9 HYDROLOGY & HYDROGEOLOGY

9.1 Introduction and Scope

9.1.1 An assessment of the impact of the proposed wind farm on hydrology, hydrogeology and geology, inclusive of the impact on peat and peat hydrology, is provided in the following chapter. Statutory responses to the Scoping Report (Technical Appendix 1.1) and recent Welsh Government advice on Sustainable Drainage Systems (SuDS) have been used to determine the scope of the assessment.

9.1.2 This chapter presents the findings of the assessment of the potential geological, hydrological and hydrogeological effects of the proposed wind farm. The assessment includes a review of the hydrology of water features such as springs, reservoirs, ponds, watercourses, wetlands and water supplies.

9.1.3 The assessment provides baseline information, identifies potential effects, assesses the significance of these effects (based on the magnitude of the effect and the sensitivity of the site), and discusses management and monitoring measures. It also outlines mitigation measures to manage the predicted effects of the proposals and assesses the residual impacts of any effects.

9.1.4 The majority of potential hydrological effects from the proposed wind farm may arise from construction activities, and this chapter should be read alongside Chapter 3: Proposed Development. In turn, geological, hydrological and hydrogeological effects may create secondary effects on ecology, and therefore reference should also be made to Chapter 6: Ecology.

9.1.5 The assessment is primarily concerned with the site and its surroundings up to 1 km from the site boundary. However, where a hydrological connection deems it necessary the study area has been extended to those water catchments and receptors considered to be potentially affected by the proposed wind farm. The planning application boundary is shown in Figure 1.2: Planning Application Boundary.

9.1.6 Effects on peat are considered in relation to hydrology within this chapter.

9.1.7 The road widening works to the access route are considered to have negligible impact on hydrology, hydrogeology and geology, and therefore are not included in this assessment. Works are limited to minor road widening, including minor diversions through existing farm / grazing land. No peat or significant hydrological features within the proposed widening or minor diversion areas were encountered on the site walkover inspections.

9.1.8 This chapter is supported by Technical Appendix 9.1: Sustainable Drainage Management Plan Report, Technical Appendix 9.2: Coal Mining Risk Assessment, Technical Appendix 9.3: Soil and Peat Management Report, Technical Appendix 9.4: Watercourse Survey Report and Technical Appendix 9.5: Ecohydrology Impact Assessment & Remediation on GWDTEs & Peat included in Volume 4. This chapter is also supported by Figure 9.1: Drainage Catchment Areas and Receptors, Figure 9.2: Bedrock Geology, Figure 9.3: Peat Depth Plan, Figure 9.4: Aquifer Bedrock and Figure 9.5: Aquifer Superficial Deposits included in Volume 3.

9.2 Legislation, Policy and Guidelines

Legislation and Policy

9.2.2 As of January 2019 the Welsh Government brought Schedule 3 of the Flood and Water Management Act 2010 into effect in Wales. Statutory National Standards (SuDS Standards) on the design, construction, operation and maintenance of SuDS were published by the Welsh Ministers in 2018.

9.2.3 A SuDS approving body (SAB) has been established within the local authority to approve SuDS for Developments of National Significance (DNS). Approval for the proposed wind farm's SuDS design would be sought from the SAB prior to construction commencing.

9.2.4 Natural Resource Wales (NRW) has statutory obligations in terms of the management and control of pollution into water resources. NRW's Best Practice Guidelines would be followed in order to prevent pollution, to provide acceptable standards of work and to make any 'significant' effects unlikely.

9.2.5 There is a range of environmental legislation that any development must adhere to throughout the development life cycle. Key legislative drivers relating to the water environment which have been considered within this assessment are listed below:

- Flood and Water Management Act 2010 (FWMA).
- SuDS Approving Body (SAB) Application – Schedule 3 of FWMA 2010
- Environment (Wales) Act 2016.
- EU Water Framework Directive 2000/60/EC.
- Groundwater (England and Wales) Regulations 2009.
- Water Supply (Water Quality) Regulations 2010.
- EC Fisheries Directive (78/659/EEC).
- Water Resources Act 1991.
- Private Water Supplies (Wales) Regulations 2010.
- Environmental Protection Act 1990.

9.2.6 The development activities associated with the construction of the proposed wind farm would need to conform to existing water legislation in Wales, and with any relevant changes regarding the abstraction of water, discharges to water and any engineering works or impoundments. These include the following requirements:

- Consent for the erection of a culvert in an ordinary watercourse or to alter any culvert in a manner that would be likely to affect the flow of an ordinary watercourse (Lead Local Flood Authority).
- Consent for the erection of any mill dam, weir or other like obstruction to the flow of an ordinary watercourse or to raise or otherwise alter such an obstruction (Lead Local Flood Authority).
- An Abstraction License for the abstraction of water from any inland water or underground strata (NRW).
- Assurance that riparian owners common law rights to receive water is undiminished in quantity or quality.

Standards and Guidelines

9.2.7 The Guidance for Pollution Prevention (GPP), published by NRW and the Construction Industry Research & Information Association (CIRIA), include the documents referred to below, which are the principal documents used for guidance on preventing contamination of surface water from construction activities. Those relevant to the proposed wind farm include:

- GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer, Version 1.2 June 2021.
- GPP5: Works and maintenance in or near watercourses, Version 1.2 February 2018.
- Statutory Standards for Sustainable Drainage Systems – designing, constructing, operating and maintaining surface water drainage systems, Welsh Government, 2018.

9.2.8 Sustainable Drainage (SuDS) Statutory Guidance, Welsh Government, 2019.

- The SuDS Manual 2015. CIRIA C753.
- Caerphilly County Borough Council (CCBC) Land Drainage Byelaws 2018

9.2.9 Other relevant guidance includes:

- Welsh Assembly Government Planning Policy Wales Technical Advice Note (TAN) 15, Development and Flood Risk.

- Assessing the impact of wind farm developments on peatlands in Wales, Countryside Council for Wales.
- Engineering in the Water Environment, Good Practice Guide, Temporary Construction Methods, First Edition, March 2009, SEPA.
- DEFRA Good Practice Guide for Handling Soils (MAFF, 2000).

9.3 Consultation

9.3.1 A range of consultation has been undertaken for the site. A summary of the consultee responses in relation to hydrology and hydrogeology is provided in Table 9.1.

Table 9.1 Summary of Consultation Responses

Consultee	Summary of Comments	Response/Action Taken
PEDW	The proposed development has the potential to impact on the local water regime both on the surface and underground. A survey of the hydrological features within the site and up to 500 m from the site boundary is required. A full hydrological and hydrogeological assessment is required in the Environmental Statement. Groundwater monitoring is required to establish baseline condition before construction. The groundwater monitoring plan should be prepared in consultation with NRW and relevant LPAs. Sufficient information should be included in the Environmental Statement. to provide a detailed baseline of the hydrological regime. Flood Risk can be scoped out of Environmental Statement. Shallow mining may be present. Shallow mining may contain groundwater and the potential effects of the proposal on groundwater need to be assessed. The Environmental Statement should include a Coal Mining Risk Assessment, including risk of subsidence. Areas where peat is greater than 0.5 m should be avoided. Peaty areas that cannot be avoided should be surveyed in accordance with the Scottish Government Guidance 'Guidance on Developments in Peatland'. Potential impacts on peat need to be assessed as part of the Environmental Impact Assessment process. The final design of the scheme should be informed by the presence of peat on-site. The ecological effects of disturbing peat on-site should be addresses in the ecology chapter of the Environmental Statement.	Issues identified in the scoping response will be covered across this assessment and in the Sustainable Drainage Management Plan. The risks associated with coal mining are described in Technical Appendix 9.2: Coal Mining Risk Assessment of the ES and related studies presented elsewhere. Peat soils definition from Soil Survey of England & Wales used following Consultation with NRW and LQAS.
Caerphilly County Borough Council (CCBC)	There are a plethora of small watercourses found throughout the area which appear to be prone to flooding as well as most of the area showing to be at risk of groundwater flooding. Most of the site is susceptible to groundwater flooding.	Development avoids all fluvial flood risk areas. Issues identified by CCBC will be covered across this assessment.

