) and at significantly higher elevation (55m to 75m). This requires an extensive, deep and complex fracture network to exist in the bedrock. - Much of polluting substances lost to ground (i.e. hydrocarbon products) likely to retained in Shallow weathered materials (soils) or fractures with limited connectivity, in the vicinity o the spillage. Localised impact. - Cable trenches cover a very small area that requires dewatering relative to the total potential catchment area. - Temporary affect on groundwater near area of ingress. **No measurable effect at the spring predicted**	Unlikely	Negligible	**Very Low Risk**	1.1.3
		Eastern section (BH129 to BH130)	*Groundwater Dewatering to maintain dry excavations:* Groundwater levels in boreholes are highly variable ranging between 0.5 to 14.3 mbgl. This groundwater drawdowns of between 0 and 1.3 m will be required to maintain dry trenches	-	HCM2: Groundwater transport in a shallow, highly fractured and locally extensive sandstone or mudstone unit(s) in the Elwy Formation	Short-term, temporary reduction in groundwater throughflow to the spring at the fishery.	- Shallow trenches, with a small groundwater drawdown required and limited dewatering requirements predicted. - There is evidence of fractures and/or a interconnected fracture network in boreholes constructed in the eastern section that could provide a connected pathway to the spring. - A long, complex fracture network is required for any connection with the spring fishery (>875m long, with height above spring decreasing from 57 m at BH129 to 13m at BH131). - Cable trenches cover a very small area that requires dewatering relative to the total potential catchment area (Assuming a toral catchment area of 1km^2, the 4 cable circuits over the 1km length of the eastern CRC section cover only 1% of the catchment area). - Short-term, temporary dewatering effect that should recover afterward construction phase. **No measurable effect at spring predicted**	Possible	Negligible	**Very Low Risk**	1.2.1
			Accidental releases: Accidental release of polluting material into excavation trench and migration into saturated fractures in the bedrock aquifer. Hazardous liquids include fuels (hydrocarbons), hydraulic fluids, oils/grease and include fuels and hydraulic fluids associated with construction vehicles and plant.	Pollution prevention management plan and emergency response plan		Transport of contaminants in dissolved phase to the to the spring at the fishery.	- Small release volumes and risk minimisation expected through implementation of pollution prevention management plan and emergency response plan. - Accidental release rather than continuous release during construction phase. - There is evidence of fractures and/or a interconnected fracture network in boreholes constructed in the eastern section that could provide a connected pathway to the spring. - A long, complex fracture network is required for any connection with the spring fishery (>875m long, with height above spring decreasing from 57 m at BH129 to 13m at BH131. - Cable trenches cover a very small area that requires dewatering relative to the total potential catchment area (Assuming a toral catchment area of 1km^2, the 4 cable circuits over the 1km length of the eastern section cover only 1% of the catchment area). - Short-term, temporary effect on groundwater near area of ingress. **No measurable effect at spring predicted**	Possible	Negligible	**Very Low Risk**	1.2.2
			Ingress of silt laden surface runoff: Ingress of silt laden surface runoff from the cable corridor in the excavated trenches and migration into saturated fractures. Runoff may also contain low concentrations of metals and hydrocarbons associated with construction vehicles.	Surface water management plan for cable route corridor		Transport of contaminants in dissolved phase to the to the spring at the fishery.	- Runoff into excavations minimised by control measures defined in the surface water management plan for the construction area. - There is evidence of fractures and/or a interconnected fracture network in boreholes constructed in the eastern section that could provide a connected pathway to the spring. - A long, complex fracture network is required for any connection with the spring fishery (>875m long, with height above spring decreasing from 57 m at BH129 to 13m at BH131. - Cable trenches cover a very small area that requires dewatering relative to the total potential catchment area (Assuming a toral catchment area of 1km^2, the 4 cable circuits over the 1km length of the eastern section cover only 1% of the catchment area). - Short-term, temporary effect on groundwater near area of ingress. **No measurable effect at spring predicted**	Possible	Negligible	**Very Low Risk**	1.2.3
