

MONA OFFSHORE WIND PROJECT

Preliminary Environmental Information Report

Volume 3, annex 16.1: Aquifers, groundwater abstractions and ground conditions



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FINAL

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Glossary

Term	Meaning
Abstraction licence	The authorisation granted by the Environment Agency to allow the removal of surface water or groundwater.
Aquifer	A water-bearing geological unit that can yield economically viable amounts of groundwater.
COMAH Site	Industrial sites that subject to the Control of Major Accident Hazards Regulations 1999 based on the substances stored on the facility and quantities thereof
Groundwater	Water that is contained in underground rocks and sediments below the ground surface.
Groundwater Body	Groundwater bodies are the discrete groundwater management units defined by the Environment Agency as required under Article 5 of the Water Framework Directive.
Source Protection Zone	Groundwater catchment areas defined by travel time around important potable groundwater abstraction sites to safeguard drinking water quality. Certain land-uses are controlled or prohibited with certain source protection zone areas.

Acronyms

Acronym	Description
BGS	British Geological Survey
COMAH	Control of Major Accident Hazards
GCR	Geological Conservation Review
GHGC	Geology, hydrogeology and ground conditions
JNCC	Joint Nature Conservation Committee
MDS	Maximum Design Scenario
NRW	Natural Resource Wales
PWSS	Private Water Supply Source
RIGS	Regionally Important Geological Site
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest

Units

Unit	Description
m	Metres
mAOD	Metres above Ordnance Datum
km ²	Square kilometres

1 AQUIFERS, GROUNDWATER ABSTRACTIONS AND GROUND CONDITIONS

1.1 Introduction

1.1.1.1 This technical report provides a summary of key information on aquifers, groundwater abstractions, pollution incidents and ground conditions to inform the baseline environment and assessment of volume 3, chapter 16: geology, hydrogeology and ground conditions of the Preliminary Environmental Information Report.

1.1.2 Study area

1.1.2.1 The study area to be used for the assessment of geology, hydrogeology and ground conditions focuses on areas located above Mean High Water Springs (MHWS) where potential impacts are most likely to occur on geological and hydrogeological receptors. As such, the geology, hydrogeology and ground conditions (GHGC) study area includes:

- The area of land to be temporarily or permanently occupied during the construction, operation and maintenance and decommissioning of the Mona Offshore Wind Project (hereafter referred to as the Mona Proposed Onshore Development Area).
- Geological and hydrogeological receptors within 1km of the Mona Proposed Onshore Development Area. The 1km buffer was used as impacts on geological, hydrogeological and ground conditions receptors are most likely to occur within this distance.
- Ground condition constraints within the Mona Proposed Onshore Development Area.

1.1.2.2 The GHGC study area will be reviewed and modified in response to refinements made to the Mona Proposed Onshore Development Area during the EIA process.

1.2 Methodology

1.2.1 Desk top data sources

1.2.1.1 The data presented in this technical report has been taken from the following sources:

- Geological information from the British Geological Survey (BGS) and Natural Resources Wales (NRW)
- Aquifer unit information from the BGS
- Information regarding ground conditions within the geology, hydrogeology and ground conditions study area taken from a Groundsure Insights report that includes the following datasets:
 - General information regarding geological, hydrogeological and hydrological setting
 - Groundwater abstraction licences
 - Current and historical landfill sites

- Current and historical waste sites
- Pollution incidents
- Discharge consents
- Current and historical land-use
- Mining and ground working areas (coal and non-mining)
- Geotechnical constraints

- Historical Ordnance Survey mapping and some aerial photography.

1.2.2 Geology

1.2.2.1 The bedrock geology and superficial deposits present across the GHGC study area has been obtained from the mapped data of the BGS. Nationally, regionally and locally important geological sites are also presented and, where present, include:

- Sites of Special Scientific Interest (SSSI) of geological and geomorphological importance
- Geological Conservation Review (GCR) sites as defined by the Joint Nature Conservation Committee (JNCC)
- Regionally Important Geological Sites (RIGS).

1.2.3 Hydrogeology

1.2.3.1 Aquifer units in the bedrock geology and superficial deposits have been obtained from the designations provided by the BGS. Key groundwater receptors have been reviewed and, where present, include:

- Licensed groundwater abstractions (active and historical) as presented in the Groundsure Insights report.
- Groundwater Source Protection Zones (SPZs) that have been defined to safeguard drinking water quality around important potable groundwater abstraction sites.
- Nationally and locally important ecological sites that may have a groundwater dependence.

1.2.3.2 The location and details of Private Water Supply Sources (PWSSs) present within the GHGC study area will be defined through the landowner consultation (and associated site walkover surveys where required) to be presented within the Environmental Statement.

1.2.4 Ground conditions

1.2.4.1 Ground conditions, most notably land quality, is a potentially constraint during the construction of the Mona Offshore Wind Project. A qualitative ground condition constraints assessment has been undertaken for the key aspects across the GHGC study area. The assessment is based on the Groundsure Insights report, the details of which are summarised in Table 1.1.

Table 1.1: Summary of the Groundsure Insight report to inform geology, hydrogeology and ground conditions.

Title	Extent of data coverage	Contractor	Format	Date
Mona Onshore Route	18.7 km ²	Groundsure	Hardcopy report	27/06/2022

1.2.4.2 The qualitative assessment considers the potential risk posed by the land use (current and historical) and activities identified in the GHGC study area, based on the following risk criteria:

- **High Risk** - Presence of an activity or land use with the potential to result in highly contaminated land or groundwater, particularly where activities are recent, well-defined and/or situated close to or within the Mona Onshore Proposed Development Area.
- **Moderate Risk** - Presence of an activity or land use with the potential to result in contaminated land or groundwater. Or higher risk activities or land use situated at distance from the Mona Onshore Proposed Development Area or are historical in nature.
- **Low Risk** - Activity or land-use considered unlikely to result in significant contamination. Or potentially contaminative activity or land use which by virtue of position, age or certainty is considered unlikely to represent a significant constraint to the Mona Onshore Proposed Development Area.

1.2.4.3 On the constraints plans only those activities or land uses with a risk considered to be above low risk have been presented.

1.3 Results

1.3.1 Geology

1.3.1.1 The bedrock geology and superficial deposits across the geology, hydrogeology and ground conditions study area are presented in Figure 1.1 and Figure 1.2 respectively.

Geological and Groundwater Dependent Designated Sites

1.3.1.2 Designated sites identified within the GHGC study area are shown in Figure 1.1 and Figure 1.2 and summarised in Table 1.2.

Table 1.2: Protected sites within the GHGC study area

RPS ID	Site name	Site Type	Qualitative risk ranking	Justification
PS_01	Coedydd ac Ogofau Elwy a Meirchion	SSSI	Low	The SSSI is designated on the basis of the geological and palaeontological interest of Galltfaenan, Cefn and Pontnewydd Caves. It also has botanical interest in the presence of semi-natural broadleaved woodland, rare lowering plant and scarce bryophyte assemblages. Located 0.6km southwest of the Mona Onshore Proposed Development Area.
PS_02	Llanddulas Limestone and Gwrych Castle Wood	SSSI	Moderate	The SSSI includes geological features, but is designated largely on the basis of ecology rather than its geological or geomorphological importance. Located within the Mona Onshore Proposed Development Area
PS_03	Coed y Gopa	SSSI	Low	The SSSI is principally designated on the presence of bat roosts. Located 600m east of the Mona Onshore Proposed Development Area.
PS_04	Traeth Pensarn	SSSI	Low	The SSSI is designated on the basis of importance of botanical features in coastal zone. Located within the Mona Onshore Proposed Development Area

1.3.1.3 The Coedydd ac Ogofau Elwy a Meirchion SSSI contains four GCR sites which are important for the Pleistocene sediments and vertebrate mammalian fossils within the caves. The Coedydd ac Ogofau Elwy a Meirchion SSSI (and the GCR sites) are located outside the Mona Onshore Proposed Development Area.

1.3.1.4 There are two RIGs within the GHGC study area: they are summarised in Table 1.3 and shown in Figure 1.1 and Figure 1.2. Both of the RIGs are located outside the Mona Onshore Proposed Development Area.

Table 1.3: Summary of RIGS in the GHGC study area.

RPS ID	Site Name	Notes
GS_01	Cefn yr Ogof	It is noted that BGS records show localised areas of tufa formation approximately 200m to the northeast of this site.
GS_02	Cefn Meiriadog	-

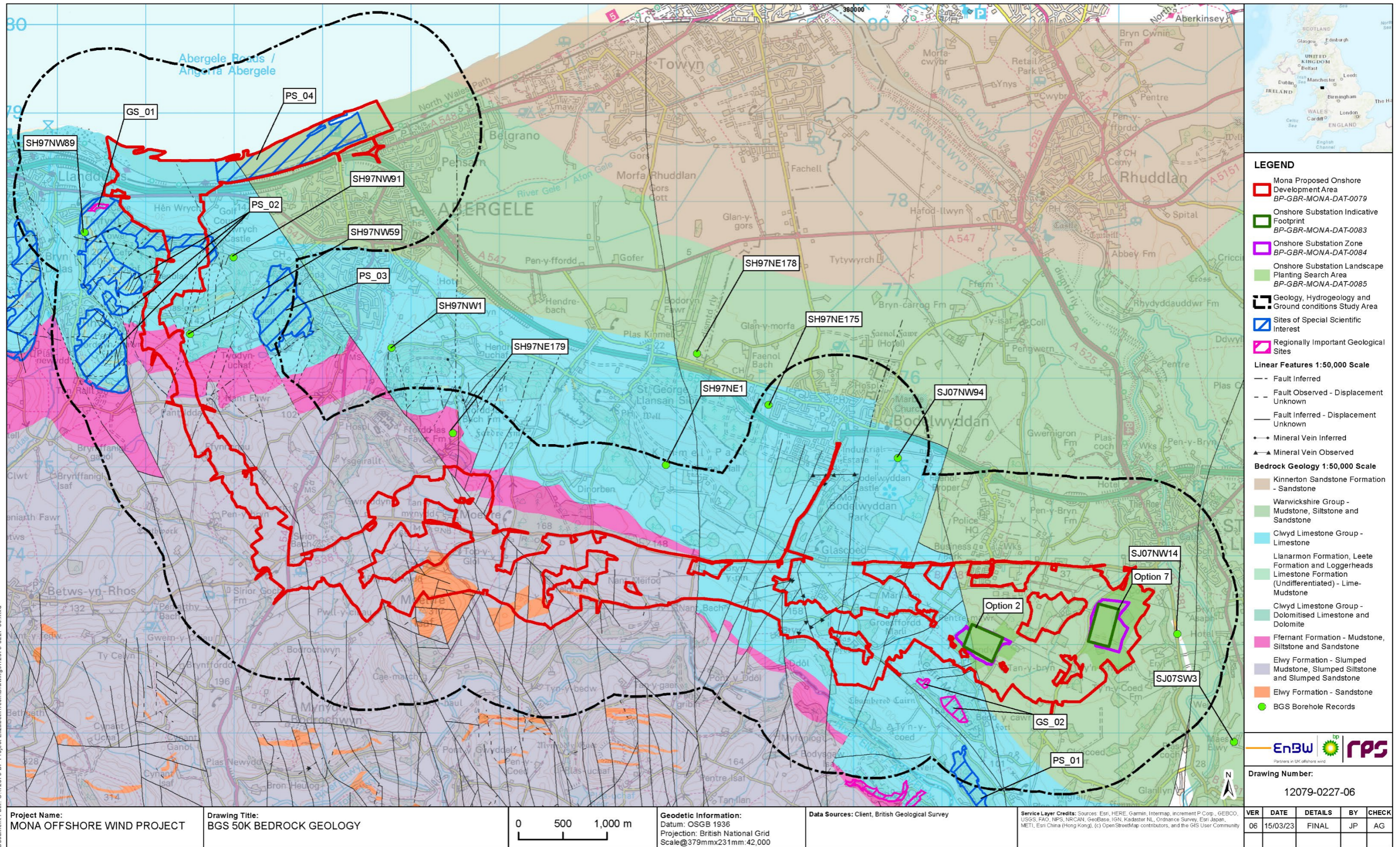


Figure 1.1: Bedrock geology and designated sites within the GHGC study area.

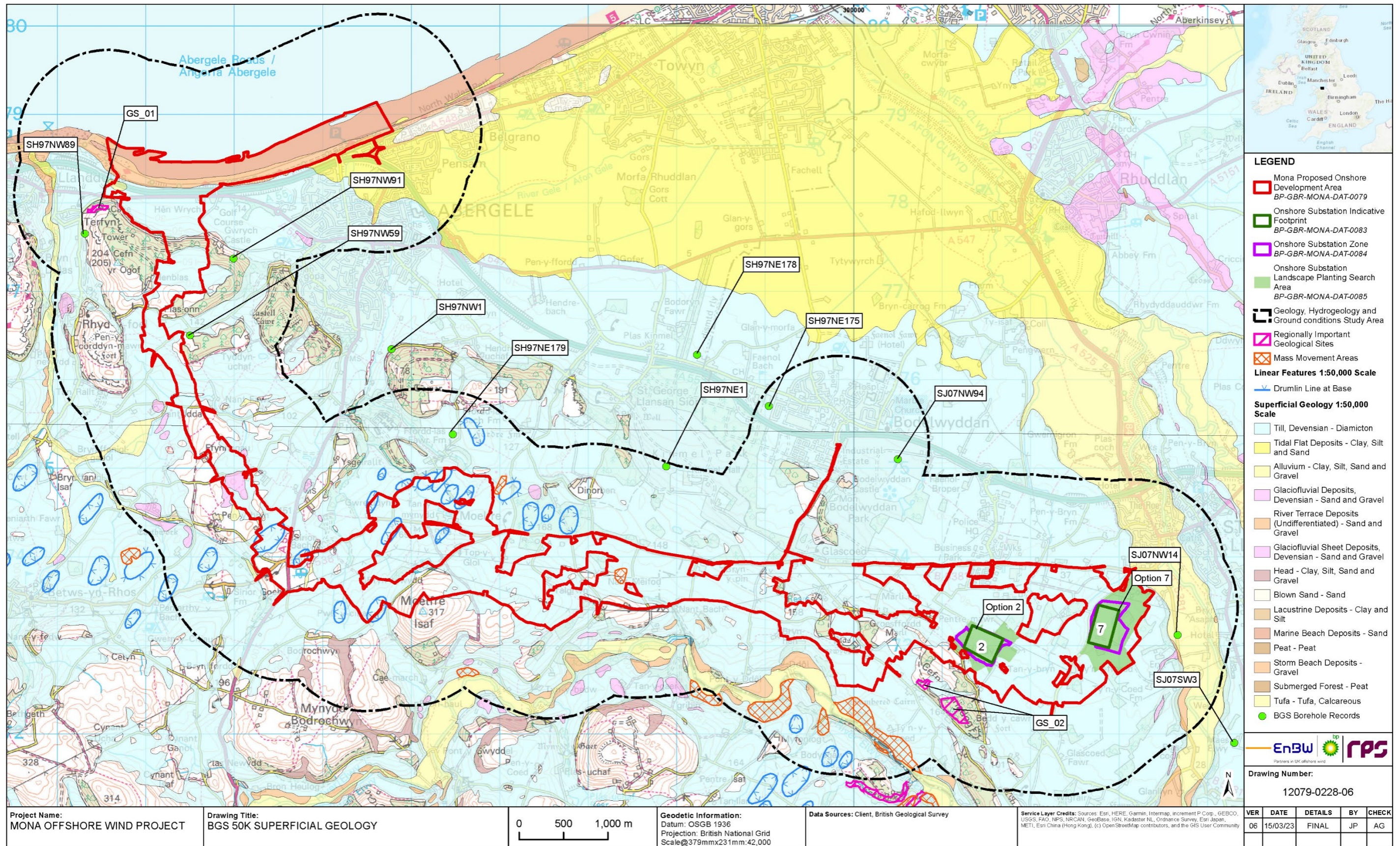


Figure 1.2: Superficial deposits and designated sites within the GHGC study area.

1.3.2 Hydrogeology

Aquifer designation

1.3.2.1 Aquifer designations for the bedrock geology and superficial deposits across the GHGC study area are shown in Figure 1.3 and Figure 1.4 respectively. The following designations are presented in those drawings:

- **Principal aquifers** that yield significant groundwater that support regionally or nationally important supplies and support rivers, lakes and wetlands.
- **Secondary A aquifers** that comprise permeable layers that can support local water supplies and may form an important source of baseflow to rivers.
- **Secondary B aquifers** that are mainly lower permeability layers that may store and yield limited amounts of groundwater.
- **Secondary undifferentiated** aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type, but generally have only a minor resource value.
- **Unproductive strata** that are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them

Licensed groundwater abstractions

1.3.2.2 A total of 14 licensed abstractions have been identified in the geology, hydrogeology and ground conditions study area. Those abstractions are shown in Figure 1.3 and Figure 1.4. and are summarised in Table 1.4. Only GWA_06 and GWA_07 are active: both are situated above the Warwickshire Group bedrock in St Asaph, approximately 1km northeast of the Proposed Onshore Development Area.

Table 1.4: Licensed groundwater abstractions within the GHGC study area.