Consultee	Summary of Comments	Response/Action Taken
	CCBC Land Drainage bylaws must be adhered to, namely no construction is permitted within 8m of a watercourse or on the watercourse itself without written consent from the SAB. Recommend guidance: The SUD's Manual C753, Technical Advice Note 15 and the Statutory standards for sustainable drainage systems. SAB process should be started as soon as possible. A site investigation should be carried out to investigate the suitability of SuDS on-site, in accordance with the hierarchy found under Standard 1 – Surface Water runoff Destination, of the Statutory Standards for Sustainable Drainage Systems.	
Torfaen County Borough Council (TCBC)	Highlighted a spring that runs east into TCBC and Afon Llwyd catchment. Where individual sites or access roads cross or have to divert these an Ordinary Watercourse Consent will be required.	Issues identified by TCBC will be covered across this assessment.
NRW (through PEDW scoping direction)	Notes that the proposed development has the potential to impact the local water regime both on the surface and underground. Requests that a survey of hydrological features within the site and up to 500m from site boundaries is required. Notes that the proposal has the potential to impact existing water flows and quality during construction and decommissioning. Requires groundwater monitoring to establish baseline condition before construction. Reference provided to various pollution and hydrology guidelines on the NRW website. Reference provided to document Assessing the impact of wind farm developments on peatlands in Wales, Countryside Council for Wales. Advised to avoid deep peat and address the effects of the wind farm on peat hydrology.	Issues identified will be covered across this assessment and in the Sustainable Drainage Management Plan.

Other Consultation

9.3.2 Consultation was undertaken with local authorities and Dwr Cymru in order to identify the location and nature of private water supplies. Details of private water supplies are included in paragraph 9.5.28 and Figure 9.1: Drainage Catchment Areas and Receptors.

9.4 Assessment Methodology

Baseline Characterisation

9.4.2 Baseline characterisation considers the current hydrological and hydrogeological characteristics of the site to inform the assessment of the effects of construction and operation of the proposed wind farm on the existing conditions. The baseline characterisation has been developed through a combination of

- Desk study of data sources.
- Site walkover.
- Watercourse survey.
- Peat survey.

- Geotechnical investigation (boreholes and trial pits).

Study Area

9.4.3 The proposed wind farm infrastructure is predominantly located across the highest flat ground which forms the tops of Mynydd Llwyd (to the north), Mynydd Twyn-glas (central) and Mynydd Maen (to the south). The hydrological study area encompasses catchments draining the site. The study area extends 1 km from the site boundary to include areas downstream of the watercourses on-site. Outwith this boundary it is considered that any impact from the proposed wind farm would not be detectable due to the combination of small hydrological impacts from the development, combined with the lessening area contribution of catchments affected by the development downstream. The extent of the hydrological study area takes a precautionary approach to ensure that all potential effects are identified.

Items scoped out of Assessment

9.4.4 On the basis of the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the EIA team and experience from other relevant projects, the following have been 'scoped out':

- Fluvial flood risk. The proposed wind farm is located outside flood zones 2 and 3 and is therefore considered to be at no risk of fluvial or coastal / tidal flooding. Any further flood risk assessment would concentrate on the impact of flood risk to others.
- Effects to hydrology/hydrogeology/geology as a result of potential localised public road alterations as these are not considered likely to result in significant effects on receptors considered within this chapter.
- The activities and features associated with the proposed development including the environmental effects of blasting within borrow pits, piled foundations, and the indicative method of grid connection, are not anticipated to have any significant impact on receptors within this chapter.
- Any proposed activities involving blasting, such as the development of borrow pits, must adhere to applicable construction and quarrying regulations. These sites have been strategically located to avoid disturbing peat, minimising the need for significant construction mitigation measures. If rock blasting is required during excavation, it is unlikely to increase the potential impacts on receptors identified in this chapter, as the proposed locations have been chosen to ensure limited effects on them.

Data Sources and Guidance

9.4.5 The following data sources have been consulted as part of the preparation of this assessment:

- Ordnance Survey (OS) Mapping at scales 1:10 000, 1:25,000 and 1:50 000 scale;
- British Geological Survey (BGS) Groundwater Vulnerability Map of Wales at 1:50 000 scale;
- British Geological Survey (BGS) Hydrogeological Map of Wales at 1:50 000 scale;
- River Basin Management Plan Western Wales River Basin District. (https://naturalresources.wales/media/674895/ww-rbmp.pdf);
- NRW information on known local abstractions (https://nrwregulatory.naturalresources.wales/Permits);
- NRW Flood mapping (https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en).

Assessing Significance

9.4.6 The significance of effects of the proposed wind farm on existing baseline conditions are assessed using professional judgement through a combination of the magnitude of the potential effect and the sensitivity of the receptor to determine the significance of that effect.

Sensitivity Criteria

9.4.7 Table 9.2: Sensitivity Criteria below defines the sensitivity of the receiving environment, i.e. its baseline quality as well as its ability to absorb the effect without perceptible change.

Table 9.2: Sensitivity Criteria

Sensitivity of Environment	Definition
Not Sensitive	Environment is insensitive to impact showing no discernible change. Receptor lies outside the sphere of influence of the Proposed Development.
Low	Environment responds in a minimal way to effect, such that only minor change(s) are detectable. Receptor is at low risk from flooding (less than 0.1 % AEP). Receptor not used for water supplies (private or public). Soil type and associated land use not sensitive to change in hydrological regime (e.g. intensive grazing of sheep and cattle).
Moderate	Environment clearly responds to effect(s) in quantifiable and/or qualifiable manner. Water body is classified by EA / NRW as being Moderate. Receptor is at moderate risk from flooding (0.1 % Annual Exceedance Probability (AEP) to 0.5 % AEP) but does not act as an active floodplain or flood defence. Moderate classification of groundwater aquifer vulnerability. Soil type and associated land use is moderately sensitive (e.g. arable, commercial forestry)
High	Environment is subject to major change(s) due to effect. Water body is classified by EA / NRW as being High-Good status or is close to the boundary of a classification: Moderate to Good or Good to High. Nationally designated sites such as SSSIs, or non-designated sites meeting SSSI selection criteria, National Nature Reserves (NNRs), Marine Nature Reserves, Nature Conservation Review Grade 1 sites (Ratcliffe 1977) which may depend upon the hydrology of the site. Receptor is at risk from flooding above the 0.5 % Annual Exceedance Probability (AEP) and/or water body acts as an active floodplain or flood defence. Receptor is used for public and/or private water supply (including Drinking Water Protected Areas). Groundwater vulnerability classified as high. Presence of a Groundwater Dependent Terrestrial Ecosystems (GWDTE) as defined by NRW. Soil type and associated land use is highly sensitive (e.g. an impermeable soil with artificial drainage present).

Magnitude of Effect

9.4.8 The magnitude of change has been established based on the criteria presented in Table 9.3: Effect Magnitude Criteria. Differentiations between categories in Table 9.3 are based upon professional judgement.

Table 9.3: Effect Magnitude Criteria

Magnitude of Potential Effect	Definition
Major	Total loss of, or alteration to, key features of the baseline environment such that post development characteristics or quality would be fundamentally or irreversibly changed.
Moderate	Loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be partially changed.

Magnitude of Potential Effect	Definition
Minor	Small changes to the baseline resource which are detectable, but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions.
Negligible	A very slight change from the baseline conditions, which is barely distinguishable, and approximates to the 'no-change situation'.

Significance Criteria

9.4.9 The combination of magnitude and sensitivity combine to provide a matrix categorisation of significance. These are presented in Table 9.4: Effect Significance Criteria.

9.4.10 **Moderate** or **Major** impacts are deemed significant in the context of the EIA Regulations. Impacts that are **Minor** or **Negligible** are judged to be not significant. Differentiations between categories in Table 9.4 are based upon professional judgement.

Table 9.4: Effect Significance Criteria

Magnitude of Potential Effect	Sensitivity		
	High	Moderate	Low
Major	Major	Major	Moderate
Moderate	Moderate	Moderate	Minor
Minor	Moderate	Minor	Negligible
Negligible	Minor	Negligible	Negligible

9.5 Baseline Conditions

Desktop Surveys, Site Walkovers, Peat Surveys and Geotechnical Investigation

9.5.2 A site walkover of the main site to assess hydrological features was undertaken on 31st May 2023 by Mark Crabtree of Renewable Energy Systems Ltd and Rob Low of Rigare Ltd. Weather on the day of the site visit was dry.

9.5.3 The site walkover confirmed that watercourses shown on the OS 1:50,000 scale mapping existed on the ground. The site visits also assessed the watercourse conditions and underfoot conditions (such as soil moisture) for the indicative access track routes and turbine locations. Photographs were taken to record and to identify receptors and any other hydrological features of note.

9.5.4 A study of OS mapping, Google Earth and historical mapping has been undertaken to confirm the connectivity of watercourses and downstream hydrology.

