Foel Fach Wind Farm Limited.

Foel Fach Wind Farm - Environmental Statement Volume III

Appendix 7.7: Groundwater-Dependent Terrestrial Ecosystems Assessment

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Author	Douglas Morrison	**Technical reviewer**	Catherine Isherwood
Date:	13/06/25	Date:	27/06/2025
Project manager	Catherine Isherwood		
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EXECUTIVE SUMMARY

A groundwater-dependent terrestrial ecosystem (GWDTE) assessment has been prepared for the Proposed Development to address concerns over development in areas with, or areas that have potential to affect, sensitive groundwater-dependent habitats. Habitats with potentially high and moderate groundwater dependency are found throughout the Application Site. It is concluded that these habitats are unlikely to be truly groundwater dependent due to a number of factors, including a lack of groundwater sources, topography and the presence of peat soil and clay forming aquitards. These habitats are instead likely to rely on a combination of rainfall and surface runoff, with some direct surface water in areas adjacent to watercourses. Nevertheless, habitats which have a high potential for groundwater dependency are considered to be sensitive and a level of protection is required to minimise and, if necessary, mitigate any impacts that may occur. Design and mitigation measures have been detailed to reduce the impacts of the Proposed Development on the potential GWDTE habitats.

1 INTRODUCTION

1.1.1 This report provides a Groundwater-Dependent Terrestrial Ecosystems (GWDTEs) Assessment for Foel Fach Wind Farm and associated infrastructure, hereafter referred to as the 'Proposed Development'.

1.1.2 This report forms an Appendix to the Environmental Statement (ES) for the Proposed Development and should be read in conjunction with the ES. It has been produced in response to concerns over development in areas with are, or that have potential to affect, sensitive groundwater-dependent habitats which were raised in the consultation with Natural Resource Wales (NRW) and the Planning and Environment Decisions Wales (PEDW). Detailed guidance has been produced for the assessment of the effects of wind farm infrastructure on GWDTEs in Scotland by SEPA (2017), which states that all GWDTEs within 100 metres (m) of tracks and temporary infrastructure or within 250 m from borrow pits and turbine infrastructure should be identified. Further details of these sensitive receptors should be provided along with mitigation measures to protect them if necessary. This guidance is relevant for the assessment in Wales.

1.1.3 GWDTEs are protected under the Water Framework Directive (WFD) and are potentially sensitive receptors to the impacts of development. This report identifies the potentially groundwater-dependent habitats present within the Application Site or the 'Site', and identifies and assesses the potential impacts of the Proposed Development on these habitats. Design and mitigation methods to avoid or minimise these risks are set out, along with good construction practices that will be employed during all site works.

1.1.4 Within this Appendix the following definitions will be used: the 'application boundary' which is the red line planning boundary of the Proposed Development, and the 'Site' which is the land footprint within the application boundary.

1.2 Site Location

1.2.1 The Application Site ('Site') is located within the administrative boundary of Gwynedd Council, North Wales, approximately 3.1 km north east of Bala. Eryri National Park is situated to the west of the Site, with the nearest turbine (T01) located approximately 1.9 km east of the national park boundary. The Site elevation varies from approximately 225 metres (m) Above Ordnance Datum (AOD) to approximately 550 m AOD.

1.2.2 The majority of the Site is located on an area of grazing moorland with a number of parcels of registered common land. Two registered common land parcels are located in the eastern area of the Site. The majority of the land within the Site is Countryside and Rights of Way Open Access land, with areas of agricultural land. A number of Public Rights of Way (PRoW) are present within and adjacent to the Site, although none are nationally designated trails. Small wooded areas are present within the Site. Ancient woodland and larger areas of forestry are present outside the application boundary, to the south.

1.3 Development Proposals

1.3.1 The Proposed Development infrastructure would include:

- 10 no. three bladed horizontal axis wind turbines, up to 200 or 220 metres in height to the blade tip (where specified)
- wind turbine foundations and hardstanding areas which will include crane pad hardstanding areas and laydown/storage areas
- an onsite substation
- a battery energy storage system (BESS)
- permanent wind monitoring equipment (LiDAR)
- site access improvements, through the upgrading of the existing junction off the B4501
- onsite access tracks (new roads and upgraded existing roads/tracks), passing places and vehicle turning heads
- underground power cables linking the wind turbines and the substation
- watercourse crossings and associated infrastructure
- drainage system
- micrositing up to 50 m
- onsite signage, and
- biodiversity enhancements proposals.

1.3.2 Full details of the Proposed Development design are provided in **ES Volume II, Chapter 2: Description of the Proposed Development.**

1.4 Aims

1.4.1 This report aims to undertake a review of relevant baseline information, including all habitat and vegetation data and hydrogeological details, in order to provide an assessment of the risk to groundwater-dependent habitats. Recommendations have been made for mitigation measures, including best practice measures, that will be implemented to minimise the risk of disturbance or damage to sensitive habitats during construction works and ongoing development operations.

1.5 Assessment Method

1.5.1 This assessment has involved the following stages:

- Desk study
- Vegetation mapping
- Hydrogeological assessment
- Detailed assessment of sensitive habitats, and
- Identification of protection and mitigation measures.

2 DESK STUDY

2.1 Information Sources

2.1.1 The desk study involved a review of available relevant information sources on the ground conditions at the Proposed Development. Information sources included:

- Ordnance Survey (OS) topographical mapping at 1:50,000, 1:25,000 and VectorMap Local raster.
- British Geological Survey (BGS) geological mapping, superficial and bedrock
- BGS online borehole records.
- Centre for Ecology and Hydrology Flood Estimation Handbook Web Service.
- Data provided by the client, including turbine foundation and track design specifications.
- Gwynedd Council and Conwy County Borough Council private water supplies records.
- National Soil Map of England and Wales (NATMAP) at 1:250,000 scale.
- Scottish Environment Protection Agency's A functional wetland typology for Scotland *(in the absence of a Welsh equivalent, this is a useful reference for wetland identification).*

2.2 Climate and Topography

Climate

2.2.1 The Site is located in the northern region of the UK Meteorological (Met) Office's 'Wales regional climatic area'. Wales has an essentially maritime climate, characterised by often mild, wet and windy conditions (Met Office, 2016).

2.2.2 Rainfall in Wales varies widely, with highest average annual totals recorded in the central upland spine between the Bannau Brycheiniog and Eryri (Met Office, 2016). Bala monitoring station is the nearest monitoring station to the Site, situated approximately 4 km south (Met Office, 2025). Rainfall data from this station is likely to provide a good representation of the Site and surrounding area.

2.2.3 Most of the rainfall occurs during the autumn and winter months (October to January), with December and January having the highest recorded monthly rainfall totals (up to 177 millimetres (mm)). From January to July, rainfall declines to a monthly low of 75 mm. From July, rainfall slowly increases towards the end of the year. Rainfall recorded at the Bala climate station is slightly lower than the Wales climatic region; however, seasonal fluctuations are consistent with the rest of the region.

Topography

2.2.4 The Site is located on relatively high ground, with elevations ranging from 250 m to 569 m AOD. The highest point within the Site is the peak of Garnedd Fawr in the north which lies at 569 m AOD. The topography of the Site slopes downward from north-east to south.