			Groundwater Dewatering to maintain dry excavations: Groundwater levels in boreholes have been shown to range between 1.5 mbgl to 4.8 mbgl but are typically greater than 1.80 mbgl. LBs are unlikely to intercept groundwater. The JBs may extend below groundwater, although the depth is unlikely t o significantly exceed 0.5m. As with the excavation trenching, this suggests limited groundwater dewatering will be required.	-		Short-term, temporary reduction in groundwater throughflow to the spring at the fishery.	As for trenching for onshore cables above (Ref 1.1.1.) Small area of coverage	Unlikely	Negligible	**Very Low Risk**	2.1.1

Mona Offshore Windfarm
Hydrogeological Risk Assessment for Tan-y Myndd Trout Fishery

Construction Activity	Description of Activity	Section of Cable Route Corridor Considered	Potential effects on local groundwater in the cable route corridor	Incorporated Mitigation	Groundwater Pathway Affected	Effect on spring fed Tan-y Mynydd Trout Fishery Considered	Key Risk Notes	Likelihood of Pathway	Severity of Consequence	RISK RANKING	Reference
Excavations for the emplacement of joint bays and link boxes	Joint Bays (JBs) and Link Boxes (LB) are installed in dry pits at intervals along cable route corridor. The maximum depth of JBs is 2.0m with a surface area of 200m^2 (c. 14m x 14m). In contrast LBs are shallower with depth of only 1.0m and surface area of only 6m^2. Both JBs and LBs are installed at 750m to 1,750m along the cable route corridor. Dry excavations are required for JBS and LBs, so groundwater dewatering is required in the excavations that extend below the groundwater table. That groundwater will be discharged to the surface water drainage system	Western and central section (BH180 to BH173 inclusive)	*Accidental releases:* Accidental release of polluting material into excavation for JBs and migration into saturated fractures in the bedrock aquifer. Hazardous liquids include fuels (hydrocarbons), hydraulic fluids, oils/grease and include fuels and hydraulic fluids associated with construction	Pollution prevention management plan	HCM1: Groundwater transport through a large-scale regional fault / fault zone and an associated interconnected fracture network in the mudstones Elwy Formation	Transport of contaminants in dissolved phase to the to the spring at the fishery.	As for trenching for onshore cables above (Ref 1.1.2.) Small area of coverage	Unlikely	Negligible	**Very Low Risk**	2.1.2
			Ingress of silt laden surface runoff: Ingress of silt laden surface runoff from the cable corridor in the excavations for the JBs and migration into saturated fractures. Runoff may also contain low concentrations of metals and hydrocarbons associated with construction vehicles.	Surface water management plan for cable route corridor		Transport of contaminants in dissolved phase to the to the spring at the fishery.	As for trenching for onshore cables above (Ref 1.1.3.) Small area of coverage	Unlikely	Negligible	**Very Low Risk**	2.1.3
			Barrier to groundwater flow through emplacement of JBs: The emplacement of each JB has the potential to limit vertical recharge to underlying fracture network and localised impact on shallow lateral groundwater flow should significant, hydraulically connected fractures be intercepted. Each JB has a depth of c.2m (although only of proportion of this will be saturated); a width of c. 14m and footprint of 200m2. The total length of the western section of the CRC is c. 1km and total catchment for the spring estimated to be of the order of 1km^2. The face of the JBs perpendicular to groundwater flow therefore represents c. 1.4% of the downgradient face of the CRC over 1km, although this area is only partially saturated. The footprint of the JBs represents lest than 0.1% of the total catchment area for the spring.	-		Long-term reduction in groundwater throughflow to the spring at the fishery.	- JBs cover a very small proportion of the total catchment area (<0.1%). - JBs cover a very small proportion of the aquifer face perpendicular to possible groundwater flow (<1.4%) - There is little evidence of fractures and/or interconnected fracture network in boreholes constructed in the western section that could provide a connected pathway to the spring given the lateral distance and vertical height difference. - If fractures are laterally continuous, groundwater flow would likely be able circumvent the JBs. **Although the emplacement of the JBs would likely to remain in place permanently, their construction is unlikely to cause any measurable effect on groundwater discharge at the spring at the fishery given their small area of impact on lateral or vertical groundwater flow pathways.**	Unlikely	Negligible	**Very Low Risk**	2.1.4