9.5.5 A watercourse survey of the receptors and hydrological features was undertaken on the 18th and 19th of July 2023 by Evan Evans and James Mason of Renewable Energy Systems Ltd. The purpose of the survey was to assess the condition of the receptors and hydrological features. Photographs were taken to record the condition of the receptors and features. Findings are summarised in the Watercourse Survey report and drawing included in Technical Appendix 9.4: Watercourse Survey Report. Weather on the day of the site visit was dry.

9.5.6 The Welsh Government Data Map Wales Unified Peat Map of Wales suggests that there is a localised area of peat between 1.0m to 1.2m deep, located in the south of the wind farm site. The area of peat is situated on the higher ground, approximatley 200m to the east of T12.

9.5.7 Additional site walkover surveys and peat probing were undertaken in four phases by SLR Consulting Ltd. Phase 1 on 24th November 2021 and 25th November 2021, Phase 2 between 14th March 2023 and 17th March 2023, Phase 3 (allowing for turbine moves) on 11th and 12th September 2023, and Phase 4 (allowing infrastructure moves for Consultation responses) between 30th April and 2nd May 2024. Multiple phases of surveys included peat coring to calibrate peat probe depths and provide stratum descriptions. The findings of the surveys have been used to determine the baseline peat depths within the site boundary. Refer to Figure 9.3: Peat Depth Plan and Technical Appendix 9.3: Soil and Peat Management Plan.

9.5.8 A Geotechnical Investigation campaign was undertaken between 6th March 2023 and 13th March 2023. Four boreholes to 20 m depth and four trial pits to approximately 3 m depth were undertaken. Borehole and trial pit logs are included in the Phase 2 Site Investigation – Coal Mining Risk Assessment report included in Technical Appendix 9.2: Coal Mining Risk Assessment.

9.5.9 Both boreholes and trial pits recorded bedrock at shallow depth. Groundwater was not encountered during the investigation works. A seepage of perched groundwater was encountered at the base of the peat in the borehole at T3.

Land Cover and Land Use

9.5.10 It has been noted through previous consultation and desktop review that the site has been subject to historical coal mining activities. More information on the historic coal mining activities can be found in Technical Appendix 9.2: Coal Mining Risk Assessment.

9.5.11 Current land use consists of mainly rough upland farmland with a mixture of footpaths and tracks. This is mainly characterised by a mixture of acid grassland and heather moorland, the westerly areas of which are grazed (by sheep and cattle) and the north-easterly and easterly parts more lightly grazed. More information on vegetation types and classes can be found in Chapter 6: Ecology.

Meteorological Summary

9.5.12 The site has a mild climate, with an unevenly distributed annual rainfall and strong winds. According to the Flood Estimation Handbook, total annual average rainfall is some 1449 mm over the site[1]. On average, snow lies at the site on average 5 to 10 days per year[2].

Geology

Bedrock geology

9.5.13 A desktop review of the geological data provided by the British Geological Survey (BGS) maps indicates that bedrock lies near the surface. The bedrock includes Hughes Member Sandstone over Rhondda Member Sandstone in turn over Deri Formation (Mudstone) and South Wales Coal Measures Formation. Refer to Figure 9.2: Bedrock Geology.

9.5.14 Coal Authority mapping shows the entire site to sit in an area where coal mining has been reported. Furthermore, the mapping shows numerous bands of high risk areas for development.

9.5.15 A desktop Coal Mining Risk Assessment (CMRA), followed by an intrusive Geotechnical Investigation (boreholes and trial pits) at targeted turbine locations was undertaken to establish the ground conditions and assess the identified risk from shallow coal workings.

9.5.16 At all trial pit and borehole locations the same sequence of lithologies were recorded which varied slightly in thickness. The exploratory holes encountered a layer of peat over varying amounts of clay, sands and gravels, with sandstone bedrock at relatively shallow depths.

9.5.17 The boreholes recorded intact sandstone bedrock throughout and there was no evidence of any underground coal mining to the full depths of drilling. The assessment concluded that no further investigation or remediation with regards to coal mining hazards is required. Refer to the Phase 2 Site Investigation Coal Mining Risk Assessment included in Technical Appendix 9.2.

Peat

9.5.18 Although BGS maps indicate a lack of superficial deposits, peat is present within the site bounds. An extensive peat survey has been carried out by SLR, taking in nearly 4000 points within the red line boundary. Refer to Figure 9.3: Peat Depth Plan and Technical Appendix 9.3 for Soil and Peat Management Plan.

[1] Centre for Ecology and Hydrology (2009) Flood Estimation Handbook Version 3.

[2] https://www.metoffice.gov.uk/public/weather/climate (accessed July 2023)

9.5.19 There is relatively little peat within the site, compared with peatland sites further north in Wales and the rest of the UK. There is no obvious evidence of historical peat mining on the site, and the likely explanation for the limited amount of peat is that the site has been, and is, climatically marginal for blanket mire development. The rainfall is relatively low because of its rain-shadow location to the east of the South Wales high ground, and its southerly location means evapotranspiration is relatively high because of warmer temperatures. These two factors will have combined to result in relatively low water tables, which in turn mean that decomposition of organic matter is relatively high (but on balance slightly less) compared to its accumulation.

9.5.20 Peat has been considered as a primary potential receptor for hydrological impacts.

Hydrogeology

9.5.21 The site is not located in a source protection zone.

9.5.22 Figure 9.4: Bedrock Aquifers included in Volume 3 shows the location of bedrock aquifers in proximity to the site. The site is underlain by a Secondary Aquifer A. A Principal Aquifer lies approximately 1 km from the eastern boundary of the site.

9.5.23 The site is underlain by the Hughes Member of the Pennant Sandstone Formation, described as green-grey lithic arenites (medium coarse sandstones) with thin mudstone / siltstone and seatearth interbeds, and mainly thin coals.

9.5.24 These Coal Measures sandstones are very well cemented, extremely hard and dense and in consequence possess very little primary porosity or intergranular permeability. The sandstone permeability is directly related to the distribution and size of fractures present in the sandstone horizons. Historical mine workings within the Coal Measures have resulting in increased fracturing, however there is no record of historical shallow mine workings within the footprint of the proposed wind farm infrastructure, and therefore no direct flow pathway through fractures into the deep underlying groundwater aquifers.

9.5.25 Figure 9.5: Superficial Aquifers included in Volume 3 shows the location of superficial deposit aquifers in proximity to the site. To the east of the site is an aquifer defined as a Secondary Aquifer Undifferentiated, a minor value aquifer with variable characteristics of material type. The proposed wind farm is outside the footprint of the aquifer, but within the zone of contribution to the aquifer, therefore has the potential to impact on water flows and water quality.

9.5.26 The proposed wind farm infrastructure is predominantly located across the highest flat ground which forms the tops of Mynydd Llwyd (to the north), Mynydd Twyn-glas (central) and Mynydd Maen (to the south). Groundwater was not encountered at the four borehole locations (T3, T7, T8 and T11) to a depth of 20 m. Bedrock was found to be shallow in all four boreholes.

9.5.27 Due to the low productivity of the underlying bedrock the majority of the subsurface flow of water infiltrating over the proposed wind farm would be shallow, probably perched, groundwater system within the peat, supported by poorly permeable underlying mineral deposits. The predominant flow direction of this subsurface water is primarily controlled by surface topography/bedrock topography.

Ecohydrology / Groundwater Dependent Terrestrial Ecosystems

9.5.28 For the assessment of Ecohydrology and Groundwater Dependent Terrestrial Ecosystems, refer to Rigaire Ltd Technical Memorandum included in Technical Appendix 9.5: Ecohydrology Impact Assessment & Remediation on GWDTEs & Peat.

Private Water Supplies

9.5.29 There are a number of private water supplies (PWS) in the vicinity of the site. The NRW Public register for Water Resources Licences provides details of applicants with abstraction licenses. Caerphilly County Borough Council (CCBC) and Torfaen County Borough Council (TCBC) hold records of private water supplies within their county borders.

9.5.30 The private water supplies within CCBC and TCBC, and the registered public licenced abstractions are included in Table 9.5. The locations of the PWS and the registered public licenced abstractions can be found in Figure 9.1: Drainage Catchment and Receptors.