2.2.5 The Site is surrounded by four prominent hills: Cerrig y Gordref (497 m AOD) to the north, Foel Goch (611 m AOD) to the north-east, Moel Darren (509m AOD) to the east at the edge of the application boundary and Garw Fynydd (490 m AOD) to the south. Craig y Garn (461 m AOD) is located at a greater distance to the west, across the Afon Mynach valley.

2.2.6 The southern part of the Site slopes smoothly down from the peaks of Moel Emoel (549 m AOD) and Eglwys-Anne Warren Ffridd (463 m AOD) towards Llyn Maen Bras at approximately 355 m AOD.

2.3 Geology

2.3.1 Geological information is derived from the BGS GeoIndex and the Geological Survey of England and Wales 1:63,360/1:50,000 geological map series (BGS, 2025; BGS, 1993).

Bedrock Geology

2.3.2 The Site is underlain by bedrock of Ordovician age, primarily belonging to four named formations: Nant Ffrancon Subgroup, Glyn Gower Siltstones, Ceiswyn Formation and the Moelfryn Mudstones Formation. These formations mainly consist of interbedded mudstones, siltstones and sandstones (BGS, 2025). All four formations have been dated to the Caradoc Series, from the Upper Ordovician period.

2.3.3 The Nant Ffrancon subgroup covers a small area in the west of the Site. The Glyn Gower Siltstones covers a larger part of the central and eastern areas of the Site. The Ceiswyn Formation covers the majority of the central area of the Site. These formations are characterised by coarse to fine-grained sedimentary units forming interbedded sequences (BGS, 2025).

2.3.4 The Moelfryn Mudstones Formation covers the southern central region of the Site. It comprises mainly fine-grained mudstone beds with thin siltstone and sandstone beds in places (BGS, 2025).

2.3.5 A number of historical earthquakes have been recorded in the region, two of which are within 5 km of the Site (BGS, 2025). These occurred in 1744 and 1903, and with a Richter local magnitude (RML) of 2.9 and 2.3 respectively. Two modern instrument earthquakes are also located with 5 km of the Site, both towards the north-east near Ty-nant. The earthquake recorded in 1974 has a RLM of 3.5 and earthquake recorded in 1995 has a RML of 1.4.

Superficial Geology

2.3.6 The superficial geology consists primarily of diamicton till, with a small pocket of peat soil to the north of the Site at the col between Foel Tyn-y-ddol and Pen y Bwlch Gwyn (BGS, 2025). Diamicton till is a variable glacial sediment deposited in the late Pleistocene, consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand.

2.3.7 No artificial ground was identified within the Site (BGS, 2025).

2.4 Soils and Peat Soils

2.4.1 Soil and peat soil information is derived from Cranfield University's National Soils Mapping (Cranfield University, 2015) and extensive peat survey data gathered for the Proposed Development.

2.4.2 Soils and peat soil mapping are shown on **ES Volume IV, Figure 7.4: Soils and Peat Soils** and **ES Volume IV, Figure 7.5: Peat Soil Depth**.

2.4.3 The Site is primarily underlain by soils described as very acidic loamy upland soils with a wet peaty surface. The south-west is underlain by freely draining acidic loamy soils over rock, while the west is underlain by slowly permeable seasonally wet acidic loamy and clayey soils. Within the central region of the Site, to the north, there is a small area of soils described as slowly permeable wet very acidic upland soils with a peaty surface (Cranfield University, 2015). Further details of soils within the Site are provided in **Table 7.7.1.**

Table 7.7.1 Soil Types Within the Site (Cranfield University, 2015)

Soil association	Description	Drainage	Habitats	Area %
Hafren	Very acid loamy upland soils with a wet peaty surface	Surface wetness	Grass moor and heather moor with flush and bog communities in wetter parts	65.92
Manod	Freely draining acid loamy soils over rock	Freely draining	Steep acid upland pastures dry heath and moor; bracken gorse and oak woodlands	20.41
Brickfield 1	Slowly permeable seasonally wet acid loamy and clayey soils	Impeded drainage	Seasonally wet pastures and woodlands	10.36
Wilcocks 2	Slowly permeable wet very acid upland soils with a peaty surface	Impeded drainage	Grass moor and some heather with flush and bog communities in wetter parts	2.77
Lake	Lake or water body			0.54

2.4.4 There is no internationally accepted definition of peat. The International Peatland Society (IPS, 2025) defines peat as the following:

> *"Peat is the surface organic layer of a soil that consists of partially decomposed organic matter, derived mostly from plant material, which has accumulated under conditions of waterlogging, oxygen deficiency, high acidity and nutrient deficiency."*

2.4.5 In Wales, organic-rich soils are considered to be peat soil if they have a thickness of more than 40 centimetres (cm) of organic material within the upper 80 cm of a soil profile. The exception to this is where the organic-rich soils sit directly over bedrock, in which case a thickness greater than 30 cm is required for the soil to be considered peat soil (Welsh Government, 2022).

2.4.6 Organic soils which are 0.4 m or thinner can also support peatland vegetation and as a result are also considered within Wales' broader peatland system. These soils are typically described as 'peaty gleys' or 'peaty podzols', or as having a 'peaty surface layer'. Peaty soils typically have a higher plant fibre content and are less decomposed than peat soil.

2.4.7 The Peatlands of Wales Map indicates that 1.9% of the land within the Site has peat soil present (Welsh Government, 2022). The map uses an evidence score from 1 (low) to 10 (high) to indicate the level of confidence that peat soil is present in any given cell. Only those cells scoring more than 2 on this scale of 1-10 are captured in the Peatlands of Wales peat soil distribution map.

2.4.8 The peat soil mapped on Site consists exclusively of evidence score 2 peatland (1.9% of the land within the Site) and is located to the south of Foel Tyn-y-ddôl and to the north of Llaithgwm.

2.4.9 An area covering 16.3% of the Site has an evidence score of 1 and is therefore not considered to be peat soil, as a result of weak confidence. The remaining 81.8% of the Site does not have an evidence score assigned, indicating the absence of peat soil.

2.4.10 The conducted peat soil surveys identified areas of peat soil within parts of the Site, with recorded depths of up to 1.92 m.

2.4.11 Most of the Site (approximately 78%) has soils or peaty soils under 0.3 m in thickness. Areas of peat soil are restricted to pockets of boggy ground, with a higher concentration in the north-eastern part of the Site. More details of peat soil and peatland condition are provided in **ES Volume III, Appendix 7.4: Peat Management Plan** and **ES Volume III, Appendix 7.5: Peat Slide Risk Assessment**.

2.4.12 The Site is predominantly used for rough grazing for cattle and sheep. Two registered common land parcels are located in the eastern area of the Site

2.5 Hydrogeology

2.5.1 The Site is underlain by Caradoc Rocks (undifferentiated), considered to be a low productivity aquifer with limited yields, flowing through fractures and other discontinuities in mudstone, siltstone and sandstone (BGS, 2025).

2.5.2 The groundwater body associated with the Site is the Dee Silurian/Ordovician. NRW Water Watch Wales (NRW, 2025) identifies the groundwater body as having ‘good’ overall status.

2.5.3 Regional groundwater flow will tend to mimic the natural topography. Within the northern and western areas of the Site, groundwater is likely to flow west towards the Afon Mynach valley, along the western application boundary. Within the southern part of the Site groundwater is likely to flow south into Llyn Maen Bras and the River Dee. For groundwater within the eastern part of the Site, flow would be towards the Nant Cefn Coch.

