8 WATER (HYDROLOGY & HYDROGEOLOGY)

8.1 INTRODUCTION

Keohane Geological & Environmental Consultancy (KGEC) was commissioned by Jennings O'Donovan & Partners Ltd. (JOD) on behalf of Dreenacreenig West Wind Farm Limited (hereafter known as the Developer), to assess the potential impacts of the Proposed Development on the water environment (surface and ground water). It addresses the potential significant direct, indirect and cumulative impacts on water resulting from the proposed wind farm development at Derreenacrinnig West, Drimoleague, County Cork, including its Grid Connection to Ballylickey substation and turbine delivery route (TDR) upgrade works. The existing surface water and groundwater environments are described, potential impacts on these environmental aspects assessed and evaluated, and where appropriate, measures recommended to avoid, reduce or mitigate potential impacts. The residual impacts following mitigation are then summarised. Aquatic ecology of the site was assessed by Doherty Environmental Consultants Ltd and is presented in **Chapter 6**.

A full description of the Proposed Development is provided in **Chapter 2**. In summary the Proposed Development is a wind farm consisting of three turbines, hardstands, access roads, substation, temporary construction compound, on-site cabling, biodiversity enhancement, improvement along the TDR, Grid Connection to the Ballylickey substation, all associated site works and all ancillary infrastructure. This Proposed Development will replace the wind farm permitted by planning permission PL 88.239767 (10/857), which consisted of seven turbines. A large portion of the civil works for the permitted wind farm were completed in 2017 and 2018. The work completed included construction of the access road to permitted turbines T01 to T06, cranage areas for turbines T01 to T06, opening of the rock borrow pit, construction compound and platform for the substation. Also at that time, the ESB commenced work on the Grid Connection to Ballylickey, but this work was suspended. The ESB subsequently applied separately for a Grid Connection in 2021, which included removal of the conductors and poles already erected. That application was refused permission by An Coimisiún Pleanála (planning numbers 21/737 and ACP-315059-22 refer). However, the partially constructed line will be removed by ESB in the near future.

A 40-year operational lifespan is sought for the wind farm. However, part of the substation and the Grid Connection will be handed over to the distribution system operator (DSO) to own and operate. As part of the national grid, permission for this infrastructure is sought in perpetuity.

8.1.1 Scope & Purpose

This chapter of the EIAR provides details of the surface water and groundwater environments in which the development is proposed. It identifies the surface water catchment(s), drainage patterns, surface water users, runoff characteristics, flooding potential, groundwater users and hydrogeology. It provides baseline water quality data based on publicly available information and monitoring carried out as part of this assessment.

The purpose of the assessment is to identify the potential direct impacts of the Proposed Development on the hydrology (surface water quality, uses, runoff characteristics etc.) and hydrogeology (groundwater quality, uses etc.) within the site and potential indirect impact beyond the site boundary; and to assess the potential impacts in the context of other developments (proposed / completed) to determine cumulative effects. Having identified and quantified the potential impacts, to detail measures to avoid, mitigate and / or reduce significant potential negative impacts for the construction of the development, during its operational phase and its decommissioning. To audit the effectiveness of the construction phase mitigation measures, a site-specific surface water quality management plan has been prepared, along with a Construction Environmental Management Plan (CEMP) (refer to **Appendix 2.1**).

8.1.2 Statement of Authority

KGEC were commissioned by JOD on behalf of the Developer to carry out an assessment of effects of the Proposed Development on the water environment.

This chapter was prepared by Dan Keohane of KGEC. KGEC is a Cork-based consultancy specialising in geological, hydrological and environmental sciences. Mr. Keohane has over 25 years' experience in environmental assessment. In the past 20 years, KGEC has prepared planning applications, EIARs and/or geotechnical assessments for over 40 wind farm developments throughout Ireland and UK. He has also been involved in the construction of over 30 wind farms in Ireland.

Mr. Keohane (BSc Hons Geology; MSc Applied Geophysics) received an honors degree in Geology from UCC in 1989, and a master's degree in Applied Geophysics from UCG in 1991. Mr. Keohane has been working on EIA for wind farms for the past twenty years, having worked on over 50 projects in Ireland and the UK. Areas of expertise include geological assessment, peat landslide risk assessment, groundwater assessment, surface water, hydrology and erosion control during construction. He has practical experience in

wind farm construction, performing environmental oversight and monitoring during their construction phase. He has also been involved with the environmental assessment and / or construction of several grid connections in Counties Cork, Kerry, Sligo, Mayo and Donegal. He has also been involved with other types of infrastructural projects, including roads, quarries, waste management facilities and residential/commercial developments.

8.1.3 Policies & Guidelines

There are several local, national and international policies and guidelines relied upon in the preparation of this chapter. These include:

1. Water Framework Directive (WFD) (2000/60/EC).
2. County Cork Development Plan 2022-2028.
3. European Commission (EC), 2017 EIA guidelines[1, 2, 3].
4. Department's EIA guidelines, 2018[4].
5. Environmental Protection Agency (EPA), EIA guidelines, 2022[5].
6. Office of Public Works (OPW), 2009 flood risk assessment (FRA) guidelines[6].
7. Department's FRA guidelines clarification, 2014[7].
8. Institute of Geologists of Ireland, 2013 EIS (EIA) guidelines[8].
9. National Roads Authority (now TII) 2008 guidelines for geology, hydrology and hydrogeology assessments[9].
10. National Roads Authority, 2005 guidelines for crossing watercourses during construction[10].
11. Construction Industry Research and Information Association (CIRIA), 2015 SuDS handbook[11].
12. CIRIA, 2017 SuDS manual[12].
13. CIRIA, 2006 guidance on control of water pollution from linear construction projects[13].
14. CIRIA, 2001 guidance on control of water pollution from construction sites[14].
15. Department's wind farm planning guidelines, 2006[15].
16. Department's draft revised wind farm planning guidelines, 2019[16].
17. Irish Wind Energy Association (IWEA), 2012. Best Practice Guidelines, 2012[17].
18. Scottish Natural Heritage (SNH) guidelines on wind farm decommissioning, *2013*[18].
19. Forest Service Water Quality Guidelines, 2000[19].
20. Eastern Regional Fisheries Board. *Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites*.
21. ESB, 2012. HV Cables – General Construction Methodology.

22. Inland Fisheries Ireland (IFI) guidelines on protection of fisheries during construction works, 2016[20].

Wind Farm Planning Guidelines

The 2006 wind farm planning guidelines set out some general considerations for surface water. These are:

- Site drainage and hydrological effects, such as water supply and quality and watercourse crossings.
- Degradation of habitats through alteration or disturbance, in particular arising from changes to hydrology that may alter the surface or groundwater flows and levels, and drainage patterns critical in peatlands and river headwaters.
- Storage and transfer of material, including use of bounded storage areas for use during construction and operational phases to avoid any pollution of surface or ground waters.
- Avoid the excavation of drains, where possible, unless it is necessary for geotechnical or hydrological reasons.
- If drains are unavoidable, ensure that silt traps are constructed and that there is only diffuse discharge of water.
- Avoid blocking existing drains.
- Important features such as streams should be properly bridged or culverted.
- Culverts should be placed under roads, where appropriate, to preserve existing surface drainage channels.
- Carefully monitor and control any pumping of water from excavated turbine bases to ensure that water is directed into existing water courses, forestry drains or specially constructed drains, all with adequate capacity to deal with the volumes of water encountered.

In addition to the above, the 2019 draft wind farm guidelines require / recommend that:

- Developers and the Local Authority should have regard to the WFD nand support the implementation of the relevant recommendations and measures as outlined in the relevant River Basin Management Plan (RBMP).
- A FRA be carried out in accordance with the 2009 flood risk management guidelines.
- A CEMP be prepared prior to construction and include the mitigation measures detailed in the EIAR. A draft should be submitted with the planning application. In relation to surface water, the following is recommended to be included in the CEMP:

- containment of all construction-related fuel and oil within specially constructed bunds to ensure that fuel spillages are fully contained; such bunds shall be roofed to exclude rainwater.
- a water and sediment management plan, providing for means to ensure that surface water runoff is controlled such that no silt or other pollutants enter local water courses or drains.
- details of a water quality monitoring and sampling plan.

County Development Plan

Chapter 11 of the Cork County Development Plan (CDP) 2022-2028 sets out the objectives for the protection of surface water quality and compliance with the WFD and River Basin Management Planning. Section 11.2 of the CDP reiterates the integrated WFD approach to manage water quality in a river basin catchment basis with the aim of maintaining and improving water quality. The key objectives of the WFD being to:

1. *To prevent the deterioration of water bodies and to protect, enhance and restore them with the aim of achieving at least good status.*
2. *To achieve compliance with the requirements for designated protected areas*.

Section 11.3 details the River Basin Management Planning approach to the achieve the above WFD objectives, with the RBMP (2018 to 2021) setting out the specific initiatives, including enhanced stakeholder involvement, agricultural advisory services, management of water abstractions, blue dot programme, prioritised areas for action, identifying pressures, etc. Consultation for the third cycle of the RBMP[21] to cover the period 2022 to 2027 ended in March 2022.

The Plan identifies 21 priority areas for action in County Cork as listed in Table 11.1 of the CDP. None are in the river catchments draining the site. Monitoring indicates that 78% of the rivers in County Cork have good or high water quality status; 16% have moderate status; and 6% have poor quality. Where waters are currently at less than good status, they must be improved until they reach good status and there must be no deterioration in the existing status of waters. Across the Country, water quality data shows a decrease in the number of waterbodies achieving good status and corresponding increases in the number of moderate and poor ranked waterbodies between 2007 and 2013. A reversal of this trend was seen between 2013 and 2018. There was a notable increase in the percentage of good quality surface waters but a 6% decrease in high status surface waters. The water quality of the rivers draining the site is discussed below in **Section 8.2.2**.

Three sensitive water catchments are identified in the Plan, namely the Blackwater, Cork Harbour and the Bandon River at Dunmanway. None of these have connectivity with the Proposed Development.

Objective WM11-1 of the 2022-2028 CDP in relation to the WFD and the RBMP:

a) *Protect and improve the County's water resources and ensure that development permitted meets the requirements of the RBMP and does not contravene the objectives of the EU Water Framework Directive.*
b) *Promote compliance with the RBMP and associated environmental standards and objectives set out in the European Communities (Environmental Objectives) Surface Water Regulations, 2009 and the European Communities (Environmental Objectives) Groundwater Regulations, 2010, to prevent deterioration; restore good status; reduce chemical pollution, and achieve water related protected areas objectives in rivers, lakes, groundwater, estuaries and coastal waters (as applicable).*
c) *Secure the objectives and facilitate the implementation of the associated Programme of Measures of the RBMP 2018-2021 and any successor plan for ground, surface, estuarine, coastal and transitional waters in the Plan area as part of the implementation of the EU Water Framework Directive.*
d) *Support an integrated and collaborative approach to local catchment management in order to assist in the implementation of the RBMP.*
e) *In acknowledgement of the sustained pressures on ecological status being experienced in Blue Dot catchment waterbodies, additional measures, as deemed necessary to protect and restore these waterbodies to high status may be required for development permitted in such catchments. Measures may include, but are not limited to, a water management plan (including the construction phase), tertiary treatment and appropriate SUDs measures.*
f) *Support the prioritisation of the provision of water services infrastructure in:*
    - *Metropolitan Cork, the Key Towns and Main Towns to complement the overall strategy for economic and population growth while ensuring appropriate protection of the environment.*
    - *All settlements where services are not meeting current needs, are failing to meet the requirements of the Urban Wastewater Treatment Directive, and where these deficiencies are*
        - *interfering with Councils ability to meet the requirements of the Water Framework Directive; or*
        - *having negative impacts on Natura 2000 sites.*

g) *Development may only proceed where appropriate wastewater treatment is available which meets the requirements of environmental legislation, the WFD and the requirements of the Habitats Directive*.

Objective WM11-2 addresses surface water protection:

a) Protect and improve the status and quality of all surface waters throughout the County, including transitional and coastal waters.

b) At least secondary treatment should be provided to all wastewater discharges from any new development, to surface waters.

Drinking water is addressed in Section 11.8 of the 2022-2028 CDP. Objective 11-8, water supply, states:

a) Support the prioritisation of the supply of adequate drinking water for the resident population and invest and expand the water supply in line with future population targets.

b) Ensure that all drinking water in the County complies with the European Union (EU) Drinking Water Directive 98/83/EC and that all surface water and groundwater supplies comply with the requirements of Surface Water Directive 75/440/EC and Groundwater Directive 80/68/EEC.

c) Conserve sources of drinking water and minimise threats to either the quality or quantity of drinking water reserves that might result from different forms of development or development activity and other sources of pollution.

Part of the Derreenacrinnig West site is within the catchment of the Ilen River, which has two public drinking water abstractions; one near Skibbereen and one approximately 1.8 km south of the wind farm site – refer to **Section 8.1.6** and **Section 8.2.3**.

Surface water and sustainable urban development is addressed in Section 11.10 of the 2022-2028 CDP. Objectives is relation to this are:

WM 11-10: Surface Water and SuDS:

a) Require that all new developments incorporate sustainable drainage systems (SuDS). Efforts should be taken to limit the extent of hard surfacing and impermeable paving.

b) Optimise and maximise the application of Sustainable Urban Drainage Systems (SuDS) to mitigate flood risk, enhance biodiversity, protect and enhance visual and recreational amenity; all in the most innovative and creative manner appropriate and in accordance with best practices. Proposals should demonstrate that due consideration

has been given to nature based solutions in the first instance in arriving at the preferred SuDS solution for any development.

c) *Provide adequate storm water infrastructure in order to accommodate the planned levels of growth expected for the County.*

d) *Where surface water from a development is discharging to a waterbody, appropriate pollution control measures (e.g., hydrocarbon interceptors, silt traps) should be implemented*.

WM 11-11: River Channel Protection:

a) *Ensure adequate protection measures along watercourses, keeping them free from development by ensuring development is kept 10m or other appropriate distance from stream and riverbanks in line with best practice for riparian corridors. Development altering the hydromorphology of a watercourse will not normally be permitted, where it may result in the deterioration in the status of a water body through for example, impacts on water quality, quantity or flow rate, riparian habitat or protected species.*

b) *There will be a presumption against the use of culverts and opportunities to actively remove existing culverts and re-naturalise/ daylighting watercourses will be encouraged in development proposals.*

WM 11-12: Surface Water Management:

Manage surface water catchments and the use and development of lands adjoining streams, watercourses and rivers in such a way as to minimise damage to property by instances of flooding and with regard to any conservation objectives of European sites within the relevant catchments and floodplains.

Flooding is addressed in Section 11.11 of the 2022-2028 CDP. Objective WM11-14 addresses the overall approach to flood risk management:

Take the following approach in order to reduce the risk of new development being affected by possible future flooding:

- *Avoid development in areas at risk of flooding; and*
- *Where development in floodplains cannot be avoided, to take a sequential approach to flood risk management based on avoidance, reduction and mitigation of risk.*

In areas where there is a high probability of flooding - 'Zone A' - avoid development other than 'water compatible development' as described in Section 3 of 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' issued in November

2009 by DoEHLG. In areas where there is a moderate probability of flooding - ¬ 'Zone B' - avoid 'highly vulnerable development' described in section 3 of 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' issued in November 2009 by DoEHLG.

Implement the recommendations of the South Western CFRAM study.

The wind farm site is not in an area at risk of flooding, however, the Grid Connection crosses the flood zone of the Mealagh River. A FRA is provided in **Section 8.2.5**.

8.1.4 Sources of Baseline Data

The main sources of baseline data and information relating to the water environments include:

1. Surface water data including catchments, flows, surface water quality etc - EPA www.epa.ie, www.catchments.ie and http://www.wfdireland.ie/maps.html . For the purposes of this assessment, watercourses shown on the EPA web-mapping are defined as streams / rivers and watercourses not shown are referred to as drains (these are generally man-made drains).
2. Historical flood information and flood risk maps - OPW www.opw.ie , www.cframs.ie and www.floodmaps.ie
3. Rainfall data - Met Eireann www.met.ie
4. Designated sites – National Parks & Wildlife Service www.npws.ie .
5. Peatland hydrology – Geomorphology of Upland Peat, Evans and Warburton, 2010.

8.1.5 Methodology

The assessment was carried out with reference to relevant policies, regulations and guidelines, as listed above. As much of the wind farm infrastructure has already been constructed, the input in terms of water-related constraints normally used during site design was not required. That input was made during the 2010 environmental assessment which informed the route and design of the access road, turbine locations, hardstand construction, etc. The assessment methodology was therefore modified to include:

1. Consultation with agencies with an interest in the water environment, including IFI, OPW, Geological Survey of Ireland (GSI), Uisce Éireann (UE), Department of Housing, Local Government and Heritage (DHLGH) and Environmental Health Service (EHS).
2. A literature review was carried out to determine any policies and / or guidelines to which the Proposed Development should have regard.