Table 9.5: Private Water Supplies within CCBC and TCBC

Private Water Supplies (PWS)			
Council	**Location**	**NGR**	**Notes**
Caerphilly County Brough Council (CCBC)	Pen y Caeau Farm, Abercarn Mountain Road	323236, 198284	None.
	Blaengawney Farm, Hafodyrynys	322976, 197862	None.
	Cilonydd Farm, Pantside	322893, 197164	None.
	Glan Shon, Newbridge	322467, 195970	None.
	Rhyswg Fawr, Farm House	322662, 194602	None.
	Rhyswg Ganol Farm, Rhyswg Mountain Road	323807, 194827	None.
Torfaen County Borough Council (TCBC)	Crumlin Road	326204, 200138	Three properties at this location.
	Blaendare Farm Lane	327110, 199434	None.
	Belle Vue Lane	326837, 196495	None.
	Belle Vue Lane	326714, 196193	None.
	Unnamed track	326556, 195401	None.
	Ty Canol	326188, 194846	None.
	Pant-yr-yrfa	325343, 19338	None.
	Blaen-y-cwm	325831, 193306	Two properties at this location.

Table 9.6 Registered Public Licenced Abstraction Locations

Abstraction Locations					
Holder	**License no.**	**Source**	**Type**	**NGR**	**Notes**
Dwr Cymru	20/56/12/0051	Surface	Public Water Supply	327686, 199313	Springs and streams feeding Penyrheol Reservoir (Dwr Cymru have confirmed reservoir is drained and is no longer in use)
	20/56/12/0051	Surface	Public Water Supply	327686, 199313	Intake chamber at Penyrheol Reservoir (Dwr Cymru have confirmed reservoir is drained and is no longer in use)
	20/56/12/0051	Surface	Public Water Supply	327804, 199169	Intake chamber at Penyrheol Reservoir (Dwr Cymru have confirmed reservoir is drained and is no longer in use)
	20/56/12/0051	Surface	Public Water Supply	326909, 198529	Nant Lleucu to Penyrheol Reservoir (Dwr Cymru have confirmed reservoir is drained and is no longer in use)
	20/56/11/0007	Surface	Public Water Supply	325136, 193514	Spring to Pant-Yr-Eos Reservoir

Hydrology

9.5.31 The site contains a number of watercourses and head waters which drain down towards these rivers. Namely the Nant Gwyddon drain and Nant Carn drain located to the south of the site discharge to the Ebbw River. The east of the site drains to the Blaen Bran Reservoir which then discharges to the Afon Llwyd. The north-east of the site drains via watercourses that discharge to the Cwm Lickey Pond, before ultimately discharging to the Afon Llwyd. The north of the site is drained via a series of unnamed drains and watercourses that discharge into the Cwm y Glyn and ultimately the Afon Llwyd. A watercourse survey of these receptors was conducted on the 18th and 19th of July 2023, the findings of which have been summarised in the Watercourse Survey report and drawing included in Technical Appendix 9.4: Watercourse Survey Report.

9.5.32 The River Usk and the Ebbw River both flow north to south with the River Usk located east of the site and the Ebbw River west of the site. The Afon Llwyd also flows north to the south and is located to the east of the site, the Afon Llwyd discharges to the River Usk.

9.5.33 Turbines T10, T11 and T12 are located in the catchment of Nant Gwyddon which flows into the Ebbw River.

9.5.34 Turbine T13 is located in the catchment of the Nant Carn which flows into the Ebbw River.

9.5.35 Turbines T1, T3, T4, T5, T6 and T7 are located in the catchment of a number of unnamed drains and watercourses that flow north from the site before heading west and discharge into the Afon Llwyd.

9.5.36 Three potential borrow pits are located in the vicinity of turbines T6 and T7 and are located within the catchment of an unnamed watercourse that flows north before discharging into the Afon Llwyd.

9.5.37 Turbines T2, T8 and T9 are located in the catchment of the Cwm Lickey watercourse and pond which outfall to the Afon Llwyd, a tributary to the River Usk.

Water Quality

9.5.38 As part of River Basin Management Plans, NRW classify the current status and identify the pressures and possible measures to address these to reach future classification objectives of all waterbodies. The sub-catchments of the site drain into three waterbodies. The Ebbw River, The River Usk and the Afon Llwyd.

9.5.39 The Ebbw River has a 'Moderate' ecological status under the NRW / EA River Basin Management Plan (RBMP) classification.

9.5.40 The River Usk has a number of surface water bodies contributing to its classification with 37 rivers and three groundwater bodies. Within its catchment 33 % of surface water bodies are at good overall classification status, with 59 % at moderate and 9 % at poor overall status under the NRW / EA RBMP classification. Due to the River Usk being considered a Special Area of Conservation (SAC) it will be designated as having 'good' ecological classifications status. Although the majority of surface water bodies contributing to the River Usk (59 %) are classified as having 'moderate' classification status.

9.5.41 The Afon Llwyd has a 'Moderate' ecological status under the NRW / EA RBMP classification.

9.5.42 Water quality within the sub-catchments may be affected by the construction and operation of the proposed wind farm.

Flooding

9.5.43 Caerphilly County Borough Council and Torfaen County Borough Council were consulted regarding flood risk in the vicinity of the proposed wind farm. Both stated they have no concerns with regards to flood management in the area.

9.5.44 The NRW indicative flood map was also examined regarding flood risk. The flood mapping demonstrated that there is little to no risk of flooding within the site boundary.

9.5.45 Given the above, the site would not be categorised as sensitive to flood risk. The assessment will consider the impact of alterations to the runoff regime within the site bounds and the resultant impact on the downstream receptors.

9.5.46 Groundwater flooding was highlighted as a risk by CCBC, however no evidence of groundwater flooding within the proposed wind farm footprint has been identified. No groundwater was

encountered in boreholes, no evidence of groundwater flooding was evident during the site visits or site surveys, and no historical evidence of groundwater flooding has been encountered by landowners.

9.5.47 Given the above, the site would not be categorised as sensitive to groundwater flood risk. The assessment will consider the impact of alterations to the runoff regime within the site bounds and the resultant impact on groundwater.

9.6 Mynydd Maen Wind Farm Design Considerations

9.6.1 The objective of reducing potential impacts was an inherent part of the design of the infrastructure of the proposed wind farm. This section presents the layout design constraints, along with mitigation of the site drainage to be incorporated in Technical Appendix 9.1: Sustainable Drainage Management Plan. As such, these measures are assumed to be in place for the purposes of the assessment presented below.

Layout Design Constraints

9.6.2 The design of the proposed wind farm has evolved through a number of iterations, taking account of environmental designations and constraints. The information collated within the baseline assessment was used to identify hydrologically sensitive areas of the site and hence develop a map of constraints to inform the location of the infrastructure of the proposed wind farm. The hydrological features and constraints are presented in Figure 9.1: Drainage Catchment Areas and Receptors.

9.6.3 These constraints include an exclusion zone in the vicinity of the surface water features (e.g. drain, watercourse or wetland) mapped on OS 1:50,000 scale, which in accordance with GPP5, has conservatively been defined as 50 m. These exclusion zones are shown in Figure 9.1: Drainage Catchment Areas and Receptors. Infrastructure would be located at least 50 m from surface water features, with the exception of an upgrade to an existing access track crossing.

Avoidance of peat

9.6.4 Areas of peat within the site boundary have been avoided as far as practicable. Small, isolated pockets of peat up to 0.75 m in depth, are located within the footprint of T6 and T8 turbine infrastructure. A small pocket of peat up to 1 m in depth is located within the substation footprint. These peat areas could not be avoided because of limitations to turbine infrastructure position and orientation, due to constraints such as existing utility buffers, turbine separation distances, watercourse buffers, and topography. The track layout has been developed to avoid areas of peat, and where unavoidable, excavations / disturbance would be kept to a minimum.

Watercourse Crossings

9.6.5 During the design phase of the proposed wind farm, hydrological constraints were identified and considered alongside others. The proposed wind farm track layout was developed to avoid significant watercourse crossings as far as practicable. The track layout intercepts one significant watercourse shown on 1:50,000 scale OS mapping. The proposed watercourse crossing point is close to the site entrance and is located at an existing watercourse crossing. Prior to construction an application for an Ordinary Watercourse Consent would be submitted.

Site Drainage Design

9.6.6 Correct design of the site drainage is an important element in maintaining the long term continued stability of any peat, minimising erosion, maintaining the supply to GWDTEs, and avoiding the potential to impact on sensitive receptors. The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated by incorporating the measures outlined in the Sustainable Drainage Management Plan for the site. Refer to Technical Appendix 9.1 for the Sustainable Drainage Management Plan Report.

Micrositing

9.6.7 The layout of the turbines, and hence tracks and cables, is subject to a 50 m micrositing allowance. The assessment of impacts presented within this chapter has been based upon the layout defined in Chapter 3: Proposed Development. Any micrositing changes would respect the exclusion zones and

hydrological layout constraints, shown in Figure 9.1: Drainage Catchment Areas and Receptors such that no infrastructure would be moved to the extent that impacts would be any greater than those reported in this chapter.