		Eastern section (BH129 to BH130)	*Groundwater Dewatering to maintain dry excavation:* Groundwater levels in boreholes are highly variable ranging between 0.5 to 14.3 mbgl. As with the western/central section of the CRC, localised dewatering may be required for JBs. The water level data suggests groundwater drawdowns of between 0 and 1.5 m will be required to maintain dry excavations for the JBs, with small drawdowns for the LBs.	-	HCM2: Groundwater transport in a shallow, highly fractured and locally extensive sandstone or mudstone unit(s) in the Elwy Formation	Short-term, temporary reduction in groundwater throughflow to the spring at the fishery.	As for trenching for onshore cables above (Ref 1.2.1.) Small area of coverage	Possible	Negligible	**Very Low Risk**	2.2.1
			Accidental releases: Accidental release of polluting material into excavation for JBs and migration into saturated fractures in the bedrock aquifer. Hazardous liquids include fuels (hydrocarbons), hydraulic fluids, oils/grease and include fuels and hydraulic fluids associated with construction	Pollution prevention management plan		Transport of contaminants in dissolved phase to the to the spring at the fishery.	As for trenching for onshore cables above (Ref 1.2.2.) Small area of coverage	Possible	Negligible	**Very Low Risk**	2.2.2
			Ingress of silt laden surface runoff: Ingress of silt laden surface runoff from the cable corridor in the excavations for the JBs and migration into saturated fractures. Runoff may also contain low concentrations of metals and hydrocarbons associated with construction vehicles.	Surface water management plan for cable route corridor		Transport of contaminants in dissolved phase to the to the spring at the fishery.	As for trenching for onshore cables above (Ref 1.2.3.) Small area of coverage	Possible	Negligible	**Very Low Risk**	2.2.3
			Barrier to groundwater flow through emplacement of JBs: The emplacement of each JB has the potential to limit vertical recharge to underlying fracture network and localised impact on shallow lateral groundwater flow should significant, hydraulically connected fractures be intercepted. Each JB has a depth of c.2m (although only of proportion of this will be saturated); a width of c. 14m and footprint of 200m2. The total length of the western section of the CRC is c. 1km and total catchment for the spring estimated to be of the order of 1km^2. The face of the JBs perpendicular to groundwater flow therefore represents c. 1.4% of the downgradient face of the CRC over 1km, although this area is only partially saturated. The footprint of the JBs represents lest than 0.1% of the total catchment area for the spring.	-		Long-term reduction in groundwater throughflow to the spring at the fishery.	- JBs cover a very small proportion of the total catchment area (<0.1%). - JBs cover a very small proportion of the aquifer face perpendicular to possible groundwater flow (<1.4%) - There is little evidence of fractures and/or interconnected fracture network in boreholes constructed in the western section that could provide a connected pathway to the spring given the lateral distance and vertical height difference. - If fractures are laterally continuous, groundwater flow would likely be able circumvent the JBs. **Although the emplacement of the JBs would likely be permanent, their construction is unlikely to cause any measurable effect on groundwater discharge at the spring at the fishery given their small area of impact on lateral or vertical groundwater flow pathways.**	Possible	Negligible	**Very Low Risk**	2.2.4
		Western and central section (BH180 to BH173 inclusive) Crossing TR-15, TR-16 and TR-17. Maximum depth of HDD between 5.1mbgl to 8.6mbgl. Length of each drilled section 98m to 115m.	*Groundwater dewatering during drilling process:* Groundwater levels in boreholes in the western and central section of the CRC have been shown to range between 1.5 mbgl to 4.8 mbgl, but are typically greater than 1.80 mbgl. This suggests most HDD sites will be below the water table. Active dewatering is not required although drilling can result in the loss of water around the annulus of the drill during the construction. This effect will be temporary as the cable ducting will be grouted into place using bentonite cement. The duration of drilling is likely to be c. 2days.	-	HCM1: Groundwater transport through a large-scale regional fault / fault zone and an associated interconnected fracture network in the mudstones Elwy Formation	Short-term, temporary reduction in groundwater throughflow to the spring at the fishery.	