3. A desk-based assessment of the water quality, flows, drainage pattern and uses in the catchment relevant to the Proposed Development, was undertaken. Any particularly sensitive receptors were identified – water abstractions for drinking water, sensitive aquatic habitats or fauna, etc. The water management proposals in the planning documentation for the permitted wind farm and Grid Connection and nearby developments were reviewed.
4. Field surveys were conducted to identify any significant water features and collect surface water samples for laboratory analyses. Existing culverts were inspected to identify any issues relating to capacity, blockages etc. This included walkover / windscreen survey of the TDR (local road L-8767-0) and the Grid Connection route (GCR).
5. Review of the biodiversity chapter prepared for the project by Doherty Environmental Consultants Ltd to assess the interaction of surface / groundwater with ecology.
6. Findings from the desk-based study and field surveys were used to develop mitigation for the completion of the Proposed Development. It is noted that the layout of the wind farm is essentially fixed, so modification to the site design isn't a factor for the Derreenacrinnig West Wind Farm, as would be typical for most proposed wind farms at this stage of the EIA process. Also, the Grid Connection follows that of the original route, of which much of the overhead portions were constructed previously by the ESB without affecting the water environment.

The site walkovers and collection of data were carried out on several occasions between July 2024 and March 2025. Data collected included:

1. Mapping of surface water drainage.
2. Collection of surface water samples for analysis.
3. Search for local users of surface water for drinking water supply.
4. Search for local users of groundwater for drinking water supply.

The information collected during the desk-based assessment and site walkovers were used to establish the importance, quality and sensitivity of the receiving surface water (**Table 8.1**) / groundwater (**Table 8.2**) environments. This follows the NRA Guidelines (2008).

Table 8.1: Estimation of Importance of Hydrology Attributes

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale.	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery. Locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding. Locally important amenity site for wide range of leisure activities.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes. Quality Class C (Biotic Index Q3, Q2-3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes. Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 8.2: Estimation of Importance of Hydrogeology Attributes

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source

Importance	Criteria	Typical Examples
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

8.1.6 Consultation

As part of the EIA process, consultation was carried out with organisations and individuals regarding the Proposed Development, namely IFI, OPW, GSI, UE, DHLGH and EHS, all of which provided responses. The information package sent, and the consultation responses received, are provided in **Appendix 1.3 – Scoping Opinion** of this EIAR. The relevant responses are summarised here and incorporated, where appropriate, into the avoidance, mitigation and monitoring proposals for the Proposed Development.

Inland Fisheries Ireland (IFI)

IFI responded in November 2023 with the following advice:

1. There should be no drainage or other physical interference with the bed or bank of any watercourse without prior consultation with IFI.
2. Suspended solids and or hydrocarbon contaminated site run-off waters must be controlled adequately so that no pollution of surface waters can occur. More specifically IFI feels the following issues should be addressed.
    - Identifying and zoning the project for environmental impact should a peat slip occur.
    - Setting out contingency plan should a peat movement occur.
    - Setting out a plan for the control of silt in such a scenario, including measures to be put in place at the initial stages of construction.
3. In the event of any watercourse crossings being bridged or culverted the following general criteria should apply,
    - The free passage of fish must not be obstructed.
    - The original slope of the riverbed should be maintained with no sudden drops on the downstream side. Design details on any proposed crossing should be incorporated at planning stage.

- Bridges are preferable to culverts.
- All instream works should be carried out only in the July-September period.

4. IFI requested that the scoping study should include an electrofishing survey of any watercourse on which it is proposed to construct a crossing [this is within the scope of the aquatic ecology assessment].
5. IFI also requested that the applicant revert when further information and design detail is available.

Office of Public Works (OPW)

The OPW responded in February 2024. It noted that the civil works (access roads and drainage works) have been substantially complete. With minimal further ground works proposed as part of the new planning application, the OPW had no further comments or observations with respect to the scope of the EIA. It reiterated its comments from the previous consultation as follows:

1. Any new culverts or bridges (or modifications to any existing culverts or bridges) will require Section 50 consent from the OPW.
2. A FRA should be carried out in accordance with the guidelines.
3. The assessment should have regard to the cross-cutting nature of hydrology / flooding with other aspects of the environment (e.g., landscape, material assets, human beings etc.).

   The OPW reiterated the above comments in response to the further consultation invitation (dated 05 December 2024). It also commented on the proposed Grid Connection as follows:

4. Cabling buried in the road as they cross bridges, with no interference with the bridge openings, or buried beneath the bed of the watercourse, do not require a Section 50 consent.
5. Cabling or ducting passing through the opening of any bridge, thereby modifying the bridge, or the construction of new supports to carry the ducting across a river, would require a Section 50 consent.

Geological Survey of Ireland (GSI)

The GSI advised of its programmes focused on the various geological aspects, such as groundwater, aquifers, groundwater protection schemes, groundwater source protecting mapping, flood monitoring, surface water – Tellus geochemistry, etc. It recommended use of its on-line data and information services. It noted the classification of the aquifers underlying the project site – i.e., '*Locally Important Aquifer – Bedrock which is Moderately*

Productive only in Local Zones' and a 'Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones'.

Uisce Éireann (UE)

UE initially indicated that there are two public drinking water supply surface water abstractions downstream of the wind farm site, namely:

1. The Drimoleague abstraction and water treatment plant located approximately 1.8 km downstream of the wind farm.
2. Ilen River abstraction point at Ballyhilty, located approximately 12.8 km downstream of the wind farm.

UE requested that careful consideration be given to potential impact of the Proposed Development on the surface water quality at these abstraction points. Provision for appropriate surface water monitoring and mitigation measures should be put in place. UE also provided a generalised EIA scoping response. In subsequent clarifications with UE, it was advised that the recently completed upgrade works in Skibbereen and surrounding areas resulted in the closure of the Drimoleague abstraction. Water distributed from the UE facility near Castledonovan Bridge is sourced from Ballyhilty.

Department of Housing, Local Government & Heritage (DHLGH)

The DHLGH make general recommendations in relation to environmental impact assessment (EIA) such as including an assessment of all aspects of the Proposed Development, any cumulative impacts with other projects and prioritising mitigation by avoidance. Most of its recommendations addressed the built and natural heritage, which are addressed in **Chapter 14** (Archaeology & Cultural Heritage) and **Chapter 6** (Biodiversity). Specific recommendations in relation to the water environment include:

1. Consideration should be given to potential changes in surface water flow paths which could lead to peat or soil instability – i.e., the interaction between these two aspects of the environment.
2. Consideration should be given to potential changes in surface water affecting blanket bog fauna.
3. A detailed site drainage map should be provided showing all existing watercourses, drainage ditches, settlement ponds, etc.
4. The importance of protecting ground and surface water quality in connection with wetlands was emphasised. Construction work should not be allowed to impact on water quality and measures to prevent siltation and / or fuel affecting water quality and aquatic species should be detailed.

5. A 10m buffer should be provided on both banks of watercourses for the protection of otter habitat.
6. Floodplains should be identified and left undeveloped. A FRA should be carried out, if applicable.

Environmental Health Services (EHS)

The HSE advised of the guidance documents, webinars and high court judgements to be considered in the preparation of the EIAR. Matters specific to water include:

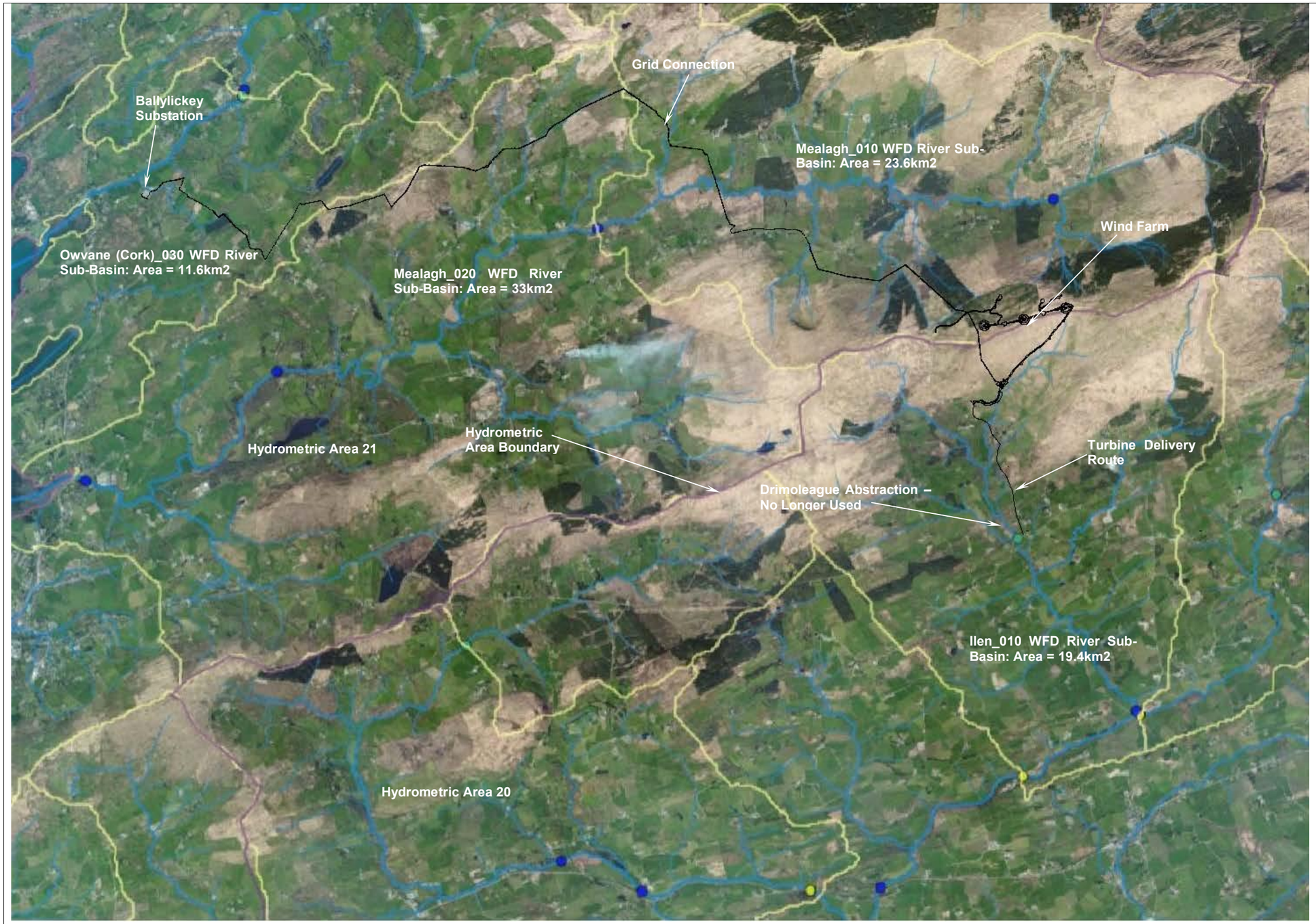
1. The EIAR should identify public, group and private drinking water sources, including surface water and groundwater, in the vicinity of the project site.
2. An assessment of any potential significant impacts on drinking water sources should be undertaken and mitigation measures detailed to protect these resources.
3. Any impacts on surface water as a result of the construction of the underground cables should be identified and addressed in the EIAR.
4. An assessment of any likely significant cumulative impacts with all existing or proposed wind farm developments in the vicinity should be included.

8.2 HYDROLOGY IN THE RECEIVING ENVIRONMENT

The site straddles two WFD catchments / hydrometric areas; No. 20 (Bandon-Ilen) and No. 21 (Dunmanus-Bantry-Kenmare). Hydrometric area No. 20 includes the surface catchment drained by the rivers Bandon and Ilen and all streams entering tidal water between Templebreedy Battery and Mizen Head, County Cork. Hydrometric area No. 21 includes the surface catchment drained by all streams entering tidal water in Dunmanus, Bantry and Kenmare Bays between Mizen Head and Glanearagh Head, County Kerry. Hydrometric areas and WFD river sub-basins are shown on **Figure 8.1** (source https://gis.epa.ie/EPAMaps/).

The southern part of the wind farm infrastructure, southern section of the Grid Connection and TDR upgrade works are located in the Ilen_010 WFD river sub-basin and the Ilen_SC_010 WFD sub-catchment; both located in the northwestern part of hydrometric area No. 20. This sub-basin is drained by the Derreenacrinnig East Stream, which joins the Ilen River approximately 780 m to the south of the wind farm entrance. The Ilen River flows generally in a southerly direction to Skibbereen, where it turns west / southwest discharging to Roaringwater Bay. Roaringwater Bay is a Special Area of Conservation (SAC) and proposed Natural Heritage Area (pNHA) - Roaringwater Bay and Islands SAC / pNHA (site code 00101). WFD River sub-catchments are also shown on **Figure 8.2**.

The northern most parts of the wind farm and most of the Grid Connection are located in the Mealgh_SC_010 WFD sub-catchment, with the western end of the Grid Connection in the Coomhoola_SC_010 WFD sub-catchment. From south to northwest, the Grid Connection passes through the Mealagh_010, Mealagh_020 and Owvane (Cork)_030 WFD river sub-basins. These river catchments are in the southeastern part of hydrometric area No. 21. The northern part of the wind farm site drains to two unnamed first order streams, which flow to the north to the Mealagh River. The Mealagh River flows generally in a south-westerly direction, discharging to Bantry Bay at Donemark. The Ballylicky Stream flows past the Ballylickey substation and discharges to the Owvane River. The Owvane River also discharges to Bantry Bay. Bantry Bay hosts several designated sites, the closest being Cusroe, Whiddy Island pNHA and Glengarriff Harbour and Woodland SAC & pNHA.



Legend

Water Quality Indices – Q-Values

- Q5, Q4-5; High Status/Unpolluted
- Q4; Good Status/Unpolluted
- Q3-4; Moderate Status/Slightly Polluted
- Q3, Q2-3; Poor Status/Moderately Polluted
- Q2, Q1-2, Q1; Bad Status/Seriously Polluted

- WFD River Sub-basin Boundary
- Hydrometric Area Boundary

Client:
Dreenacreenig West Wind Farm Limited

Project:
Derreenacrinnig Wind Farm

Title:
Hydrometric Areas & WFD River Sub-Basins

Keohane Geological & Environmental Consultancy

Ivy House
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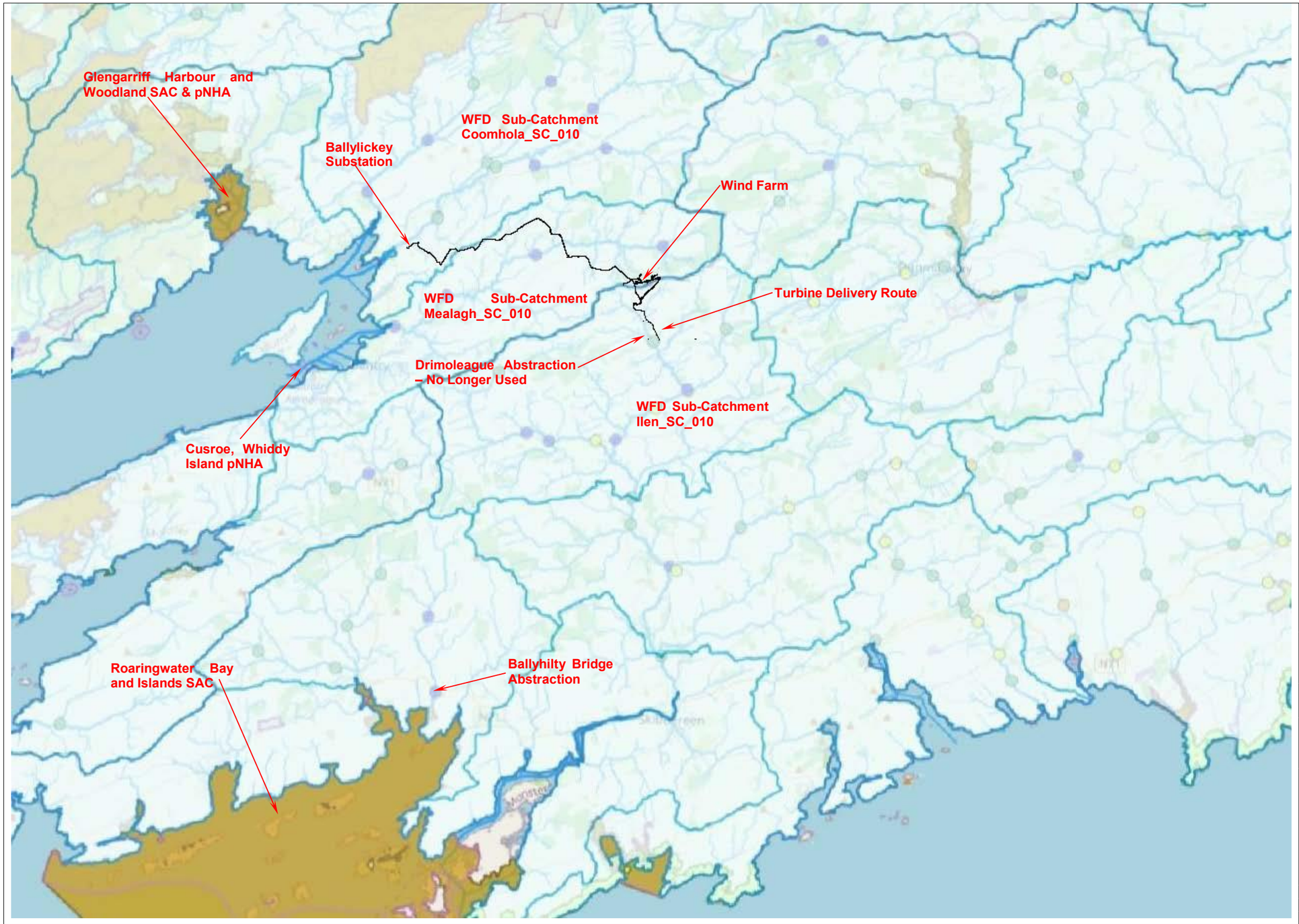
Scale - NTS	Drawn By – DK
Date – 05/062025	Checked - DK
Revision - EIAR	Figure 8.1

Figure 8.1: Hydrometric Areas & WFD River Sub-basins



Legend

Water Quality Indices – Q-Values

- Q5, Q4-5; High Status/Unpolluted
- Q4; Good Status/Unpolluted
- Q3-4; Moderate Status/Slightly Polluted
- Q3, Q2-3; Poor Status/Moderately Polluted
- Q2, Q1-2, Q1; Bad Status/Seriously Polluted

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Natural Heritage Area (NHA)
- WFD Sub-Catchment

Client: Dreenacreenig West Wind Farm Limited

Project: Derreenacrinnig Wind Farm

Title: WFD River Sub-catchments & Designated Site

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Figure 8.2: WFD River Sub-catchments & Designated Sites

Drainage from the wind farm site is largely controlled by the man-made roadside drainage and forestry drainage. The wind farm access road ascends the mountain in an easterly direction cutting obliquely across the slope. Roadside drainage has been installed on the upslope side of the road to intercept small drains and sheet flow. It is periodically culverted under the road before discharging to the Derreenacrinnig East Stream. At the eastern-most end of the site, the road alignment turns back to the west. Initially, this section of road is in the Ilen River catchment, but crosses into the Mealagh River catchment after approximately 400 m. For the remainder of its length, it runs along the northern side of the ridgeline. The local drainage from the wind farm is shown on **Figure 8.3**.