9.7 Potential Effects

9.7.1 This section describes the direct potential significant impacts of the proposed wind farm on the baseline environment on the water quality, water resources, peat hydrology and surface and groundwater in the sub-catchments. These impacts then have indirect impacts upon water use (specifically PWS), GWDTE and aquatic ecology. Possible geological, hydrological and hydrogeological effects from the construction and operation of wind farms are related to:

- **Groundwater and surface water quality** - oil/fuel/chemical pollution (from for instance, accidental spillage or incorrect transport or storage during concrete preparation and refuelling procedures, or from leaching of concrete from turbine bases and installations) could affect water quality and indirectly affect ecological receptors and also human activities such as water abstracted for drinking supply.
- **Erosion and sediment loading** - unmanaged erosion/sediment deposition and suspended solids generated from ground disturbance could be mobilised by surface run-off or cause modification to stream channel morphology, with resulting damage to habitats. Sediment could also affect water abstracted for drinking supply.
- **Natural drainage patterns/runoff volumes and rates** - alteration of existing drainage could disturb surface and subsurface water flows to either water dependent habitats or to water supply abstraction points, unless properly managed. Tracks and other hardstanding areas could provide new pathways and affect the response of the catchment to rainfall. Inappropriate water crossings could result in blockages and flooding, with the potential to exacerbate erosion. Storage of peat in inappropriate locations, in combination with susceptible landforms and geology, could result in alteration of water flows, causing potential sedimentation in sensitive watercourses.
- **Linkage between groundwater and surface water** – alterations in linkages and flow pathways between groundwater identified by the presence of Groundwater Dependent Terrestrial Ecosystems (GWDTE) and surface water during construction, operation and decommissioning.

9.7.2 The potential effects of wind farm developments are summarised below in Table 9.5. It must be noted that the effects listed in Table 9.5 are only potential and their inclusion does not necessarily indicate that they would occur at this site.

Table 9.5 Summary of Potential Effects on Hydrology/Hydrogeology and Peat arising from Wind Farm Developments

Activity	Specific Element/Activity	Potential Effects	Potential Sensitive Receptors
Construction	Use of vehicles and machinery	Increase in surface run-off from soil compaction.	Surface water / peat hydrology and channel morphology
		Damage to peat including peat drainage.	Peat hydrology
		Long-term disruption of natural flow paths within the top of the peat body	Peat hydrology
	Works next to or near watercourses	Change in flow velocities	Surface water hydrology and channel morphology
		Increased erosion and subsequent changes in bed and bank stability	Surface water hydrology and channel morphology

Activity	Specific Element/Activity	Potential Effects	Potential Sensitive Receptors
		Increased flood risk	Surface water hydrology and channel morphology
		Entrance of sediment into watercourses via dust or suspended in runoff	Peat / surface water quality
	Earthworks and borrow pit operation	Increased sedimentation of watercourses / peat lands	Peat / surface water quality
		Pollution from suspended material	Peat / Surface water quality
		Disturbance of contaminated soil and subsequent pollution of watercourses and/or groundwater	Peat / Surface water quality Groundwater quality
	Materials management	Pollution from spills or leaks of fuel, oil and construction material	Peat / Surface water quality Groundwater quality
	Drainage, cable trenches and earthworks	Reduction in water table	Groundwater hydrology
		Changes to groundwater distribution and flow	Groundwater hydrology
		Creation of new drainage pathways as a result of wind farm infrastructure (tracks and cable trenches).	Peat hydrology
		Floating roads reduce hydraulic connectivity of peat beneath track.	Peat hydrology
	Concrete base installation	Changes to groundwater quality through leaching	Groundwater quality
		Increased drainage into void during construction	Peat / Surface water hydrology
Operation of wind farm and ongoing site maintenance	Use of vehicles and machinery	Increase in Increase in surface run-off from soil compaction Run-off from access roads	Surface water hydrology and channel morphology Surface water hydrology and channel morphology
	Site drainage	Rapid transfer of rainwater to watercourses via drains	Surface water hydrology and channel morphology
	Materials management	Pollution from maintenance work spills or leaks of fuel or oil	Surface water quality Groundwater quality
	Use of machinery	Sediment-loading of watercourses	Surface water quality
	Physical presence of turbine foundations	Possible minimal alteration of groundwater flow	Groundwater hydrology
Decommissioning	Use of vehicles and machinery to remove turbines and associated infrastructure	Temporary increase in surface run-off from soil compaction	Surface water hydrology and channel morphology
		Contamination from spills or leaks of fuel or oil	Surface water quality Groundwater quality

Activity	Specific Element/Activity	Potential Effects	Potential Sensitive Receptors
	Physical presence of former turbine foundations	Possible minimal alteration of groundwater flow	Groundwater hydrology
Flood events	Flooding within the site boundary	Damage to both the river crossing and the more general infrastructure of the track	Access infrastructure
		Injuries due to the presence of personnel in the vicinity of the river crossing during a flood event	Human health
		Personnel becoming trapped within the site during a flood event	Access and egress
		Consequences associated with flooding would be exacerbated downstream if culverting was improved at the site	Downstream sites

9.8 Mitigation and Management

9.8.1 From the assessment of potential effects, the following key issues which have demonstrated a potential effect significance of Minor/Moderate, Moderate and High would need particular attention for mitigation and management:

- The potential for sedimentation and/or pollution from construction operations in the vicinity of watercourses.
- Potential effects relating to leakage, inappropriate location and the use of diesel fuel, oils and other lubricants, and storage of cement and concrete additives that could leak or spill during transfer causing pollution to water features.
- Potential leakage of liquid concrete during mixing and transportation operations and leakage of liquid concrete during pours resulting in release of suspended solids into water features
- The potential for tracks and cable trenching to become preferential pathways altering sub-surface water flows.
- The potential to alter peat hydrology.
- The potential to increase flood risk to others.
- The potential to affect groundwater quality.

Construction Phase Mitigation

9.8.2 Mitigation undertaken at the construction stage is fundamental to the development of the wind farm and involves both management and monitoring. These measures are considered as additional to those measures used to inform the proposed wind farm layout. Mitigation measures presented in this section aim to reduce the significance of any effect on a receptor. Best practice would be followed throughout, and covers a number of aspects such as:

- The contractor tendering process.
- Site induction and training.

- The development and implementation of a Construction Environmental Management Plan (CEMP) (see Chapter 3: Proposed Development for more detail).
- Adherence to standard pollution prevention guidance.

9.8.3 Mitigation measures stated in the following sections are used to illustrate specific measures to minimise potential effects. However, the CEMP would be used to develop a detailed plan of when, and where, these measures would be implemented in order to gain maximum benefit from their use.

9.8.4 The use of a comprehensive Sustainable Drainage Systems (SuDS) design philosophy would mitigate against runoff, sedimentation and pollution events identified within this chapter. This philosophy would seek to ensure that all runoff is intercepted, prior to entering a natural watercourse.

9.8.5 Where specific activities have been identified as having a moderate significance (or higher), best practice in conjunction with specific mitigation measures would be required to reduce the significance to an acceptable level.

Specific Mitigation against a Pollution Event

9.8.6 Specific measures for the mitigation of a pollution event include:

- The placement of drip trays under plant/vehicles when not in use.
- The regular inspection and maintenance of plant to prevent leakage of fuel or oil.
- The use of interceptors to prevent oil/fuel/grit discharging into watercourses.
- The bunding of any fuel or oil store to at least 110 % of the volume of the contaminant being stored (or to contain 125 % of the largest tank's capacity in the case of multiple storage tanks).
- The siting of potentially polluting activities such as refuelling and vehicle maintenance within the identified construction compounds/parking area.
- The use of impermeable membranes wherever there is a risk of a potentially polluting substance infiltrating the ground.

Procedures in the Case of a Pollution Event

9.8.7 Appropriate equipment such as emergency spill kits, drip trays, to be used in the case of a pollution event occurring will be kept on-site at all times. All construction staff would be made aware of this equipment and related procedures.

9.8.8 The procedures would detail the location(s) of potential sources of contamination, the responsible person on-site to deal with any contamination event, emergency contacts in the event of a spill and initial actions to be taken should any spill occur. Spill kits would be kept on-site at all times and staff would be made aware of their location and procedures for use.

Specific Mitigation against a Sedimentation or Erosion Event

9.8.9 Additional to the embedded mitigation measures to maintain setback distances from significant watercourses, further mitigation against a sedimentation or erosion event would be the design and implementation of a comprehensive SuDS philosophy.