- The loss of groundwater from HDD conduits during construction may occur before the cable ducting installed. - Limited length of CRC potentially affected (Sub water table HDD drill holes will cover less than 25% (c. 225m) of the c. 1km length of the eastern/central section, assuming: 3 crossings; 100m total length of drill holes; and 75% of that length being sub water table). - There is little evidence of fractures and/or interconnected fracture network in boreholes constructed in the western section over the depth of HDD that could provide a connected pathway to the spring. - The western section is located at large lateral distance from the spring (>575m) and at significantly higher elevation (55m to 75m). This requires an extensive, deep and complex fracture network to exist in the bedrock. - Short-term, temporary dewatering effect that should recover afterward construction phase. **No measurable effect at spring predicted**	Unlikely	Negligible	**Very Low Risk**	3.1.1
			Loss of drilling fluids: Short term loss of drilling fluids into saturated fracture system, most notably bentonite grout during the installation of the cable ducts.	Method Statement for monitoring drilling fluids in more sensitive areas		Transport of contaminants in dissolved phase to the to the spring at the fishery.	- Potential loss of drilling / grouting fluids in to bedrock factures. - Loss of drilling fluids / grouting will be minimised by careful monitoring during drilling and modifying density / consistency of grouting accordingly. - Limited length of CRC potentially affected (Sub water table HDD drill holes will cover less than 25% (c. 225m) of the c. 1km length of the eastern/central section, assuming: 3 crossings; 100m total length of drill holes; and 75% of that length being sub water table). - There is little evidence fractures and/or interconnected fracture network in boreholes constructed in the western section over the depth of HDD that could provide a connected pathway to the spring. - The western section is located at large lateral distance from the spring (>575m) and at significantly higher elevation (55m to 75m). This requires an extensive, deep and complex fracture network to exist in the bedrock. - Any losses will likely be localised to the drilling area given the complexity of the fracture network within the groundwater catchment area. **No measurable effect at spring predicted**	Unlikely	Negligible	**Very Low Risk**	3.1.2

Mona Offshore Windfarm
Hydrogeological Risk Assessment for Tan-y Myndd Trout Fishery

Construction Activity	**Description of Activity**	**Section of Cable Route Corridor Considered**	**Potential effects on local groundwater in the cable route corridor**	**Incorporated Mitigation**	**Groundwater Pathway Affected**	**Effect on spring fed Tan-y Mynydd Trout Fishery Considered**	**Key Risk Notes**	**Likelihood of Pathway**	**Severity of Consequence**	**RISK RANKING**	**Reference**
Trenchless drilling techniques at crossings within the CRC	HDD drilled sections c. 100m in length for each cable circuit at each crossing. Target depth beneath each constraint of 5mbgl. Drilling at a diameter of 1.4m. Installation of ducting for cable circuits, with a bentonite / cement seal against bedrock. 6 preliminary locations within the c. 2km length of CRC under consideration. Drilling duraction likley to be c. 2 days.		*Barrier to groundwater flow / sealing fractures by sub-water table cable ducts:* The emplacement of permanent subwater table cable ducts at each crossing has the potential to have an impact on shallow lateral groundwater flow (typically < 5m) should significant, saturated and hydraulically connected fractures be intercepted / crossed.	-		Long-term reduction in groundwater throughflow to the spring at the fishery.	- Grouted ducting creating a long-term barrier to the lateral groundwater flow where a hydraulically interconnected fracture network is intercepted / crossed. - Limited length of CRC potentially affected (Sub water table HDD drill holes will cover less than 25% (c. 225m) of the c. 1km length of the eastern/central section, assuming: 3 crossings; 100m total length of drill holes; and 75% of that length being sub water table). - There is little evidence of fractures and/or interconnected fracture network in boreholes constructed in the western section over the depth of HDD that could provide a connected pathway to the spring. - The western section is located at large lateral distance from the spring (>575m) and at significantly higher elevation (55m to 75m). This requires an extensive, deep and complex fracture network to exist in the bedrock. **No measurable effect at spring predicted**	Unlikely	Negligible	**Very Low Risk**	3.1.3