Local road L-8767-0 on which TDR upgrade works are required crosses several drains and streams, including the Derreenacrinnig East Stream. Existing crossings include stone culverts, concrete pipe culverts and a mass concrete clear-span bridge. Local drainage along the TDR works is shown on **Figure 8.4**.

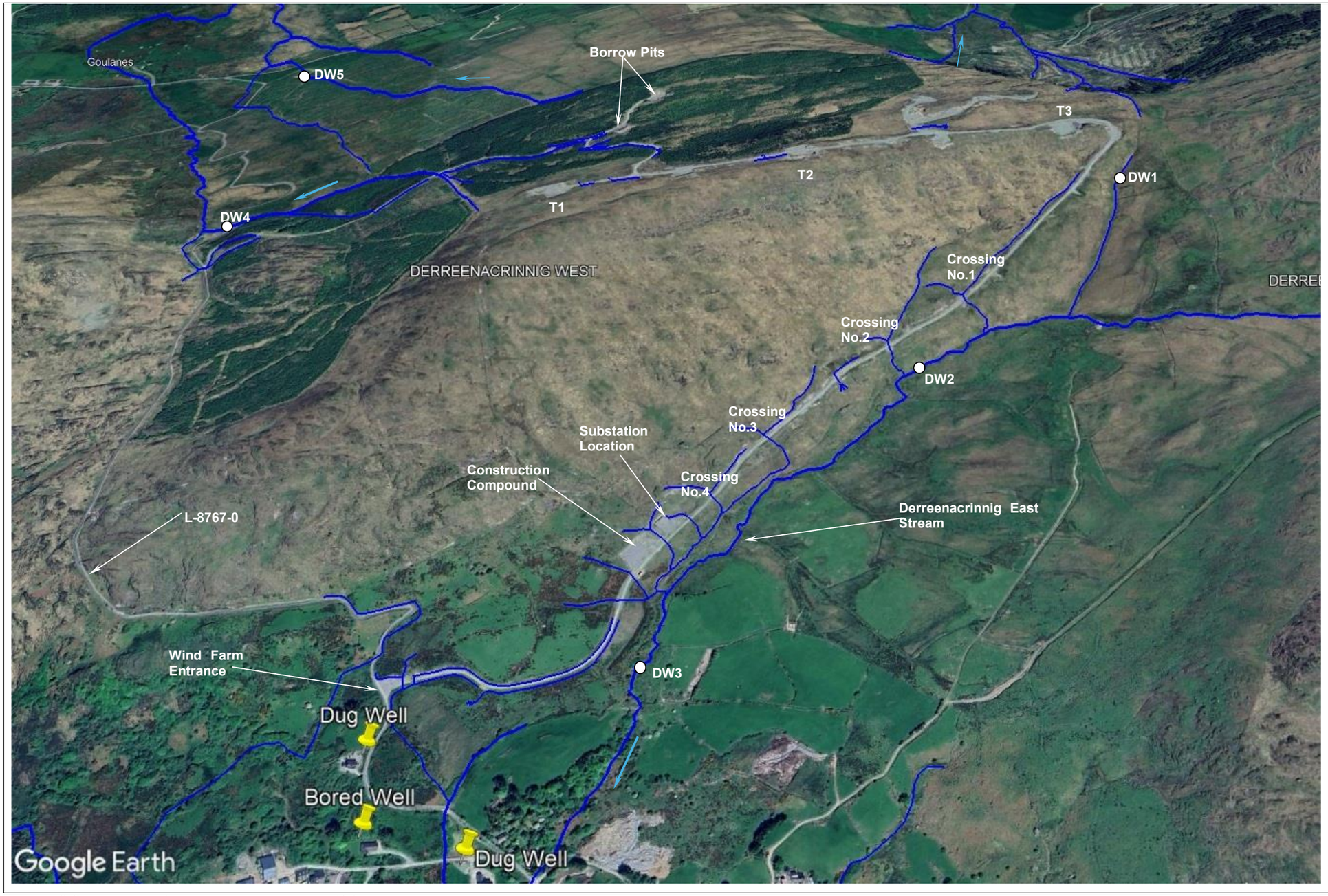
The GCR crosses multiple drains, streams and rivers, including the Mealagh River. Much of the GCR is overhead line (OHL) mounted on single wooden poles, so can be constructed with minimal interaction with the water environment. There are six underground cabling sections proposed along the route (totalling approximately 3,180 m), some of which cross watercourses.

8.2.1 Runoff Estimates

The nearest synoptic weather station to the site is Cork Airport (W665662), approximately 56 km to the northeast of the site at an elevation of 154 mOD. The mean monthly rainfall for Cork Airport synoptic station is summarised in **Table 8.3**. The long-term average rainfall for Cork Airport is 1,239 mm/annum for 1991 to 2020. An extreme rainfall event of 73.2 mm/day was recorded during that 30-year period. The 30-year (1991 to 2020) rainfall 1 km x 1 km grid data available from Met Eireann indicates a rainfall of 1,978 mm/year for the wind farm site.

Table 8.3: Monthly and Annual Average Rainfalls (mm)

Cork Airport													
Period	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
1961 - 1990	148	116	97	70	84	68	65	90	97	126	109	137	**1,207**
1981 - 2010	131.4	97.8	97.6	76.5	82.3	80.9	78.8	96.8	94.6	138.2	120	133.1	**1,228**
1991- 2020	131.3	97.2	91.5	86.5	80.8	83.3	87.2	94.6	92	131.2	127	136.6	**1,239**
Greatest Daily Total – Cork Airport													
1991 - 2020	39.3	39	55.2	37.7	34.9	51.3	73.2	59	58.9	52.1	47.9	61.4	**73.2**
1km x 1km Grid – Derreenacrinnig West													
1991 - 2020	225	174	142	126	111	124	136	144	153	206	211	227	**1,978**



Legend

- Surface Water Sampling Location (DW1 to DW6)
- Watercourse
- Flow Direction

Client: Dreenacreenig West Wind Farm Limited

Project: Derreenacrinnig Wind Farm

Title: Local Drainage – Wind Farm Site

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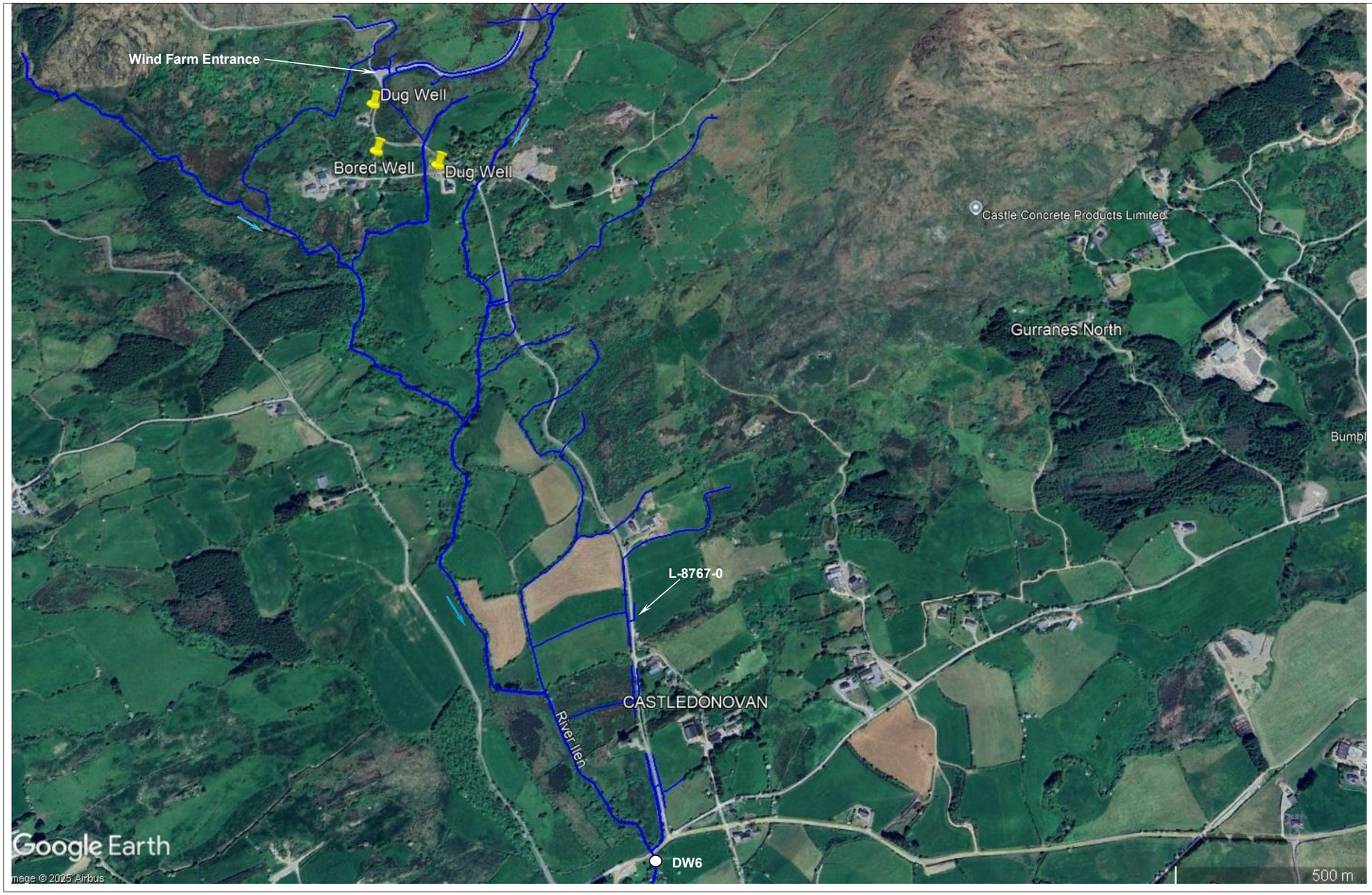
Revision - EIAR	Figure 8.3

Figure 8.3: Local Drainage – Wind Farm Site



Legend

- Surface Water Sampling Location (DW1 to DW6)
- Watercourse
- Flow Direction

Client: Dreenacreenig West Wind Farm Limited

Project: Derreenacrinnig Wind Farm

Title: Local Drainage – Turbine Delivery Route

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Figure 8.4: Local Drainage – Turbine Delivery Route

The catchment characteristics are quantified as soil type 5 (low winter rain acceptance potential). The soils are poorly drained and on moderate to steep slopes. Based on the mean annual gridded rainfall data for 1 km x 1 km grid 111,000/51000 (i.e., 1,978 mm), Q_{BAR} for the site is estimated at 21.1 l/sec/ha.

The EPA Hydrotool gives the long-term flows in the upper-most sub-catchment of the Ilen River, including the Derreenacrinnig East Stream – see **Plate 8.1** for catchment area. The flows are given on **Table 8.4**. The contributing area of the wind farm is approximately 63 ha and the flows from this area are also provided in **Table 8.4** on a pro-rata basis. The long average rainfall for the catchment is given in the Hydrotool as 1,791 mm and the dry weather flow is given at 0.015 m^3/sec (i.e., 95%tile flow). The dry weather flow in the Derreenacrinnig East Stream, where it joins the main channel of the Ilen River (and drains the southern part of the wind farm site) is estimated at approximately 0.00567 m^3/sec.

The EPA Hydrotool also gives the long-term flows in the upper-most sub-catchment of the Mealagh River, including the unnamed streams draining the northern part of the wind farm – see **Plate 8.2** for catchment area. The flows are given on **Table 8.4**. The contributing area of the wind farm is approximately 40 ha and the flows from this area are also provided in **Table 8.4** on a pro-rata basis. The long average rainfall for the catchment is given in the Hydrotool as 1,794 mm and the dry weather flow is given at 0.035 m^3/sec (i.e., 95%tile flow).

Table 8.4: Stream Flow Estimates

Flow Percentile	Ilen River Q (m^3/sec)	Contributing Flow from Wind Farm – Q (m^3/sec)	Mealagh River Q (m^3/sec)	Contributing Flow from Wind Farm – Q (m^3/sec)	Total Flow from Wind Farm Q (m^3/sec)
Q1	1.348	0.1606	3.411	0.1113	0.2719
Q5	0.799	0.0952	2.127	0.0694	0.1646
Q10	0.609	0.0725	1.648	0.0538	0.1263
Q20	0.37	0.0441	0.985	0.0321	0.0762
Q30	0.259	0.0309	0.677	0.0221	0.0529
Q40	0.179	0.0213	0.455	0.0148	0.0362
Q50	0.128	0.0152	0.315	0.0103	0.0255
Q60	0.092	0.0110	0.222	0.0072	0.0182
Q70	0.066	0.0079	0.158	0.0052	0.0130
Q80	0.044	0.0052	0.105	0.0034	0.0087
Q90	0.025	0.0030	0.06	0.0020	0.0049
Q95	0.015	0.0018	0.035	0.0011	0.0029
Q99	0.006	0.0007	0.013	0.0004	0.0011

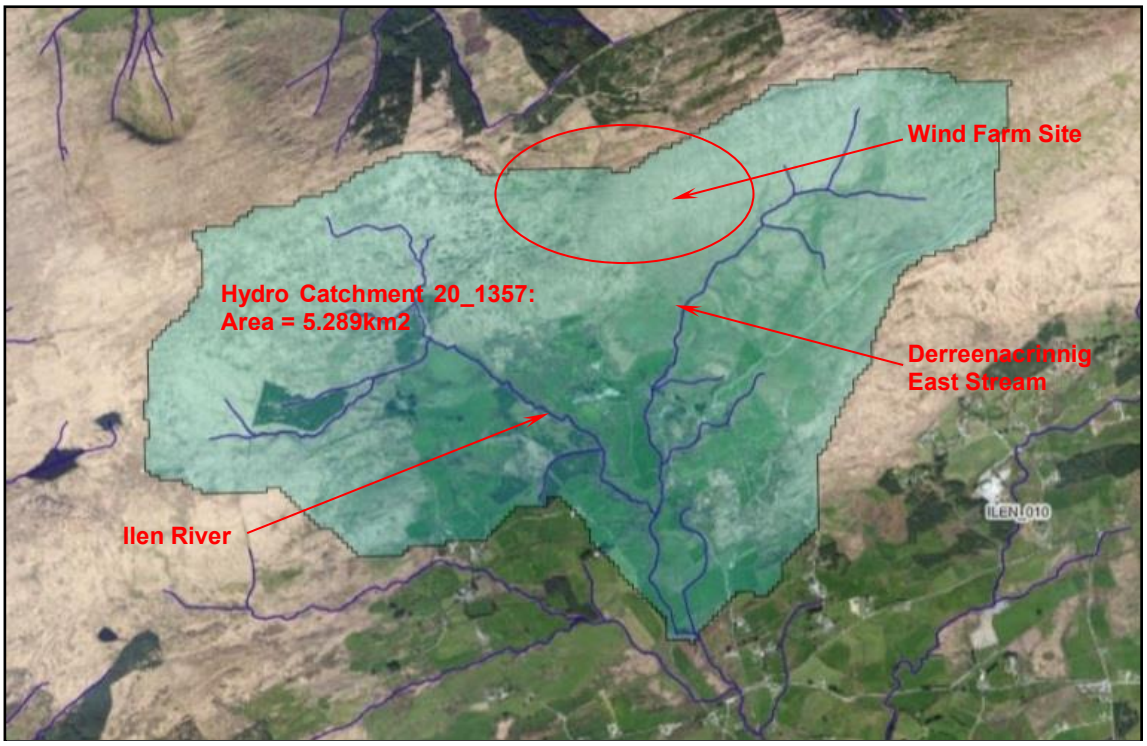


Plate 8.1: EPA Hydrotool Catchment – Upper Ilen River (20_1357)