9.8.10 The Sustainable Drainage Management Plan Report (SDMP) included in Technical Appendix 9.1 would be issued to the Contractor and would form part of the Contract documents. The mitigation measures identified in the SDMP would inform the final proposed wind farm sustainable drainage strategy. The specific mitigation measures against sedimentation and erosion outlined in the SDMP would be implemented by the Contractor.

Specific Mitigation against a Runoff Event

9.8.11 The implementation of the controlling runoff measures identified in the SDMP would maintain the existing flow regime as far as practicably possible. Runoff from tracks and hardstands would be attenuated in swales and settlement ponds. Attenuated flows would be discharged over existing

vegetation prior to discharging into receiving watercourses, as per the existing drainage regime for the site.

Specific Mitigation against altering Peat Hydrology

9.8.12 Measures to preserve site hydrology identified in the SDMP would be implemented during the construction phase Refer to Technical Appendix 9.5 for the Technical Memorandum on Ecohydrology Impact Assessment & Renediation on GWDTE and Peat. Good construction practice and methodologies would be incorporated into the CEMP and monitored during the construction phase. Where hydrological impacts are possible, designing and emplacing mitigation measures which will reproduce upslope hydrological processes downslope of the infrastructure, through:

- Excavation of necessary upslope drainage ditches, including upslope interception ditches at construction sites and upslope trackside drains where needed.
- Routing intercepted runoff and seepage from the above beneath the wind farm infrastructure in regular culverts.
- Excavation of downslope, contour-parallel recharge trenches as close to the wind farm infrastructure as possible. The intercepted water will flow into and pond evenly along the recharge trench, and either infiltrate into the ground downslope or overtop diffusely during significant rainfall events. The result will be to reproduce the cross-slope distribution and nature of the hillslope hydrology downslope of the wind farm infrastructure, thus achieving hydrological neutrality.

It is important to note that under this approach, the previous practice of point discharge of intercepted clean water, into nearby streams or at discrete points on the downslope hillside, will not be used.

- Designing, excavating and maintaining a dirty water system, with appropriate treatment, within the infrastructure hydrological envelope as described above.

9.8.13 With regard to slope hydrology (surface and shallow subsurface), including peat deposits and related ecohydrological condition, the aim of mitigation measures is, as far as possible, to achieve hydrological neutrality for the infrastructure. It is necessary to intercept and/ or manage downslope flows immediately upslope of infrastructure, through cut-off trenches and trackside ditches. The effect is to intercept and concentrate more-or-less diffuse downslope flows in channels, and previous practice has typically been to route the flows through / around the infrastructure via culverts, and then to discharge them into adjacent streams, or from a single point on to the downslope hillside. The proposal here is to route the flows into recharge trenches immediately downslope of the infrastructure. A recharge trench is a level trench, 0.75-1.0 m deep, which holds the intercepted water so that it can re-infiltrate diffusely across the slope, with the aim / result that the upslope distribution and rates of downslope flows is restored – hence hydrological neutrality. The length and spacing of upslope interceptor drains and recharge trenches would be designed to ensure minimal cross-slope distribution of water. This means that the recharge trench would 'mirror' and receive the drainage water from each upslope interceptor drain.

Borrow Pit Surface Water Management

9.8.14 The borrow pit locations have been selected away from watercourses and beyond a 50 m buffer area defined for site selection. Cut-off drainage and / or face crest bunding would divert surface flow around the operational areas and leave only incident rainfall to collect in the borrow pit.

9.8.15 All cut-off drains would be constructed in advance of any borrow pit operations occurring within the site. Borrow pit floor levels would slope gently down to the rear of the areas forming a natural pool to retain any surface water and enable suspended sediments to settle out. Water collected in a sump in the low point of the borrow pit would then be pumped to a settlement pond (located within the proposed borrow pit areas).

9.8.16 No water from excavations and dewatering activities would be allowed to enter surface waters directly. Stockpiles (of superficial deposits and aggregate) would be located in suitable locations to ensure that there is no risk of material washing out and contaminating watercourses.

Foul Drainage Management

9.8.17 There are no public sewers in proximity to the site. Disposal of sewerage from temporary and permanent facilities on the site would be designed prior to construction commencing in accordance with the methods outlined in GPP4: Treatment and Disposal of Sewage where no Foul Sewer is available, and treatment systems would be sized in accordance with British Water Code of Practice – Flows & Loads.

9.8.18 Permanent welfare facilities would be located within the control building and substation compound, in the form of one toilet and two sinks. The substation location has been selected away from watercourses and beyond a 50 m buffer area defined for site selection.

9.8.19 The preferred option for treatment is via a septic tank with effluent to discharge to a soakaway. Infiltration tests would be carried out to confirm the infiltration properties of the existing ground in the vicinity of the compound.

9.8.20 The necessary approvals would be sought prior to the installation of any sewage treatment system.

Management of Earthworks Stockpiles

9.8.21 It would be necessary for the CEMP to prescribe methods and timing involved in excavating, handling and storing topsoil and subsoil for use in reinstatement. A method statement to govern the process would be produced and would be based on the following principles:

- Careful consideration will be given to the location of topsoil and subsoil storage areas for all facilities during construction, either by siting in a flat dry area away from watercourses or by the addition of cut-off drains above the storage, which will help to maintain a buffer from streams. The areas will be regularly inspected to ensure that erosion of the material is not taking place.
- The size and location of storage areas will be carefully assessed to prevent the risk of rainwater moving storage materials. In areas where there is a risk of high rainwater and erosion potential, cut off drains will be employed on the ground above storage areas to divert flow away.
- Settlement lagoons and silt traps will be inspected regularly especially after a period of heavy rainfall. This inspection period will be agreed during the development of the CEMP. Maintenance will be carried out in periods of dry weather where possible.

Management of Excavated Peat

9.8.22 As previously noted, the project layout design has resulted in relatively little peat needing to be disturbed during the construction process. The combination of minimised peat disturbance through project design, proposed careful and effective management and preservation of disturbed peat and effective ecohydrological mitigation for peatland identified to be within the potential impact zone of proposed infrastructure, has been designed to fulfil, as a minimum, the requirements of paragraph 6.4.34 of PPW12.

9.8.23 It would be necessary for the CEMP to prescribe methods involved in excavating, handling and storing peat for use in reinstatement. Refer to Technical Appendix 9.3 for the Soil and Peat Management Plan Report. A method statement to govern the process would be produced and would be based on the following principles:

- Peat characterisation - Where excavation of peat is required, a decision will be made and documented on which peat can be replaced *in situ*, or at least replaced within the relevant excavation after construction (locally managed peat), and which peat should be relocated within the site (relocated peat).
- Excavation – The acrotelmic (including the vegetated turves) layers of soils and peat should be recognised during excavation and reuse activities. For excavation works good practice

would include peat excavated as turves, generally not seperating acrotelm from the underlying peat due to the low anticipated thickness of peat, turves excavated as large as possible, avoiding contamination of excavated soils and peat with substrate material and timing works to avoid very wet weather. In the rare event that the water table might be lowered in adjacent peat left in-situ, the remaining peat would need to remain saturated by spray irrigation.

- Transport – good practice would include minimising movement of turves once excavated minimising cross-contamination between peat and non-peat materials.
- Handling – a detailed peat handling plan should include refined estimates of excavation volumes at each infrastructure location, storing locally to excavation locations wherever possible and prevention of drying or dessication.
- Temporary storage around infrastructure (locally managed peat) - Any peat soils to be removed during construction would require a temporary storage area near to the construction works/area of re-use. Where peat cannot be transferred immediately to an appropriate restoration area, short term storage will be required. In this case, good practice should consist of storing peat sufficient distance from cut faces, avoiding locally steep slopes, avoid drying and dessiciation of stored peat and regular inspection of potential onset of instability.
- Relocated peat - Soil and peat relocation will only be required where reinstatement or reuse is not immediately possible, in which case stored soils and peat should be located as close to the excavation as practical and reinstated at the end of the construction phase. Some temporary storage of peat for habitat restoration purposes may be required for slightly longer dependant on the proposed habitat restoration works. Soil and peat storage residence times should be minimised by ensuring that the excavation and storage of soils and peat is considered at an early stage during the develop of the construction programme. To ensure that the long term storage locations are suitable in terms of environment, construction practicality and safety, the precise location of temporary soil and peat stockpiles should be determined at a site level following consideration and assessment of suitable areas by the ECoW, geotechnical engineer and contractor. It may be possble to relocate peat to supplement areas of previously restored peatland within the Mynydd Maen project area or to areas where peat has previously been lost with the aim of extending areas where peat is seen to be functioning well.