RPS ID	Point name	Status	Geology/ aquifer	Licence number	Notes
GWA_01	Borehole A	Historical	Clwyd Limestone Group	24/66/7/0044	Approximately 1km from the Proposed Onshore Development Area.
GWA_02	Borehole at Bryn Pin Mawr	Historical	Clwyd Limestone Group	24/66/6/0013	Approximately 50m from the Proposed Onshore Development Area.
GWA_03	Mine adit	Historical	Clwyd Limestone Group	24/66/7/0016	Approximately 660m east from the Proposed Onshore Development Area. Distance measured from closest point on Engine Hill where no significant construction activities (as defined by the MDS) are taking place.

RPS ID	Point name	Status	Geology/ aquifer	Licence number	Notes
GWA_04	Well b - St. Asaph livestock market	Historical	Warwickshire Group	24/66/6/0017	Approximately 750m from the Mona Onshore Proposed Development Area
GWA_05	Well	Historical	Warwickshire Group	24/66/6/0004	Approximately 750m from the Proposed Onshore Development Area.
GWA_06	Well b - St. Asaph livestock market	Active	Warwickshire Group	24/66/6/0017	Approximately 950m from the Proposed Onshore Development Area.
GWA_07	Well a - St. Asaph livestock market	Active	Warwickshire Group	24/66/6/0017	Approximately 950m from the Proposed Onshore Development Area.
GWA_08		Historical	Warwickshire Group	WA/466/0006/0003	Approximately 950m from the Proposed Onshore Development Area.
GWA_09	8m deep, 250mm diameter borehole (superficial deposits)	Historical	Superficial deposits / Warwickshire Group	24/66/6/0011	Approximately 950m from the Proposed Onshore Development Area.
GWA_10	Borehole at St. Asaph Mart	Historical	Warwickshire Group	24/66/6/0017	Approximately 950m from the Proposed Onshore Development Area
GWA_11		Historical	Warwickshire Group	WA/466/0006/0003	Approximately 950m from the Proposed Onshore Development Area.
GWA_12	109m deep, 114mm dia. Borehole.	Historical	Clwyd Limestone Group	24/66/6/0012	Approximately 1.1km from the Proposed Onshore Development Area.
GWA_13	Well	Historical	Warwickshire Group	24/66/6/0002	Approximately 1.1km from the Proposed Onshore Development Area.
GWA_14	100m deep, 120mm diameter borehole	Historical	Warwickshire Group	24/66/7/0043	Approximately 830m from the Proposed Onshore Development Area.

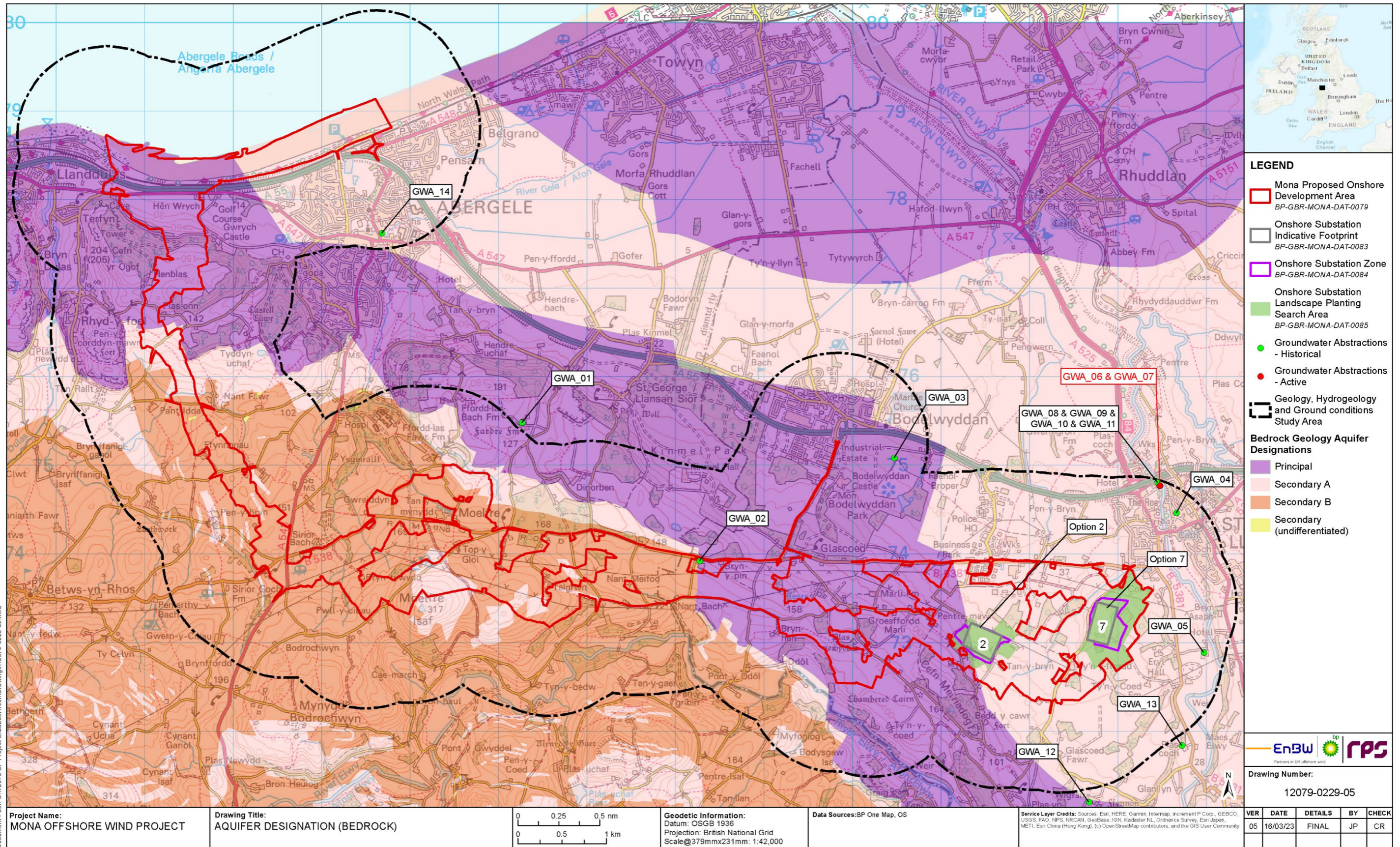


Figure 1.3: Bedrock aquifer units within the GHGC study area.

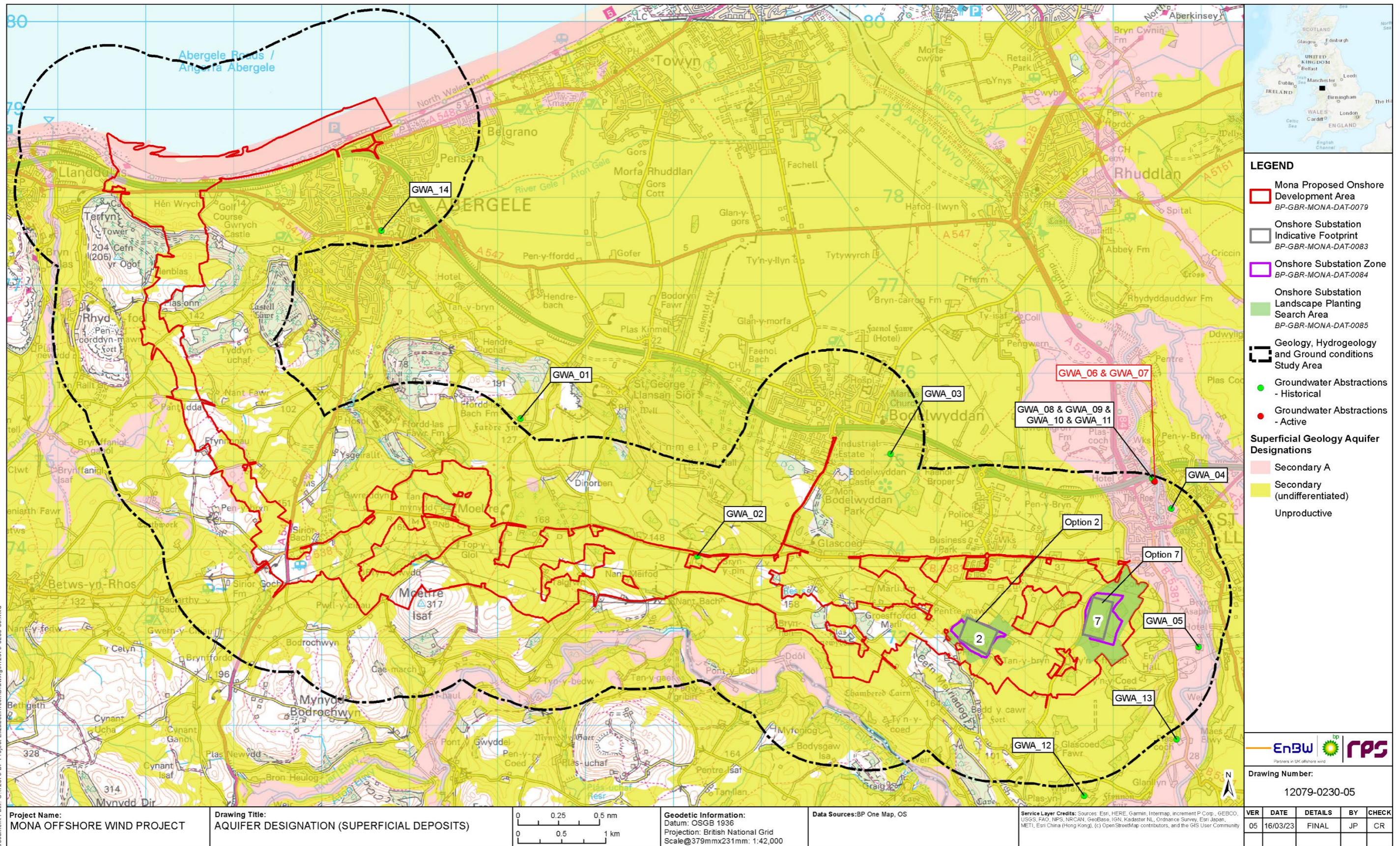


Figure 1.4: Superficial aquifer units within the GHGC study area.

Groundwater Source Protection Zones

1.3.2.3 There are no groundwater Source Protection Zones (SPZs) within the GHGC study area. The closest SPZs are at Llannerch Park and Trofarth Farm. The Llannerch Park abstraction borehole is located 2.3km to the east of the Mona Onshore Proposed Development Area and abstracts groundwater from the Kinnerton Sandstone formation. The Trofarth Farm abstraction borehole is located over 8km to the west southwest of the Mona Onshore Proposed Development Area where water is abstracted from the Elwy Formation.

1.3.3 Ground conditions

1.3.3.1 The detailed ground condition constraints maps are presented in Figure 1.5A to Figure 1.5E.

Landfill sites

1.3.3.2 Details of the current and historical landfill sites presented in those figures are summarised Table 1.5.

Table 1.5: Landfill sites (current and historical) within the geology, hydrogeology and ground conditions study area

RPS ID	Site name and status)	Waste type accepted	Qualitative risk ranking	Justification
LF_01A	Llanddulas Beach Landfill (Historical)	Industrial, Commercial, Household	High	The landfill contains potentially biodegradable 'household' waste and has active leachate and gas monitoring in place. The landfill is historical and located within the Proposed Onshore Development Area.
LF_01B	Llanddulas Beach No.1. (Historical)	Industrial, Commercial, Household	Moderate	The landfill contains a possible biodegradable or contaminated waste mass but is a small site and is situated on the edge of the Proposed Onshore Development Area.
LF_02	Ty Mawr Ucha Farm (Active / recent)	Non-biodegradable waste or 'other waste'	Low	The landfill is situated 620m northeast of Proposed Onshore Development Area on opposite side of high topographical area.
LF_03	Moelfre (Historical)	Inert, Household (NRW: Inert)	Low to Moderate	The landfill contains a possible biodegradable waste mass, but it is a historical site situated on Silurian bedrock of the Elwy Formation and glacial till. It is located adjacent to the Proposed Onshore Development Area.
LF_04	Plas Newydd Cefn (Historical)	Industrial, Commercial, Household	Moderate	The landfill contains a possible biodegradable waste mass, however, it is historical and a site of small area. It is located within the Proposed Onshore Development Area.
LF_05	Ffordd Las (Historical)	Inert, Commercial, Household.	Negligible	The landfill is a small historical site. Located within approximately 600m north of Proposed Onshore Development Area..

Licensed waste sites

1.3.3.3 Details of licensed waste sites identified in the GHGC study area are summarised Table 1.6. The waste management licences for the sites at Llanddulas Beach and Ty Mawr Farm suggest they relate to the landfills LF_01A and LF_02 in Table 1.5. The licences are registered to the postcode of where the licence was registered rather than the location of the waste site, which explains the inconsistency in locations.

Table 1.6: Licensed waste sites within the GHGC study area

RPS ID	Site name	Licence number	Qualitative risk ranking	Justification
WS_01	Llanddulas Beach Landfill	JEN001	High	This is likely to be the same landfill site as LF-01A and therefore, the same risk ranking has been applied.
WS_02	Ty Mawr Farm Landfill	GRI034	Low	This is likely to be the same landfill site as LF-02 and therefore, the same risk ranking has been applied. Located 500m northeast of the Proposed Onshore Development Area.

Pollution incidents

1.3.3.4 Details of the five recorded pollution incidents identified in the GHGC study area are summarised Table 1.7. Four categories of pollution incident are recorded:

- Category 1 – major, serious, persistent and/or extensive impact or effect on the environment, people and/or property
- Category 2 – significant impact or effect on the environment, people and/or property
- Category 3 – minor or minimal impact or effect on the environment, people and/or property
- Category 4 – substantiated incident with no impact

1.3.3.5 Only the Category 1 and 2 pollution incidents that affect land and water within the GHGC study area have been presented.

Table 1.7: Environmental pollution incidents within the GHGC study area

RPS ID	Incident ID	Principal impacted medium (pollutant)	Severity category	Qualitative risk ranking	Justification
PI_01	4189	Land (Inert materials and wastes)	2	Low to Moderate	Not a major incident. The area is underlain by thick glacial till. The incident was located 220m north of the Proposed Onshore Development Area.
PI_02	1800785	Land (Household waste)	3	Low	The impact from the incident was principally on amenity, rather than land or water. The incident was located 800m north of the Proposed Onshore Development Area.
PI_03	1700857	Land (Household waste)	2	Low to Moderate	Not a major incident. The area is underlain by thick glacial till. The incident was located 900m north of the Proposed Onshore Development Area.
PI_04	1604913	Land (Inert materials or waste)	2	Moderate	As for PI_03
PI_05	1704753	Land	3	Low	As for PI_03

Licensed discharges to groundwater

1.3.3.6 Details of the eleven licensed discharges to groundwater are identified in the GHGC study area and summarised Table 1.8.

Table 1.8: Licensed discharges to groundwater within the GHGC study area.

RPS ID	Permit Number	Location (Effluent Type)	Consent Status	Qualitative risk ranking	Justification
GD_01	CG0301201	Glascoed – Chlorinated O/F (Unspecified)	Expired	Moderate	Possible organic compounds in discharge but is historical and is likely to have been controlled by risk assessment and permit conditions. Located 150m north of the Proposed Onshore Development Area.
GD_02	CM0145201	Cefn Marli sewage treatment works (presumed treated sewage)	Expired	Low	Likely to have been controlled by risk assessment and permit conditions. The discharge consent is historical. It was located 210m southwest of Proposed Onshore Development Area at lower topographic elevation.

RPS ID	Permit Number	Location (Effluent Type)	Consent Status	Qualitative risk ranking	Justification
GD_03	CM0145301	Marli Glascoed sewage treatment works (treated sewage)	Effective	Low to Moderate	As for GD_02 but is active.
GD_04	CG0193901	Abergele Hospital (Unspecified)	Expired	Low	This is a historical discharge consent. The area is underlain by Silurian bedrock. It is located 310m northwest of Proposed Onshore Development Area.
GD_05	YP3325GU	Hunters Hamlet Caravan Park (Treated sewage)	Effective	Negligible to Low	Historical discharge. Area underlain by Silurian bedrock. Located 300m southwest of the Proposed Onshore Development Area on opposite side of watercourse.
GD_06	EPRYP3325GU	Hunters Hamlet Caravan Park (Treated sewage)	New. Issued under EPR 2010	Low	As for GD_05 except active discharge.
GD_07	VP3820XR	Bryn Olwyn Farm (Treated sewage)	Effective	Low to Moderate	Active discharge. Area underlain by Silurian bedrock. but outside of Located 520m northwest of the Proposed Onshore Development Area at lower elevation.
GD_08	EPRVP3820XR	Bryn Olwyn Farm (Treated sewage)	New issued under EPR 2010	Low to Moderate	As for GD_07
GD_09	CG0428301	Castle Cove Caravan Park (Treated sewage)	Effective	Low to Moderate	Active infiltration system. Located adjacent to the Proposed Onshore Development Area.
GD_10	TP3727GC	Sewage treatment plant serving Elwydale, (Treated sewage)	Effective	Low to Moderate	Active discharge but located 100m north of the Proposed Onshore Development Area at lower elevation and down hydraulic gradient
GD_11	EP RTP3727GC	Sewage treatment plant serving Elwydale, (Treated sewage)	New. issued under EPR 2010	Low to Moderate	As for GD_10

Fuel stations and hazardous waste storage sites

1.3.3.7 Fuel stations represent a particular risk to land and groundwater quality. The details of three current or historical garages identified in the GHGC study area are summarised Table 1.9.