2.5.4 There are no superficial aquifers within the Site.

2.5.5 OS base mapping identifies one spring in the western part of the Site (SH 91921 40665), one well immediately outside the application boundary in the south-western part of the Site (SH 91634 40450) and one 28 m outside the application boundary to the north-west (SH 91625 41518). These are unlikely to be affected by the Proposed Development.

2.5.6 Two additional wells are present at the Site entrance (SH 91124 40906 and SH 91095 40907). These wells are both located adjacent to the access track into the Proposed Development and are likely to be affected by nearby groundworks.

2.5.7 A further 24 springs and wells are identifiable on OS base mapping within 2 km of the application boundary. It is highly unlikely that any of these wells and springs would be affected by the Proposed Development.

2.6 Hydrology

2.6.1 Catchment data obtained from the Flood Estimation Handbook (FEH, 2025), shows that the Proposed Development lies within five catchment areas: Medrad to the north, Meloch to the east, Dee-Alwen to Llyn Tegid to the south, Tryweryn-Dee to Mynach to the south-west, and Mynach to the north-west. Catchment areas and key watercourses are shown in **ES Volume IV, Figure 7.6: Hydrological Catchments and Watercourses**.

Afon Medrad

2.6.2 The Afon Medrad catchment, covering a small area at the northern edge of the Site, has a total area of 15.2 km^2 and drains 0.03% of the Site.

2.6.3 Drainage for the catchment is provided by the Afon Medrad and its tributaries.

2.6.4 Within the Site, the Medrad catchment is described by (NRW, 2025) as an area of unimproved acid grassland with areas of wet modified bog, acid flush and bracken.

Afon Meloch

2.6.5 The Afon Meloch catchment, covering the eastern part of the Site, has a total area of 16.1 km^2 and drains 39.42% of the land within the Site.

2.6.6 Drainage is provided by the Nant Cefn Coch, which is a minor tributary of the Afon Meloch, and the Afon Meloch itself.

2.6.7 The Afon Meloch catchment has been described by (NRW, 2025) as an area of unimproved acid grassland on Moel Darren, including large areas of wet modified bog, acid flush and bracken.

River Dee-Alwen to Llyn Tegid

2.6.8 The River Dee-Alwen to Llyn Tegid catchment, covering the central southern part of the Site, has a total area of 6.2 km^2 and drains 26.70% of the land within the Site.

2.6.9 Drainage is provided by unnamed minor watercourses feeding Llyn Maen Bras, and by the Nant Hafhesp and its tributaries downstream of Llyn Maen Bras.

2.6.10 The River Dee-Alwen to Llyn Tegid catchment is described by (NRW, 2025) an area of unimproved acid grassland with large areas of wet modified bog, acid flush and bracken.

Afon Tryweryn-Dee Mynach

2.6.11 The Afon Tryweryn-Dee to Mynach catchment, covering the south-western corner of the Site, has a total area of 20 km^2 and drains 0.12% of the land within the Site.

2.6.12 Drainage is provided by unnamed minor watercourses feeding into the Afon Tryweryn.

2.6.13 The Afon Tryweryn-Dee to Mynach catchment is described by (NRW, 2025) as a mixture of enclosed improved grassland, improved and marshy grasslands with small areas of woodland, and an area of unimproved acid grassland with wet, modified bog.

Afon Mynach

2.6.14 The Afon Mynach catchment, covering the north-western part of the Site, has a total area of 17.1 km^2 and drains 33.72% of the land within the Site.

2.6.15 Drainage is provided by the Afon Mynach and its tributaries.

2.6.16 Within the Site, the eastern part of the Afon Mynach catchment is described by NRW's Environmental Information Portal (NRW, 2025) as an area of unimproved acid grassland with large areas of wet modified bog, acid flush and bracken. Conversely, the western part towards the application boundary is described as semi-improved neutral grassland.

Catchment Statistics

2.6.17 Catchment statistics are derived from the FEH Web Service (FEH, 2025) and are shown in **Table 7.7.2** The catchment wetness index (PROPWET) for the Site is 0.71 indicating the Site is wet 71% of the time. The area has a moderate baseflow index (BFIHOST19) of between 0.325 and 0.407, indicating a low to moderate groundwater contribution to regional watercourses, although this may have a strong seasonality. The standard percentage runoff (SPRHOST) is moderate, indicating that 39-45% of rainfall within the Site is converted into surface runoff from rainfall events. BFIHOST19 and SPRHOST are likely to vary within the study area as a result of local changes in bedrock, superficial geology and soil types.

Table 7.7.2 Site Catchment Statistics

Catchment Name	Catchment Wetness Index (PROPWET)	Base Flow Index (BFI HOST19)	Standard Percentage Runoff (SPR HOST)	Area %
Afon Mynach	0.71	0.325	45.03%	34.03%
Afon Meloch	0.71	0.367	41.95%	39.16%
River Dee-Alwen to Llyn Tegid	0.71	0.407	39.26%	26.50%
Afon Tryweryn-Dee to Mynach	0.71	0.325	45.03%	0.44%
Afon Medrad	0.71	0.353	41.95%	0.03%

2.7 Private Water Supplies

2.7.1 The PWS records of Gwynedd Council and Conwy County Borough Council have been consulted to determine the presence of PWS within the Site and within a 5 km study area. A desk-based study identified further properties which were not accounted for in the Council records. Overall, 103 PWS have been identified within 5 km of the application boundary, two of which are present within the proximity of the Site. Nine of the PWS identified were found to have potential linkage with proposed infrastructure development and were subject to a full Private Water Supply Risk Assessment. This is provided as a separate Appendix. The nine properties included in the PWSRA are detailed in **Table 7.7.3**.

Table 7.7.3 PWS Included in Risk Assessment

Council ID	Source Location	Source Type	Grid Ref	Distance from nearest infrastructure
Null	Llaithgwm	Spring	292268, 340790	275 m south of proposed access track
Null	Wern Fawr	Spring	291923, 340665	230 m south-east of proposed access track
Null	Glan-yr-afon (three properties)	Not provided	291028, 340934	200 m north of proposed site entrance.
5649	Ty Cipar	Unknown	290975, 341385	490 m north of proposed entrance compound
Null	Nant Gau	Unknown	291283, 341898	875 m north of proposed entrance compound
Null	Bromhault	Unknown	291167, 341827	800 m north of proposed entrance compound

Council ID	Source Location	Source Type	Grid Ref	Distance from nearest infrastructure
Null	Maespyllan	Spring	292364, 341794	575 m north of proposed access track
Null	Hendre-bach	Unknown	291879, 342153	1,080 m north of proposed access track
Null	Pentre-tai-yn-y-cwm	Spring	295574, 340261	960 m south-east of turbine infrastructure
7336	Cwm Hwylfod	Unknown	295608, 339995	1,220 m south-east of turbine infrastructure

3 VEGETATION AND GROUNDWATER DEPENDENCY

3.1.1 GWDTEs are defined by the UKTAG (UKTAG, 2004) as:

> *"A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentration of substances (and potential pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body."*

3.1.2 In line with the guidance provided in (UKTAG, 2004), a dual ecological and hydrogeological approach to identifying potential GWDTEs has been used. This involves a detailed study of vegetation communities in order to determine the potential level of groundwater dependency, combined with a detailed hydrogeological study in order to identify locations where groundwater reaches the surface and is therefore able to provide a source of water to terrestrial ecosystems.