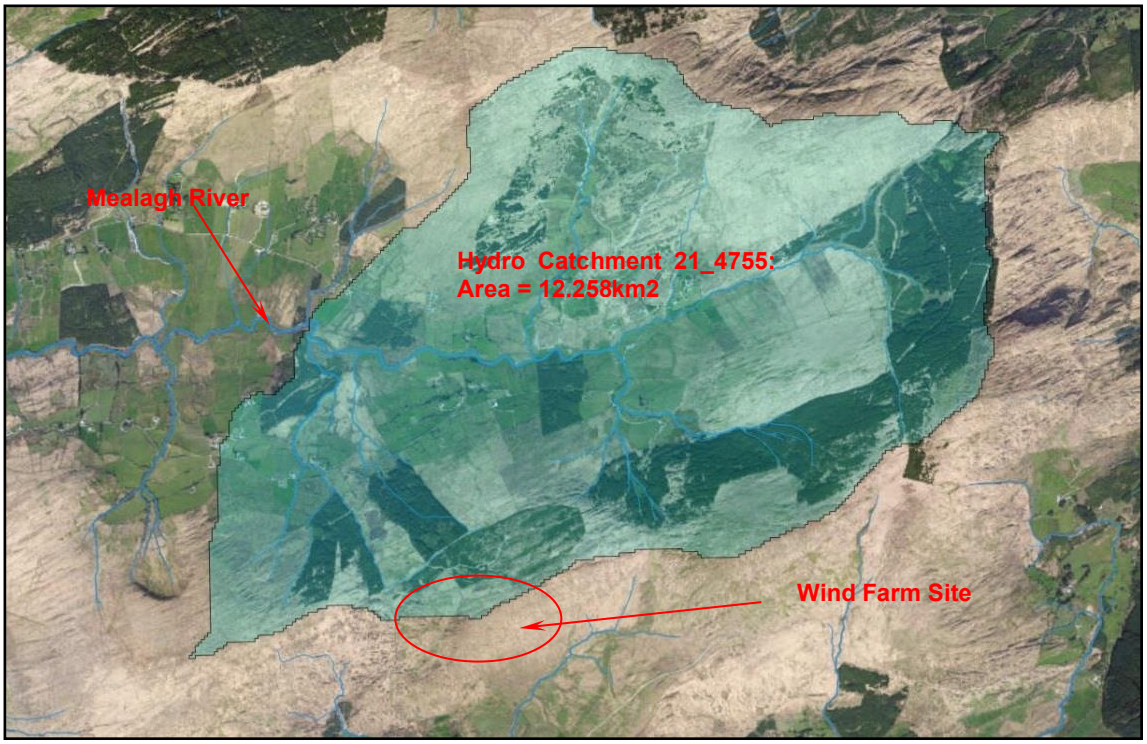


Plate 8.2: EPA Hydrotool Catchment – Upper Mealagh River (21_4755)

8.2.2 Surface Water Quality

The EPA monitors water quality in the rivers and streams across the country – refer to https://gis.epa.ie/EPAMaps/ for most recent data. There are several monitoring points downstream of the project site in both the Ilen and Mealagh rivers. The most recent water

quality (Q-value) data in the rivers is provided in **Table 8.5**. The EPA monitoring stations are shown on **Figure 8.1** [for the Ilen River, the stations downstream to Ilen Bridge].

Table 8.5: EPA Water Quality Data

River	Monitoring Location	Q-value
Ilen	Bridge near Castle Donovan	Q4 (2024 result)
	Just upstream of Clodagh River Confluence	Q4-5 (1989 result)
	Moyny Bridge	Q3-4 (2024 result)
	Ilen Bridge	Q4-5 (1989 result)
	Bridge northwest of Bishops Village	Q4 (2024 result)
	Bridge near Madore	Q4 (1989 result)
	Just upstream of Salvnose River confluence	Q4-5 (2003 result)
	Bridge 3 km north of Skibbereen	Q4 (2024 result)
Mealagh	Bridge north of Keimeen	Q4-5 (2020 result)
	Bridge south of Ardsmore	Q4-5 (2020 result)
	Bridge north of Drumbrow House	Q4-5 (2003 result)
	Dunnamark (Donamark) Bridge	Q4-5 (2024 result)
Owvane	Upstream Pierson's Bridge	Q4-5 (2024 result)
	Downstream Pierson's Bridge	Q4 (2009 result)

The river waterbody WFD status 2016 – 2021 is 'Good' for the Ilen River as far downstream as Moyny Bridge. Between Moyny Bridge and Ballyhilty Bridge, the status is 'High'. Between Ballyhilty Bridge and Skibbereen the status is rated as 'Good'. The Ilen River is assigned 'Not at Risk' as far downstream as Ballyhilty Bridge, below which it is assigned 'Review'. The river waterbody WFD status 2016 – 2021 is 'High' for the Mealagh River and it is assigned 'Not at Risk'. There are no EPA licenced facilities in either catchment near the project site. There are a number of Section 4 discharge licences in the lower reaches of the Mealagh River and in the Ilen River near Skibbereen. There is also an industry near Skibbereen for which an EPA integrated pollution control (IPC) licence application has been lodged.

Five surface water samples (DW1 to DW5) were collected from the streams draining the site. Samples were collected on 21 June 2024 during low flow conditions. The sampling was repeat on 19 November 2024 following a rainfall event to assess water quality during higher flow conditions. Samples were submitted to UCC's Aquatic Services Unit for analysis. Sample locations are shown on **Figure 8.3**. Results are summarised in **Table 8.6**. Photographs of the sampling locations are provided in **Appendix 8.1**; and laboratory certificates are provided in **Appendix 8.2**.

Table 8.6: Surface Water Results – 16 July & 19 November 2024

Parameter	Units	DW1		DW2		DW3		DW4		DW5	
		16/07	19/11	16/07	19/11	16/07	19/11	16/07	19/11	16/07	19/11
Nitrate	mg/l, N	<0.010	0.63	0.029	0.046	0.024	0.125	<0.010	0.063	0.031	0.63
Nitrite	mg/l, N	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	0.001
Total Ammonia	mg/l, N	0.009	0.014	<0.005	0.016	<0.005	0.013	<0.005	0.017	0.011	0.017
Unionised Ammonia	mg/l, N	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ortho-Phosphate	mg/l, P	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
Total Phosphate	mg/l, P	0.004	0.003	0.003	0.005	0.003	0.007	0.006	0.005	0.003	0.005
Biochemical Oxygen Demand	mg/l, O_2	1.1	0.8	0.9	0.8	1.1	0.6	0.9	0.5	0.9	0.5
Total Suspended Solids	mg/l	1.8	<0.2	0.4	0.4	0.2	0.2	0.4	<0.2	0.2	<0.2
Turbidity	NTU	1.65	0.13	0.69	0.32	0.10	0.22	0.64	0.34	0.46	0.18
pH[1]	pH Units	7.44	7.31	7.68	7.44	8.28	7.05	7.45	7.65	7.65	7.73
Temperature[1]	°C	14.9	8.8	17.0	7.9	17.4	8.6	12.5	8.3	11.9	7.9
Conductivity[1]	µS/cm	100	72	112	62	110	74	80	62	49	38

Notes:

1. Indicates field measurement.

The BOD (i.e., <1.3mg/l), and total ammonia (<0.040mg/l) concentrations at all locations indicate high water quality[22]. Turbidity and TSS concentrations are low at all locations for both sampling events.

The EPA Phosphorus Pollution Impact Potential at the site is ranked 5[1] (fields on the western side of the landholding and south of the Derreenacrinnig East Stream); the wind farm site itself is not ranked. The EPA Nitrate Pollution Impact Potential at the site is ranked 7.

8.2.3 Surface Water Usage

The immediate area around the site is not serviced by mains water. The drinking water supply for dwellings and farms is sourced from dug wells, bored wells and springs. The EPA maintain a register of water abstractions greater than 25 m^3/day. Those downstream of the wind farm site include:

1. Public drinking water supply operated by Uisce Éireann. It is located downstream of the site on the Ilen River near Ballyhilty Bridge and abstracts approximately 8,900 m^3/day.
2. Public drinking water supply. It is located downstream of the site on the Ilen River near Castledonovan Bridge (Drimoleague abstraction). It is now inactive but previously abstracted approximately 223 m^3/day.
3. Public drinking water supply operated by Uisce Éireann. It is located at Lough Bofinna near Derryginagh, Bantry and abstracts approximately 1,580 m^3/day. It is in a different catchment to the wind farm and Grid Connection.
4. Public drinking water supply operated by Uisce Éireann. It is located at Drumbow Lough approximately 3 km northeast of Bantry and abstracts approximately 975 m^3/day. It is in a different catchment to the wind farm and Grid Connection.

Abstraction locations (downstream of the project site) are shown on **Figure 8.1** and / or **8.2**. There may be other unregistered abstractions downstream of the site. No private surface water abstraction points were identified in the streams draining the site.

8.2.4 Peatland Hydrology

Peatlands are defined as areas of deep peat soils with an organic layer deeper than 50 cm. Water is the single most important factor to enable peat accumulation and water lodging is a prerequisite environmental parameter for peat formation and preservation; in most cases,

[1] Pollutant Impact Potential for Phosphorus has 7 ranking from PIP-1 to PIP-7. PIP-1 is the highest ranking - i.e., highest potential to cause pollution.

peat consists of over 95% water by weight. Changes in the hydrological regime that sustains the peatland will invariably disturb the normal hydro-ecological functioning of the peatland.

There are several types of peatlands, namely fens, flushes, raised bogs and blanket bogs. Fens are distinguished from bogs in that they are connected to the groundwater system and thus receive water, nutrient, and mineral inputs from below. Fens are minerotrophic (minerals supplied by inflowing water), rheophilous or soligenous (water input other than precipitation – i.e., groundwater) and less acidic than bogs. These conditions control the vegetation present, with sedges and reed species dominant on fens. Fens and flushes can occur on bogs where there is a local input of water from springs or groundwater.

Bogs are hydrologically isolated from groundwater movement and rely on precipitation as the only water and nutrient input source. Bogs are ombrotrophic (receive all their water and nutrients from precipitation), acidic (pH <4) and are oligotrophic (low nutrient input and low amounts of calcium and magnesium). These conditions control the vegetation assemblages present, with Sphagnum dominant on bogs.

For peatland, water movement occurs predominantly in the upper acrotelm layer which is typically 10 to 70cm deep and consists of the actively growing vegetation and dead material not yet decomposed. Water movement (lateral discharge) in the underlying catotelm is negligible – between 0.5 and 1mm/year (Van der Schaaf, 1995[23]).

For blanket peatland such as that at the Derreenacrinnig West site, the drainage is largely unconstrained by topography. In these conditions, it is found that >1,300 mm/year precipitation is needed to sustain the peatland. As noted above, data from Met Eireann indicates that the long-term rainfall for the site is 1,790 mm/annum. With decreasing slope, the required rainfall volumes decrease.

The wetland habitats mapped at the wind farm site are wet heath (HH3) and upland blanket bog (PB2). Most of the wind farm site is dominated by wet heath where peat depth is <0.5 m, with localised areas of flush – refer to **Chapter 6** for habitat maps. In parts of the site where peat is greater than 0.5 m, wet heath grades into small pockets of upland blanket bog. The wetland habitats mapped along the Grid Connection are wet willow woodland (WN6), wet heath (HH3), and wet grassland (GS4).

The main causes of blanket bog degradation include drainage, grazing, burning, afforestation, peat cutting and construction (i.e., roads, wind farms, etc). Drainage, afforestation, and road construction has occurred at the proposed wind farm site.

As the construction of wind farm infrastructure is largely completed, the remaining works will not impinge significantly further on the peatlands. The peatland in which the wind farm has been constructed was generally thin and had been drained for land improvement and forestry. Additional drains were constructed in 2017 / 2018 during the construction of the access road and hardstands. These man-made drains have altered the natural peatland hydrology at the site. The drains have two opposing affects as follows:

1. The drains will transmit rainfall off the hillside more quickly and concentrate flows more than would otherwise be the case.
2. The drains lower the water table in the peatland providing greater storage capacity. [It should be noted that often-repeated description of peat as a "sponge" slowly releasing large amounts of water to a stream is erroneous; a wet sponge cannot hold much additional water]. However, once the storage capacity is reached, the drains on the hillside will control runoff characteristics; the increased storage capacity resulting from the drains only providing a brief reprieve.

The slope of the site will control which of these opposing effects will dominate. For the Derreenacrinnig West wind farm site, slopes are up to 80°, which will result in flashy runoff. There are no significant level areas within the site that would buffer runoff volumes. Rainfall input will therefore have a rapid response of rising flow (discharge) in the drains / streams, followed by an almost equally rapid fall back to a very low base flow level.

8.2.5 Flood Risk Assessment

This FRA was carried out in accordance with the 2009 OPW Flood Risk Management Guidelines as updated and clarified in 2014. FRA is carried out in three stages, with increasing detail in progressive stages. The need for progression to a more detailed stage is dependent on the outcome of each stage until the level of detail of the FRA is appropriate, or it has been demonstrated that flooding is not a relevant issue for the area or site. The three stages are:

1. Flood risk identification.
2. Initial FRA.
3. Detailed FRA.

Stage 1 - Flood Risk Identification

The purpose of this stage is to identify whether there may be any flooding or surface water management issues related to the Proposed Development site that may warrant further investigation. A number of sources of reference information are available as outlined below.

County Development Plan 2022

Volume 6 of the CDP 2022 (mapping portal) provides information on areas which are liable to flooding. Two zones are distinguished – Zone A and Zone B (all other areas are Zone C). These are defined as follows:

- Flood Zone A – High Probability of Flooding from rivers and the sea. Areas where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
- Flood Zone B – Moderate Probability of Flooding from rivers and the sea. Areas where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding).
- Flood Zone C – Low Probability of Flooding from rivers and the sea. Areas where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Plate 8.3 shows an extract from the CDP flood zone mapping. It shows that the wind farm and TDR upgrade works are not within flood zones A or B. The GCR passes over the flood zone of the Mealagh River, but using OHL, which will have no significant effect on flooding.

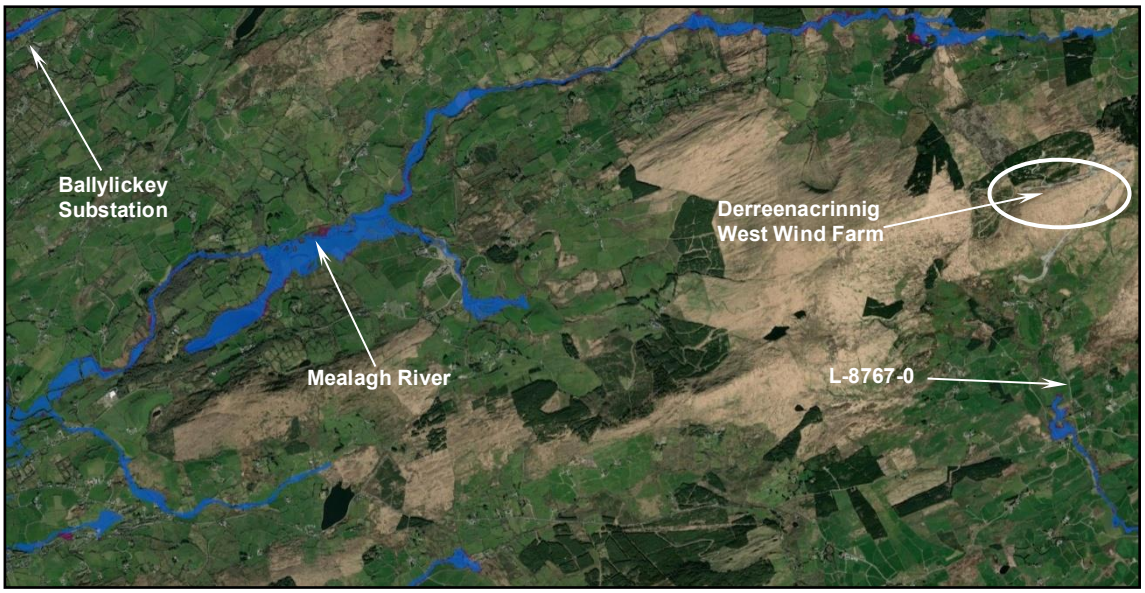


Plate 8.3: County Development Plan – Flood Zone Mapping

National Flood Hazard Mapping

These digital maps (https://www.floodinfo.ie/map/floodmaps/), managed by the OPW, identify flood areas with Annual Exceedance Probability (AEP) of 0.1% (low – 1:1,000), 1% (moderate – 1:100) and 10% (high 1:10). The flood mapping provided for some parts of the Country includes:

- Catchment-based FRA & Management (CFRAM) flood extents mapping - present day and future scenarios. The objective of the CFRAM programme was to identify and map the existing and potential future flood hazard and flood risk in the areas at potentially significant risk from flooding – i.e., Areas for Further Assessment (AFAs). For these AFAs, identify flood management measures and prepare Flood Risk Management Plans. These associated maps are 'predictive' flood maps showing areas predicted to be inundated during a theoretical or 'design' flood event with an estimated probability of occurrence. CFRAM identified 300 AFAs; the site is not included in this mapping. The closest CFRAM mapping is located in Lahadane, Bantry on the lower reaches of the Mealagh River (refer to **Plate 8.4**) and at Skibbereen on the lower reaches of the Ilen River.