Table 1.9: Recent and historical fuel stations within the GHGC study area

RPS ID	Address	Status	Qualitative risk ranking	Justification
FS_01	Penreefail Crossroads, Moelfre, Abergele, Conwy, LL22 8PN	Open	Moderate	The fuel station is underlain by Silurian bedrock (Elwy Formation) and glacial till. It is located 25m south of the Proposed Onshore Development Area.
FS_02	Lower Denbigh Road, St Asaph, Denbighshire, LL170EG	Obsolete	Low	It is a historical fuel station site and is located 400m northeast of the Proposed Onshore Development Area, at low elevation and down hydraulic gradient.
FS_03	Lower Denbigh Road, St Asaph, Denbighshire, LL170EG	1961 - 1987	Low	As for FD_03 (Same station)

1.3.3.8 Only one site has been identified within the GHGC study area that is licensed for the storage of hazardous substances. That site is summarised Table 1.10.

Table 1.10 Hazardous substance storage within the GHGC study area

RPS ID	Locations (Substances)	Application Ref Number	Qualitative risk ranking	Justification
HZ_01	Pilkington Special Glass Ltd, St Asaph. (Substances not known)	46/2000/0756	Moderate	Substances not known. Site is no longer in operation. Located 50m north of the Proposed Onshore Development Area and is underlain by thick glacial till.

Historical licensed industrial activities

1.3.3.9 Four historical licensed industrial activities are identified with the GHGC study area. Those sites are shown in Figure 1.5A to Figure 1.5E and summarised Table 1.11. It is evident that the four licensed activities all relate to the former Pilkington Glass factory site in St. Asaph. The site is no longer operational.

Table 1.11 Historical licensed industrial activities within the GHGC study area.

RPS ID	Permit number	Location (Process)	Effective date	Status	Qualitative risk ranking	Justification
HA_01	AP4742	Glascoed Road, St. Asaph. LL17 0ER (Inorganic Chemical Processes)	02/03/1998	Superseded By Variation	Moderate to High	The area is underlain by thick glacial till and is located 100m north of the Mona Onshore Proposed Development Area
HA_02	BD0583	Glascoed Road, St. Asaph. LL17 0ER (Inorganic Chemical Processes)	30/11/1998	Revoked	Moderate to High	As for HA_01
HA_03	BC0693	Glascoed Road, St. Asaph. LL17 0LL (Inorganic Chemical Processes)	06/07/1999	Superseded By Variation	Moderate	The area is underlain by thick glacial till and is located approximately 40m northwest of Proposed Onshore Development Area.
HA_04	BK4995	Glascoed Road, St. Asaph. LL17 0LL (Inorganic Chemical Processes)	31/05/2001	Revoked. Now IPPC	Moderate	As for HA_03

1.3.3.10 Table 1.5 to Table 1.11 identify those activities and land uses that are considered to represent the highest risk with respect to ground conditions within the GHGC study area and potentially the most significant constraints for the construction phase and operation and maintenance phase of the Mona Offshore Wind Project.

1.3.3.11 There is also evidence of a wide range of other current, recent or historical activities and land uses. These features are shown in the constraints mapping in Figure 1.5A to Figure 1.5E.

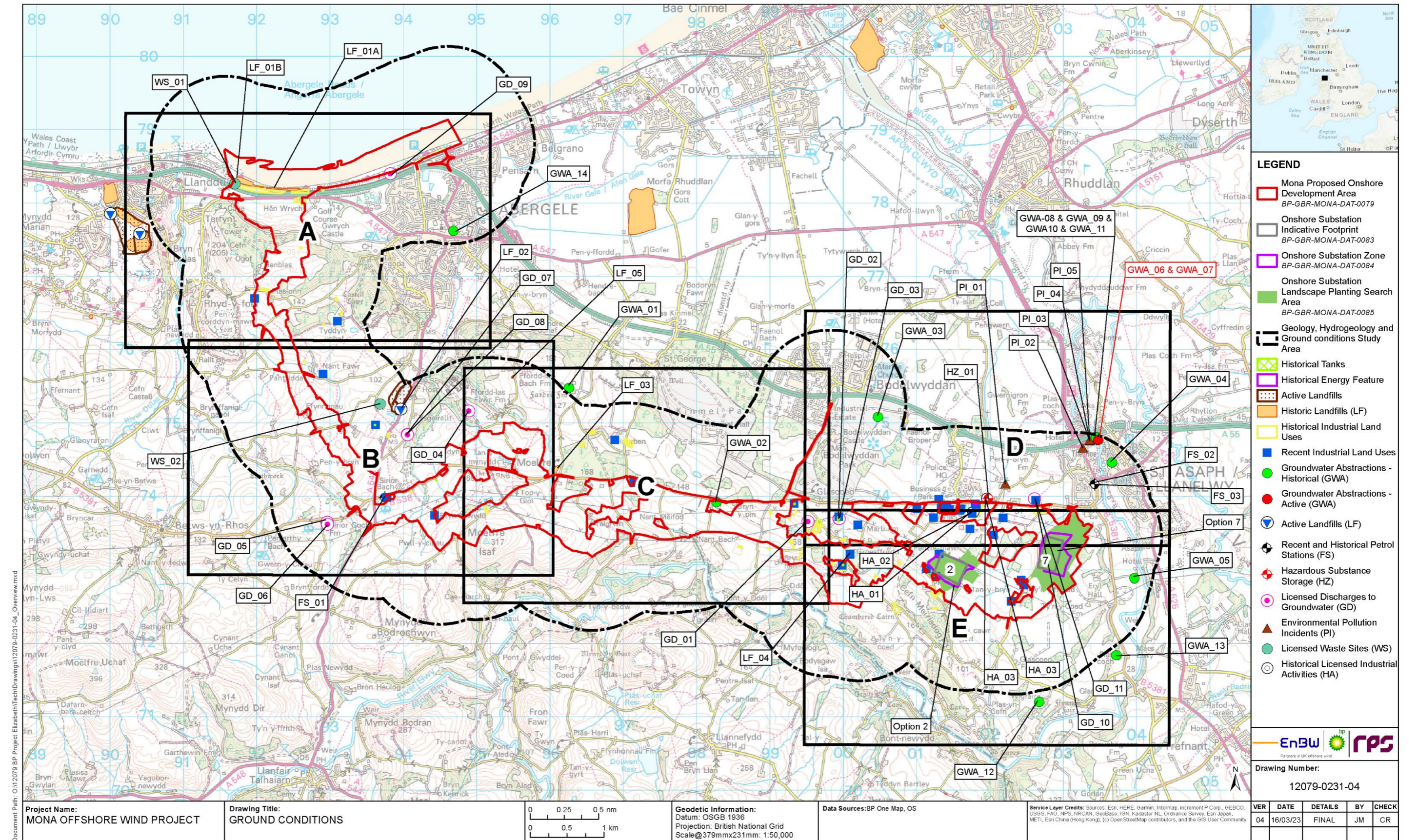


Figure 1.5: Overview of ground conditions constraints within the GHGC study area

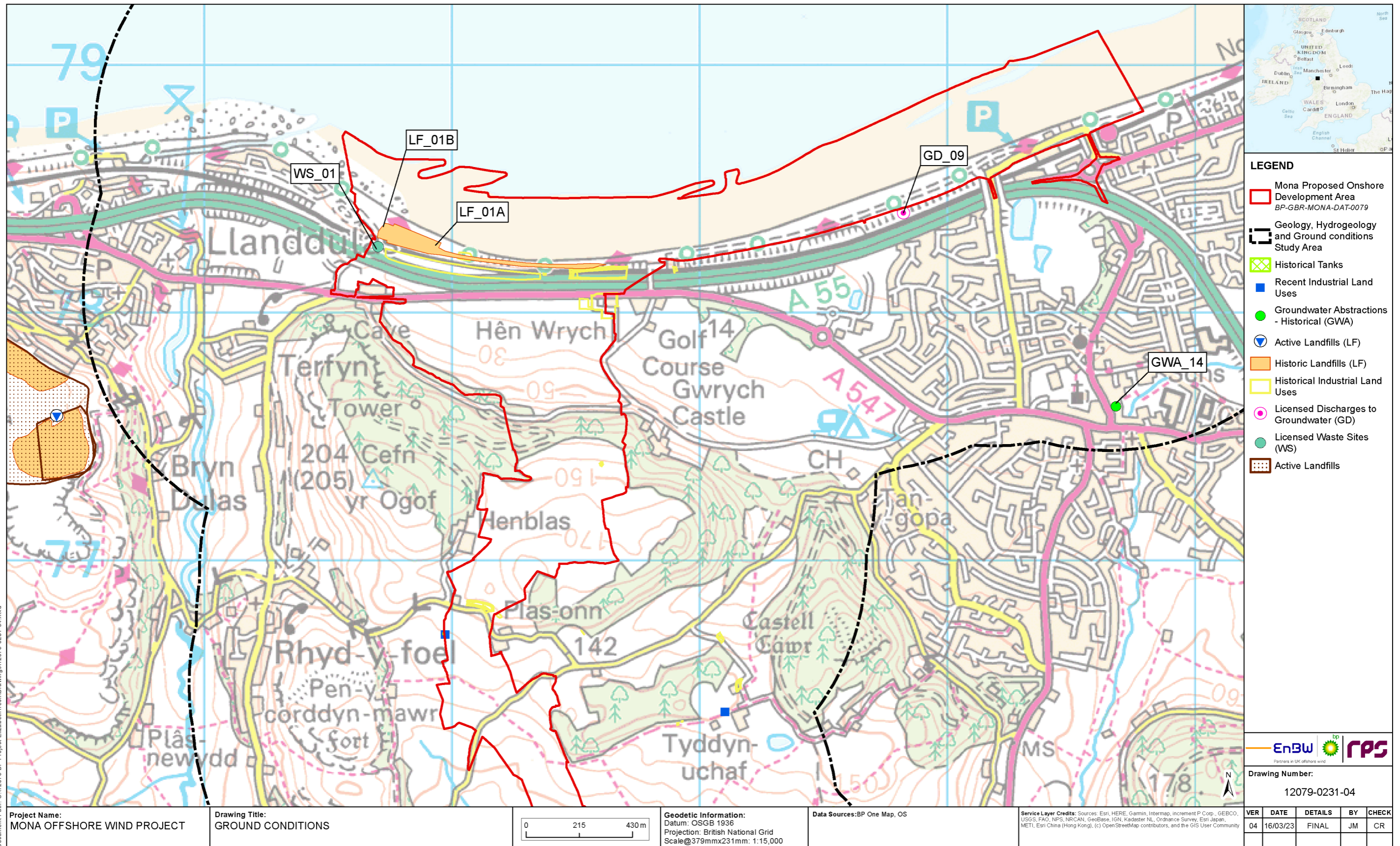


Figure 1.5A: Ground conditions constraints within the GHGC study area (Sheet A)

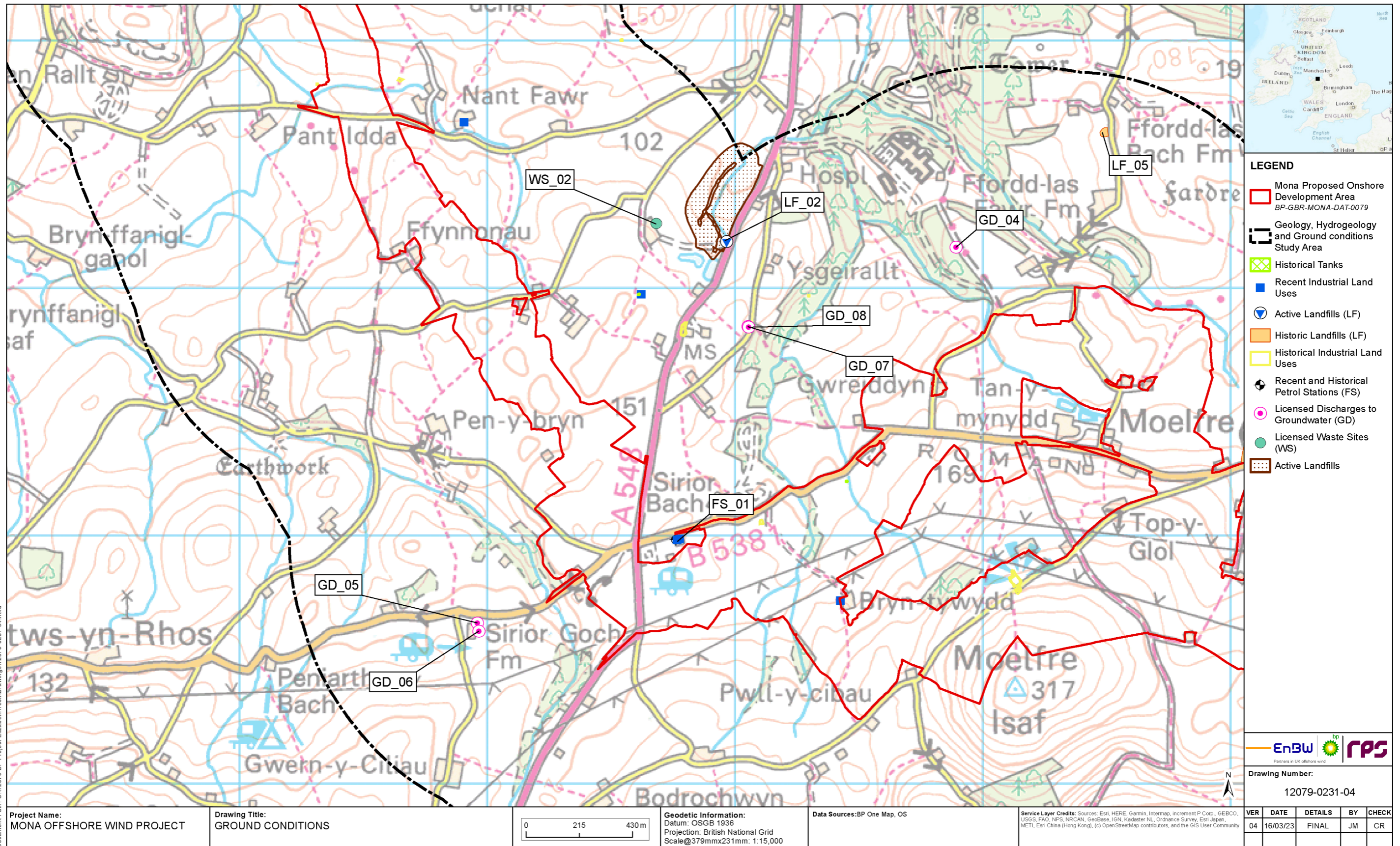


Figure 1.5B: Ground conditions constraints within the GHGC study area (Sheet B)

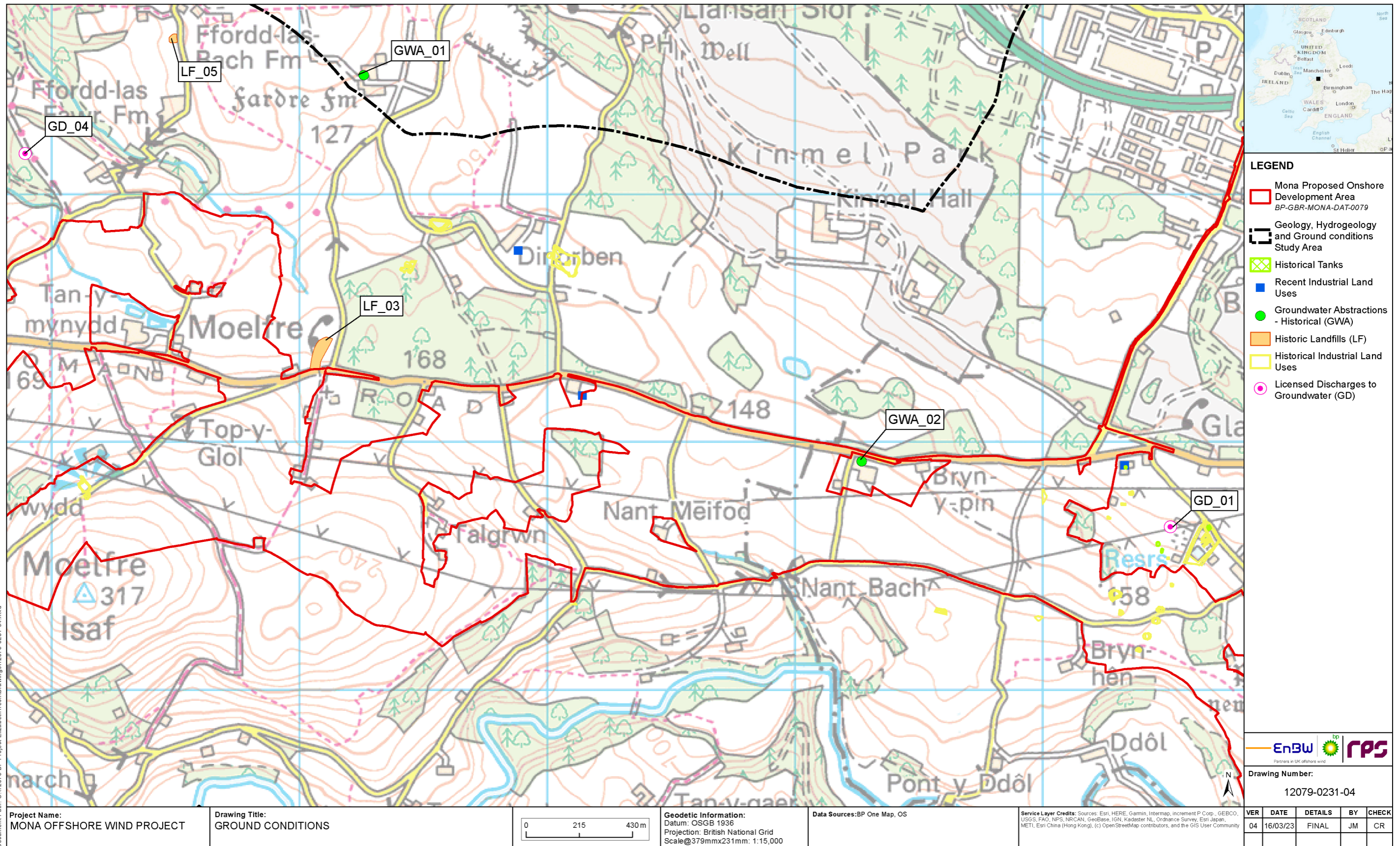


Figure 1.5C: Ground conditions constraints within the geology, hydrogeology and ground conditions study area (Sheet C)