3.1.3 Determining groundwater dependency is complex as most water-dependent terrestrial ecosystems rely on a combination of groundwater, surface water and rainwater, and many vegetation communities will use whatever source of water is available. In some topographical and hydrogeological conditions, a particular ecosystem can be groundwater-dependent whereas in others the same ecosystem is surface water-dependent. Seasonal patterns of water availability influence water use, providing an additional level of complexity; groundwater reliance is typically greater in the summer when rainfall and surface water are less available (Isherwood, 2013).

3.2 Vegetation Mapping

3.2.1 Vegetation on site has been surveyed using Phase 1 habitat and National Vegetation Classification (NVC) survey methods and is reported in full in **ES Volume II, Chapter 5: Terrestrial Ecology**, with mapping provided in **Figure 7.7.1** at the rear of this report. Some areas are only covered by the Phase 1 habitat method. The key findings relating to groundwater dependency are summarised below.

3.2.2 The UKTAG Annex 1 table (UKTAG, 2009) differentiates communities by class, where Class 1 is high potential groundwater dependency, Class 2 is moderate potential groundwater dependency and Class 3 is low potential groundwater dependency.

3.2.3 NVC survey mapping indicates that of the potentially groundwater-dependent communities, most of the Site is covered in mire with smaller areas of blanket mire, rush-pasture, grassland and wet heath. The Phase 1 habitats data shows that there are also some small areas of broadleaved woodland, scrub and swamp.

3.2.4 The potentially groundwater-dependent NVC communities identified within the Site and their groundwater dependency classifications can be found in **Table 7.7.4**. The bracketed value applies in certain hydroecological settings.

Table 7.7.4 Potential Groundwater Dependency Classification of Identified NVC Communities within the Site

NVC Community	UKTAG (2009) Groundwater Dependency Classification (May vary for different ecological settings – noted in brackets)
M23 – (*Juncus effusus/acutiflorus – Galium palustre*) **rush-pasture**	1 (2)
M6 – (*Carex echinata - Sphagnum recurvum/auriculatum*) **mire**	2 (1)
U6 – (*Juncus Squarrosus – Festuca ovina*) **grassland**	2 (1)
M15 – (*Scirpus cespitosus – Erica tetralix*) **wet heath**	2 (1)
M19 – (*Calluna vulgaris – Eriphorum vaginatum*) **blanket mire**	3 (2)

3.2.5 In the areas where no NVC data is available, the Phase 1 Habitats data has been considered and those habitats where there is potential groundwater dependency are identified in **Table 7.7.5**.

Table 7.7.5 Phase 1 Habitats within the Site with Potential Groundwater Dependency

Phase 1 Habitat
A1.1.1 – Woodland: broadleaved, semi-natural
A2.2 – Scrub: scattered
B5 – Marsh/marshy grassland
E2.1 – Acid/neutral flush
F1 – Swamp

4 DETAILED ASSESSMENT

4.1.1 The area assessed, which consists of land within the application boundary and a 250 m buffer zone around this, has been reviewed to identify areas of NVC habitats that require assessment. Due to a lack of available habitat data, in the west and south-west of the Site the buffer is less than 250 m. There is only a small area to the south and west of the proposed access track between the B4501 and the proposed temporary borrow pit, where the infrastructure buffer extends beyond the area of available habitat data.

4.1.2 Detailed consideration is required for sensitive habitats that lie within 100 m of the access tracks, compounds and temporary works, which typically have excavations less than 1 m in depth; or within 250 m of excavations deeper than 1 m, which include the turbine foundations and a temporary borrow pit (SEPA, 2017). The combined infrastructure buffer is provided as a green dashed line in the figures provided, for reference purposes. An overview map of the Proposed Development showing the areas of potentially groundwater-dependent communities is provided in **Figure 7.1.1**.

4.2 Conceptual Site Model

4.2.1 Of the NVC communities identified in **Table 7.7.4:**

- UKTAG (2009) identifies M23 in English or Welsh hydroecological settings as 1 (2), with the bracketed value applying in certain hydroecological settings. Therefore, these NVC communities are potentially highly groundwater-dependent, or potentially moderately groundwater-dependent in certain hydroecological situations.
- UKTAG (2009)identifies M6, U6 and M15 in English or Welsh hydroecological settings as 2 (1), with the bracketed value applying in certain hydroecological settings. Therefore, these NVC communities are potentially moderately groundwater-dependent, or potentially highly groundwater-dependent in certain hydroecological situations.
- UKTAG (2009) identifies M19 in English or Welsh hydroecological settings as 3 (2), with the bracketed value applying in certain hydroecological settings. Therefore, these NVC communities are potentially lowly groundwater-dependent, or potentially moderately groundwater-dependent in certain hydroecological situations.

4.2.2 In this sense, the community, M23, is considered to be more sensitive than the other communities, and M19 is the least sensitive potential groundwater-dependent habitat on the Site.

4.2.3 Regarding the habits listed in **Table 7.7.5**, UKTAG, 2009 does not include them as they are categories from the Phase 1 Habitats method and the UKTAG listing requires NVC categories (JNCC, 2010). While JNCC, (2008) provides comparable NVC communities for these Phase 1 Habitats, they cannot be directly 'translated' into NVC categories because there can be more than one NVC that relates to a single Phase 1 habitat type. Instead, professional judgement has to be used to consider whether the Phase 1 habitats could include potentially groundwater-dependent habitat types.

4.3 Habitats on Peat Soil

4.3.1 A significant spatial proportion of the habitats identified as potentially highly groundwater-dependent are largely on areas of confirmed peat soil over 0.3 m in depth, notably areas of NVC category M6, although pockets of M19 are also found in these areas. Water flow though peat does occur but is very slow, except in areas with peat pipes or conduits to allow focused flow, and peat bodies are typically considered in a hydrogeological context to be impermeable. Water held within peat is not usually considered to form part of the groundwater body as it is not available for use as a water supply.

4.3.2 Raised mire and blanket mire, such as is present within the Site, are generally considered to be ombrotrophic and receives all their nutrients from rainwater (JNCC, n.d). Localised flushing can occur adjacent to watercourses but this is rarely extensive away from the watercourse channel. It is recognised that peat soil present within the Site has a wide range of depths; however, it remains likely that the dominant water source in the Site, regardless of peat soil depth, is rainwater with shallow through-flow within the uppermost vegetated layer.

4.3.3 Bedrock in the Site is classed as a low productivity aquifer; it is therefore unlikely that the small amount of potential groundwater within the bedrock is accessible to surface habitats.

4.3.4 There are no superficial aquifers within the Site.

4.3.5 OS base mapping identifies one spring in the western part of the Site (SH 91921 40665), one well immediately outside the application boundary in the south-western part of the Site (SH 91634 40450) and one 28 m outside the application boundary to the north-west (SH 91625 41518).

4.3.6 Two additional wells are present at the Site entrance (SH 91124 40906 and SH 91095 40907). A further 24 springs and wells are identifiable on OS base mapping within 2 km of the application boundary.

4.3.7 All of the springs and wells are located at lower elevations than the Proposed Development, except for the access track into the Site, and confirm that shallow groundwater is unlikely to be present or accessible within the main development area.