		Eastern section (BH129 to BH131) Crossing TR-18, TR-19 and TR-18. Maximum depth o HDD between 5.1mbgl to 8.2mbgl. Length of each drilled section 82m to 117m.	*Groundwater dewatering during drilling process:* Groundwater levels across the eastern section are variable, ranging between 0.5 to 14.3 mbgl. This suggests at lease some of the HDD sites will be below the water table. Active dewatering is not required although drilling can result in the loss of water around the annulus of the drill during construction. This effect will be temporary as the cable ducting will be grouted into place using bentonite cement. The duration of drilling is likely to be c. 2days..	-	HCM2: Groundwater transport in a shallow, highly fractured and locally extensive sandstone or mudstone unit(s) in the Elwy Formation	Short-term, temporary reduction in groundwater throughflow to the spring at the fishery.	-The loss of groundwater from HDD conduits during construction may occur before the cable ducting installed. - Limited length of CRC potentially affected (Sub water table HDD drill holes will cover less than 25% (c. 225m) of the c. 1km length of the eastern/central section, assuming: 3 crossings; 100m total length of drill holes; and 75% of that length being sub water table). - There is evidence of fractures and/or a interconnected fracture network in boreholes constructed in the eastern section that could provide a connected pathway to the spring. - A long, complex fracture network is required for any connection with the spring fishery (>875m long, with height above spring decreasing from 57 m at BH129 to 13m at BH131). - Short-term, temporary dewatering effect that should recover afterward construction phase. **No measurable effect or short term measurable change that will not affect the function of the springs.**	Possible	Negligible	**Very Low Risk**	3.2.1
			Loss of drilling fluids: Short term loss of drilling fluids into saturated fracture system, most notably bentonite grout during the installation of the cable ducts.	Method Statement for monitoring drilling fluids in more sensitive areas		Transport of contaminants in dissolved phase to the to the spring at the fishery.	- Potential loss of drilling / grouting fluids in to bedrock factures. - Loss of drilling fluids / grouting will be minimised by careful monitoring during drilling and modifying density / consistency of grouting accordingly. - Limited length of CRC potentially affected (Sub water table HDD drill holes will cover less than 25% (c. 225m) of the c. 1km length of the eastern/central section, assuming: 3 crossings; 100m total length of drill holes; and 75% of that length being sub water table). - There is evidence of fractures and/or a interconnected fracture network in boreholes constructed in the eastern section that could provide a connected pathway to the spring. - A long, complex fracture network is required for any connection with the spring fishery (>875m long, with height above spring decreasing from 57 m at BH129 to 13m at BH131). - Any losses will likely be localised to the drilling area given the complexity of the fracture network within the groundwater catchment area. **No measurable effect at spring predicted**	Possible	Negligible	**Very Low Risk**	3.2.2
			Barrier to groundwater flow / sealing fractures by sub-water table cable ducts: The emplacement of permanent subwater table cable ducts at each crossing has the potential to have an impact on shallow lateral groundwater flow (typically < 5m) should significant, saturated and hydraulically connected fractures be intercepted / crossed.	-		Long-term reduction in groundwater throughflow to the spring at the fishery.	- Grouted ducting creating a long-term barrier to the lateral groundwater flow where a hydraulically interconnected fracture network is intercepted / crossed. - Limited length of CRC potentially affected (Sub water table HDD drill holes will cover less than 25% (c. 225m) of the c. 1km length of the eastern/central section, assuming: 3 crossings; 100m total length of drill holes; and 75% of that length being sub water table). - There is evidence of fractures and/or a interconnected fracture network in boreholes constructed in the eastern section that could provide a connected pathway to the spring. - A long, complex fracture network is required for any connection with the spring fishery (>875m long, with height above spring decreasing from 57 m at BH129 to 13m at BH131). **No measurable effect at spring predicted**	Possible	Mild	**Very Low Risk**	3.2.3