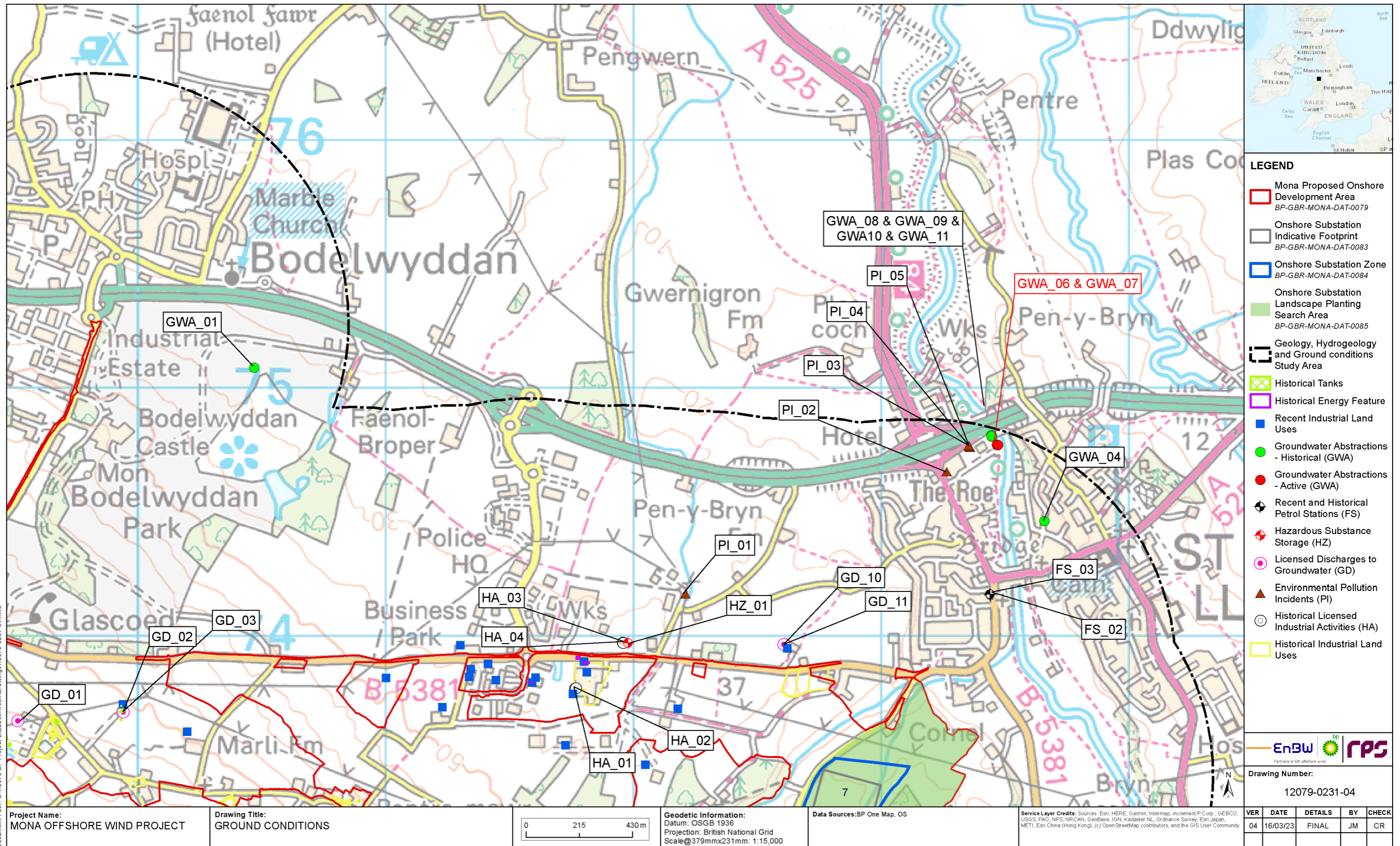


Figure 1.5D: Ground conditions constraints within the GHGC study area (Sheet D)

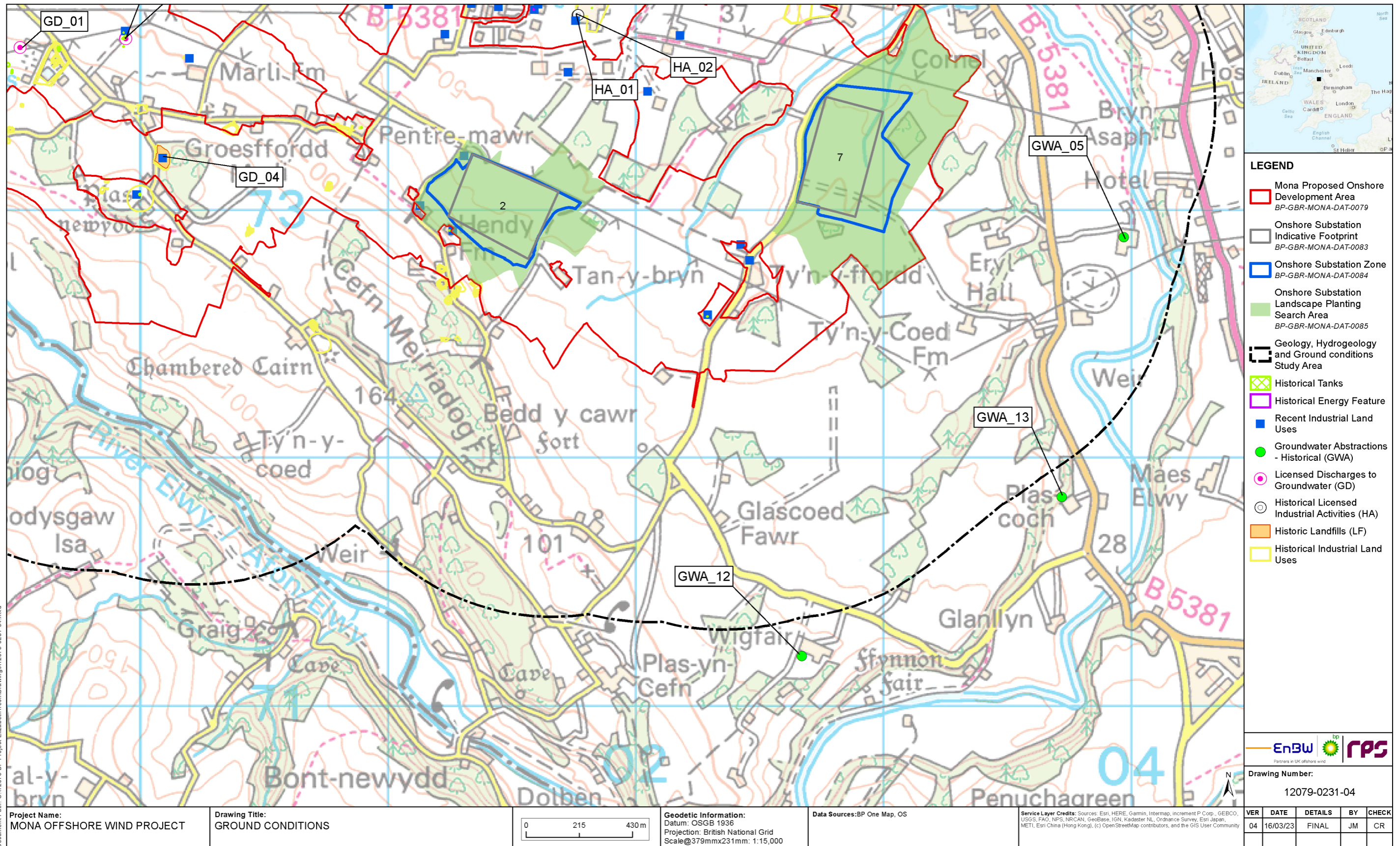


Figure 1.5E: Ground conditions constraints within the GHGC study area (Sheet E)

Historical mining operations

- 1.3.3.12 The Groundsure Insights reports presents multiple datasets that relate to historical mining within the geology, hydrogeology and ground conditions study area. The digital data for those datasets has been used to produce Figure 1.6. Individual features and their associated risk will be reviewed as part of route refinement and detailed design.
- 1.3.3.13 Several historical mines have also been identified from BGS reporting. These features are listed in Table 1.12 and shown in Figure 1.6. A strong spatial correlation can be observed between these reported mines and the historical mining features / datasets identified in the Groundsure Insights.

Table 1.12 - Historical mines reported by the British Geological Survey within and adjacent to the GHGC study area

Name	Easting	Northing	Qualitative risk ranking	Justification
Cefn yr Ogof	291700	377300	Low	Located 400 to 500m west of the Proposed Onshore Development Area.
Castell Cawr – North / Ffos-y-Bleiddiaid	293600	376600	Negligible to Low	Located 1km east of the Proposed Onshore Development Area.
Castell Cawr – South / Tyddyn Morgan Mine	293700	376400	Negligible to Low	Located 1km east of the Proposed Onshore Development Area.
Nant uchaf Mine	293400	376000	Negligible to Low	Located 720m east of the Proposed Onshore Development Area.
Bodelwyddan Mine	299700	374900	Low	Located adjacent to Proposed Onshore Development Area. Distance measured from closest point on Engine Hill where no significant construction activities (as defined by the MDS) are taking place.
Score Mine	299300	373700	Moderate to High	Located 50m southeast of the Proposed Onshore Development Area.
Coed-Carreg-Dafydd Mine	299500	373300	Moderate to High	Located within Proposed Onshore Development Area.
Panty Celyn Lead Mine	301300	372700	Moderate	Located adjacent to Proposed Onshore Development Area.

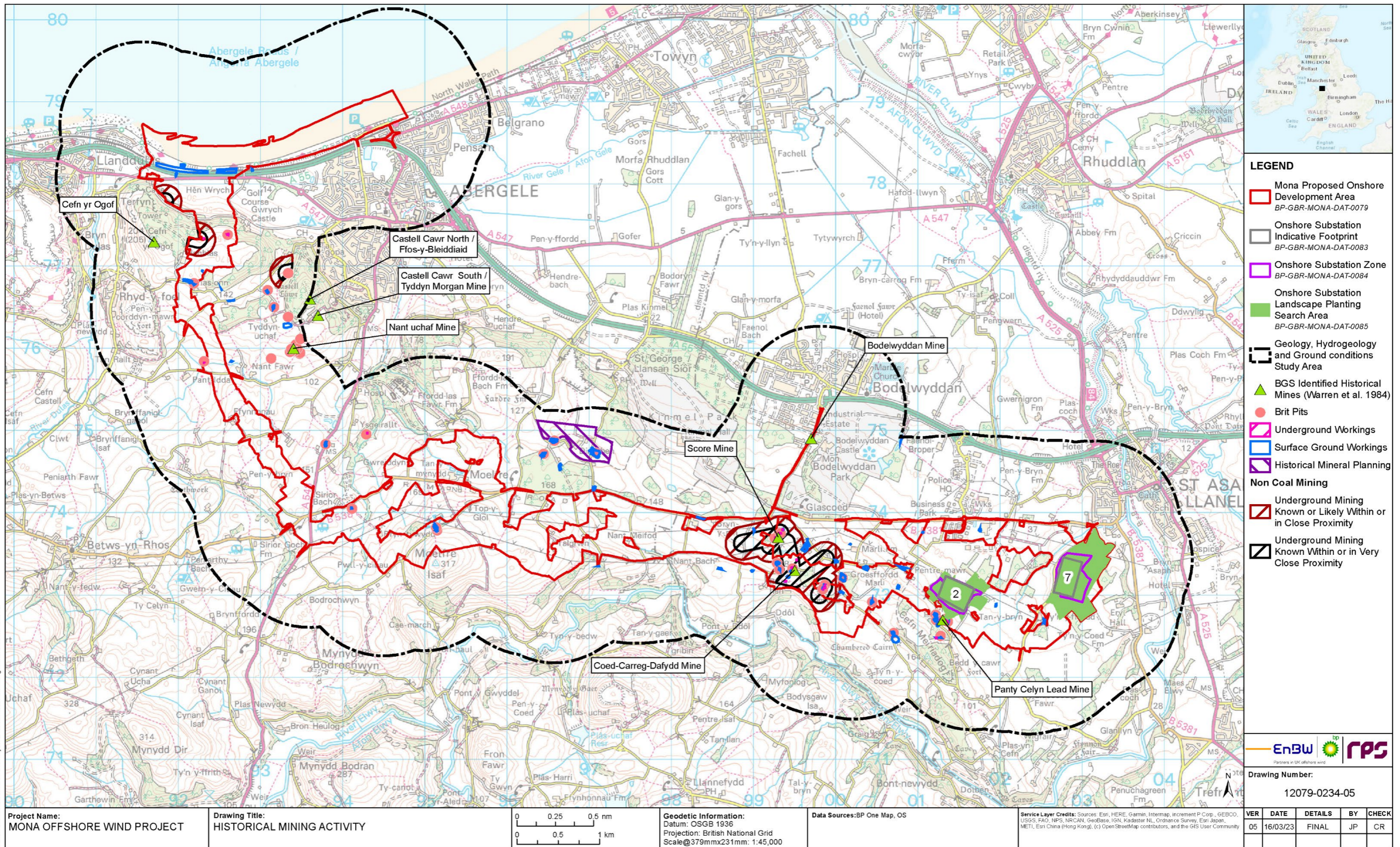


Figure 1.6: Overview of historical mining activity within the GHGC study area

1.4 References

Groundsure Insight Report: Mona Onshore Route, Report Ref. GSIP-2022-12806-10820 (A to E). 27 June 2022 (available on request).

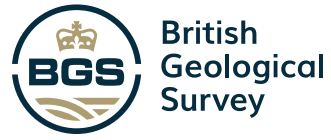
NRW Environmental Pollution Incidents. Available:

<https://lle.gov.wales/catalogue/item/EnvironmentalPollutionIncidents/?lang=en> Accessed: March 2017.

British Geological Survey 1:50,000k Data purchased from Bluesky Mapshop. Available:

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/2/> Accessed July 2022.

Appendix A BGS Borehole records



Version 2.0.6.6
BGS ID: 140216 : BGS Reference: SH97NE1
British National Grid (27700) : 297880,375020
[Report an issue with this borehole](#)

<< < Prev Page 1 of 5 > Next >>

LOG OF STRATA OVERLEAF.

Handwritten: Sites B, C on SH97 SE.

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.	Date Received	1" O.S. Map No.	Site marked (use symbol) on 1" Map on 6" Map
--	---------------	-----------------	--

RECORD OF WELL (SHAFT OR BORE)
(attach copies of analyses if available)

At Kinnel Park

Town or Village St. Asaph

County F. Flint Six-inch quarter sheet ABCD

For Mr. Hughes (deceased) * State whether owner, tenant, contractor, consultant, etc. :-

Address (if different from above) _____

Level of ground surface above sea-level (O.D.) X ft. If well-top is not at ground level, state how far (above; below; _____ ft.)

SHAFT _____ ft.; diameter _____ ft.; Details of headings _____

BORE _____ ft.; diameter of bore: at top _____ ins.; at bottom _____ ins.

Details of permanent lining tubes _____

Water struck at depths of _____ ft. below well-top.

Rest-level of water _____ ft. above well-top. Suction at _____ ft. Yield on _____ hours' test pumping at _____ galls. per _____ with depression to _____ ft. below well-top.

Recovery to rest-level in _____ mins. Capacity of pump _____ g.p.h. Date of measurements _____

Description of permanent pumping equipment:

Make and/or type _____ Motive power _____

Capacity _____ gallons per hour. Suction at _____ ft.

Amount pumped _____ galls. per day. Estimated consumption _____ galls. per week.