4.4 Habitats not on Peat Soil

4.4.1 Most of the identified habitats are at least partially within areas with no identified peat soil. These areas can be divided into two categories: areas with less than 0.3 m of soil; and areas of clay, where there is less than 0.3 m of soil above the clay. The presence of clay was determined through peat coring across the Site.

4.4.2 Across the Site, even where there is less than 0.3 m of soil, the soil often has a peaty element to it e.g. peaty loam. Peaty soils typically do not allow much water to pass through, meaning they are less likely to host communities that are highly groundwater-dependent. The areas with thinner soils are typically found on areas of higher elevation. GWDTEs are less frequently found in these areas as they have less supply of groundwater. Springs and seepages require a supply of groundwater, which itself relies on water entering the rock at a higher elevation.

4.4.3 The areas of clay are generally found in depressions and at lower elevations, forming a blanket across the bedrock in these areas. Clay is impermeable and acts as a confining layer, preventing rainfall and infiltration from reaching the groundwater and also preventing groundwater from being accessible from the surface. Clay is very widespread across the Site and while the cores taken give an impression of where clay is present, it is likely that clay is more widespread across the Site as core sampling was focused largely around areas of proposed infrastructure.

4.4.4 Combining these factors with the low productivity nature of the bedrock aquifer underlying the Site, it is most likely that these habitats are not groundwater-dependent in these locations.

4.5 Potential Impacts

4.5.1 Potential impacts to identified potential GWDTE include **direct** and **indirect** impacts.

4.5.2 **Direct** impacts would arise as a result of habitat loss through construction activity and the associated requirement to excavate vegetation and soil material within the identified sensitive habitat areas.

4.5.3 **Indirect** impacts would arise as a result of changes in water supply to sensitive habitat or of changes in the nutrient supply as a result of 'flushing'. Most sensitive habitats are nutrient-poor and require continued supply of nutrient-poor water to retain their structure and vegetation community. Excavation works can provide a sudden influx of nutrient material from soil disturbance, which can overwhelm such nutrient-poor communities causing temporary or permanent changes to the habitat as a result. Nutrient flushing is usually associated with changes to water supply pathways, and specifically with introduction of drainage from areas of active excavation that discharge into or upslope of such sensitive habitat areas.

4.6 Conclusions Relating to Groundwater Dependency

4.6.1 It is concluded that those habitats within the study area that are found on peat are unlikely to be groundwater-dependent as there is no groundwater source available to them.

4.6.2 It is also concluded that the habitats within the study area cannot be truly described as groundwater-dependent because there is no reliable source of shallow groundwater on which they can depend, due to their position relative to the topography and the presence of peat soil and clay forming aquitards. These habitats are instead likely to rely on a combination of rainfall and surface runoff, with some direct surface water in areas adjacent to watercourse. In many cases, habitats tend to follow the watercourses and waterbodies within the Site, indicating a reliance on surface water.

4.6.3 Nevertheless, habitats which have a high potential for groundwater dependency are considered to be sensitive and a level of protection is required to minimise and, if necessary, mitigate any impacts that may occur. The areas of habitats identified above are within the combined infrastructure buffer and are discussed individually in the following sections.

Potential GWDTE Area 1

4.6.4 Area 1 covers the section of the Site where the proposed access track runs from the west at the B4501 road to the proposed temporary borrow pit in the east near Llaithgwm.

Habitats Present

4.6.5 No NVC data is available for Area 1 and so Phase 1 habitat data has been used instead.

4.6.6 Two areas B5 Marsh/Marshy Grassland are found 350 m east of the B4501 road, a short distance east of the proposed construction compound.

4.6.7 Two areas of A1.1.1 Broadleaved Woodland – Semi-natural are found within Area 1. One area is found south-west of the proposed borrow pit, with a second larger area slightly further round the hill to the north-west.

4.6.8 An area of A2.1 – Dense/continuous Scrub – Semi-natural is located to the north-west of the proposed temporary borrow pit but extends across the borrow pit area, crossing the mapped track and terminating just short of the proposed access track.

4.6.9 A very small area of A2.2 – Scattered Shrub is indicated south of the borrow pit.

Setting and Infrastructure

4.6.10 Bedrock in this area is formed of the Nant Ffrancon Subgroup, Glyn Gower Siltstone and Ceiswyn Formation. Where present, superficial deposits in the area are diamicton till, but these are absent on steeper slopes such as around the proposed borrow pit. Cores taken identified clay in the area, which corresponds to the diamicton till mapped in this area.

4.6.11 The bedrock is a low productivity aquifer with flow virtually all through fractures and other discontinuities, although small amounts of groundwater may be present in near-surface weathered zones and secondary fractures.

4.6.12 Infrastructure in Area 1 includes the access track, entrance compound and borrow pit.

4.6.13 The area drains via an unnamed tributary and field drains into a tributary of the Afon Tryweryn.

Assessment and Mitigation

4.6.14 A pipe was observed at the base of the proposed borrow pit area which the farmer confirmed is a field drain providing water for livestock. No indicators of groundwater at surface were present within the study area, although a spring is mapped just south of the infrastructure boundary, on the southern side of the valley. Two now-disused wells are present immediately north of the Site entrance.

4.6.15 The presence of clay across much of Area 1 indicates that access to groundwater would be limited for the habitats in the area. Habitats on clay rely on rainfall, surface water and shallow through-flow within the vegetated layer, as they are isolated from groundwater by the clay.

4.6.16 The areas of B5 Marsh/Marshy Grassland near the proposed access track are in close association with field drains and most likely derive their main water supply from surface water.

4.6.17 The area of A1.1.1 Broadleaved Woodland – semi-natural located north-west of the borrow pit is topographically isolated from the proposed borrow pit excavation area and is unlikely to be affected by the excavation.

4.6.18 The area of A1.1.1 Broadleaved Woodland and A2.1 Dense/continuous Scrub at the borrow pit area are likely to experience some direct and indirect impacts. Part of the A2.1 habitat would be lost as part of the borrow pit excavation works, although most of the habitat area would be retained. The small area of A1.1.1 adjacent to the borrow pit may experience a change in water supply as a result of the excavation works.

4.6.19 The borrow pit area would have perimeter drainage installed prior to the start of excavations. The preferred method would be to use earth bunds, rather than installation of cut-off drains, to divert surface water around the proposed excavation area. Cut-off drains would only be used if earth bunds are not suitable. Earth bunds would be covered with a geotextile material and seeded to prevent mobilisation of sediment from the bund structures.

4.6.20 Any cut-off drains would be minimised in terms of length and depth, to minimise concentration of flows and unnecessary diversion of water. Water discharge from drainage systems would be spread across the ground in order to minimise changes to flow in downstream sensitive habitats and would not be discharged directly into sensitive habitat areas.

4.6.21 Surface water collecting in borrow pit excavation would be directed into a settlement pond to allow for removal of sediment. Treated water would not be discharged into or directly upslope of the A1.1.1 habitat area, to minimise potential for water and nutrient flushing into this area. If necessary, water would be directed into trackside drainage to avoid potential impacts on the sensitive habitat area.

4.6.22 There may be an option to improve or extend areas of habitats through vegetation management and/or drainage management within Area 1 as a compensation for the unavoidable direct habitat loss, particularly in relation to the area of A2.1 lost as a result of the borrow pit works. This would be discussed with the Environmental Clerk of Works (ECoW) as part of the construction works mitigation.