Water Quality – Oil, Fuel and Chemical Contamination

9.8.24 Fuel and oil spillages are potential sources of contaminants. Tracks and compounds where vehicles are re-fuelled or on stand-by, and areas where chemicals and fuel are stored, are potential sites of contamination. Construction Compounds are shown in Figure 3.8: Typical Temporary Construction Compound.

9.8.25 A location map of all potential contamination sources would be produced, and would include fuel, oil and chemical storage areas; vehicle compounds, refuelling sites, waste depots and on-site sewage systems. Mitigation is to be incorporated in accordance with NRW's GPPs. Best practice would be adopted for handling potentially polluting substances, such as fuel, oil, cement, and concrete additives, including:

- Designated facilities designed and used for storage and refuelling, away from watercourses.
- A list of emergency procedures, responsive to a risk assessment of areas of high sensitivity.
- Site induction of all personnel on emergency spillage procedures and staff trained in emergency procedures.
- A contact list for emergency services, the relevant environmental regulators, the local water supply and sewerage undertakers, the Health and Safety Executive and specialist clean up contractors, if required.
- Emergency response equipment available at appropriate locations.

9.8.26 In the unlikely event of an environmental pollution incident, there would be an emergency response procedure to address any accidental pollution incident. For example, a procedure requiring the use

of spill kits to contain the material and procedures to ensure that NRW is notified on their Pollution Hotline number (0300 065300) within 30 minutes of an incident (unless unsafe to do so), would be applied.

9.8.27 The procedure would remain in place throughout the operational phase of the proposed wind farm.

Groundwater Management for Turbine Foundation Construction

9.8.28 A full geotechnical investigation would be performed prior to detailed design and construction, which will include assessment of groundwater levels. The geotechnical monitoring results would be used to confirm the assumption that groundwater levels are below turbine foundation excavation levels. In the unlikley event that groundwater is encountered during the turbine foundation works, excavations for turbine foundations would allow for temporarily dewatering to provide a safe working environment. This would normally comprise shallow perimeter trenches to capture rainwater and any inflows from the ground, and lead to a sump for subsequent removal of any excessive water ingress by pumping. Any removed water would be appropriately treated to manage contained fines. On completion of foundation construction and backfilling, groundwater levels would be allowed to return to equilibrium levels.

PWS and Groundwater Monitoring Plans

9.8.29 A Private Water Supply Monitoring Plan (PWSMP) would be produced prior to construction commencing on-site. The PWSMP would include details of the monitoring methodology, a seasonal monitoring schedule ahead of and during construction, monitoring locations, and monitoring frequency.

9.8.30 Due to the low productivity of the underlying bedrock and lack of direct flowpath for water infiltrating over the proposed wind farm into the deep groundwater sources, groundwater monitoring would be limited to monitoring shallow groundwater in the superficial deposits. A groundwater monitoring plan would be produced prior to construction commencing on-site. The groundwater monitoring plan would include details of the monitoring methodology, a seasonal monitoring schedule ahead of and during construction, monitoring locations, and monitoring frequency.

9.9 Predicted Effects

Pollution Risk

9.9.2 During the construction phase, there is the potential for a pollution event to affect surface water bodies impacting on their water quality. This would have a negative effect on the receptor.

9.9.3 Pollution may occur from excavated and stockpiled materials during site preparation and excavation of borrow pits. Contamination of surface water runoff from machinery, leakage and spills of chemicals from vehicle use and the construction of hardstanding also have the potential to affect surface water bodies. Potential pollutants include sediment, oil, fuels and cement.

9.9.4 The following sections will discuss each of the identified hydrological features, the likelihood of an event impacting its catchment and as a result, the magnitude of potential effect following mitigation that an event would have on a feature. With the result being as per the definition in Table 9.4: Effect Significance Criteria.

Nant Gwyddon Catchment

9.9.5 The proposed infrastructure works within the Nant Gwyddon catchment would consist of three turbines and their associated hardstandings, approximately 2 km of access track and the substation equipment required for the proposed wind farm. None of which sits within the 50 m buffer of the watercourses branching off the Nant Gwyddon. It can be assumed that a pollution incident that would impact the Nant Gwyddon catchment is unlikely to occur. Based on the likelihood of a pollution event impacting the catchment and distance to the watercourses within the catchment, the significance of the predicted effect would be negligible.

Nant Carn Catchment

9.9.6 The Nant Carn catchment would contain one turbine, approximately 470 m of access track and associated hardstandings located outside the 50 m buffer. As a result, it can be considered that a

pollution event that would impact this catchment is unlikely to occur. Based on the likelihood of a pollution event impacting this catchment, and distance to the watercourses within the catchment, the resulting significance of a pollution event within this catchment is considered to be negligible.

Cwm y Glyn Catchment

9.9.7 The Cwm y Glyn catchment of the site is drained by a series of land drains and watercourses that ultimately discharge to the Afon Llwyd. The Cwm y Glyn catchment would contain six turbines and their associated hardstandings, approximately 4.5 km of access track, three potential borrow pits and the temporary construction compound required for the proposed wind farm. The majority of which sits outside of any 50 m buffer zones, apart from an existing watercourse crossing and associated access track that would need upgrading. Due to the enhanced risk of a pollution event within the buffer zone, it is considered that the significance of a predicted effect would be minor rather than negligible.

Cwm Lickey Pond Catchment

9.9.8 The Cwm Lickey Pond catchment would contain two turbines and associated hardstandings and approximately 1.4 km of access track. All of which sits outside of the required 50 m buffer zone. As a result, it can be considered that a pollution event that would impact this catchment is unlikely to occur. The significance effect of a pollution event within this catchment is considered negligible.

Blaen Bran Reservoir Catchment

9.9.9 Approximately 440 m of access track and one turbine would be located within this catchment. Both the track and turbine are located outside the defined 50 m buffer zones. The likelihood of an event occurring and distance to the watercourses within the catchment means the resulting significance effect of a pollution event within this catchment is considered to be negligible.

Hydrogeology

9.9.10 Due to the low productivity of the underlying bedrock, and the relatively shallow nature of the proposed wind farm construction works, the majority of the subsurface flow of water infiltrating over the proposed wind farm would be within the surface weathered zone of the bedrock and within the superficial deposits. Given the lack of a direct flow path down to the underlying aquifers, it is considered that a pollution event that impacts on the water quality of the deep groundwater is unlikely to occur. Should pollutants reach the groundwater the resulting magnitude of a pollution event would be minor in relation to the overall groundwater body. The potential effect of a pollution event on the deep groundwater, would be of negligible significance.

GWDTE and Peat

9.9.11 For the assessment of pollution risk to Peat and Groundwater Dependent Terrestrial Ecosystems, refer to Rigaire Ltd Technical Memorandum included in Technical Appendix 9.5: Ecohydrology Impact Assessment & Remediation on GWDTEs & Peat. No significant impacts are predicted after mitigation measures have been applied.

Private Water Supplies and Abstraction Locations

9.9.12 There are a number of private water supplies (PWS) and licenced public abstractions in proximity to the site. Due to the hydrogeology of the site and shallow nature of the works, any abstractions supplied by deep boreholes are unlikely to be affected by the proposed wind farm. Based on an assessment of the zone of contributions (ZoC) of each the surface water fed abstraction location, only the abstractions within the Cwm Lickey Pond catchment are likely to be affected by the proposed works. Correspondence with Dwr Cymru has confirmed that the abstraction locations within this catchment are no longer operational. Based on hydrogeology and assessment of PWS / licenced abstraction locations in relation to the proposed works, the resulting significance effect of a pollution effect on PWS and abstraction locations is considered to be minor.

Sedimentation and Erosion

9.9.13 During the construction phase, there is potential for erosion and sedimentation. Erosion and sedimentation may occur during site preparation which includes borrow pit excavation, construction

of tracks and turbines. Sediment may be transported in surface water runoff or be washed into watercourses from stockpiled material leading to a reduction in the capacity or blockage of the channel. The likelihood of this occurring would be reduced through ensuring all stockpiled materials are located at least 50 m away from watercourses and through the application of best practice measures.

Nant Gwyddon, Nant Carn, Blaen Bran, Cwm Lickey Pond Catchments

9.9.14 The likelihood of an event and distance to the watercourses, i.e. greater than 50 m, means the resulting significance of sedimentation or erosion event within the aforementioned catchments is considered to be negligible.