Well made by _____ Date of well _____

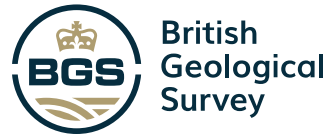
Information from _____

ADDITIONAL NOTES

* estate now owned by Messrs. John Lang & Sons (Builders) London - managed by Messrs. Brooks & Arkwright, 24 High Street, Mold.

X { A. O.D. c. 300 ft. - called the Roman Well c. 5 ft diam. disused.
 B. O.D. c. 295 ft. - filled in - disused.
 C. O.D. c. 295 ft. - bricked in - disused.
 D. O.D. c. 72 ft. - c. 4 ft diam. dyke well known. overflows. (28/8/50)

not able to get any further information.
 visited & noted
 cited A.D.F. on Dec 22 5 SW Daily (28/8/50)



Version 2.0.6.6
BGS ID: 140216 : BGS Reference: SH97NE1
British National Grid (27700) : 297880,375020
Report an issue with this borehole

<< < Prev Page 2 of 5 v Next > >>

Unsure for name of top
Oldest estate land - had no recollection of the name
The "Red Sandstone" suggests that it is in the N. of the
estate along the way to stony in the G. & G. L.

28/8/02

For Survey use only
Date received: DEC 1950
G.S.M. Office File No.
Site marked on 1" map (use symbol)
(*11815) Wt. 29051/0.369 10,000 9/89
A. & E.W. Ltd. Gp. 488

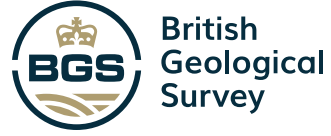
RECORD OF WELL SH 97 NE 107

At Ma Hughes Kimmel Park
Town or Village Abergyle County Dumfries
Exact site not known ? SH 98 76 map is ver (table)

Level of ground surface above sea-level (O.D.) _____ ft. If well starts below ground surface, state how far _____ ft.
Shaft _____ ft., diameter _____ ft. Bore _____ ft. Diameter of bore: at top _____ ins.; at bottom _____ ins.
Details of permanent lining tubes (internal diameters preferred) 10 1/2" x 3" from 3 1/2' down

Water struck at depths of (feet) _____
Rest-level of water below top of well 18 feet. Suction at _____ feet. Yield on nil hours' test
gallons per _____ (with pump of capacity _____ g.p.h.); depressing water level to _____ feet
below top. Time of recovery _____ hrs. Amount normally pumped daily _____ g.p.h. for _____ hours.
Quality (attach copy of analysis if available) _____
Sunk by Le Grand S. for Mr. _____ Date of well 1888
Information from Le Grand 8.8/26.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS		DEPTH	
		Feet.	Inches.	Feet.	Inches.
	Brown & grey clay	4.267	14	16	4.267
	clay	7.627	25	39	11.887
	Fine brown sand	4.877	16	55	16.767
? Drift	Dead sand & brown clay	2.287	7	62	6 19.057
	light blue clay	1.987	6	69	21.03
	Dark sandy clay & stone	7.317	24	93	28.34
	Red sand & small black gravel	1.217	4	97	29.56
	Dark sandy clay & stone	2.747	9	106	32.307
6 units Slat.	Red sandstone	5.48	18	124	37.797
	loose				
	Open, Berwick, 24.417 ft, 2.017				
	(Mudstone & shales below)				
	Kimmel Avenue is some 300 yds. N. of St. Michael's Church Abergyle Kimmel Park is perhaps the park N. of the road but not yet named on 6" map				
	? Kimmel Park 3 miles S.E. of St. Michael's Church. (Sheet 107) Kimmel Park is now a military camp. B.F.B. Aug. 1942 Glasgow School				



Version 2.0.6.6

BGS ID: 19787804 : BGS Reference: SH97NE175
British National Grid (27700) : 299040,375700
[Report an issue with this borehole](#)

<< < Prev Page 1 of 1 v Next > >>



SH97/11

DRILLING LOG

3 0231
DRAGON DRILLING (WATER & ENERGY) LIMITED
BRICKFIELD LANE
RUTHIN
LL15 2TN
TEL: 01824 707777

SITE: 353 -Mc Lords, LL18 5SX BH No.: 1 BGS No. SN15/52 Grid Ref - SH99047570 AOD m DATE 31/3/2015

OPERATION	SIZE (MM)	FROM DEPTH (M)	TO DEPTH (M)	TOTAL	DEPTH (M)	DESCRIPTION	MATERIAL & DEPTH (M)
Set up				1			
Drilling with Augers	200	GL	14.0	14.0		Soils and Stone	0.0 Bentonite
Drilling Mud	215	GL	32.0	32.0		Clay Some Stones	
Symertex	194	GL	60.0	60.0		Boulder Clay and Gravel	15.0 Gravel
						Boulder	
						Clay Gravel and Boulders	
						Limestone - Water Strike 1L / Sec	
						Limestone	60.0 Gravel
						Water controlled by the use of a tanker	

PREDICTED DEPTH (M)	ACTUAL DEPTH (M)	GROUNDWATER (MBGL)	END CAP	SLOTTED (M)	PLAIN (M)	CASING HEIGHT (MAGL)	STONE (MBGL)	BENTONITE (MBGL)
100.00	60.0	42.0	YES	30.0	30.0	GL	15.0 - 60.0	0.0 - 15.0



[Report an issue with this borehole](#)



DRILLING LOG

British Geological Survey

LOG NUMBER 9WB 339

DRAGON DRILLING (WATER & ENERGY) LIMITED
GRAIG LELO INDUSTRIAL ESTATE
CORWEN

LL21 9SD
TEL: 01824 707777

British Geological Survey

SITE: Thorncliffe JOB REFERENCE: 583 SITE BH NUMBER: 1 BGS No: SN18/165 GRID REF: SH98237628 DATE: 6/6/18

OPERATION	SIZE (MM)	FROM DEPTH (M)	TO DEPTH (M)	TOTAL
Set up	-	-	-	1
Permanent Steel	194	0.5 AGL	10.5	11
Cement	-	0.5 AGL	11	11.5
Mud drilling (Drag bit)	152	0.5 AGL	35	35.5
CFA drilling	200	GL	11	11
Airlift	-	-	-	-

DEPTH (M)	DESCRIPTION	MATERIAL & DEPTH (M)
0 - 0.6	Soils	
0.6 - 7.8	Stiff red clay	
7.8 - 8.6	Stiff red clay and round gravel	Solid casing size - 113mm
8.6 - 10.5	Stiff red clay and round gravel (slightly damp)	Bentonite type - Granules
10.5 - 25	Red boulder clay	Slotted casing size - 113/1mm
25 - 30	Grey sandy clay	Gravel pack size - 6mm
30 - 35	Small rounded gravel	Glass media size - n/a
	Hole collapsing past 30m	
	4m ³ of drilling mud used	
	Water strike depths - 30m (Rest level 1.3m AGL)	

PREDICTED DEPTH (M)	ACTUAL DEPTH (M)	WATER STRIKE (MBGL)	LITRES PER MINUTE (Artesian)	SLOTTED (M)	PLAIN (M)	END CAP	GRAVEL/GLASS PACK (MBGL)	BENTONITE (MBGL)
60	35	30	30	30 - 18	18 - GL	yes	30 - 17	17 - GL

DRILLING FOR: Commercial water supply

NAME: Jordan McVey (LEAD DRILLER)



DRILLING LOG

British Geological Survey

British Geological Survey

LOG NUMBER 3WB 386
 DRAGON DRILLING (WATER & ENERGY) LIMITED
 GRAIG LELO INDUSTRIAL ESTATE
 CORWEN
 LL21 9SD
 TEL: 01824 707777

SITE: Fford Cas Fawr, Abergele JOB REFERENCE: 1551 SITE BH NUMBER: 1 BGS No: SN18/238 GRID REF: SH95477538 DATE: 04/09/2018

OPERATION	SIZE (MM)	FROM DEPTH (M)	TO DEPTH (M)	TOTAL	DEPTH (M)	DESCRIPTION	MATERIAL & DEPTH (M)
Set up				1			
Symmetrix Drilling	198	G.L.	13.5	13.5	0 - 0.5	Soils	
Open Hole Drilling	180	13.5	107	93.5	0.5 - 12	Large gravel	Solid casing size - 113
Mud Drilling					12 - 13	Fractured mudstone	
CFA Drilling					13 - 25	Mudstone	Bentonite type - Granules
Airlift				5	25 - 34	Sandstone (red / brown)	
					34 - 38	Wet sandstone	Slotted casing size - 113
					38 - 40	Sandstone with grey siltstone	
					40 - 107	Grey siltstone with occasional bands of sandstone	Gravel pack size - 6mm
						Water strike depths - 35m, 75m, 100m	Glass media Size - /

DRILLING FOR: Water supply

NAME: Mal Macdonald

(LEAD DRILLER)

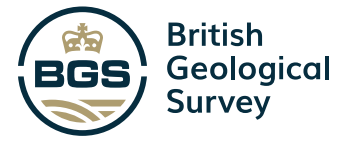
RECORD OF BOREHOLE (SHAFT) NO. 1

1" N.S. 95
 1" O.S.
 Grid
 Ref.

At Abergele Sanatorium,
 Town or Village Denbighshire, County Denbighshire, Six-inch quarter sheet 48E
 Exact site (A rough sketch-map or a tracing from a map is very desirable)
 in parish of
 Level of ground surface above sea-level (O.D.) ft. If well starts below ground surface, state how far ft.
 Shaft ft., diameter ft. Bore ft. Diameter of bore: at top ins.; at bottom ins.
 Details of permanent lining tubes (internal diameters preferred). 20' 12" tubes at surface; & 30' 10" tubes at surface.
 Water struck at depths of (feet)
 Rest-level of water below top of well 80 feet. Suction at feet. Yield on hours' test gallons per (with pump of capacity g.p.h.); depressing water level to feet below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.
 Quality (attach copy of analysis if available)
 Sunk by Messrs. J. Thom for Mr. Abergele Sanatorium Date of well 1928
 Information from Messrs. John Thom, Patrioreft, Manchester.

GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS		DEPTH	
		Feet.	Inches	Feet.	Inches.
Quaternary - till	Clay and stones			18	- 5.49
	Clay and gravel			31	- 9.46
CARBONIFEROUS	Broken limestone			46	- 14.03
LIMESTONE	Broken limestone			54	- 16.47
	Limestone			120	- 36.6
	Small cavity				
	Jointy limestone			180	- 54.9
	Limestone with iron ore			189	- 57.65
	Limestone			266	- 81.13
	Limestone with iron ore			276	- 84.18
	Limestone with streaks of shale			286	- 87.23
	Hard light blue limestone			300	- 91.50
	Limestone very jointy			369	- 112.55
	Cavity			370	- 112.85
	Limestone jointy			400	- 122.0

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.		
For Survey use only		
Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)
British Geological Survey (*11815) Wt.28061/0.869 10,000 9/89 A.& E.W.Ltd. Gp.686		



Version 2.0.6.6

BGS ID: 641443 : BGS Reference: SH97NW1
British National Grid (27700) : 294777,376345
[Report an issue with this borehole](#)

SH 97 NW 1 95 / 2

Report on Visit to Boring at Abegeli.

Boring visited 24th Nov. 1958.

Boring in Carboniferous limestone made by John Thom, Patrick & Lances for the Manchester Corporation for water supply for Sanatorium.

Visit was made in company with E. Neascom D.Sc of Liverpool University, who is mapping & zoning the limestone of this area.

The cores were much broken & the upper 200 feet very unfruitful. The boring appears to be put down on a fault, not shown on the geological maps, but Dr Neascom was aware of its existence.

owing to the faulty & broken nature of the cores, no well defined fossil horizon was found in the upper part, but the presence of *Davosella blaykensis* at 300 feet indicates the base of D1. - the lowest horizon known in this area.

Since making this visit it has been decided to bore another 100 feet in order to put in an air lift as the water contains too much sand for ordinary pumps to be used.

This additional boring will pass through the limestone & possibly the basal conglomerate also.

The present yield is 1000 gallons per hour, but the presence of sand is considered to indicate that the joints are not yet cleaned out and a larger yield is anticipated when this has been achieved by further pumping.

Rep. Jones

WELLS AND BORINGS.

12. Is the water raised by pump or air lift? **Pump**.....

13. Depth from top of well or boring to bottom of suction pipe **263ft.** ^{80.22m}

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(B) UNDERGROUND WATER—(WELLS AND BORINGS).

(In each case please state whether a well and/or boring is in question.)

95 1/2
SH 97 NW 1

I. GENERAL.

1. Exact site of well or boring
 (A map or sketch showing position would be useful.)

Boring at Ty-garddwr Pumping Station, Childrens' Sanatorium, Abergele, Denbighshire. See Map herewith. (Plan AS/B1)

2. Surface level of ground above Ordnance Datum ^{55.82m}
183 ft.

3. Date of construction **1928**

WELLS.

4. Depth of well from surface level of ground (i.e., 2 above). If top of well is below the surface level of the ground (i.e., 2 above) state how much **None** --- ft.

5. Depth of floor of galleries at site of well: also dimension and direction of galleries **None** --- ft.

BORINGS.

6. Depth of boring from surface level of ground (i.e., 2 above). If boring is in bottom of well, state depth of well **From level of surface of ground. (no well sunk) 400ft. 122.0m**

7. (a) Diameter of top of boring **See Plan AS/B4 herewith** in.

(b) Diameter of bottom of boring... .. **do.** in.

8. Tubed from, top of boring to **do.** ft.

9. Lining tubes perforated at depths of **Not perforated** ft.

10. Water struck during boring at depths of **Not known** ft.

11. What was rest level on completion of boring? **60 feet 18.3m**

(2) If not state hardness
 (3) For what purpose is the water used? **Drinking, culinary and steam heating purposes.**

British Geological Survey British Geological Survey British Geological Survey

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II. If systematic measurements of water levels are made, state whether these include:—

(a) Pumping levels..... **None taken** (b) Rest levels **None taken**
 (c) Time of recovery to rest level on cessation of pumping **Not known**
 (d) Changes in pumping level, if rate of pumping is altered. **Not known**
 Also state: (e) at what intervals records are taken (i.e., daily, weekly, etc.) **Not taken**

Please furnish a specimen graph of records taken over as long a period as available (up to 1 year).

None taken

III. If measurements are made only occasionally, please indicate what is, or has been, done in this respect and furnish examples of any graphs or figures available.

None taken

IV. YIELDS.

(1) Number of gallons pumped per hour **5,000**
 (2) Is pumping continuous? **No.**
 (3) If not, how many hours pumping per day? **0**
 (4) Maximum daily yields available
 Estimated
 Based on actual tests **65,000 gallons per day on continuous test (and possibly more available).**

V. If a section or record of strata can be given please attach to this form.

See Plan AS/B4 herewith

VI. (1) If a chemical analysis can be given please attach.

See sheet herewith

RECORD OF WELL (SHAFT OR BORE) N.S. SH97/1

At Aberclee Sanatorium O.S. Grid Ref. 95 2

Town or Village Aberclee County Denbighshire Six-inch quarter 95 2

Exact site SH 9477 7634 SH97NW/1 etch-map (if from a map is very desirable)

Level of ground surface above sea-level (O.D.) _____ ft. If well starts below ground surface, state how far _____ ft.

Shaft _____ ft., diameter _____ ft. Bore _____ ft. Diameter of bore: at top _____ ins.; at bottom _____ ins.

Details of permanent lining tubes (internal diameters preferred) 20" 12" tubes at surface; & 30" 10" tubes at surface

Water struck at depths of (feet) _____

Rest-level of water ^{below} top of well _____ feet. Suction at _____ feet. Yield on _____ hours' test _____ gallons per _____ (with pump of capacity _____ g.p.h.); depressing water level to _____ feet below top. Time of recovery _____ hrs. Amount normally pumped daily _____ g.p.h. for _____ hours.

Quality (attach copy of analysis if available) _____

Sunk by Messrs. J. Thom for Mr. Aberclee Sanatorium Date of well 1928

Information from Messrs. John Thom, Patricroft, Manchester.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS		DEPTH	
		Feet.	Inches.	Feet.	Inches.
BOULDER CLAY	Clay and stones			18	-
	Clay and gravel			31	-
	Broken limestone			46	-
	Broken limestone			54	-
	Limestone			120	-
DINANTIAN	Small cavity			-	-
	Jointy limestone			180	-
DYSEATH	Limestone with iron ore			189	-
	Limestone			266	-
LIMESTONE GROUP	Limestone with iron ore			276	-
	Limestone with streaks of shale			286	-
(WEATHERED AT TOP)	Hard light blue limestone			300	-
	Limestone very jointy			369	-
	Cavity			370	-
	Limestone jointy			400	-

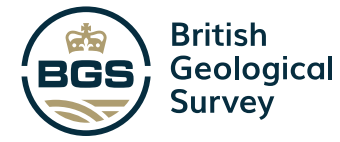
In use sited as Denbigh A SE 2 E as per 1948

licensed to abstract 1.25 million gallons/day

Average abstraction 1973 15.5 million gallons/month

[Supply to Hospital & associated cottages only]

D. J. LONE
24/2/77



Version 2.0.6.6
 BGS ID: 641443 : BGS Reference: SH97NW1
 British National Grid (27700) : 294777,376345
[Report an issue with this borehole](#)

<< < Prev Page 21 of 22 Next > >>

INDEX No 31 SH97/1

CLWYD & DEESIDE HOSPITAL MANAGEMENT COMMITTEE

P. J. HOYE, F.R.A.S., F.C.I.S., F.R.ECONOM.
GROUP SECRETARY.
TEL.: RHYL 4606.
RHIANFA, RUSSELL ROAD, RHYL.

Our Ref: NE/AH. 705/3
Yr. Ref: WMS/MB/1174

15th October, 1968.