Plate 8.4: CFRAM Flood Zone Mapping

- National Indicative Fluvial Mapping (NIFM) river flood extents mapping - present day and future scenarios. These maps show the modelled extent of land that might be flooded by rivers (fluvial flooding) during a theoretical or 'design' flood event with an estimated probability of occurrence, rather than information for actual floods that have occurred in the past. Data has been produced for catchments greater than 5 km^2 in areas for which flood maps were not produced under the National CFRAM Programme. The NIFM flood mapping extends from Mealagh Bridge downstream to Lahadane (where CFRAM mapping is available). The Medium and Low Probability flood extents is shown on **Plate 8.5**.

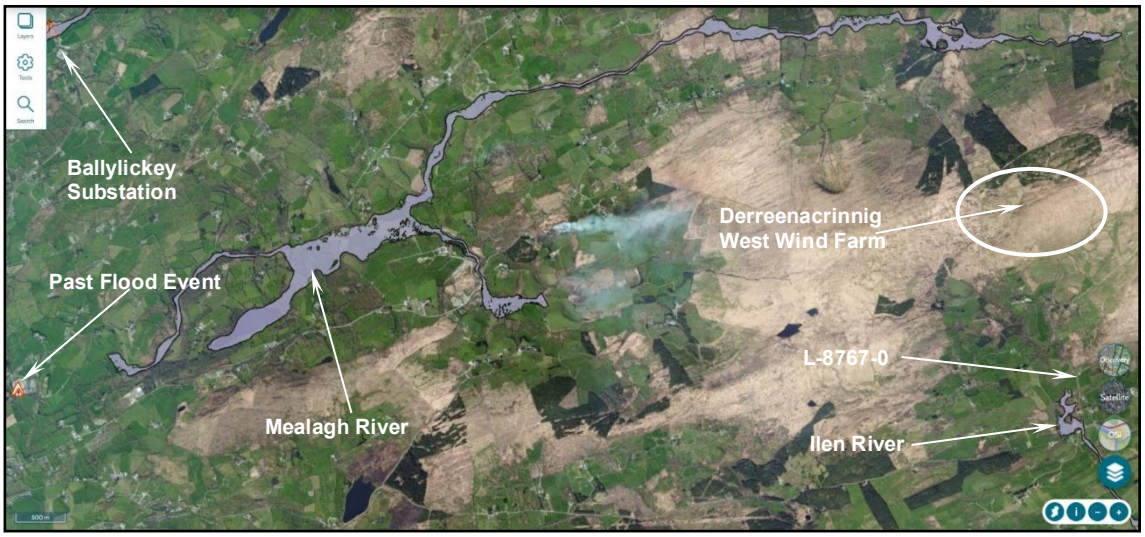


Plate 8.5: NIFM Flood Zone Mapping

- Geological Survey of Ireland (GSI) groundwater flooding probability maps. These maps pertain to areas of the Country underlain by limestone bedrock. The site is underlain by sandstone. They do not show groundwater flooding at the project site.

- Past Flood Events. A number of past flood events datasets are included as follows:
  - Previous fluvial and pluvial flooding incidents: These show locations where single or reoccurring flood events take place. Typically flood reports (Area Engineer's report) for each incident are available. The past surface water flooding incidents are shown on Plates 8-2 and 8-3. None are shown to occur at the site. The nearest flood incidents occur in Lahadane on the Mealagh River (refer to Plates 8.4 and 8.3). On the Ilen River, flooding is shown to occur at Madore and Marsh (Skibbereen) downstream of the wind farm.
  - Past flood event extents: This shows the areal extent of the flooding. None are shown to occur at the site.
  - Geological Survey Ireland (GSI) Winter 2015/2016 Surface Water Flooding: this doesn't show flooding at the site. It shows flooding to have occurred at lakes in West Cork.
  - Geological Survey Ireland (GSI) Maximum Historic Groundwater Flooding: this doesn't show flooding at the site.

OSI (Tailte Eireann) Mapping

Ordnance Survey of Ireland mapping shows areas 'liable to flooding'. The historic 6-inch mapping was inspected. The site and immediate surrounds are not identified as being at risk of flooding.

Local Knowledge

According to local sources, there has never been a flooding issue at the wind farm site. The construction of the wind farm infrastructure in 2017 / 2018 has not caused flooding issues at the site.

Site Walkover

As part of the hydrology impact assessment, a site walkover was carried out to map the drainage at the site. During this site walkover it was noted that the site itself was not at any risk of flooding. The conclusion of the site walkover is that the wind farm infrastructure can be completed with negligible change in current runoff characteristics. Similarly, the TDR upgrade works can be carried out with negligible increases in runoff characterises from the local road. The Grid Connection will be mostly OHL with six sections of underground cabling. The OHL section will cross the Mealagh River and flood zone, but the poles will not change the flood risk. The underground sections will be completed with like-for-like surface finishes, so it is concluded that the Grid Connection can be constructed with little / no changes to runoff characteristics.

Stage 1 Conclusions

The site has never flooded, and based on several sources, it is not identified as being in a flood zone extent. Having confirmed that the project site is not within the potential flood extents and that the completion of the construction works will not change the current hydrology of the project site, the assessment need not progress to Stage 2.

8.2.6 Importance of Surface Water / Hydrology Attributes

Based on the NRA Guidelines, the importance of the site in terms of surface water and hydrology is rated as extremely high. While not extending into the proposed wind farm site, drainage from the southern part of the site flows into Roaringwater Bay cSAC, which is protected by EU legislation. Drainage from the northern part of the site flows into Bantry Bay which hosts a number of SACs, including Sheep's Head SAC and Glengarriff Harbour and Woodland SAC.

As noted in **Chapter 6** (Biodiversity), the Ilen, Mealagh and Owvane are important fisheries rivers and are of high local importance from a biodiversity perspective.

8.2.7 Hydrogeology / Groundwater

As discussed in **Chapter 7** (Land & Soils), the project site is underlain by the several formations of Devonian and Lower Carboniferous age. These consist predominately of mudstones and sandstone formations. These formations form part of the Skibbereen-Clonakilty WFD groundwater body (GWB) (on the southern part of the wind farm site, southern section of the Grid Connection and the TDR upgrade) and the Beara-Sneem WFD GWB on the northern part of the wind farm and the majority of the GCR. The ground waterbody WFD status 2016 – 2021 is Good for both ground waterbodies, as it was for 2013 - 2018. Both are categorised as 'Not at Risk'.

The GSI has classified the formations underlying the Site as Locally Important Aquifers – Bedrock which is Moderately Productive only in Local Zones (LI), and Poor Aquifers - Bedrock which is Generally Unproductive except for Local Zones (PI) – refer to **Figure 8.5**. Locally important (LI) aquifers generally are capable of 'good' well yields of between 100 and 400 m^3/day. Wells in LI aquifers are usually capable of providing sufficient water for domestic, agricultural and small group schemes. Transmissivity values of greater than 50 m^2/day are typical. Borehole productivity class is generally III – IV, where class I is the best and V being the worst. Class III - IV have specific capacities of between 10 and 100 m^3/day/m. Poor aquifers (PI) generally are capable for providing sufficient water for domestic and agricultural purposes only. Transmissivity values are mostly less than 50 m^2/day. Borehole productivity class is mostly IV and V.

There are no groundwater wells at the site. According to the GSI well database, there are no wells on or near the wind farm site or the TDR upgrade. One well is shown near the GCR at Shandrum Beg at coordinates 502619 / 553208. This well is 30.5 m deep with rock at 0.6 m. It is reportedly used only for domestic supply with a yield of 21.8 m^3/day (i.e., a poor yield). The area in the immediate vicinity of the wind farm is not serviced by mains water. A well survey carried out as part of the assessment identified a number of wells in the area servicing houses and farms. These consisted of drilled boreholes and large diameter dug wells. Locations are shown on **Figure 8.3** and **8.4**.

The groundwater vulnerability across most of the wind farm site is rated extreme (X – bedrock outcrop / subcrop or E - bedrock within 3m of ground surface). Similarly, most of the TDR upgrade is rated as extreme (X and E), with parts at the southern section near Castledonovan rated as high (bedrock between 3 and 5 m). The GCR varies between extreme and moderate (bedrock between 5 and 10 m). The moderate vulnerability occurring along the Mealagh River valley. Aquifer vulnerability is shown on **Figure 8.6**.

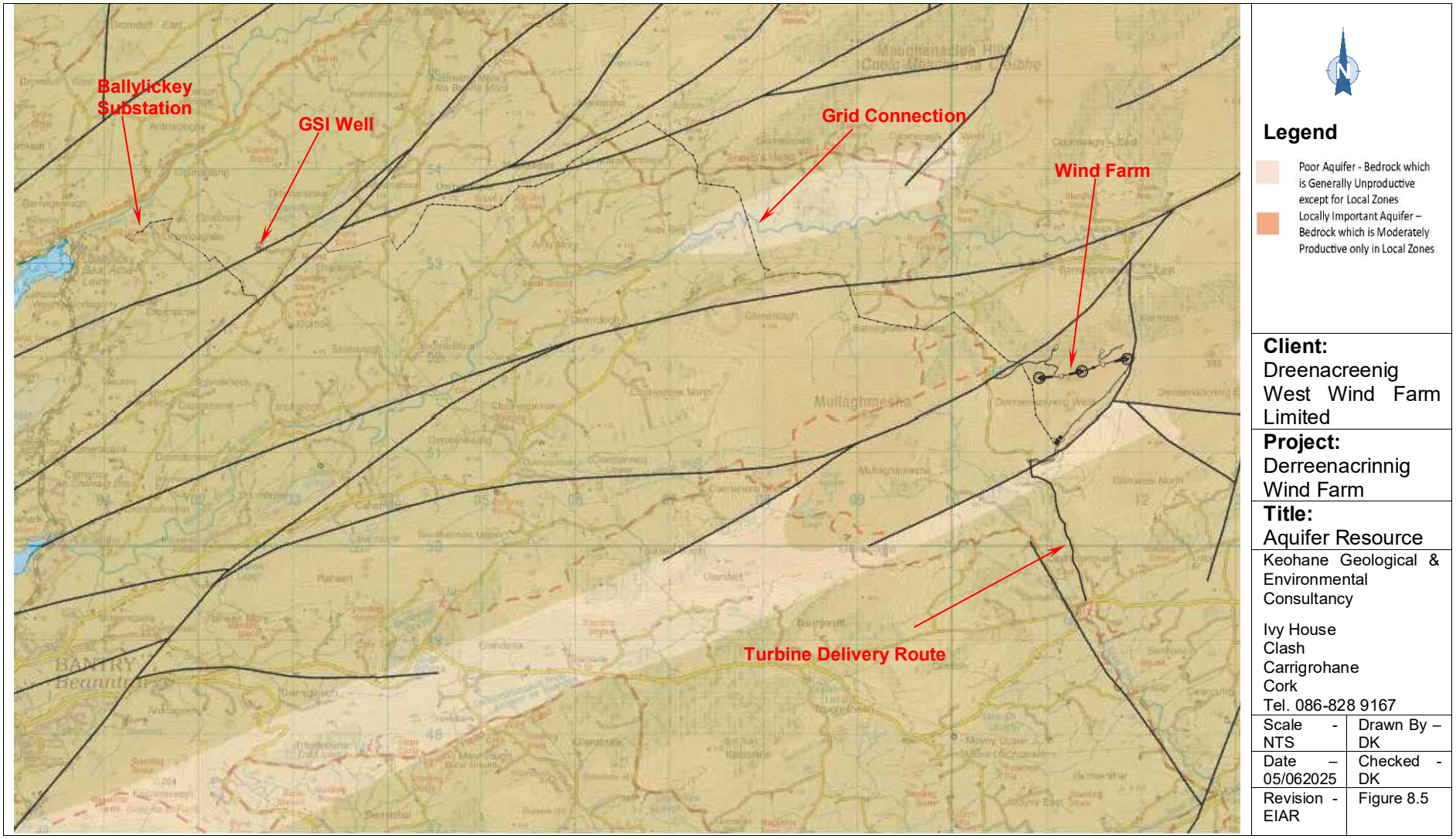


Figure 8.5: Aquifer Resource Map

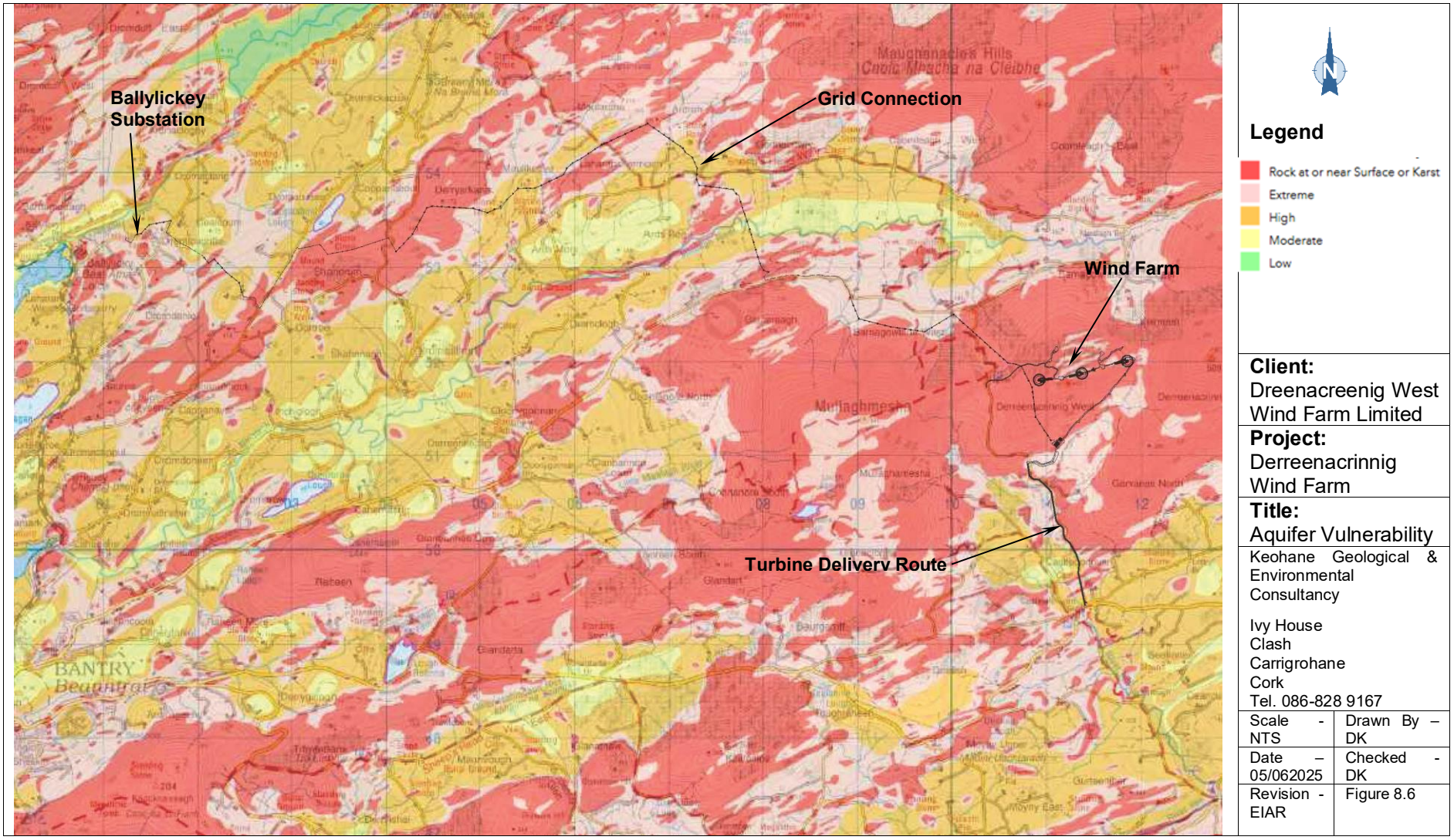


Figure 8.6: Aquifer Vulnerability Map

Groundwater flow direction follows generally the surface topography, providing baseflow to the streams and rivers draining the Site. Groundwater was encountered in the trial pits excavated at the wind farm site in 2016 at depths between 0.1 m and 2 m below ground level. Groundwater was not recorded in the four rotary core boreholes drilled at the wind farm. This may have occurred as the upper unconsolidated material is cased off during the drilling process, sealing off any shallow water (as encountered in the trial pits).

8.2.8 Importance of Groundwater / Hydrogeology Attributes

Based on the NRA Guidelines, the importance of the site in terms of groundwater and hydrogeology is rated as Medium. The bedrock aquifer is classified as locally important – refer to **Table 8.2** in **Section 8.1.5**.