Cwm y Glyn Catchment

9.9.15 The watercourse crossing and track works located within the 50 m watercourse buffer zone give rise to a potential location where sediment may enter the watercourse. The significance of an event in the Cwm y Glyn catchment is therefore considered minor.

GWDTE and Peat

9.9.16 For the assessment of sedimentation and erosion risk to Peat and Groundwater Dependent Terrestrial Ecosystems, refer to Rigaire Ltd Technical Memorandum included in Technical Appendix 9.5: Ecohydrology Impact Assessment & Remediation on GWDTEs & Peat. No significant impacts are predicted after mitigation measures have been applied.

9.10 Cumulative Effects

9.10.1 A cumulative effect is considered to be an additional effect on hydrological resources arising from the proposed wind farm in combination with other proposed developments likely to affect the hydrological environment. A 10 km cumulative effects search radius has been applied as this aligns with NRW guidelines and is the commonly applied radius for cumulative impacts assessments. This distance captures the most likely zone of influence for significant cumulative effects, particularly for project of a similar scale and scope.

9.10.2 At distances greater than 10 km it is considered that schemes are unlikely to contribute to a cumulative hydrological effect due to attenuation and dilution over distance of potentially polluting chemicals. Similarly, to affect the hydrology of a catchment would require the developments considered within the cumulative assessment to be located within the same catchment or aquifer as the proposed wind farm.

9.10.3 Other projects, such as smaller-scale developments, have not been considered within this cumulative effects search area due to their limited size and scope, which do not result in comparable impacts to those of a wind farm. Furthermore, a review has confirmed that no developments, other than those listed in 9.10.4, of a similar size and scope to that of a wind farm are located within 10 km of the Proposed Development. As a result, the 10 km search area is deemed appropriate for assessing cumulative effects in this context.

9.10.4 Consultation with the Local Authorities and the Planning Inspectorate has confirmed there are a number of wind farms currently at pre-application stage, submitted or to be submitted for planning approval within 10 km of the site:

- DNS 3278009 Abertillery Wind Farm (approximately 6.3 km north)
- DNS 3270299 Mynydd Carn-y-Cefn (approximately 6 km north-west)
- DNS 3273368 Mynydd Llanhilleth (approximately 4.5 km north)
- DNS CAD-02114-J9X4S6 Trecelyn Wind Farm (approximately 2 km west)

9.10.5 Off-site cumulative hydrological effects are primarily related to changes in water quality and increase in flood risk. The implementation of the outlined mitigation and management would adequately protect hydrological receptors and therefore would be suitable to ensure the protection of those situated downstream, and would not exacerbate any effects arising from other developments.

9.10.6 Potential disturbance would be if Abertillery Wind Farm, Mynydd Carn-y-Cefn Wind Farm, Mynydd Llanhilleth Wind Farm, and Mynydd Maen Wind Farm were built at the same time. Any cumulative effects would occur at the confluence on the River Usk where the watercourses draining these developments meet. The catchment area would be approximately 124,000 hectares, thus any potential impacts would be significantly diluted. Therefore, there would be no cumulative effects from these developments.

9.10.7 Potential disturbance would be if Trecelyn Wind Farm and Mynydd Maen Wind Farm were built at the same time. Any cumulative effects would occur on the Ebbw River at Abercarn where the watercourses draining these developments meet. The catchment area would be approximately 13,000 hectares, thus any potential impacts would be significantly diluted.

9.10.8 Considering the potential hydrological impacts associated with the development and the size of the catchments leading to the points of confluence, it can be reasonably concluded that the proposed wind farm would result in negligible cumulative effects.

9.10.9 These recent developments have been designed in compliance with current industry-standard guidelines and are managed in alignment with best practices, industry standards, and applicable legislation, planning policies, and guidance overseen by statutory consultees. These measures ensure that potential impacts on soils, geology, and the water environment are effectively mitigated and controlled at their source.
As a result, the cumulative impact is considered negligible, and the potential effect on identified receptors is assessed as negligible and not significant.

9.11 Conclusions and Residual Effects

9.11.1 This assessment has identified areas of activity, particularly during construction and decommissioning operations which have the potential to affect the hydrology/hydrogeology of the site. Particular attention was paid to the risk of affecting peat and surface water hydrology, receiving watercourses and the potential flood risk.

9.11.2 The magnitude and significance of each of the aforementioned potential effects was assessed. Prior to mitigation, there was the potential for effects of minor to negligible significance to occur in regard to both water quality and water quantity.

9.11.3 To reduce the significance of these effects, a number of mitigation and management measures are proposed.

9.11.4 With these measures in place, it is considered that the significance of the residual effect of the proposed wind farm on the hydrology and hydrogeology of the site is negligible to minor. Table 9.6 below outlines the significant effects and residual effects after mitigation.

9.11.5 The assessment concludes that that the construction, operation and decommissioning effect of the proposed wind farm are minor or negligible which is considered not to be significant.

Table 9.6: Summary of Potential Effects, Mitigation and Residual Effects

Predicted Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Sedimentation of surface water bodies from construction activities (Moderate)	Setback distances of wind farm infrastructure and spoil locations. Avoidance of watercourse track crossings. Use of comprehensive SuDS philosophy including:	Through specification in the CEMP and final design. Through identification in the CEMP; Implementation of the SDMP. Through specific action by contractors, e.g. erection of fencing to define site bounds.	Negligible

Predicted Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
	Settling of runoff from track construction. Use of sediment traps at regular intervals along drains. Use of check dams. Minimisation of exposed earth.		
Pollution of all receptors (Ebbw River, River Usk, Afon Llwyd, Blaen Bran Reservoir, Cwm Lickey Pond, GWDTE/ Peat and PWS) from fuel/oil spill	Setback distances of wind farm infrastructure from watercourses. Potentially polluting activities such as refuelling and vehicle maintenance to be contained within the construction compound and parking areas identified to reduce risk of runoff in these areas. Use of oil/fuel/grit interceptors and a roofed refuelling area. Use of drip trays under plant. Regular maintenance of plant.	Through general principles in the CEMP. Through training/induction of appropriate site personnel. Development of a pre-construction maintenance programme.	Negligible
Runoff event on all receptors (Ebbw River, River Usk, Afon Llwyd, Blaen Bran Reservoir, Cwm Lickey Pond, GWDTE/ Peat and PWS) from partially constructed drainage systems	Phased construction of drainage systems to ensure risk is minimised at the end of each working day. Appropriate use of sustainable drainage features such as settlement ponds/swales/check dams. No drainage water to be directly discharged into natural watercourses. Minimisation of partially constructed drainage systems at times of high risk (i.e. wet weather).	Through specification in the CEMP and final design. Through specification in the CEMP and final design. CEMP to detail forward planning and use of weather forecasts to highlight high risk periods.	Negligible
Alterations to peat hydrology	Development of a layout that avoids deep peat. Use of a comprehensive SuDS philosophy.	Through appropriate design in the CEMP. Through implementation of stated mitigation measures by contractor.	Minor
Increased flood risk to others	Appropriate use of sustainable drainage	Through implementation of the SDMP.	Negligible

Predicted Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
	features such as settlement ponds/swales/check dams.	Through specific action by contractors.	
Operation			
Reduced water quality as a result of accidental spillages/ loss of chemicals or hydrocarbons.	Operational pollution prevention, water quality monitoring and emergency response plan	Operational pollution prevention, water quality monitoring and emergency response plan	Negligible
Reduced water quality and quantity of the PWS receiving runoff from the site.	Operational pollution prevention, water quality monitoring and emergency response plan. Layout design and appropriate site drainage measures and site drainage design.	Operational pollution prevention, water quality monitoring and emergency response plan	Negligible
Decommissioning			
Sedimentation of surface water bodies from construction activities	Use of comprehensive SuDS philosophy including: Minimisation of exposed earth. Planned staging of the works to retain SuDS during earthworks operations. Use of sediment traps at regular intervals along drains.	Implementation of the SDMP. Through specific action by contractors, e.g. provision of method statements and staging / decommissioning plan.	Negligible
Pollution of all receptors (Ebbw River, River Usk, Afon Llwyd, Blaen Bran Reservoir, Cwm Lickey Pond, GWDTE/ Peat and PWS) from fuel/oil spill	Potentially polluting activities such as refuelling and vehicle maintenance to be contained within the construction compound and parking areas identified to reduce risk of runoff in these areas. Use of oil/fuel/grit interceptors and a roofed refuelling area. Use of drip trays under plant. Regular maintenance of plant.	Through general principles in the CEMP. Through training/induction of appropriate site personnel.	Negligible