Mr. H. H. Crann,
Chief Officer,
Dee & Clwyd River Authority,
2 Vicar's Lane,
CHESTER.

Dear Sir,

Water Resources Act 1963
Borehole at Aberclee Chest Hospital
(N.G.R. 948 763)

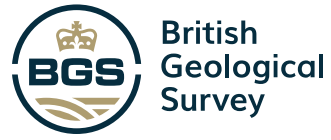
With reference to your letter of the 25th ultimo, I regret I have no information regarding the strata at various depths in respect of the above borehole which was constructed by Messrs. John Thom Ltd., Canal Works, Patricroft, Manchester.

Regarding the taking of measurements of the water level, this is a little difficult but I am informed by my Committee's Group Engineer that the levels have been checked over many years with very little variation.

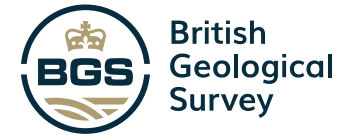
The borehole is 400 ft. deep by 10" diameter and the standing level of water is approximately 100 ft. and the pumping level is 150 ft. at 5000 G.P.H. extraction.

Yours faithfully,
John
Group Secretary.

* Records received from Consultant Engineer & Successors to John Thom Ltd.



BGS ID: 13330435 : BGS Reference: SH97NW59
British National Grid (27700) : 292500,376500
[Report an issue with this borehole](#)



BGS ID: 13330435 : BGS Reference: SH97NW59
British National Grid (27700) : 292500,376500
[Report an issue with this borehole](#)

ENVIRONMENT AGENCY

Form WR - 38 Ref: betws lodge, abergele.doc Agency No.

BOREHOLE RECORD

A. SITE DETAILS

WELSH E-A

SH97/9
95 SH97NN/59

Borehole drilled for:	Mr Crowther
Location:	Betws Lodge, Tan Y Gopa Road, Abergele
N.G.R.:	SH 925 765
Ground Level (if known):	SURFACE
Drilling Company:	W.B. & A.D. MORGAN LTD., PRESTEIGNE, POWYS. LD8 2UF
Date of Drilling:	Commenced: 5/7/04 Completed: 8/7/04

B. CONSTRUCTION DETAILS

Borehole datum (if not ground level) <u>GROUNDLEVEL</u>	
(Point from which all measurements of depth are taken e.g. flange, edge of chamber, etc.)	
Borehole drilled diameter.....	200 mm from 0 to 89 m/depth
	mm from _____ to _____ m/depth
	mm from _____ to _____ m/depth
Casing material: u.P.V.C diameter	103 mm from 0 to 89 m/depth
and type (e.g. plain steel, plastic slotted)	
Plain diameter	103 mm from 0 to 46.9 m/depth
Slotted diameter	103 mm from 46.9 to 52.7 m/depth
Plain diameter	103 mm from 52.7 to 58.5 m/depth
Slotted diameter	103 mm from 58.5 to 70.1 m/depth
Plain diameter	103 mm from 70.1 to 75.9 m/depth
Slotted diameter	103 mm from 75.9 to 87.5 m/depth
Plain diameter	103 mm from 87.5 to 89 m/depth
Grouting details:	13m to surface
Water struck at:	57m, 73m, 75 m (depth below datum - mbd)
Rest water level on completion:	m (depth below datum - mbd)
Estimated blowout yield:	900 Gallons per hour

C. STRATA LOG

Description of Strata	Thickness (m)	Depth (m)
Overburden - soft gravels & limestone boulders	9	9
Medium/hard light brown/grey limestone	80	89
Other Comments (e.g. gas encountered, saline water intercepted, etc.)		
Gravel Pack Quantity:	2,650kg	Temp Steel Casing: 9m x 220mm Depth and Diameter
Cement:		
Rig & Crew:	Tiger, D. Harner, M. Turnbull	

ENVIRONMENT AGENCY

Form WR - 38 Ref: betws lodge, abergele.doc Agency No.

BOREHOLE RECORD

A. SITE DETAILS

WELSH E-A

SH97/9
95 SH97NN/59

Borehole drilled for:	Mr Crowther
Location:	Betws Lodge, Tan Y Gopa Road, Abergele
N.G.R.:	SH 925 765
Ground Level (if known):	SURFACE
Drilling Company:	W.B. & A.D. MORGAN LTD., PRESTEIGNE, POWYS. LD8 2UF
Date of Drilling:	Commenced: 5/7/04 Completed: 8/7/04

B. CONSTRUCTION DETAILS

Borehole datum (if not ground level) <u>GROUNDLEVEL</u>	
(Point from which all measurements of depth are taken e.g. flange, edge of chamber, etc.)	
Borehole drilled diameter.....	200 mm from 0 to 89 m/depth
	mm from _____ to _____ m/depth
	mm from _____ to _____ m/depth
Casing material: u.P.V.C diameter	103 mm from 0 to 89 m/depth
and type (e.g. plain steel, plastic slotted)	
Plain diameter	103 mm from 0 to 46.9 m/depth
Slotted diameter	103 mm from 46.9 to 52.7 m/depth
Plain diameter	103 mm from 52.7 to 58.5 m/depth
Slotted diameter	103 mm from 58.5 to 70.1 m/depth
Plain diameter	103 mm from 70.1 to 75.9 m/depth
Slotted diameter	103 mm from 75.9 to 87.5 m/depth
Plain diameter	103 mm from 87.5 to 89 m/depth
Grouting details:	13m to surface
Water struck at:	57m, 73m, 75 m (depth below datum - mbd)
Rest water level on completion:	m (depth below datum - mbd)
Estimated blowout yield:	900 Gallons per hour

C. STRATA LOG

Description of Strata	Thickness (m)	Depth (m)
Overburden - soft gravels & limestone boulders	9	9
Medium/hard light brown/grey limestone	80	89
Other Comments (e.g. gas encountered, saline water intercepted, etc.)		
Gravel Pack Quantity:	2,650kg	Temp Steel Casing: 9m x 220mm Depth and Diameter
Cement:		
Rig & Crew:	Tiger, D. Harner, M. Turnbull	

24-1. TIF
RECORD OF WELL

For Institute use only Licence No. N.....

At *Llanthun College*
 Mine Adit
 Town or Village *Bodelwyddan*
 County *Flint*

SJ07/24
 107/53

EXACT SITE OF WELL
 Six-inch National Grid sheet and reference *SJ 005 751 SJ07NW*
 For *The Bunsar, Llanthun College*
 State whether owner, tenant, builder, contractor, consultant, etc.: *owner*
 Address (if different from above)

*DELETE AS NECESSARY
 If well top is not at ground level state how far above* below:
 SHAFT.....ft (.....m); diameter.....ft (.....m);

HEADINGS (please attach details—dimensions and directions)

BORE.....ft (.....m); diameter: at top.....in (.....mm);
 at bottom.....in (.....mm)

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.):

Water struck at depths offt (.....m) below well top

TEST CONDITIONS
 Rest level of water.....ft (.....m) above* below well top. Suction at.....ft (.....m)
 Yield on.....hours* test pumping at.....galls per (.....l/s) with
 depression to.....ft (.....m) below well top. Recovery to rest level inmins*
 hours
 Capacity of pump.....g.p.h. (.....l/s)
 Date of measurements.....

NORMAL CONDITIONS
 DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:
 Make and/or type Motive power.....
 Capacity.....galls (.....m³) per hour. Suction atft (.....m)
 below well top. Amount pumped.....galls (.....m³) per day. Estimated
 consumptiongalls (.....m³) per week

Well made by Date of sinking.....

LOG OF STRATA OVERLEAF
 ADDITIONAL NOTES ANALYSIS (please attach copy if available)
licence No. 24/66/7/16/6, for 1230 gpd, 0.45D mqa.

Received from *Dec. & Lloyd RA*
 Date *5-8-68*
 Observation well.....

5507/24

Sampling point: 3400 TEAM 3, RIVER SAMPLES
Grid: SJ0000000000

Sampling Date: 15-AUG-1995 Time: 1120

Sampler: Jason Liptrot

Point type: FZ FRESHWATER - UNSPECIFIED

Mechanism: S SPOT

Purpose: UI UNPLANNED REACTIVE MONITORING (POLLUTION INCIDENTS)

Material: 2ZZZ ANY WATER

Notes: MINE DISC 1 SH 9980 7500
9977 7495

Abstraction from New Engine Shaft

Determinand	Unit	Result
0050 LEAD - AS PB	ug/l	11.80000
0061 PH - AS PH UNITS	PHUNITS	8.32000
0062 CONDUCTIVITY @20C	uS/cm	528.00000
0076 TEMPERATURE WATER	CEL	13.00000
0085 BOD ATU	mg/l	< .50000
0111 AMMONIA - AS N	mg/l	.04000
0116 NITROGEN TOTAL OXIDISED - AS N	mg/l	1.68000
0117 NITRATE	mg/l	1.68000
0118 NITRITE	mg/l	< .00200
0135 SOLIDS SUSPENDED @105C	mg/l	< 3.00000
0153 ALKALINITY PH 8.3	mg/l	.52000
0158 HARDNESS TOTAL	mg/l	243.00000
0162 ALKALINITY PH 4.5	mg/l	221.00000
0172 CHLORIDE ION - AS CL	mg/l	44.60000
0180 ORTHO-PHOSPHATE	mg/l	.02700
0193 CARBONATE - AS CO3	mg/l	.62400
0205 SODIUM DISSOLVED - AS NA	mg/l	28.90000
0209 POTASSIUM DISSOLVED - AS K	mg/l	1.67000
0215 COPPER - AS CU	mg/l	.00700
0237 MAGNESIUM - AS MG	mg/l	5.40000
0241 CALCIUM - AS CA	mg/l	88.20000
0245 ZINC - AS ZN	mg/l	.62000
0251 CADMIUM DISSOLVED - AS CD	mg/l	.00400
0356 ARSENIC - AS AS	mg/l	< .00200
0375 CHROMIUM - AS CR	mg/l	< .00050
0403 MANGANESE - AS MN	mg/l	.00400
0421 IRON - AS FE	mg/l	.01200
6383 SOLIDS DISSOLVED @180C	mg/l	352.00000
7375 SILICA AS SI	mg/l	2.48000
9584 BICARBONATE - AS HCO3	mg/l	270.00000

5507/24

Sampling point: 3400 TEAM 3, RIVER SAMPLES
Grid: SJ0000000000

Sampling Date: 15-AUG-1995 Time: 1210

Sampler: Jason Liptrot

Point type: FZ FRESHWATER - UNSPECIFIED

Mechanism: S SPOT

Purpose: UI UNPLANNED REACTIVE MONITORING (POLLUTION INCIDENTS)

Material: 2ZZZ ANY WATER

Notes: LOWER ADIT SJ 005 7510 - Mine adit discharge

Determinand	Unit	Result
0050 LEAD - AS PB	ug/l	4.50000
0061 PH - AS PH UNITS	PHUNITS	8.38000
0062 CONDUCTIVITY @20C	uS/cm	623.00000
0076 TEMPERATURE WATER	CEL	13.00000
0085 BOD ATU	mg/l	< .50000
0111 AMMONIA - AS N	mg/l	.07000
0116 NITROGEN TOTAL OXIDISED - AS N	mg/l	3.95000
0117 NITRATE	mg/l	3.95000
0118 NITRITE	mg/l	< .00200
0135 SOLIDS SUSPENDED @105C	mg/l	< 3.00000
0153 ALKALINITY PH 8.3	mg/l	.62000
0158 HARDNESS TOTAL	mg/l	244.00000
0162 ALKALINITY PH 4.5	mg/l	276.00000
0172 CHLORIDE ION - AS CL	mg/l	40.40000
0180 ORTHO-PHOSPHATE	mg/l	.01400
0193 CARBONATE - AS CO3	mg/l	.74400
0205 SODIUM DISSOLVED - AS NA	mg/l	28.70000
0209 POTASSIUM DISSOLVED - AS K	mg/l	1.57000
0215 COPPER - AS CU	mg/l	< .00200
0237 MAGNESIUM - AS MG	mg/l	5.37000
0241 CALCIUM - AS CA	mg/l	88.70000
0245 ZINC - AS ZN	mg/l	.36000
0251 CADMIUM DISSOLVED - AS CD	mg/l	.00200
0356 ARSENIC - AS AS	mg/l	< .00200
0375 CHROMIUM - AS CR	mg/l	< .00050
0403 MANGANESE - AS MN	mg/l	.00800
0421 IRON - AS FE	mg/l	.00900
6383 SOLIDS DISSOLVED @180C	mg/l	415.00000
7375 SILICA AS SI	mg/l	3.69000
9584 BICARBONATE - AS HCO3	mg/l	337.00000

WELSH WATER AUTHORITY
 DEE AND CLWYD DIVISION
 HYDROGEOLOGY SECTION
 GROUND WATER QUALITY ANALYSES

5507/24

Name of Site ... Lawther... College... Drainage Tunnel

D.C.D. Ref. No. SI 07/5 N.G.R.

Analysis Group: Group 'A'

Sampling Location and Other Details

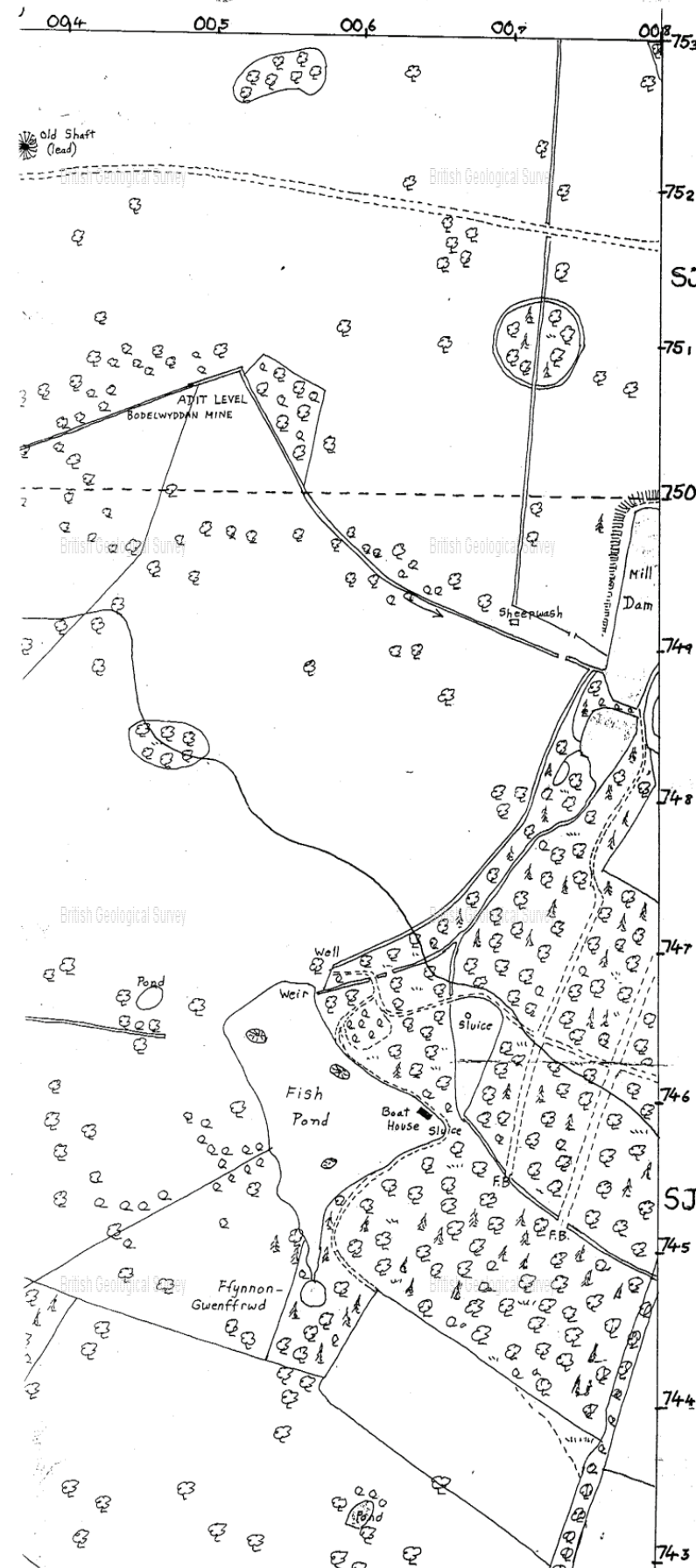
Date	21.7.77	14.9.82			
Time G.M.T.		1435			
Water Level (m.A.O.D.)					
Flow (g.p.h.)		0.5 mgd			
Temperature					
pH	7.2	7.33			
Specific Conductivity		603			
Total Dissolved Solids		377			
Sodium	34.2	21.2			
Potassium	4.48	2.63			
Calcium (as CaCO ₃)	106	106			
Magnesium (as CaCO ₃)	9.7	11.5			
Chlorides	37	36.9			
Sulphates	35	30.4			
Carbonates		NIL			
Bicarbonates		282			
Nitrates as N		3.33			
Nitrites as N		< 0.01			
Tot. Ox. Nitrogen as N	3.70	3.34			
Ammoniacal Nitrogen		< 0.05			
Silicates		3.6			
Orthophosphates		< 0.05			
Suspended Solids		N.D.			
Alkalinity (Total)	259	282			
Iron (Total)	0.18	0.304			
Manganese (Total)		0.0188			
Hardness (Total)		312.2			
Copper		0.015			
Zinc		0.309			
Chromium		< 0.010			

Sampler ?