Potential GWDTE Area 2

4.6.23 Area 2 covers the land either side of the access track running from Llaithgwm, north-east to the first junction on the access track 200 m north of T02.

Habitats Present

4.6.24 There are a number of potential GWDTE in Area 2, mainly consisting of ribbon-like bands on the north-western slopes of Pen y Bwlch Gwyn.

4.6.25 The western part of Area 2 includes eight areas of M23 rush-pasture, five of which cross the access track. The remaining three areas are fully or partially downslope of the access track.

4.6.26 The eastern part of Area 2 includes six areas of M6 mire, five of which cross the access track and one area which is downslope of the access.

Setting and Infrastructure

4.6.27 Bedrock in this area is from the Glyn Gower Siltstone and Ceiswyn Formation. Where present, superficial deposits in the area are diamicton till but mapped superficial deposits are absent from parts of the area. Cores taken identified clay extending upslope beyond the mapped extent of glacial till.

4.6.28 The bedrock is a low productivity aquifer with flow virtually all through fractures and other discontinuities, although small amounts of groundwater may be present in near-surface weathered zones and secondary fractures.

4.6.29 Infrastructure in Area 2 consists of a section of the proposed access track.

4.6.30 The westernmost area of M23 rush-pasture, near Llaithgwm, drains west into the Afon Tryweryn via an unnamed tributary. The remainder of Area 2 drains north and north-west into a series of tributaries to the Nant Gau and ultimately into the Afon Tryweryn.

Assessment and Mitigation

4.6.31 No indications of groundwater at surface were identified in any parts of Area 2. There are no mapped springs or seepage points within the area.

4.6.32 The presence of clay soils across much of Area 2 indicates that access to groundwater would be limited for habitats in the area. Habitats on clay rely on rainfall, surface water and shallow through-flow within the vegetated layer, as they are isolated from groundwater by the clay.

4.6.33 Some parts of Area 2 show mapped peat soils. Similar to clays, access to groundwater would also be limited for these habitats as a result of the effectively impermeable nature of peat soils. Habitats on peat soil also rely on rainfall, surface water and shallow through-flow and are isolated from groundwater by the peat soils.

4.6.34 The sinuous, ribbon-like form of most of the identified habitat types indicates that they follow natural drainage pathways down the hill slope. While not mapped as watercourses, these drainage pathways form the headwater gathering area for the small mapped watercourses further downslope. They are indicative of collected surface water in shallow notches in the slope, rather than any kind of groundwater at surface.

4.6.35 The three larger areas are all located in areas where the slopes are gentler, and indicate areas where surface water collects before continuing downslope. Two of these areas are in close association with mapped watercourses and the third is a short distance upslope from a mapped watercourse. The topographical setting indicates that rainfall and surface runoff are the principal water sources in all cases.

4.6.36 **Direct** impacts on the identified sensitive habitats primarily include habitat loss from construction of the access track.

4.6.37 Where new track is required to cross areas of sensitive habitat, micrositing will be employed to minimise the area of habitat loss. Cross-drains and under-track drainage would be employed to ensure continuity of flow within the habitat area. Any required modified or additional trackside drainage would be minimised in terms of depth and length and would not discharge directly into or upslope of identified habitat areas, to minimise potential for water and nutrient flushing in these areas.

Potential GWDTE Area 3

4.6.38 Area 3 includes the summit section of Pen y Bwlch Gwyn and Moel Emoel and the slopes to the south-west, south, south-east, east and north- and east of the summits.

Habitats Present

4.6.39 Area 3 includes nine areas of M6 mire plus a large area of M19 mire.

4.6.40 Two areas of M6 mire cross access tracks and one area crosses part of the crane hardstanding for T01. Two temporary storage areas are located partly within the area of M19 habitat.

Setting and Infrastructure

4.6.41 Bedrock in this area is from the Moelfryn Mudstones and Ceiswyn Formations. Superficial deposits of diamicton till are found across Area 3, although some areas have no mapped superficial deposits. Diamicton till has a matrix of fine sediment such as clay and this is confirmed by cores taken across the area, which found clay to be present in most samples, including extending beyond the areas of mapped diamicton till.

4.6.42 The bedrock is a low productivity aquifer with flow virtually all through fractures and other discontinuities, although small amounts of groundwater may be present in near-surface weathered zones and secondary fractures.

4.6.43 Infrastructure in Area 3 includes the substation, batching compound, access track, T01, T02, T03, T04 and temporary storage areas 1, 3, 4 and 5.

4.6.44 The eastern part of Area 3 drains generally southwards towards Llyn Maen Bras. The western part drains generally westwards into the tributary watercourses of the Nant Cefn-coch system.

Assessment and Mitigation

4.6.45 No indications of groundwater at surface were identified in any parts of Area 3. There are no mapped springs or seepage points within the area.

4.6.46 The presence of clay soils across much of Area 3 indicates that access to groundwater would be limited for habitats in the area. Habitats on clay rely on rainfall, surface water and shallow through-flow within the vegetated layer, as they are isolated from groundwater by the clay.

4.6.47 Some parts of Area 3 show mapped peat soils. Similar to clays, access to groundwater would also be limited for these habitats as a result of the effectively impermeable nature of peat soils. Habitats on peat soil also rely on rainfall, surface water and shallow through-flow and are isolated from groundwater by the peat soils.

4.6.48 The sinuous, ribbon-like form of most of the M6 habitat areas indicates that they follow natural drainage pathways down the hill slope and many of them are closely associated with mapped watercourses. This indicates that they are reliant on surface water gathering in the natural drainage channels down the slopes, rather than having any connection to groundwater.

4.6.49 The two larger areas, one M6 and one M19, are both located in broad areas with much flatter slopes and indicate areas where surface water collects before continuing downslope. Both are in close association with mapped watercourses. The topographical setting indicates that rainfall and surface runoff are the principal water sources in all cases.

4.6.50 **Direct** impacts on the identified sensitive habitats primarily include habitat loss from construction of the access track, with additional **direct** impacts from the crane hardstanding for T11 and a small area affected by the earthworks associated with the substation. Temporary **direct** impacts include habitat loss arising from temporary storage areas 4 and 5, located partly on habitat M19.

4.6.51 Where new track is required to cross areas of sensitive habitat, micrositing will be employed to minimise the area of habitat loss. Cross-drains and under-track drainage would be employed to ensure continuity of flow within the habitat area. Any required modified or additional trackside and turbine hardstanding drainage would be minimised in terms of depth and length and would not discharge directly into or upslope of identified habitat areas, to minimise potential for water and nutrient flushing in these areas.

4.6.52 It may be possible to microsite the substation area to avoid intersecting the sensitive habitat area. This would be considered onsite with the ECoW during works in this area.

4.6.53 Use of temporary storage areas 4 and 5 would be assessed on-site to avoid or minimise the areas affected by materials storage. If possible, micrositing of these temporary storage areas would be undertaken to avoid intersecting the sensitive habitat area. Drainage from temporary storage areas would be directed away from the main area of M19 habitat to minimise water and nutrient flushing into this area.

4.6.54 Water collecting in the turbine and hardstanding excavations would be directed into a settlement pond to allow for removal of sediment. Treated water would not be discharged into or upslope of identified sensitive habitat areas, to minimise potential for water and nutrient flushing into these areas. If necessary, water would be directed into trackside drainage to avoid potential impacts on sensitive habitat areas.