8.3 CHARACTERISTICS OF THE DEVELOPMENT

The characteristics of the Development that could potentially have an impact on surface water quality, hydrology and groundwater include:

1. Restoration of partially completed roads and hardstands associated with permitted turbines T06 and T07: This will involve regrading of current ground profiles to their original profiles, or as close as is practical. Coarser rock would be placed first, followed by finer crushed rock and till. Peat and peaty topsoil will then be spread across the reprofiled surfaces. Runoff from the restored area could carry silt to nearby watercourses until vegetation is established. Peat and peaty topsoil will then be spread across the reprofiled surfaces with heath and acid grasslands.
2. TDR upgrade: Several locations have been identified along the L-8767-0 of the TDR which require upgrade, strengthening or widening, including its junction with the L-4711 and L-8765. Some of these TDR improvement works are adjacent to drains or streams so there is potential for runoff water to carry silt and fines to watercourses. Where road widening coincides with culvert / bridge locations, it will be required to extend the culvert / widen the bridge requiring instream works. Potential impacts are present during the construction phase.
3. Enlarging hardstand areas, turbine assemblage areas and foundation excavations: The proposed turbines are larger than the permitted ones, so the hardstands, assemblage areas and foundation requirements are greater. This work will involve the excavation of peat, tills and rock. The earthworks could release silts to receiving water courses. Foundation excavations are shallow (typically <3m in upland rocky sites) but could potentially extend into the groundwater table. This could require groundwater pumping during foundation construction. Potential impacts are present during the construction

phase, to a lesser extent during the operational phase and during the decommissioning phase depending on the extent of restoration required.

4. Construction of turbine foundations: This will require large volumes of concrete (528 m^3 per turbine typical for blinding layer and foundation, subject to detail design). Concrete has a high pH and if released into the surface water environment, could change its pH and affect aquatic fauna locally. Potential impacts are present only during the construction phase.
5. Construction of the on-site substation.
    a. This work will include excavation for foundations within the handstand area already levelled for its construction. This will expose soil to erosion from rainfall with potential to impact surface water quality. The potential impact is primarily during the construction phase. Once landscaping is re-established the risk to surface water quality is very low.
    b. The construction of the substation building will change the runoff characteristic of the site. The potential impact is primarily during the operational phase.
    c. Concrete will be used in the construction of foundations. Potential impacts are present only during the construction phase.
6. Use of potentially polluting materials.
    a. Plant and machinery on site use diesel. This is either stored on site and / or delivered to site in tanker trucks. There is potential for leaks or spills which could impact surface water and groundwater quality. The risk is present primarily during the construction and decommissioning phases and to a much lesser degree during the operational phase.
    b. Use of concrete in turbine foundations and substation foundations. As noted above, concrete has a high pH and if released into the surface water environment, could change its pH and affect aquatic fauna locally. Potential impacts are present only during the construction phase.
7. Installation of on-site cabling.
    a. Installation of underground cabling will also require crossing of drains or streams, potentially requiring minor instream works during the construction phase. Potential impacts are present only during the construction phase.
    b. Underground cabling can potentially provide a preferential flow path. The potential for this occurring is present during the operational phase.
8. Grid Connection.
    a. Pre-construction site investigation works. To inform detail design of the trenching, ground investigations will need to be undertaken. Some of these works will be intrusive investigation such as trial pit excavation and perhaps drilling. These works

will expose soil to erosion from rainfall with potential for runoff to impact surface water quality.

b. Excavation of trenches, jointing bays and holes (for poles) has the potential to release silt and fines to nearby surface water courses impacting water quality and aquatic habitats / fauna.

c. Excavation of trenches will also require crossing of drain / stream culverts under the public road. There is potential for damaging culverts.

d. Use of cement bound materials (CBM) in cable trenches as trench backfill. As noted above, concrete has a high pH and if released into the surface water environment, could change its pH and affect aquatic fauna locally.

e. Stringing of conductors on poles will include crossing of streams and rivers. Working in the vicinity of watercourses could release silt and affect water quality.

f. Underground ducting can potentially provide a preferential flow path. The potential for this occurring is present during the operational phase.

Potential impacts are primarily associated with the construction phase and to a lesser extent during the operational phase if repairs are required. As noted in **Section 8.1**, the Grid Connection permission is sought in perpetuity, so decommissioning may not occur for several decades.

9. Turbine towers. During the operational phase, driving rain is intercepted by the tower and runoff is concentrated at the base of the tower.

Groundwater wells are distant from the proposed works, so impacts on supply wells is not anticipated.

The potential direct impacts associated with the above works are deterioration of surface water quality on and leaving the site, and a potential increase in volume and rates of runoff leaving the site. Unmitigated, this could potentially result in indirect impacts to downstream aquatic habitats and users of surface water (i.e., drinking water abstractions). Unmitigated, increased runoff rates could potentially result in indirect impacts downstream such as increased erosion along the stream channels. As noted in **Section 8.2.5**, increased flooding downstream resulting from the Development is not anticipated.

8.4 IMPACTS ASSESSMENT

8.4.1 Impact Assessment Methodology

The criteria in the EPA Guidelines (2022) are used to evaluate and describe the potential impacts in terms of quality, significance, extent, probability and duration.

Table 8.7: Description of Potential Effects

Quality of Effects It is important to inform the non-specialist reader whether an effect is positive, negative or neutral	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative/Adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Describing the Significance of Effects ''Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful (also see *Determining Significance* below.).	**Imperceptible** An effect capable of measurement but without significant consequences.
	Not significant An effect which causes noticeable2 changes in the character of the environment but without significant consequences.
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very Significant An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics.
Describing the Extent and Context of Effects Context can affect the perception of significance. It is important to establish if the effect is unique or, perhaps, commonly or increasingly experienced	**Extent** Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Context Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?).
Describing the Probability of Effects Descriptions of effects should establish how likely it is that the predicted effects will occur – so that the CA can take a view of the balance of risk over advantage when making a decision.	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Describing the Duration and Frequency of Effects 'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes.
	Brief Effects Effects lasting less than a day.
	Temporary Effects Effects lasting less than a year.
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years.

	Reversible Effects Effects that can be undone, for example through remediation or restoration.
	Frequency of Effects Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually).

The NRA guidelines are used to further rate the magnitude of the impact - these are set out in **Table 8.8** (Hydrology) and **Table 8.9** (Hydrogeology). Determining the significance of the impact on the feature (hydrology / hydrogeological attribute) based on the Importance of the feature and the magnitude of the impact is given in **Table 8.10**.

Table 8.8: Estimation of Magnitude of Impact on Hydrology Attribute

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and / or quality and integrity of attribute	Loss or extensive change to a waterbody or water dependent habitat. Increase in predicted peak flood level >100mm. Extensive loss of fishery. Calculated risk of serious pollution incident >2% annually. Extensive reduction in amenity value.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm. Partial loss of fishery. Calculated risk of serious pollution incident >1% annually. Partial reduction in amenity value.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm. Minor loss of fishery. Calculated risk of serious pollution incident >0.5% annually. Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level. Calculated risk of serious pollution incident <0.5% annually.
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10mm. Calculated reduction in pollution risk of 50% or more where existing risk of 50% or more where existing risk is <1% annually.
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50mm. Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually.
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm.

For the Derreenacrinnig West site, the magnitude of impact on the hydrology attribute is rated as Negligible - negligible change in predicted peak flood level and negligible risk of serious pollution incident.

Table 8.9: Estimation of Magnitude of Impact on Hydrogeology Attribute

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off1 Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

For the Derreenacrinnig West site, the magnitude of impact on the hydrogeology attribute is rated as Negligible - negligible risk of serious pollution incident.

Table 8.10: Rating of Significant Environmental Impacts

Magnitude of Impact → / Importance of Attribute ↓	Negligible	Small	Moderate	Large
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

The following sections detail the potential impacts, prior to mitigation, which have been identified from the assessment methodology presented above. The main potential direct impacts of the development (completion of wind farm construction, construction of the Grid

Connection and TDR upgrade works) on the surface water and groundwater environments are:

- Deterioration of surface water quality from silt, concrete and / or hydrocarbons.
- Increase in runoff from a rainstorm event. This would increase the peak flow to the streams draining the site. The possible increase in runoff results from a change in the surface runoff coefficient due to turbine foundations, substation construction, extensions of the hardstand at three locations and widening of the local TDR. This potential impact is not relevant for the Grid Connection.
- Changes in flow regime could also potentially arise from preferred pathways provided by cable trenches on the wind farm and along the Grid Connection.
- Damage and replacement of culverts along the underground sections of the Grid Connection and during TDR upgrade works. Completion of the wind farm will not require the construction of the further culverts within the wind farm site.
- Use of hydrocarbons at the project site during construction which, if released to ground, could impact on groundwater quality.

Potential indirect impacts would be associated with deterioration of aquatic habitats resulting from pollution and potential for increased flooding and impacts on users of surface water as a drinking water supply downstream of the project site. Also, changes in site runoff characteristics could potentially affect peatland / wetland hydrology. These are discussed in **Section 8.4.3** in terms of surface water quality, changes in runoff characteristics and groundwater quality.

8.4.2 Do Nothing Scenario

If the proposed wind farm is not constructed, it is likely that the current land use of rough grazing and commercial forestry will continue for the foreseeable future. The surface water and groundwater environments would remain largely unchanged. Surface water sampling at the site doesn't indicate any enrichment from current agricultural or forestry activities. It is possible that more of the landbank will be planted with commercial forestry. Apart from the minor hydraulic changes brought about by this infrastructure, the surface and ground water environments at the project site would remain largely unchanged for the foreseeable future in the absence of the Proposed Development.

8.4.3 Construction Phase

Surface Water Quality

There is potential for direct and indirect impacts on surface water quality during ground investigation and construction activity from several sources. These are:

- Ground investigation will need to be carried out to inform detailed design of the grid installation techniques. Ground investigation will typically take the form of trial pit excavation, drilling and perhaps geophysical survey. From experience at other cabling projects in similar terrain, trial pit excavations will be the main method. Drilling is unlikely to be required, generally only being required where horizontal directional drilling (HDD) is being used. The potential impacts to surface water quality associated with ground investigation works are:
    - Accessing ground investigation locations with a track-mounted excavator. The machine may need to cross watercourses disturbing the stream bed, which if unmitigated would result in direct momentary to brief imperceptible negative impact on water quality. For the majority of the route, ground investigation locations will be accessed from the public road, so no impact on surface water quality is predicted for mobilisation of plant and equipment.
    - Excavation of trial pits will expose excavated soils to erosion from rain and potentially increase sediment loading to streams in small discrete areas. Unmitigated, sediment loading presents a likely localised direct brief imperceptible negative impact on water quality; an indirect brief imperceptible negative impact on habitats downstream of the site (e.g., if silt were to impact the sensitive aquatic habitats downstream of the site); and a brief imperceptible negative impact on users of surface water.
    - Potential spillage of oil and diesel used for plant and equipment. One excavator would be used for ground investigation works. Refuelling would be carried out using refuelling bowsers owned by the plant hire contractor. There is potential for leaks and spillages of diesel or oils during refuelling, breakdowns (e.g., breaking of a hydraulic hose), etc. Unmitigated and depending on the volume released, hydrocarbons reaching the surface water environment would have a likely local direct temporary slight negative impact on water quality; an indirect temporary slight negative impact on habitats downstream; and a temporary slight negative impact on users of surface water. Hydrocarbons attenuate naturally in the environment, so any negative impacts are reversible.
- Increased sediment loading of drains and streams from earthworks activities on the main wind farm site, TDR upgrade locations and Grid Connection. The earthworks would take approximately 12 to 14 weeks (depending on sequencing) and would include extension of the hardstands, excavation of turbine foundations, restoration of unused roads and hardstands, internal cabling, construction of the on-site substation, TDR road improvements, and trenching, erecting poles and installing conductors for the Grid Connection. Unmitigated sediment loading presents a likely short-term direct

negative moderate localised impact on surface water quality; a likely short to medium-term indirect slight negative impact on habitats (e.g., if silt were to accumulate in gravel beds downstream of the site); and a brief to temporary imperceptible negative impact on users of surface water. Once the earthworks and landscaping are completed, the risk of sediment loading of water courses is significantly reduced.

- Potential spillage of oil and diesel used on site for plant and equipment. During construction there would be 3 to 5 machines on the wind farm site (excavators, dump trucks, generators etc) and a similar number along the GCR and TDR upgrade, depending on the timing of works. These would be refuelled every 2 to 3 days. This is either done using refuelling bowsers owned by the plant hire contractor or refuelling by road tankers. Generators used at the site compound are typically fuelled from an on-site storage tank. The machines also use hydraulic oils and motor oils. There is potential for leaks and spillages of diesel or oils during refuelling, breakdowns (e.g., breaking of a hydraulic hose) etc. Unmitigated and depending on the volume released, hydrocarbons reaching the surface water environment would have a local short-term direct slight negative impact on water quality; a short term indirect slight negative impact on habitats downstream; and a short-term slight negative impact on users of surface water. Hydrocarbons attenuate naturally in the environment, so any negative impacts are reversible.
- Release of cement to watercourses during concrete pours for foundations. For the proposed turbines, approximately 528 m^3 will be required per foundation– i.e., up to approximately 88 loads per turbine. CBM is also used in the backfill of cable trenches installed on roadways and may also be used during the TRD upgrade works. The chutes of concrete trucks are typically rinsed down on the wind farm site. If not carried out properly, concrete or concrete washdown water could reach watercourses, affecting its pH. Unmitigated, this would be a short-term direct moderate negative localised impact on surface water quality. Concrete trucks delivering CBM to the Grid Connection and TDR upgrade works will return to the batching facility for rinse down; rinse down will not be done at the roadside.
- The underground cabling between the turbines and on-site substation will follow the existing wind farm access road. This work will involve excavating a narrow trench (0.35 m wide and 0.95 m deep), installing ducting and placement and compaction of backfill. There will also be a number of drains / stream culverts to be crossed. Once the ducting is installed, the cables are pulled through and spliced at jointing bays (if required). The potential impacts are largely associated with water quality (silt, cement, and hydrocarbons) as per other earthworks on the wind farm. These works present a likely short-term direct negative slight localised impact on water quality; a short to medium-

term indirect slight negative impact on habitats downstream of the site (e.g., if silt were to accumulate in gravel beds downstream of the site); and a brief to temporary imperceptible negative impact on users of surface water.

- Trenches may need to be dewatered prior to installing ducting and backfilling. This could occur due to the presence of groundwater or ingress of rainwater runoff. As the trenches will be shallow, the occurrence of groundwater is unlikely. The improper disposal of this silt-laden water presents a direct temporary slight negative impact on water quality; an indirect short-term significant negative impact on habitats downstream of the site (e.g., if silt were to impact the sensitive aquatic habitats); and a brief to temporary imperceptible negative impact on users of surface water.
- Portaloos will be provided for workers' welfare facilities. These will be maintained under service contract and foul effluent will be collected by a licensed waste collector. No significant impact on surface water (or ground water) is predicted.

Surface Water Runoff – Volumes & Rates

The partially constructed wind farm has already affected surface water runoff from the site. The runoff characteristics of these developed areas are different to the greenfield site conditions, i.e., it has likely to have slightly increased runoff rates and volumes. The completion of the wind farm will involve extensions of three hardstands and the restoration of redundant hardstands and roads (i.e., restoration of approximately 0.85 ha).

The TDR upgrades will increase the paved areas of the local road by approximately 828 m^2. This will increase runoff volumes slightly to multiple adjoining drains and streams, but during the operational phase.

The changes in runoff are primarily associated with the operational phase. As noted in **Section 8.2.4**, the peatland hydrology has already been modified by the installation of man-made drains and roads, and so less sensitive to changes from the completion of the wind farm construction than would otherwise be the case.

The construction of the Grid Connection will not materially change the runoff characterises along the grid route for either the OHL or underground sections.

Groundwater

The potential impacts on groundwater quality are of a similar nature to the surface water environment as discussed above. This includes potential impacts on groundwater quality

from hydrocarbon spills or leaks during the construction phase on the wind farm, along the TDR upgrade works and along the route of the Grid Connection.

Groundwater (aquifer) vulnerability has already been increased with the removal of peat and overburden during the construction of the access roads and hardstands. While this has not changed the aquifer vulnerability rating (extreme), the depth of protection provided by the topsoil / overburden has been reduced in the development footprint. This presents a likely, imperceptible, temporary negative local effect from the greenfield conditions. The restoration of sections of road and hardstands, extending to approximately 0.85 ha, will reverse this impact in these restored areas – i.e., the restoration of parts of the site will be an imperceptible, permanent positive local effect in terms of aquifer vulnerability. The roads and hardstands to remain for the operational phase of the wind farm will not be paved, so the current aquifer vulnerability rating will be unchanged. As noted already, it is unlikely that groundwater will be encountered during excavations and cuts.

Impacts on groundwater flow and groundwater supply wells are not predicted. The locations of the nearest wells to the wind farm are shown on **Figure 8.4**. The closest well to the wind farm is 480 m (i.e., distance to the substation location); 30 m from the TDR upgrade works; and 480 m from the Grid Connection. The completion of the wind farm construction is too far away to have any impact on these wells. The works associated with the TDR upgrade and the Grid Connection are shallow in nature and not predicted to affect groundwater flows or supply wells.

Wetlands

Wetlands occur within the wind farm site and along the GCR as outlined in **Section 8.2.4** and discussed in detail in **Chapter 6**. As the construction of wind farm infrastructure is largely completed, the remaining works will not impinge significantly further on the peatland / wetland. An area of approximately 0.17 ha will be developed to enlarge hardstands and roads to accommodate the larger turbines. This will be more than offset with the restoration of 0.85 ha of already developed areas.