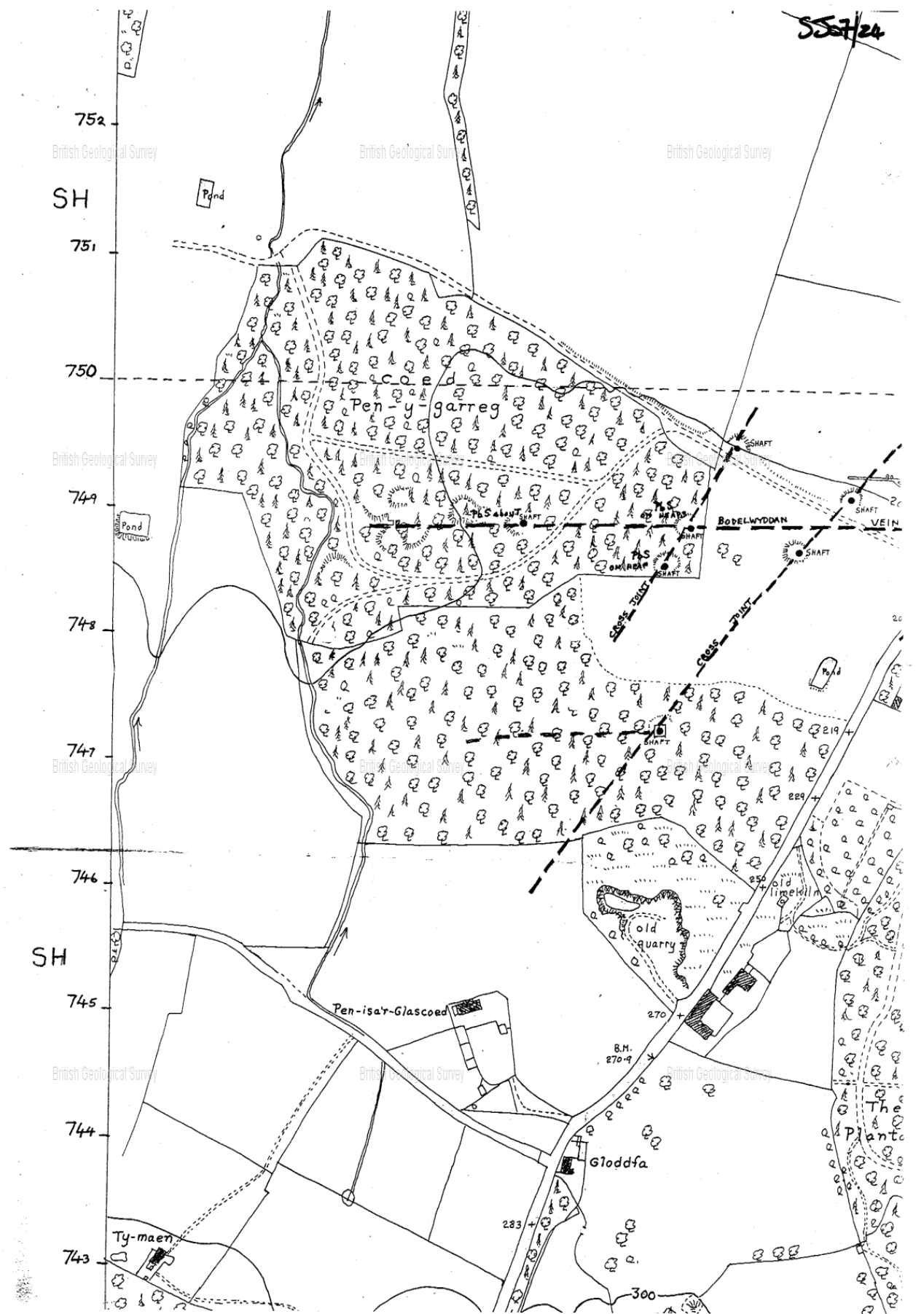
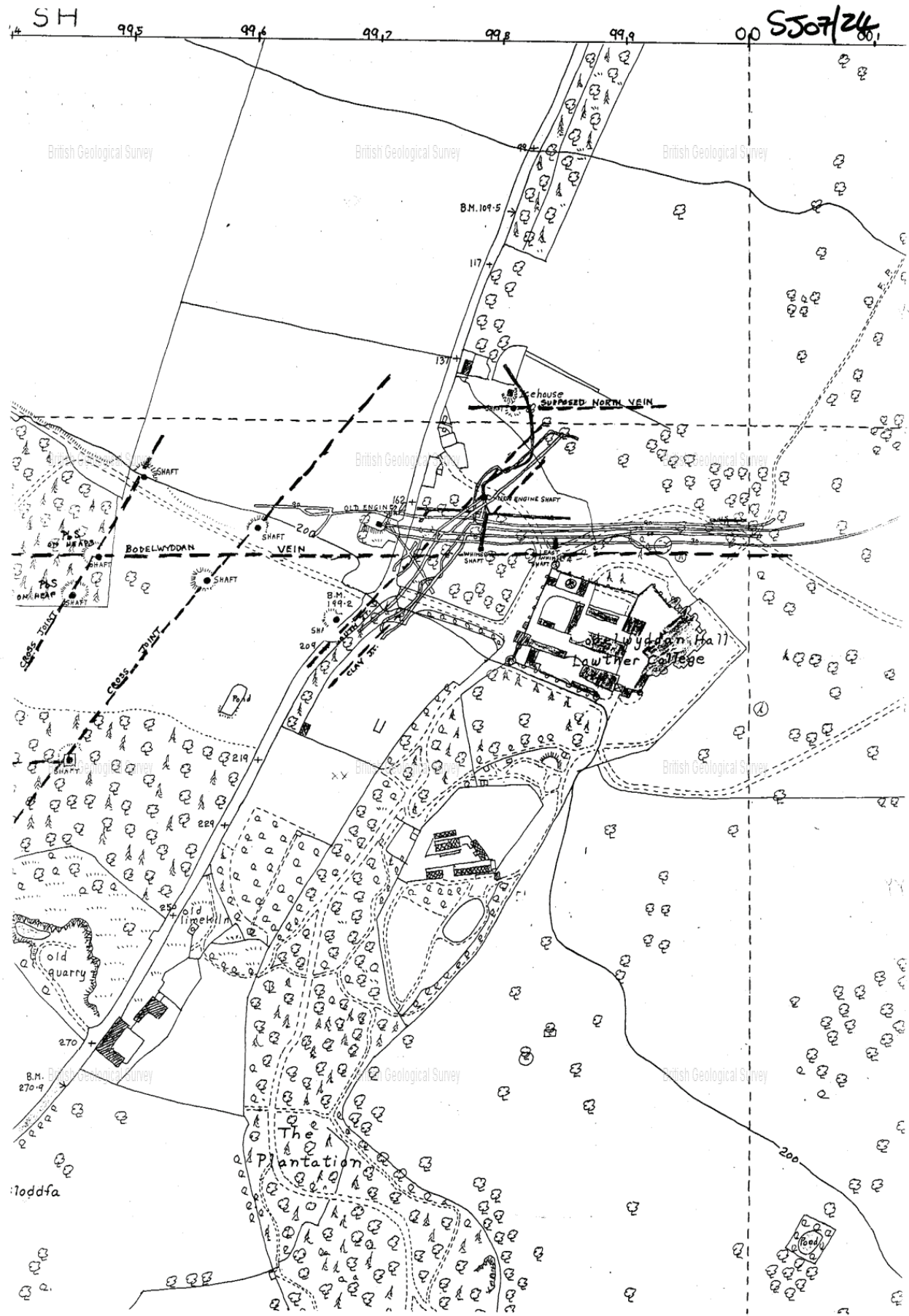
psn

Comments:

mg/litre

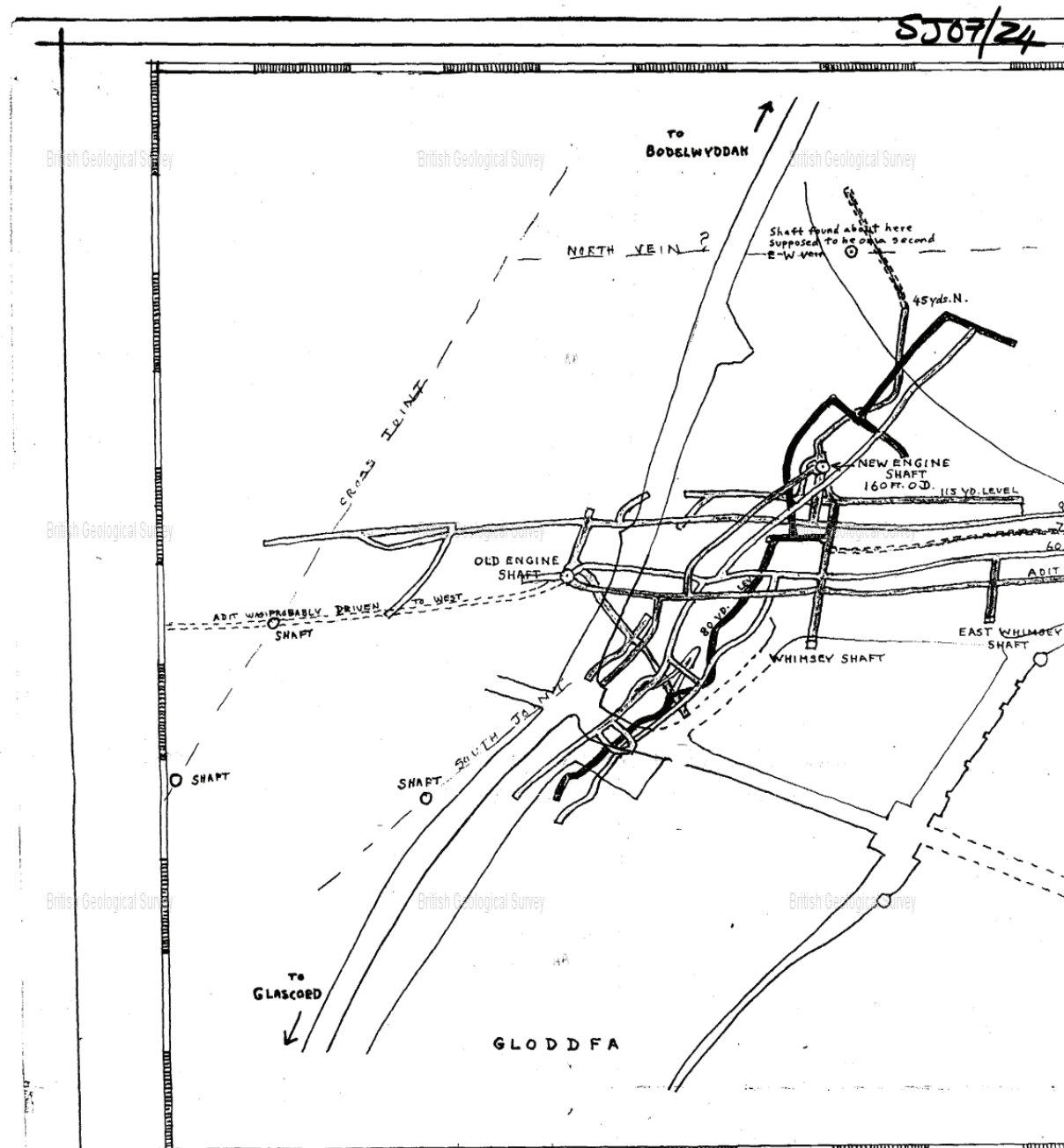
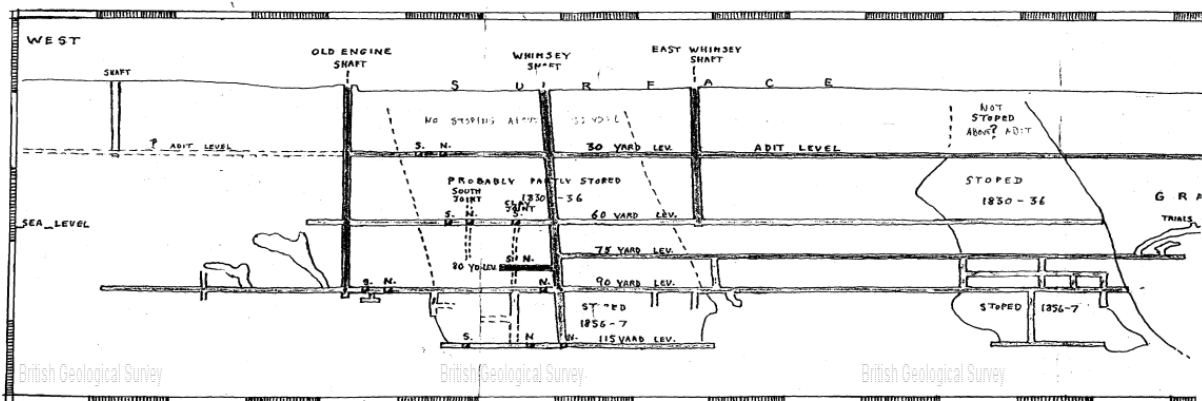


5507/24

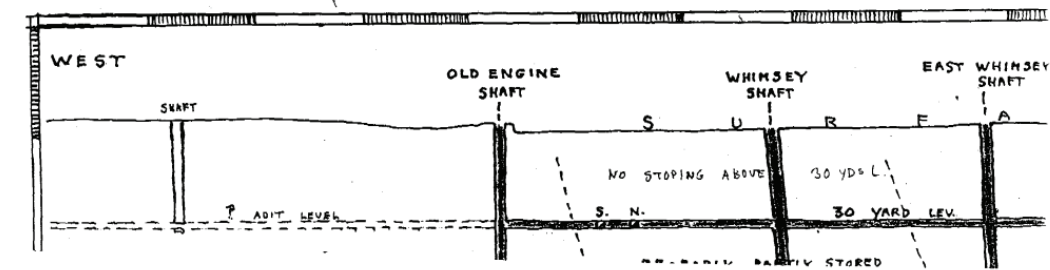


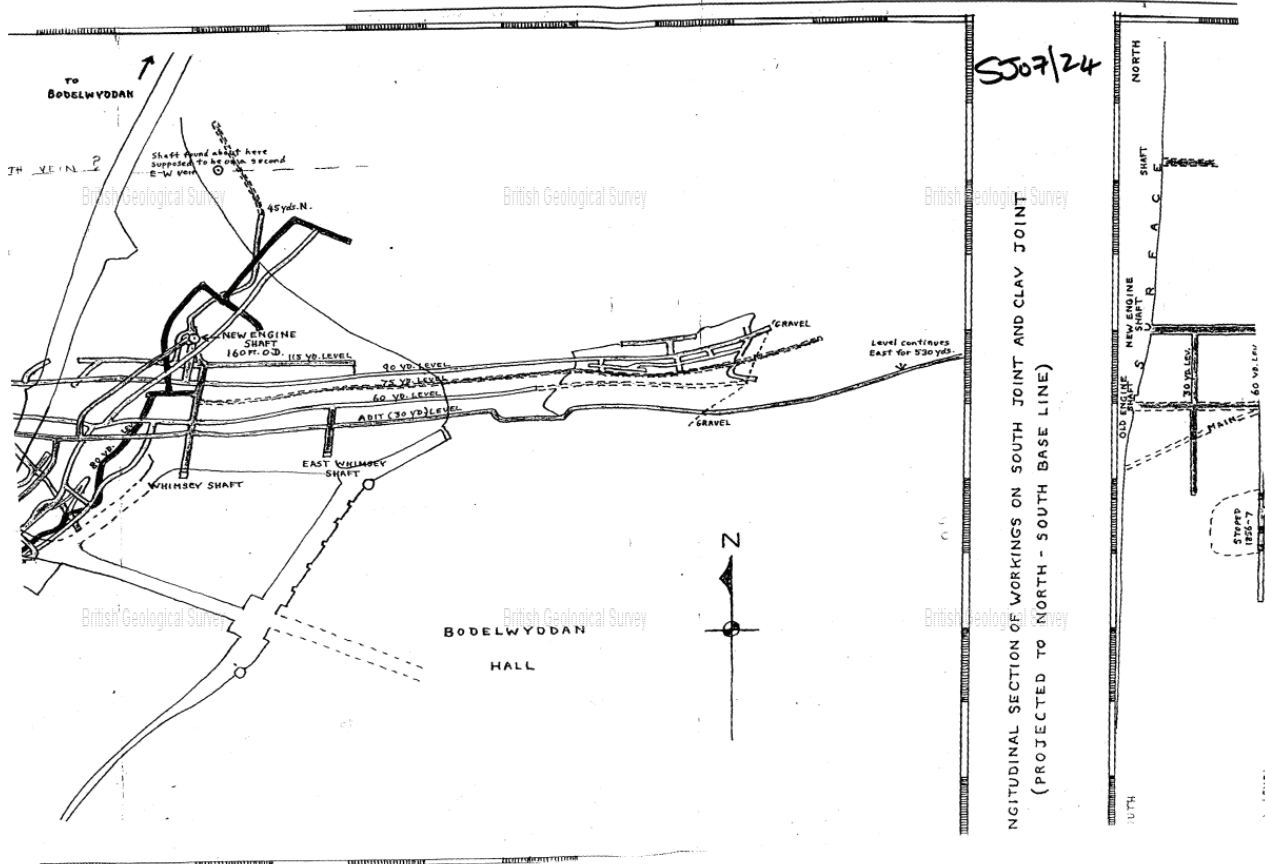


LONGITUDINAL SECTION ON BODELWYDDAN MAIN VEIN
 (PROJECTED TO AN EAST-WEST BASE LINE)