4.6.55 Deeper excavations required for T01, T02, T03 and T04 would have perimeter drainage installed prior to the start of excavations. The preferred method would be to use earth bunds, rather than installation of cut-off drains, to divert surface water around the proposed excavation area. Cut-off drains would only be used if earth bunds are not suitable. Earth bunds would be covered with a geotextile material and seeded to prevent mobilisation of sediment from the bund structures.

4.6.56 Any cut-off drains would be minimised in terms of length and depth, to minimise concentration of flows and unnecessary diversion of water. Water discharge from drainage systems would be spread across the ground in order to minimise changes to flow in downstream sensitive habitats and would not be discharged directly into sensitive habitat areas.

4.6.57 There may be options to improve or extend areas of habitats through vegetation management and/or drainage management within Area 3 as a compensation for the unavoidable direct habitat loss. This would be discussed with the ECoW as part of the construction works mitigation.

Potential GWDTE Area 4

Habitats Present

4.6.58 Area 4 includes a large expanse of M6 mire plus four small areas of M19 mire. The M6 mire in this area is M6c, a sub-community characterised by soft rush (*Juncus effusus)* which is recognised to be associated with surface water.

4.6.59 The area of M6 mire crosses the proposed access track in five locations, with a further two locations crossing the crane hardstanding for T09.

Setting and Infrastructure

4.6.60 Bedrock in this area is predominantly from the Glyn Gower Siltstones with smaller areas from the Ceiswyn Formation. Superficial deposits of diamicton till are found in the flatter parts of Area 4 and up the valley side slopes. Diamicton till has a matrix of fine sediment such as clay and this is confirmed by cores taken across the area, which found clay to be present in most samples, including extending beyond the areas of mapped diamicton till.

4.6.61 The bedrock is a low productivity aquifer with flow virtually all through fractures and other discontinuities, although small amounts of groundwater may be present in near-surface weathered zones and secondary fractures.

4.6.62 Infrastructure in Area 4 includes access track, T05-T10, the temporary working area required to construct the bridge crossing between T08 and T09, and temporary storage area 2.

4.6.63 Area 4 drains entirely via tributary watercourses to the Nant Cefn-coch.

Assessment and Mitigation

4.6.64 No indications of groundwater at surface were identified in any parts of Area 4. There are no mapped springs or seepage points within the area.

4.6.65 The presence of clay soils across much of Area 4 indicates that access to groundwater would be limited for habitats in the area. Habitats on clay rely on rainfall, surface water and shallow through-flow within the vegetated layer, as they are isolated from groundwater by the clay.

4.6.66 Some parts of Area 4 show mapped peat soils. Similar to clays, access to groundwater would also be limited for these habitats as a result of the effectively impermeable nature of peat soils. Habitats on peat soil also rely on rainfall, surface water and shallow through-flow and are isolated from groundwater by the peat soils.

4.6.67 All four areas of M19 are located across a hydrogeological separation. The one on Garnedd Fawr and the two on Moel Darren are located upslope or across a catchment divide from all proposed works. The area south of T08 is located across a watercourse. There is no hydrogeological linkage that could affect any of these habitat areas,

4.6.68 The large expanse of M6 habitat follows the valleys of the main headwater streams that form the Nant Cefn-coch. These areas are characterised by gentler slopes where surface water is able to collect before forming the mapped watercourses. The topographical setting indicates that rainfall and surface runoff are the principal water sources for this habitat area.

4.6.69 **Direct** impact on the identified sensitive habitats primarily includes habitat loss from construction of the access track, with additional **direct** impacts from the crane hardstanding of T09 and the temporary bridge working area. Some localised impacts from the foundation area for T08 are also possible, as these works would be adjacent to the area of M6 mire.

4.6.70 Where new track is required to cross areas of sensitive habitat, micrositing will be employed to minimise the area of habitat loss. Cross-drains and under-track drainage would be employed to ensure continuity of flow within the habitat area. Any required modified or additional trackside and turbine hardstanding drainage would be minimised in terms of depth and length and would not discharge directly into or upslope of identified habitat areas, to minimise potential for water and nutrient flushing in these areas.

4.6.71 Water collecting in the turbine and hardstanding excavations would be directed into a settlement pond to allow for removal of sediment. Treated water would not be discharged into or upslope of identified sensitive habitat areas, to minimise potential for water and nutrient flushing into these areas. If necessary, water would be directed into trackside drainage to avoid potential impacts on sensitive habitat areas.

4.6.72 Deeper excavations required for T05-T10 would have perimeter drainage installed prior to the start of excavations. The preferred method would be to use earth bunds, rather than installation of cut-off drains, to divert surface water around the proposed excavation area. Cut-off drains would only be used if earth bunds are not suitable. Earth bunds would be covered with a geotextile material and seeded to prevent mobilisation of sediment from the bund structures.

4.6.73 Any cut-off drains would be minimised in terms of length and depth, to minimise concentration of flows and unnecessary diversion of water. Water discharge from drainage systems would be spread across the ground in order to minimise changes to flow in downstream sensitive habitats and would not be discharged directly into sensitive habitat areas.

4.6.74 There may be options to improve or extend areas of habitats through vegetation management and/or drainage management within Area 4 as a compensation for the unavoidable direct habitat loss. This would be discussed with the ECoW as part of the construction works mitigation.

5 PROTECTION AND MITIGATION

5.1 Design and Mitigation

5.1.1 Wetland habitats are known to be sensitive to changes in their water supply, whether this is from groundwater, surface water or rainwater. With this in mind, the following good practice construction methods would be used for all development on or adjacent to wetland or bog areas:

- Where track sections cross wetland or mire areas, cross-drainage would be provided within the track construction to ensure continuity of flow. This may take the form of a drainage layer within the track, suitably closely-spaced drainage pipes, or both as appropriate. These would be determined on a case-by-case basis to suit each individual area.
- Removing protective layers of soil and superficial deposits makes groundwater vulnerable to pollution from leaks or spills from vehicles or equipment used during construction. Earthworks would be kept to a practical minimum within these areas, to reduce the area of wetland affected by the construction works.
- Trackside drainage would be kept to a practical minimum and would only be installed where required to protect the track from erosion.
- All works through and adjacent to wetland areas would be supervised by the ECoW.
- Site-specific mitigation, including drainage segregation to avoid 'flushing' from excavation works and micrositing to avoid specific higher sensitivity areas, would be identified and established where appropriate.
- Water would not be discharged directly into watercourses. Additional protection, in terms of sediment traps using silt fencing or excavated sumps or settlement ponds, would be put in place between the water discharge location and watercourses. Sediment trap installation and monitoring would be overseen by the ECoW.

5.2 Monitoring

5.2.1 Targeted monitoring would be put in place to provide a check on the identified wetland areas and to ensure that mitigation and protection measures are in place and effective.

5.2.2 The monitoring programme would include establishment of groundwater monitoring boreholes within the borrow pit and turbine foundation areas to a depth of at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

5.2.3 Surface water monitoring would be established within the existing watercourse network. Details are provided in **ES Volume III, Appendix 7.2: Watercourse Crossing Schedule**.

5.2.4 All areas of sensitive habitat would be visited and assessed prior to any construction work by the ECoW. Assessment would include collection of representative photographs of the areas which are most likely to be affected by the works. Regular assessment visits would be undertaken throughout the construction period and for a minimum of 12 months after reinstatement to ensure that habitat protection is effective and any restoration and recovery works become established.