Three types of wetland habitat occur along the Grid Connection. Most of the wetland habitats will be traversed using OHL. The installation of poles has been assessed as a likely permanent insignificant negative effect. Short lengths of underground sections will pass near wetland habitats. These occur between pole P113 and public road (wet heath), and between pole P157 and the wind farm substation (wet heath). Without mitigation, the

installation of these underground sections has been assessed as likely slight localised temporary reversible negative effects.

8.4.4 Operational Phase

Surface Water Quality

There is less potential for direct and indirect impacts on surface water quality during the operational phase of the wind farm and Grid Connection. There would be little or no earthworks, little or no concrete pours and comparably little hydrocarbons used or stored. The potential sources of surface water contamination during the operational phase are:

- Use of a back-up generator at the substation which would be fuelled from a storage tank (typically 1,300 litre capacity). There is potential for leaks or spills with the impacts similar to those of the construction stage.
- Oils and greases used in the maintenance of the turbines will be brought to site as needed and waste oils will be taken from site as they occur by the turbine maintenance contractor. The oils and greases are used in the equipment within the turbine, isolated from the environment, so do not present a risk to the surface water environment.
- There are no likely significant potential impacts on surface water or hydrology during the operational phase of the Grid Connection. It is possible that during the lifespan of the wind farm, faults / damage would necessitate repair or replacement of sections of the cable, but this would be done at the jointing bay locations or at the end points. The fault location would be identified using non-intrusive techniques and the cable section replaced by accessing it at the jointing bay / termination. Unmitigated, this would present a likely temporary localised imperceptible negative effect on surface water quality during the repair works.

Surface Water Runoff – Volumes & Rates

There is potential for direct and indirect impacts on the hydrology of the site and receiving waters during the operational phase. These are:

- The wind farm footprint extends to approximately 4.96 ha, with 2.28 ha in the Mealagh catchment and 2.68 ha in the Ilen catchment. **Table 8.11** summaries the areas of the site in each catchment – areas already developed, areas to be developed to complete the project and areas already developed and to be restored. The contributing catchments are taken at the nearest downstream node in the EPA River Flow Estimates - Hydrotool. For a given rainstorm event the volume and rate of runoff could be increased due to the change in runoff characteristic and roadside drainage. An increase in runoff rates and volumes from the site, which, if unmitigated, will be a likely long term, intermittent, imperceptible-slight negative effect downstream of the site.

- The constructed access roads cross several drains and streams between the site entrance and turbine T03. Between turbines T03 and T01, under-road drainage is provided by stone drains – culverts were not apparent. Where used, culverts are constructed with twin-wall HDPE pipes with diameters varying from 300 mm to 900 mm. Typically, a single pipe is used, but at some locations two pipes are used. Examples are shown in **Table 8.12**. Locations are shown on **Figure 8.3**. Blockages could impede flows, particularly during heavy rainfall events. Local flooding or surface water ponding could result. Unmitigated, this would be a likely long-term, intermittent, slight-moderate localised negative effect.
- During the operational phase, driving rain is intercepted by the turbine towers and runoff is concentrated at the base of the tower. This is a likely long-term, intermittent, slight negative effect.
- The substation has a roof area of approximately 54 m^2 (10 m x 5.4 m) plus the surrounding footpath with surface area of approximately 43 m^2. Runoff from these areas will be discharged directly to an adjacent drain. This will increase discharge rates and volumes to the drain, and will be a likely long-term, intermittent, slight localised negative effect.
- If backfilled with permeable material, cable trenches can potentially provide preferred pathways for water movement. This could lead to erosion of the trench backfill material, particularly on steeper slopes, between turbine T03 and the substation. Apart from one location, the underground sections of the Grid Connection are relatively flat; two sections at Dromloughlin are moderately steep. It could also provide preferential movement for contaminants. Unmitigated, this would represent a likely long-term, not-significant negative localised effect.

Table 8.11: Summary of Sub-Catchment Areas

Sub-Catchment	Total Catchment Area (ha)	Developed Area in Catchment (ha)	Additional Area in Catchment to be Developed (ha)	Area in Catchment to be Restored (ha)	Percentage of Sub-Catchment to be Developed (%)
Ilen – 20_1357	528.9	2.68 (roads + hardstand)	0.07 (T3) 0.37 (TDR)	0.038 (old T4)	0.58%
Ilen Sub-Totals	---	2.68	0.44	0.038	
Mealagh – 21_4755	1,225.8	1.69 (roads + hardstand) 0.59 (borrow pit + road)	0.04 (T1) 0.03 (T2)	0.63 (old T6 & T7) 0.038 (old T4) 0.14 (old T2)	0.12%
Mealagh Sub-Total	---	2.28	0.07	0.808	
TOTALS	**1,754.7**	**4.96**	**0.51**	**0.846**	**0.25%**

Notes:

1. Catchment Ilen 20_1357 is the smallest Hydrotool catchment that includes the wind farm and most of the TDR.

2. Catchment Mealagh 21_4755 is the smallest Hydrotool catchment that includes the wind farm.

As shown in **Table 8.11**, the percentage of the catchments being developed for the wind farm is <1%. As noted, without mitigation, the development would result in a likely long term, intermittent, imperceptible-slight negative effect on flows from the site.

Table 8.12: Main Access Road Crossings

Road Section / Crossing ID	Crossing Description	Photo
Crossing No. 1	900 mm ID HDPE pipe taking flows from roadside drain to south side of access road.	
Crossing No. 2	Two 370 mm ID HDPE pipes.	
Crossing No. 3	370 mm ID HDPE pipe. Note debris build-up at pipe intake.	
Crossing No. 4	900 mm ID HDPE pipe.	

Groundwater

The potential impacts on groundwater during the operational phase are of a similar nature to the surface water environment as discussed above. This includes potential impacts on groundwater quality from hydrocarbon spills or leaks.

A groundwater well will not be used at the wind farm for water supply.

An on-site wastewater treatment plant is not proposed for the wind farm.

8.4.5 Decommissioning

The potential impacts associated with decommissioning will be similar to those associated with construction but of reduced magnitude.

During decommissioning, it may be possible to reverse or at least reduce some of the impacts caused during construction by rehabilitating some construction areas. This will be done by covering developed areas with locally sourced peat to encourage vegetation growth. Other impacts such as possible soil compaction and contamination by fuel leaks will remain during site restoration but will be of reduced magnitude.

8.5 AVOIDANCE, REMEDIAL OR REDUCTIVE MEASURES

JOD consulted with the IFI, OPW, GSI, UE, DHLGH and EHS. Correspondence from these consultees is provided in **Appendix 1.3**. Their requirements and recommendations to mitigate against impact on the water environment are set out in **Section 8.1.6**.

The mitigation measures to address consultee requirements and recommendations, and to mitigate other potential direct and indirect impacts on water are set out in the sections below.

8.5.1 Construction Phase

General

The mitigation measures to be employed during the completion of the project to avoid, reduce and minimise the potential impacts on the water environments are set out below. These measures cover the three main components of the project (wind farm, Grid Connection and TDR upgrade). Measures specific to each component are provided below.

1. A CEMP has been prepared for the development. This will be updated and finalised prior to remobilising to site to complete construction. The CEMP will reflect the mitigation measures detailed in this EIAR.

2. A Construction Manager will be appointed to oversee construction. The Construction Manager will have overall responsibility to ensure the environmental protection measures and commitments given in the CEMP / EIAR are implemented
3. The developer will appoint an Environmental / Ecological Clerk of Works (ECoW) for the duration of the construction project. The ECoW will have an ecological and environmental management background with practical experience of wind farm construction projects. The ECoW will monitor the environmental aspects of construction (water quality, performance of surface water management infrastructure, etc.). The ECoW will have the authority to instruct the contractor to implement additional mitigation measures, if deemed appropriate. The ECoW will maintain a written record of all environmental issues on site, including incidents, corrective actions and monitoring results. This file will be made available to the relevant Authorities upon request. The ECoW will be responsible for notifying the relevant Authorities of any environmental incident.
4. To minimise soil erosion, earthworks will be suspended during extreme weather conditions. An extreme rainfall event will be classified as an event that corresponds to the Met Éireann Orange – Weather Alert for rainfall. The ECoW will monitor the weather forecast to make preparations ahead of adverse weather conditions.

Met Eireann Orange – Weather Alert for Rainfall
50 mm – 80 mm in 24 hrs
40 mm – 60 mm in 12 hrs or less
30 mm – 50 mm in 6 hrs or less

5. Following mobilisation to site, surface water management infrastructure will be the first works carried out. Additional controls will be installed as needed as construction progresses and/or as identified during site inspections of surface water management infrastructure. Measures to be employed for all elements of the project include:
    a. Clean surface water runoff will be diverted around earthworks area to minimise the volume of silted water generated. To achieve this, shallow cut-off drains / barriers will be installed.
    b. Check dams will be installed along the alignment of drains to slow flows and remove silt. These will be constructed using clean stone and geotextile spanning across the drainage channel. Alternatively, straw bales and / or sandbags will be used, which may be more efficient for works along the Grid Connection.
    c. The public roads serving the project site will be kept clean of mud and debris so that silt is not washed to downstream watercourses. If mud or debris is tracked onto the public roads from vehicles leaving the work areas, the road will be swept.

6. The release of cement to water courses will be prohibited. Concrete pours will occur in contained areas using shuttering. Rinsing down of concrete trucks will be done at a dedicated location on site – adjacent to the temporary construction compound, or at a suitable alternative location, a minimum distance of 50 m from any watercourse. The rinse down area will consist of a settlement pond (3m wide, 4m long and 1.2m deep – minimum dimensions), lined with terram and stone filter. This will have the capacity to hold enough water for the rinse down of 70 trucks using 150 litres per truck. Water will be able to percolate through the stone filter and terram while removing cement fines. This settlement pond will not receive surface water runoff so capacity to receive rinse down water is always available. Discharge from the rinse down pond will be permitted once the pH neutralises, as confirmed by the ECoW. Signage will be erected at each concrete pour location directing drivers to the rinse down area. This rinse down area will be removed at the end of the construction phase.
7. Hydrocarbons (oils, diesel and chemicals) will be stored and managed in an appropriate manner to ensure no negative impacts on land, soils, and geology. Specific measures will include:
    a. Toolbox talks on storage and management of hydrocarbon and refuelling of vehicles will be given to delivery drivers in addition to plant operatives.
    b. Any storage of oils and diesel will be in steel or plastic tanks of good integrity and bunded to 110% of tank capacity. All fuel and hydraulic fluids will be stored in the site COSHH store located in the site compound.
    c. Refuelling will be at discrete 'fuel stations', to be designated for the purpose of safe fuel storage and fuel transfer to vehicles.
    d. Refuelling may be carried out directly from delivery vehicles or from bunded fuel bowsers. Refuelling of mobile plant will not take place within 50 m of any sensitive receptor, such as a drinking water supply well or watercourse.
    e. The plant used during construction will be regularly inspected for leaks and fitness for purpose.
    f. Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice.
    g. Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of.
    h. Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.

i. Appropriate spill control equipment, such as oil soakage pads, will be kept in the site plant to deal with any accidental spillage. Spare spill kits will be kept at the construction site compound. Spill kits will be at hand during refuelling of vehicles.
j. Only emergency repairs to machinery will be permitted on site. Machinery requiring maintenance will be taken back to a garage or contractor's yard.

Wind Farm Construction

The site was originally designed to avoid the risk to the water environment as far as possible. Avoidance of risk / impact was achieved by using the existing site roads / tracks and implementing surface water management infrastructure (some of which is still in use). The construction of the wind farm was started in 2017 with most of the larger elements of the wind farm completed in 2018. The mitigation measures specific to completion of the wind farm construction to be employed to avoid, reduce and mitigate potential impacts on the water environment are:

1. Existing access roads and hardstands will be used with minor modifications to facilitate the larger turbines.
2. The proposed turbine locations are located at permitted turbine locations at which foundations have been partially excavated.
3. These turbines have been positioned at a minimum distance of 50 m from the streams draining the site.
4. Enlargement of hardstand areas and stripping of vegetation will be kept to a minimum. This will reduce areas of soil exposed to erosion.
5. Restoration of redundant areas will be carried out as soon as practical in the construction programme.
6. Stockpiled soils will be kept a minimum distance of 50 m from any watercourse. Silt fences will be placed downgradient of stockpiles to treat runoff.
7. If required, dewatering of foundations will be to temporary silt traps / settlement ponds. Flow from the silt traps will be diffuse. The water would travel overland, and any silt would be settled before reaching existing drains. As noted in **Chapter 7**, dewatering of foundation excavations is not envisaged.
8. The roads and hardstand areas will be constructed with aggregate – there will not be a hard-paved surface. This will reduce runoff volumes in practice.

Grid Connection

The mitigation measures specific to the Grid Connection to be employed to avoid, reduce and mitigate potential impacts on the water environment are:

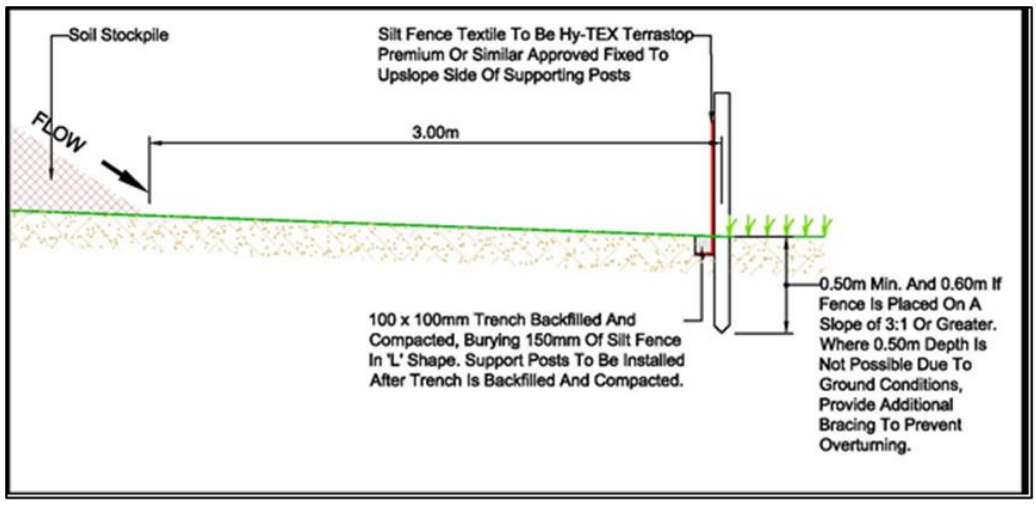
1. A minimum setback of 25 m will be used for the installation of poles in the vicinity of EPA-designated streams.
2. Surface water management infrastructure required along each section of the Grid Connection will be installed prior to commencement of works in that area.
3. Existing farm and forestry tracks will be used as far as possible to access pole locations. Wide-track machines and / or bog mats will be used on peat where ground conditions are soft. This will avoid rutting.
4. Works on stream crossings will be carried out in dry weather as far as practical when low flows occur in the streams / drains. In-stream works are not envisaged, but if needed, will be avoided between 01 October and 30 June as per IFI guidelines. The IFI will be consulted for crossings wider than 600 mm. Stream crossing design will have regard to the IFI's guidance documents for road construction[20].
5. The trenching for the Grid Connection will be done in short sections minimising the amount of disturbed ground and soil exposed to runoff. Each section of trench opened will be completed (ducting installed and backfilled) by the end of each working day.
6. The section of trenching to be completed each day will be inspected and surface water protection measures put in place prior to excavation works commencing. This will include placement of sandbags to protect existing roadside drains, placement of sandbags to direct runoff from the works area, erecting silt fencing where appropriate, locating culverts to be crossed that day, etc. Any roadside drainage affected by the trenching will be reinstated on an ongoing basis.
7. Underground sections passing through wetland habitats will be restored with the turves removed prior to excavating the trench to ensure that there is no loss of wetland habitat.
8. It is noted that other areas of wetland habitat along the GCR have been avoided by the placement of underground sections in less sensitive habitats, including at Ballylickey substation (wet willow woodland habitat avoided), between pole P18 and the public road (wet grassland habitat avoided), and between poles P101 and P102 (wet grassland habitat avoided).
9. Clay plugs will be installed along the length of the cable trenches to eliminate these acting as preferential pathways. Clay plugs will be installed at greater frequency on steeper gradients.
10. Surplus excavated inert material will be loaded directly into trucks and taken for reuse on site (this material will be clean aggregate). Tarmac from the public road will be taken off site to an authorised / licenced facility. Where the material encountered is suitable for reuse as backfill, it will be placed on the upgradient side of the trench so that any rainfall runoff (carrying silt) will be into the trench.

11. Concrete truck rinse down will not be carried out along the grid route. This will be done at the batching plant or at a dedicated location on site for concrete chute rinse down.
12. In the unlikely event that trenches need to be dewatered, pumped water will not be discharged directly to the environment. Due to the extremely high value of the receiving surface water environment, water will not be pumped from trenches to the roadside drains. The water will be treated prior to release, and this will be achieved using either filter / sediment bags, Silt-buster or vacuum tanker. The filter / sediment bag provides a robust, mobile and versatile solution for treating silty water. If a vacuum tanker is used, the water will be taken to the wind farm site and discharged into an on-site settlement pond. The water will be released into a drain leading to the pond at a rate that doesn't exceed the design parameters of the pond, to ensure the water is sufficiently treated to remove silt.