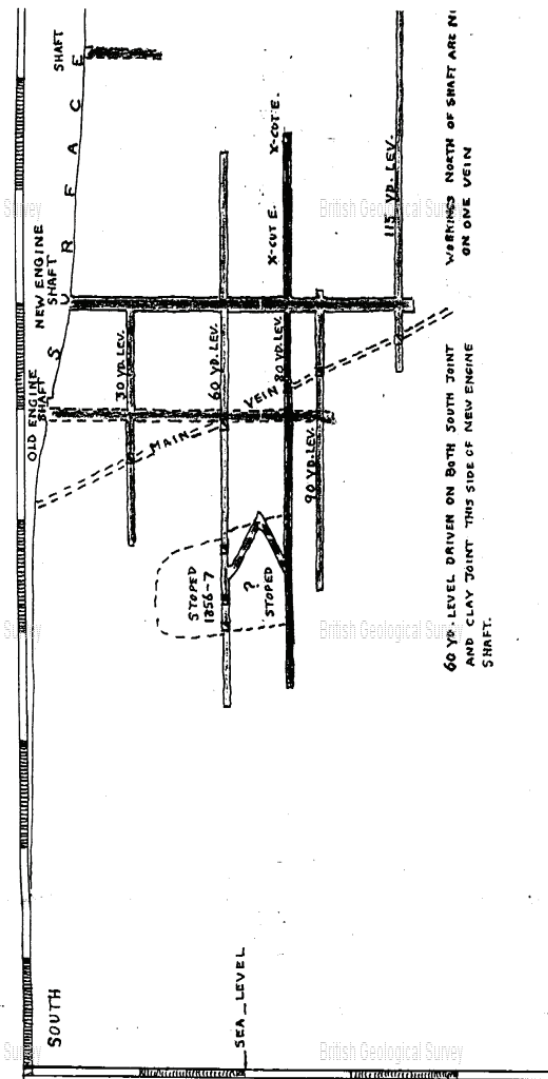


LONGITUDINAL SECTION ON BODELWYDD
 (PROJECTED TO AN EAST-WEST BASE LIN)





LONGITUDINAL SECTION OF WORKINGS ON SOUTH JOINT AND CLAY JOINT
 (PROJECTED TO NORTH - SOUTH BASE LINE)



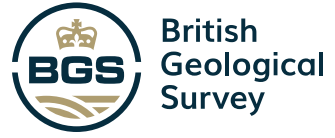
PLAN AND SECTIONS
 BODELWYDDAN MINE
 FLINTSHIRE
 SCALE 100 FT. TO AN INCH

THIS PLAN AND SECTIONS ARE BASED UPON COPIES OF THE ORIGINAL PLAN AND SECTIONS DEPOSITED AT THE MINES DEPARTMENT (PLAN NO R-301). THE ORIGINAL SURVEY WAS MADE BY THOMAS R. BUCKLEY, IN 1857, WHEN THE MINE WAS STILL AT WORK. THERE WAS NO SECTION MADE THEN ON SOUTH AND CLAY JOINTS, AND THIS SECTION IS PROJECTED FROM THE PLAN HERE. THE WORKINGS OF THE MINE ARE ALSO KNOWN TO HAVE BEEN EXTENDED BEYOND THE WESTERN END AS SHOWN HEREIN, BUT NO PLAN OR SECTION OF THESE WORKINGS IS NOW IN EXISTENCE; NOR IS THERE ANY RECORD OF WORKINGS ON OTHER VEINS WHICH ARE KNOWN IN THE IMMEDIATE AREA OF THE MINE.

S507/24

MIDDLETON-IN-TERSDALE.

5 JANUARY 1964. -JFS-



Version 2.0.6.6
BGS ID: 750877 : BGS Reference: SJ07SW3
British National Grid (27700) : 304300,371900
[Report an issue with this borehole](#)

<< < Prev Page 4 of 5 Next > >>

2-2-TWF Strata 087733
043719
SJ07/22

Maes-Elwy well.

Clay	54 0	Superficial deposits.
Clay with boulders	0 10	
Red laminated marl	5 0	
Clay, red & mottled	66 0	Solid (Carboniferous).
Red sand, passing down into sandstone	- -	

125' 10"
38 3 m

SJ07/22

2-3.TIF

SJ07/2
107

23

British Geological Survey Temporary Record Geological Survey

Maes Elwy

Map Ref: 043719

Drift	60	60	Boulder clay
Sandstone (?Up. Carboniferous)	66	126	WESTPHALIAN (COAL MEASURES)

D.J.L. 22/9/77

Information from Dr. Neaveison.
Dr. Wilson visited the site - the hole could not be found.

British Geological Survey

British Geological Survey

British Geological Survey

Information from Dr. C.D.V. Wilson, University of Liverpool
in letter to J.V. Stevens (Manchester Office) dated 19.5.58

Sited in pencil on 1" Sheet 107 and rough sited on 6" map
Dealigh. & NE 1E. 19.6.58 BN.

British Geological Survey

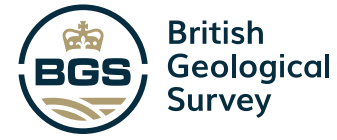
British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey



Version 2.0.6.6

BGS ID: 750888 : BGS Reference: SJ07SW14
British National Grid (27700) : 303660,373120
[Report an issue with this borehole](#)

<< < Prev Page 20 of 25 v Next > >>

33-3.TIF

Name of Shaft or Bore given by Geological Survey: SJ 07 SW/14 SJ07/33

.....St. Asaph (Wigfair, Isaf) Borehole.....

Name and Number given by owner:

For whom made I. G. S.

Town or Village St. Asaph County

Exact site 1480yd. S. 18° W. of St. Asaph (Attach a tracing from a map, or a sketch-map, if possible.)

Station: 400yd. W. 35° N. of Wigfair Isaf

Purpose for which made

Ground Level at shaft bore relative to O.D. about 60ft. If not ground level give O.D. of beginning of shaft bore

Made by Foraky

Date of sinking July 1968

Information from

Drilling log and chippings to 70ft. 5in. Date received

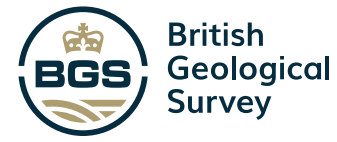
Examined by

D. Price

Nat. Grid Reference		
SJ 0366 7312		
1" N.S. Map No.	1" O.S. Map No.	Confidential or not
107		

SPECIMEN NUMBERS AND ADDITIONAL NOTES

(For Survey use only) GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS		DEPTH	
		FT.	IN.	FT.	IN.
	<u>Chippings</u>				
	Gravel			5	0
	Gravel			10	0
	Gravelly clay			15	0
	Gravelly clay			20	0
	Clayey gravel			25	0
	Clayey gravel			30	0
	Gravel			35	0
	Gravel			40	0
	Gravel			45	0
	Gravel			50	0
	Sandy gravel (grey)			55	0
	Sandy gravel			60	0
	Sandy gravel			65	0
	Gravel with red clay			70	0
	<u>Drillers log</u>				
	Drift, ? alluvial	14	6	14	6
	Gravel	8	0	22	6
	Boulder clay	8	6	31	0
	Gravel	36	5	67	5
	U.C.M.	3	0	70	5
	<u>Cores</u>				

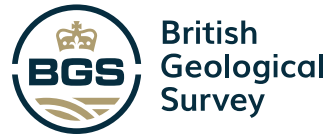


Version 2.0.6.6
 BGS ID: 750888 : BGS Reference: SJ07SW14
 British National Grid (27700) : 303660,373120
[Report an issue with this borehole](#)

33-2.TIF

For Institute use only

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA <i>If measurements start below ground surface, state how far.</i>	THICKNESS			DEPTH		
		Feet	Inches	Metres	Feet	Inches	Metres
Drift.	Alluvium, gravel and gravelly clay	67	5		67	5	
Upper Coal Measures	Red sandstone with some sandstone	426	7		424	-	

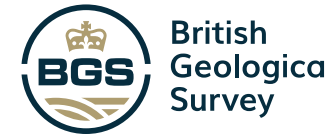


Version 2.0.6.6

BGS ID: 750888 : BGS Reference: SJ07SW14
British National Grid (27700) : 303660,373120
[Report an issue with this borehole](#)

33-6-TIF

WATER RESOURCES BOARD WELL RECORD		SHEET 2	
W.R.B. REF NO. SJ 07/33		R.A. LICENCE NO.	
4. HYDROGEOLOGY			
Topography AT WELL SITE Local depression <input type="checkbox"/> , Flat surface <input type="checkbox"/> , Hill top <input type="checkbox"/> , Hillside <input type="checkbox"/> , valley bottom <input type="checkbox"/> , Terrace <input type="checkbox"/>			
MAJOR AQUIFER		Lithology	
Depth to top of aquifer	m.	Thickness penetrated	m.
	ft.		ft.
Top of aquifer	m.	Total thickness of aquifer	m.
	ft.		ft.
Coefficient of storage		Transmissibility	$\frac{m^2/day}{galls/day/ft.}$
MINOR AQUIFER (a)		Lithology	
Depth to top of aquifer	m.	Thickness penetrated	m.
	ft.		ft.
Top of aquifer	m.	Total thickness of aquifer	m.
	ft.		ft.
Coefficient of storage		Transmissibility	$\frac{m^2/day}{galls/day/ft.}$
MINOR AQUIFER (b)		Lithology	
Depth to top of aquifer	m.	Thickness penetrated	m.
	ft.		ft.
Top of aquifer	m.	Total thickness of aquifer	m.
	ft.		ft.
ADDITIONAL NOTES: SJ 0366 7312 Dee + Clwyd R.A. Alluvium - gravel gravelly clay. 67' 5" Upper Coal Measures. Red mudstone mainly, some sandstone to 499' 4" core 80 to 120 feet. 2 1/2" core below 120 feet. Not much water, lost circulation in Coal Measures. Now filled in with cement. Information from Mr Price, I.G.S. Leeds. Telephoned by Dr M. Fleet.			



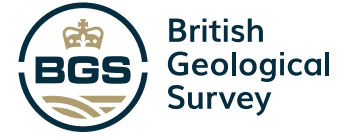
Version 2.0.6.6

BGS ID: 750888 : BGS Reference: SJ07SW14
British National Grid (27700) : 303660,373120
[Report an issue with this borehole](#)

Name of Shaft or Bore given by Geological Survey: ST ASAPH (WIGFAR 15AP) BORE: ABRIDGED		6-inch Map Registered No. 530756		COMMERCIAL IN CONFIDENCE	
GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS		DEPTH	
		FR	IN.	FR	IN.
Recent	gravel and gravelly clay	67	5	67	5
U. C. M.	Sandstone, purple and red micaceous in parts	17	0	84	5
	Mudstone and silty mudstone, purple and green	3	5	87	10
	Sandstone, soft, purple and purple-grey	3	6	91	4
	Mudstone and silty mudstone, purple, red and green, part embedded	74	3	165	7
	Mudstone, purple, grey and red, plank trees			168	6
	Sandstone, grey to purple	2	4	167	11
	Mudstone and silty mudstone, grey to purple-grey	1	11	169	10
	Mudstone, purple, red and grey; plant impressions	12	7	182	5
	? Horizon of oxidized coal			182	5
	Sealath, purple, red and green	3	7	186	0
	Mudstone, part silty, purple, red and green; plant impressions 190/6 to 192/3 and 203/3 to base	22	0	208	0
	? Horizon of oxidized coal			208	0
	Sealath, silty, variegated	3	10	211	10
	Mudstone and silty mudstone, red, purple and purple grey	53	1	264	11
	Sandstone, part micaceous, purple and grey	37	4	302	3
	Mudstone and silty mudstone, mainly red and purple	6	7	338	10
	Striped beds, grey	1	11	340	9
	Silty mudstone and siltstone, grey, red and purple	6	10	347	7
	Sandstone and striped beds, grey to purple	3	1	350	8
	coaly smut			350	8
	Sealath, grey, green and red			357	0
	Mudstone, red, purple and green; Spirifer and ? ostracods @ 362 ft	5	8	362	8
	? Horizon of oxidized coal			362	8
	Sealath, grey and greenish-grey	3	1	365	9
	Mudstone, silty mudstone and siltstone, mainly red, purple and purple-grey; sealath plant trees	29	0	394	9
	Sealath, grey, yellow and red	2	0	396	9
	Silty mudstone and siltstone, purple, red and grey	7	7	404	4
	? Oxidized coal horizon	1		404	5
	Sealath, mainly grey	2	9	407	2
	Silty mudstone and siltstone, red and purple to				

(6412) WL32837/PS.154 6

grey; scattered plant traces	7	0	414	2
COA	6		414	8
Sealoth, grey	3	9	418	5
Mudstone and silty mudstone, mainly red to purple	17	5	436	10
grey	1	8	438	6
Sealoth, grey and red				



Version 2.0.6.6

BGS ID: 751075 : BGS Reference: SJ07SW201
 British National Grid (27700) : 304870,371720
[Report an issue with this borehole](#)

RECORD OF WELL

At **PARK LODGE**

Town or Village **Llanerch Trefnant**

County **NORTH WALES**

British Geological Survey Licence No. **SJ07/57**

British Geological Survey

261 + 262 **SJ07SW 201**

Exact site of well: Six-inch National Grid sheet and reference **SJ 0487 7172**

State whether owner, tenant, builder, contractor, consultant, etc.:

Address (if different from above)

Level of ground surface above sea level (O.D.) ft (..... m)

If well top is not at ground level state how far above* ft (..... m)

below* ft (..... m)

SHAFT ft (..... m); diameter ft (..... m);

HEADINGS (please attach details—dimensions and directions)

BORE ft (..... m); diameter at top in (..... mm);

at bottom in (..... mm)

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.):

see overleaf

Water struck at depths of ft (..... m) below well top

Rest level of water ft (..... m) above* well top. Suction at ft (..... m)

below* well top. Suction at ft (..... m)

Yield on hours* test pumping at galls per (..... l/s) with

depression to ft (..... m) below well top. Recovery to rest level in mins*

hours

Capacity of pump g.p.h. (..... l/s)

Date of measurements

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and or type Motive power

Capacity galls (..... m³) per hour. Suction at ft (..... m)

below well top. Amount pumped galls (..... m³) per day. Estimated

consumption galls (..... m³) per week

Well made by **Arbor Drilling Contractors** Date of sinking **June 1992**

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

LOG OF STRATA OVERLEAF

INSTITUTE OF GEOLOGICAL SCIENCES
HYDROGEOLOGY UNIT
EXHIBITION ROAD
LONDON SW7 2DE

RECEIVED N.G.D.C.
DATE: 6-7-95
SIG: S Roach

Received from **Welsh Region NRA**
Date: **2-8-94**
Observation well
Re-order
ER log
Site marked on
1" map
6" map—Grid Sheet
(use symbol)
Copy to
Date

BOREHOLE RECORD

K.H. ROCKDRILLERS, COLWYN BAY, CLWYD.

V.P. Simmonds Esq., Llanerch Trefnant.

B/Hole Location **Park Lodge, Llanerch Trefnant**

Method of Boring **Rotary Percussion Aug**

Job No. **1** Diameter of Boring **200/150/125**

Borehole No. **1** Casing **28.54 M.G.S. 1254**

Date Commenced **24 May 92** Groundlevel **SL 55.0**

Date Completed **19th June 92**

Changes in Strata			Samples		Water Level		In-Situ Tests	
Depth	Legend	Description	Depth	Type & No.	Level	Depth of Boring	Depth	Type
		TOP SOIL						
		STIFF RED-BROWN DAMP CLAY						
		DRIES BEIGE						
		OCCASIONAL SUB-ANGULAR SMALL STONES						
		GRAVEL BED	26					
		DRY SOFT RED SANDSTONE						
		64.6						
		44.6						S.W.L 26/6/92 6.0 P.M.
		53.8						AQUA.R. IMPROVES WITH DEPTH.
		64.6						

use of diff. sq.

Kinnerton Sandstone Formation (Perm-Trias)

1/8 Site on 1:10000 geol map as in adjacent section

Classified D.W. 9/8/94

LETSE DRILLING.

DAB PUMP TYPE SAISM INSTALLED AT 58.5 M 20/7/92 AND RUN FOR 1 HOUR AT 6.0 P.M. DRAWDOWN NOT CHECKED