5.2.5 All proposed monitoring would begin at least 6 months prior to construction work, would continue throughout the construction period and for at least 12 months following reinstatement.

6 CONCLUSIONS

6.1.1 A detailed assessment of the interaction between the proposed works for the Proposed Development and any potentially GWDTE has been undertaken.

6.1.2 The potentially groundwater-dependent NVC communities identified within the Site are:

- M6 (*Carex echinata - Sphagnum recurvum/auriculatum)* **mire**,
- M19 (*Calluna vulgaris – Eriphorum vaginatum)* **blanket mire**, and
- M23 (*Juncus effusus/acutiflorus – Galium palustre)* **rush-pasture.**

6.1.3 The potentially groundwater-dependent Phase 1 Habitats (where NVC data is not present) identified within the Site are:

- A1.1.1 – Woodland: broadleaved, semi-natural
- A2.1 – Dense/continuous Scrub
- A2.2 – Scattered scrub, and
- B5 – Marsh/marshy grassland.

6.1.4 M23 has high or sometimes moderate potential groundwater dependency. M6 has moderate or sometimes high potential groundwater dependency. M19 has low or sometimes moderate potential groundwater dependency.

6.1.5 The Phase 1 Habitats listed above cannot be classified by their level of potential groundwater dependency; however, they should be considered to be potentially groundwater-dependent.

6.1.6 Owing to the distribution of habitats at the Site, habitats have been assessed in smaller sub-areas within the Site rather than across the Site as a whole.

6.1.7 The potentially groundwater-dependent habitats have been assessed specifically within the context of the Proposed Development, considering the local bedrock and superficial geology, peat soil and clay distribution, and site observations.

6.1.8 Superficial deposits within the Site consist mainly of peat and diamicton till. The bedrock is all classed as a low productivity aquifer with low potential for groundwater storage.

6.1.9 Peat soil and clay, such as are present across much of the Site, are considered to be aquitards. As a result, habitats occurring on these substrates are isolated from the groundwater and receive all their water supply and nutrients from rainwater, surface runoff and shallow through-flow in the uppermost vegetated layer. Localised flushing can occur adjacent to watercourses but is rarely extensive away from the watercourse channel.

6.1.10 It therefore determined that the dominant water sources in the Site for all identified potentially groundwater-dependent habitats are rainwater and surface runoff with shallow through-flow within the uppermost vegetated layer.

6.1.11 Impacts to wetland habitats would be kept to a practical minimum through use of best practice construction and mitigation measures. Specific mitigation measures, to avoid changes to the watercourse hydrochemistry through 'flushing' of excavated material in surface runoff, have been set out and would be adhered to during all site works. Careful construction to ensure suitable continuity of flow across site tracks would help to minimise any potential impacts to the wetland habitats present within the Site.

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FIGURES

291200E 291900E 292600E 293300E 294000E 294700E 295400E

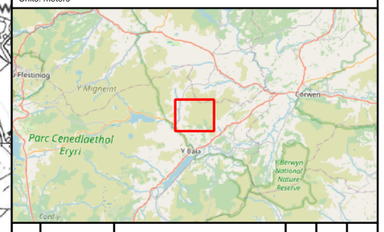
342300N 341600N 340900N 340200N 339500N 338800N

Potential GWDTE
- M19
- M23
- M6

Habitats
- A1.1.1 - Broadleaved Woodland
- A2.1 - Dense/continuous Scrub
- A2.2 - Scattered Scrub
- B5 - Marshy Grassland

LEGEND:
- Turbine
- Site Boundary
- 100 m Track Buffer
- 250 m Infrastructure Buffer
- Hardstands
- Tracks
- Verges
- Substation
- Batching Compound
- Construction Compound
- Bridge Temporary Working Area
- Batching Earthworks Cut
- Batching Earthworks Fill
- LiDAR Compound
- Borrow Pit
- Cut
- Compound Earthworks Cut
- Compound Earthworks Fill
- LiDAR Earthworks Cut
- Substation Earthworks Cut
- Substation Earthworks Fill

CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: meters



Rev	Date	Description	Drn	Chk	App
1.1	05/11/2025	Second Draft	CP	GE	CI
00	24/06/2025	First Draft	CP	EA	CI

Foel Fach Wind Farm

TITLE:
Figure 7.7.1
Potential Groundwater Dependent Terrestrial Ecosystems

ID:P664094_Figure7.7.1 Potential GWDTE

0 0.3 0.6 km
Kilometers
Scale: 1:15000 @A3

REV 1.1

Path: C:\Users\chris.palmer\OneDrive - RSK Group\Documents\00 Projects\P680\P664 Foel Fach\GIS\01 EIA & VA figures

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Habitats

- A1.1.1 - Broadleaved Woodland
- A2.1 - Dense/continuous Scrub
- A2.2 - Scattered Scrub
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LEGEND:

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CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: meters

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Foel Fach Wind Farm

Coriolis Energy | ESB Energy for generations | natural power | wrc

TITLE:

Figure 7.7.1a
Potential GWDTE Area 1

ID:P664094_Figure7.7.1a Potential GWDTE Area 1

0 0.07 0.14 km
Kilometers
Scale: 1:3500 @A3

N W E S

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341800N 341600N 341400N 341200N 341000N

Maespyllan

Sheepfold

Pen y Bwlch

Gwyn

Potential GWDTE habitats
- M19
- M23
- M6

LEGEND:
- Turbine
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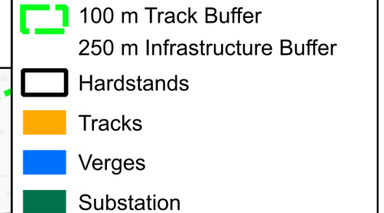
CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: meters



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00	24/06/2025	First Draft	CP	EA	CI

Foel Fach Wind Farm

TITLE:

Figure 7.7.1b
Potential GWDTE Area 2

ID:P664094_Figure7.7.1b Potential GWDTE Area 2

0 0.08 0.16 km
Kilometers
Scale: 1:4000 @A3

REV 1.1

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292800E 293000E 293200E 293400E 293600E 293800E 294000E 294200E 294400E

341600N 341400N 341200N 341000N 340800N 340600N 340400N

Potential GWDTE habitats
- M19
- M23
- M6

LEGEND:
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- Substation Earthworks Cut
- Substation Earthworks Fill

CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: meters

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Foel Fach Wind Farm

TITLE:

Figure 7.7.1c
Potential GWDTE Area 3

ID:P664094_Figure7.7.1c Potential GWDTE Area 3

0 0.1 0.2 km
Kilometers
Scale: 1:5000 @A3

N W E S

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Foel Fâch
Moel Darren
Cae'r Ceiliog
Fords
Bwlch
vyn

2 3 5 6 7 8 9 10

Potential GWDTE habitats
- M19
- M23
- M6

LEGEND:
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CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: meters

Rev	Date	Description	Drn	Chk	App
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00	24/06/2025	First Draft	CP	EA	CI

Foel Fach Wind Farm

TITLE:

Figure 7.7.1d
Potential GWDTE Area 4

ID:P664094_Figure7.7.1d Potential GWDTE Area 4

0 0.1 0.2 km
Kilometers
Scale: 1:6500 @A3

REV 1.1

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