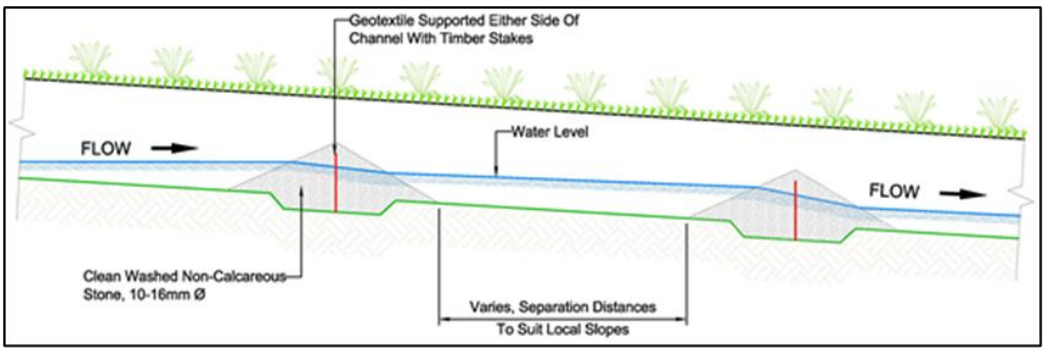
Surface Water Management Infrastructure

The infrastructure to be used to manage and treat surface water, and to control erosion the construction phase includes:

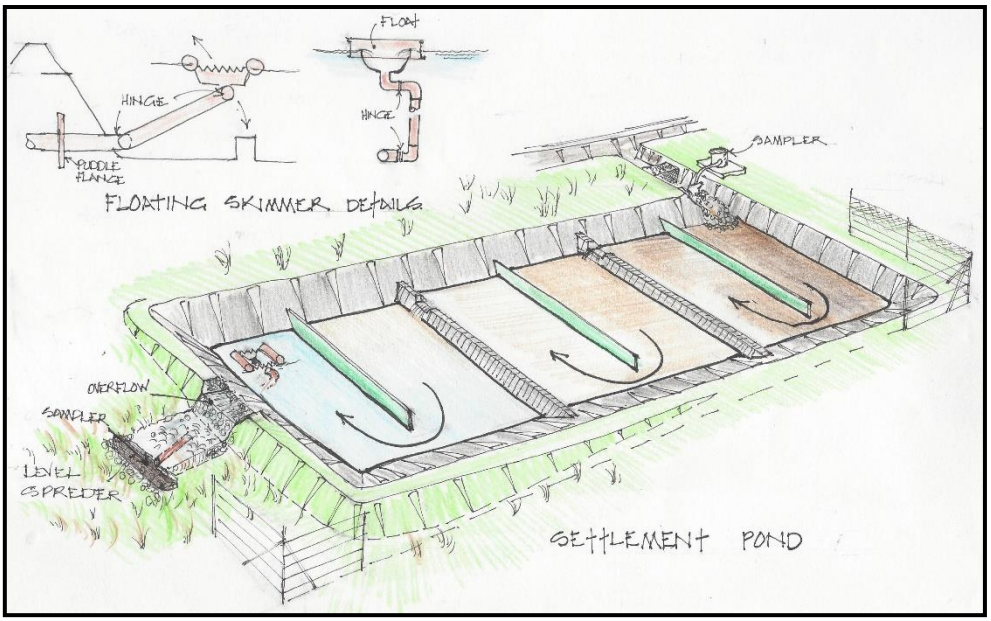
1. To reduce the volume of water to be treated during construction and to reduce the erosion potential of exposed peat and soils, clean surface water runoff will be diverted around earthworks areas. This will be done with the use of diversion barriers / channels. Diversion channels are shallow interceptor drains, while barriers can be plastic (HDPE or LDPE material approximately 0.3m high that is inserted vertically (50 to 100mm) into the peat/ground surface to divert overland flows), or sandbags.
2. Silt fences will be erected on the downslope side of any earthworks areas to intercept any overland flows that could potentially be carrying silt / fines. These are constructed with geotextile embedded in the peat and supported with wooden pegs. See example below.



3. Check dams will be installed in roadside drains (particularly in the wind farm) at frequent intervals. These will be constructed using geotextile supported by two wooden pegs, sandwiched by clean washed filter gravel, as illustrated.



4. Where dewatering of trenches is required for the underground cabling, filter / sediment bags (or similar) will be used to treat water prior to discharge to the environment. Filter / sediment bags will be placed in a vegetated area, so treated water flows overland, providing further treatment, to watercourses or drains.
5. Use of settlement ponds at the turbine locations, as appropriate. Water pumped from the foundation excavation or runoff from the works area will, where necessary, be directed to a settlement pond to remove silt and fines. The flow from the settlement ponds will be diffuse overland flow. An example is shown below.



The settlement ponds have been sized to treat runoff for a 60-minute storm duration with a 10-year return period. The size of the pond is driven by settlement of the clay particles. Additional settlement will be achieved within each pond with the installation of a forebay, internal stone filters and decanting of water from the surface of the pond. Furthermore, discharge from the ponds will be to a level spreader for overland flow downslope through

vegetated areas; there will not be direct discharge to watercourses from the settlement ponds.

Plate 8.4 shows examples of the surface water management infrastructure used in wind farm construction, including 3-chamber silt pond, road-side drainage check dam, flow barrier, clean water diversion channel and filter / sediment bags.

Plate 8.6: Surface Water Management Features

8.5.2 Site Specific Water and Sediment Management

Turbine T1

Turbine T1 is located on the western side of the site overlooking a moderately steep slope to the northwest. The cranage area has been constructed with a cut into the hillside on its southern and south-eastern perimeter. The cranage area needs to be enlarged to the north and the foundation excavation needs to be enlarged. From approximately 100 m to the east, the access road slopes towards the cranage area. Surface water runoff from the ridge to the south overlooking the road flows across the road, via a French drain type culvert, and discharges to a channel before breakout to diffuse flow onto the blanket bog. There are no natural streams near turbine T1. The surface water management will consist of:

- The existing culvert will be upgraded so that runoff doesn't flow across the road surface, with trafficking resulting in silt-laden runoff. The clean water will be piped under the road and into the existing swale / overland flow arrangement.
- A cut off trench will be installed along the south-eastern and southern perimeter of the cranage area. Water will be directed to a small settlement pond with diffuse discharge via a level spreader to the blanket bog at the southwest corner of the cranage area. This will be used to treat water from the excavation if dewatering is required.
- A silt fence will be erected to the west and downgradient of the excavation and soil stockpiling associated with the foundation and cranage area enlargement works.

Turbine T2

Turbine T02 is located on the northern side of, and adjacent to, the ridge forming the surface water divide between the Mealagh and Ilen river catchments. The turbine is in the catchment of the Ilen River, while the cranage area is in the catchment of the Mealagh River. The cranage area is flat, with its northern part made ground. A small earthen berm is constructed along the northern perimeter of the cranage area. There is an opening in the berm at the north-eastern corner through which runoff water is directed. The surface water catchment of turbine T2 extends to an area just slightly larger than the cranage area. There is a clean-water cutoff drain on the south side of the road between T1 and T2. Collected water from the ridge to the south of the road is conveyed under the road via a stone / rip-rap culvert. Commercial forestry is located immediately adjacent to the north. The surface water management will consist of:

- A silt fence will be erected to the east and downgradient of the excavation and soil stockpiling associated with the foundation enlargement works.
- A check dam will be installed at the northeast corner of the hardstand where surface water runoff exits this location.
- A settlement pond will be located downgradient from the turbine location. It will discharge via a level spreader to a vegetative buffer with sheet flow. The sheet flow will travel >50m before reaching any watercourse.

Turbine T3

Turbine T3 is located at the eastern end of the site. The access road north of the turbine location forms the surface water divide between the Ilen and Mealagh catchments. The topography falls away sharply to the south from the turbine location. The cranage area is cut into the rock rising to the west. The road leading west from turbine T3 climbs towards T2. There is a low earthen berm on both sides of the road and along the southern perimeter of the cranage area. There are no streams or drains near turbine T1. Runoff is sheet flow along the road with a break-out point located east of the turbine. The surface water management will consist of:

- A cut off trench along the western perimeter of the hardstand. This will send clean runoff water to the south onto the blanket bog.
- A settlement pond on the east side of the turbine location to collect flows from the turbine excavation location. It will discharge via a level spreader to vegetative buffer with sheet flow, with flows directed to the roadside drain on the northern side of the access road.

8.5.3 Operational Phase

Mitigation measures to be employed during the operation phase of the wind farm and Grid Connection are:

- To mimic as close as possible greenfield runoff rates and volumes, permeable finishes on roads and hardstands have been used. Break-out points have been provided along the length of the roadways to send water onto the hillside to its natural drainage pathway and over-the-edge is also used; water is not delivered to drains / streams from long sections of roads.
- Vegetation has been allowed develop in the roadside drains. This slows flows and reduces erosion potential.
- Site drainage will be inspected and maintained during the lifetime of the wind farm. Culverts will be cleared of debris, so blockages do not occur. These tasks will be included in the contract for the wind farm operator.
- Rainfall concentrated at the turbine towers will be collected and discharged to a level spreader downhill from the turbine.
- Storage of diesel for the backup generator, if used, will be in a self-bunded tank.

8.5.4 Monitoring

The ECoW will undertake weekly inspections at all outfalls from the construction works. The ECoW will be responsible for monitoring water chemistry at the agreed monitoring points in the streams draining the site, as shown on **Figures 8.3 and 8.4**. **Table 8.13** summaries the surface water quality monitoring programme.

All samples collected will be input to a database and compared to baseline monitoring data. In the event of levels being identified which are outside of the baseline or above applicable guideline or legislative values an investigation will be undertaken.

It is also proposed to establish the site-specific relationship between turbidity values and TSS to allow real-time assessment of water quality. Field measurement of turbidity will be taken at the monitoring locations and samples will be sent to a laboratory for TSS analysis. Once a sufficient number of samples have been collected, it will allow the relationship between turbidity and TSS concentration to be established.

Turbidity monitoring will be carried out on the streams draining the site. The emission limit value will be set at a turbidity value equivalent to 20mg/l, TSS; established based on sampling and analysis as described above. An investigation will be carried out in the event of an exceedance occurring. It should be noted that turbidity fluctuates naturally with the stage of the stream, higher values occurring during high flow events, so alerts may not necessarily be attributed to on-site works.

Table 8.13: Surface Water Quality Monitoring Plan

Monitoring Location	Monitoring Frequency	Monitoring Programme	Parameters
DW1 to DW6	Monthly	Starting 1 month prior to WF construction and continuing for the duration of construction.	Field Measurements – pH, temperature, conductivity, DO & turbidity. Laboratory Analysis: Nitrate, Nitrite, Total Ammonia, Unionised Ammonia, Orthophosphate, Total Phosphate, BOD, TSS, Turbidity.
DW1 to DW6	Weekly or Daily Depending on Site Activity	During and following periods of rainfall, concrete pouring, daily inspection will be carried out.	Field measurement of pH, temperature, conductivity, DO & turbidity
Along Grid Connection Route	Weekly	Starting 1 month prior to Grid Connection construction and continuing for the duration of construction.	Field Measurements – pH, temperature, conductivity, DO & turbidity. Laboratory Analysis: Nitrate, Nitrite, Total Ammonia, Unionised Ammonia, Orthophosphate, Total Phosphate, BOD, TSS, Turbidity.

Monitoring Location	Monitoring Frequency	Monitoring Programme	Parameters
Stilling Pond Discharge Points	Daily	During / following periods of heavy rainfall, daily inspection will be carried out.	Visual inspection, turbidity measurement and TSS.

Notes

1. Sampling locations along the Grid Connection will be selected by the ECoW to assess water quality as the works advance along the route.

Monthly samples will be submitted to an accredited laboratory for analysis. Test results will be maintained on site and available for inspection by Council and IFI staff.

8.5.5 Worst-Case Scenario

The worse-case scenario would be if there was a release of silt-laden water or peat slippage during construction into the watercourses draining the site. This could result in impacts on water quality, aquatic habitats, surface water users and aquatic fauna downstream of the event. As the wind farm site infrastructure is mostly already completed and with the implementation of the mitigation measures, inspections, and monitoring, the risk of this occurring is extremely low. The scenario of a peat slippage is addressed in **Chapter 7 (Land & Soils)** and is discussed here only as a hypothetical situation.

In the very unlikely event of this occurring, the following emergency response will be implemented:

1. Safety of site personnel and any potentially affected neighbours will be checked as a priority and appropriate action taken.
2. The appropriate authorities will be notified. This will include the County Council Environment Section and IFI.
3. The ECoW will assess the situation and carry out a risk assessment to inform the appropriate mitigation to be undertaken. The priority will be to prevent any further release of silt-laden water.
4. Remedial works will be carried out at the location of the incident. The rest of the project site will be inspected, and similar remedial works carried out where appropriate.
5. Surveys of the affected water course will be carried out and remedial measures carried out, where possible.

The full emergency response procedure will form part of the Site-Specific Health & Safety Plan.

8.5.6 Residual Impacts of the Proposal

With the implementation of these avoidance and mitigation measures, the predicted impacts of the Proposed Development are:

1. The impacts on surface water quality are predicted to be not significant, localised temporary negative effects during the construction phase and imperceptible, localised brief negative effects during the operational phase. No significant indirect impact is predicted on the aquatic habitats and fauna downstream of the site or surface water users.
2. The impacts on hydrology / runoff characteristics of the site are predicted to be imperceptible, localised intermittent long-term negative effects during the operational phase.
3. The impacts on wetland hydrology is assessed as having a permanent neutral effect.

8.6 CUMULATIVE IMPACTS

The wind farm straddles two sub-catchments of the Ilen and Mealagh rivers. There are several operational wind farms located within the Ilen River catchment, including Ballybane, Milane Hill, Lahanaght Hill, and Killaveenoge wind farms. Monitoring of surface water quality in the Ilen River tributaries during their construction indicated no adverse impact on water quality. Discharge from roads and hardstand to overland flow and forestry drains has mimicked greenfield runoff conditions at those sites. The grid connections for these wind farms are provided in **Section 7.6**. Of these wind farms, the only one that is connected to the Ballylickey 110 kV substation is the Ballybane Wind Farm, which uses an underground grid connection along public roads. This cable route approaches the Ballylickey substation along the N71. As such, no significant cumulative impacts are predicted with the proposed Derreenacrinnig West Wind Farm on either the surface or ground water environments for the wind farm, TDR works or Grid Connection.

8.7 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered in the compiling the water chapter.

8.8 INTERACTIONS

Interactions associated with surface water, hydrology and hydrogeology with other aspects of the environment include:

- Biodiversity: The quality of the surface water environment influences the quality of the aquatic habitats and the health of flora / fauna populations they support. This included the wetland habitats on the wind farm and along the Grid Connection. The rivers into which the site drains hold important aquatic fauna and habitats which rely on good water quality. In addition, the Ilen River discharges to the Roaringwater Bay & Islands cSAC. These are discussed in **Chapter 6** and the Natura Impact Statement (NIS) for the development.

- Soils & Geology: Management of soil (excavation and storage) will interact with surface water quality in terms of potential soil erosion and siltation of the receiving surface water environment.
- Soils & Geology: The thickness of soil over the bedrock aquifer informs the vulnerability ranking. Enlarging cranage area requires the removal of soil which will increase the aquifer vulnerability. Restoration of parts of the site will lower aquifer vulnerability.
- Biodiversity: For blanket bogs, there is an important interaction between flora, fauna, soil and hydrology. The interaction of these factors is a dynamic relationship. Blanket bogs have formed in the last 6,000 years when the conditions of high rainfall & low temperature, poor drainage and plant growth coincided - primarily along the western seaboard of Ireland. Poor drainage generally developed with the creation of an iron pan in the soil layer which inhibited the downward migration of rainwater. Water-lodged conditions developed and when plants died, the lack of oxygen in the water-lodged conditions inhibited decay, resulting in the development of peat. Various plants such as mosses, heather, sedges, grasses and lichen preferably occupied the varied habitats within the blanket bogs. The growth of the blanket bogs is approximately 1mm per year.

As the peat develops, the underlying geology (soils and bedrock) becomes less and less important. The peat forms a barrier between the surface vegetation / habitats and the underlying geology. The surface hydrology derived from rainfall runoff and the topography (depressions in the peat) is much more relevant and determines the make-up of plant communities. For example, depressions receiving overland runoff will remain water-lodged and particular plant assemblages will develop and thrive. If a road were to cut through the catchment to this depression, then it might result in diversion of water from the water-lodged area with an indirect impact on the plant assemblages. For this reason, particular attention was given to the road construction in terms of alignment and drainage.

Blanket bogs are generally more important for the birdlife they support rather than mammals. Typical mammals associated with bogs are hare, otters (near rivers / streams), deer and fox. These mammals are not however dependent on the bogs and are commonly found in other habitats.

8.9 CONCLUSIONS ON WATER

The hydrology of the wind farm site and TDR upgrade is typical of an upland area. The Grid Connection passes through a mosaic of water environments and associated habitats. The impacts on hydrology, surface water and groundwater have been identified and assessed. Where impacts have been identified, mitigation measures will be implemented to avoid or reduce the risk of impacts occurring. On balance, the wind farm and Grid Connection can

be constructed and operated with no significant impact of the surface water or groundwater environments.

8.10 REFERENCES

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