Planning and Environmental Consultants

Hydrology and Hydrogeology

Taurbeg Wind Farm Extension of Operational Life

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9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO to carry out an assessment of the potential likely and significant effects of the Proposed Project (Proposed Lifetime Extension for the existing Taurbeg Wind Farm and Proposed Offsetting Measures) on water aspects (Hydrology and Hydrogeology) of the receiving environment.

Details of the Proposed Project are described in full in Chapter 4 of this Environmental Impact Assessment Report (EIAR).

In summary, planning permission is sought for the continued operation of the existing Taurbeg Wind Farm as permitted by Cork County Council (Pl Ref No: 02/3608) for a further period of 10 years from the date of the expiry of the current planning permission (2026) as per Condition No. 7 of the existing consent. The existing Taurbeg Wind Farm comprises of 11 no. turbines. The grid connection does not form part of the Proposed Lifetime Extension but is assessed cumulatively.

The objectives of the assessment are:

- Produce a baseline study of the existing water environment (surface water and groundwater, i.e. natural resources) at the Site and Proposed Offsetting lands;
- Identify likely significant effects of the Proposed Project on surface water and groundwater natural resources during the extended operational period and the decommissioning phase;
- Identify mitigation measures to avoid, reduce or offset significant negative effects;
- Assess significant residual effects; and,
- Assess cumulative hydrological effects of the Proposed Project and other local developments (as described in Chapter 2; Section 2.11 of this EIAR).

As detailed in Section 1.1.1 of the EIAR, this chapter uses for the following terminology: ‘Proposed Lifetime Extension’, ‘the Site’, the ‘Proposed Offsetting Measures’ , the ‘Proposed Offsetting lands’ and the ‘Proposed Project’.

9.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include upland hydrology and windfarm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Gill and Conor McGettigan.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years’ environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface

water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, Derrinlough WF, and Yellow River WF, and over 100 other wind farm-related projects across the country including several lifetime extension applications.

Conor McGettigan (BSc, MSc) is an Environmental Geoscientist with over 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor has prepared the hydrology and hydrogeology chapter of environmental impact assessment reports for several wind farm development on peatlands. Conor also routinely prepares hydrological and hydrogeological assessment reports, WFD compliance assessment reports and flood risk assessments for a variety of development types including wind farms.

9.1.3 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The requirements of the following legislation are also complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 477/2011: European Communities (Birds and Natural Habitats) Regulations, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD").
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC).
- European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003);
- S.I. No: 122/2010: European Communities (Assessment and Management of Flood Risks) Regulations, resulting from EU Directive 2007/60/EC;
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

9.1.4 Relevant Guidance

The Hydrology and Hydrogeology chapter of this EIAR is carried out in accordance with the guidance contained in the following:

- Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- DoE/NIEA (2015): Wind farms and groundwater impacts - A guide to EIA and Planning considerations;
- OPW (2009) The Planning System and Flood Risk Management;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (2006);
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001;
- Land Types for Afforestation (Forest Service, 2016b);
- Forest Protection Guidelines (Forest Service, 2002);
- Forest Operations and Water Protection Guidelines (Coillte, 2013);
- Forestry and Water Quality Guidelines (Forest Service, 2000b); and,
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018).

9.2 Assessment Methodology

9.2.1 Desk Study

A desk study of the Site and Proposed Offsetting lands was completed in January and February 2024 to collect all relevant hydrological, hydrogeological and meteorological data for the above. The desk study was completed to supplement site walkover surveys and site investigations. The desk study information has been checked and updated, where necessary, in June 2025.

The desk study involved consultation with the following sources:

- Environmental Protection Agency Databases (www.epa.ie);
- Environmental Protection Agency's Hydrotool Database (www.catchments,.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 21 (Geology of Kerry - Cork); Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping (www.floodmaps.ie);
- GSI's Maximum Historic Surface and Groundwater Flood Mapping (www.floodinfo.ie); and,
- Aerial Photography, 1:5000, and 6" base mapping.

The following documents relating to the Taurbeg Wind Farm were also reviewed and are referenced as required in this chapter:

- Whiteford Geoservices Ltd, 2004. Ground Investigation for Proposed Wind Farm Site at Taurbeg, Rockchapel, Co. cork (Report No. 386/04) (Appendix 8-2);
- Environmental Impact Statement for the existing Taurbeg Wind Farm Pl. Reg. Ref: N/02/3608 (2002); and,
- RPS Geotechnical Report – 2015/2016.

9.2.2 Baseline Monitoring and Site Investigations

Hydrological walkover surveys of the Site, including detailed drainage mapping, was undertaken by HES on 26th March 2024 and 14th August 2024. These surveys were completed by Conor McGettigan of HES (please refer to Section 9.1.2 for qualifications and experience). Hydrological monitoring on these dates included surface water flow monitoring, field hydrochemistry and grab sampling. The monitoring and sampling completed in March 2024 occurred during a period of mixed weather whilst the August 2024 sampling was completed during a period of dry weather.

Recent site investigations to address the Water Section of the EIAR included the following:

- HES completed site walkover surveys and drainage mapping at the Site on 26th March 2024 and 14th August 2024 whereby water flow directions and drainage patterns were recorded;
- A total of 10 no. gouge core sample points were undertaken by HES across the Site to investigate peat and mineral subsoil lithology;
- Field hydrochemistry measurements (electrical conductivity, pH, dissolved oxygen, temperature and turbidity) and surface water flow measurements were taken to determine the origin and nature of surface water flows draining the Site;
- 2 no. rounds of 4 no. surface water samples were taken to determine the contemporary baseline water quality of the primary surface waters draining the Site;
- GDG completed site investigations at the Proposed Offsetting lands and the surrounding area in October 2024. In total 214 no. peat probes (107 no. within the Proposed Offsetting lands) and 16 no. shear vane tests (4 no. within the Proposed Offsetting lands) were completed; and GDG completed a Peat Stability Risk Assessment for the Proposed Offsetting lands which is included as Appendix 8-1.

HES also completed a detailed review of the previous planning applications and associated planning files and site investigations prior to completing further site investigations for the current application. The previous site investigations completed by Whiteford Geoservices (Appendix 8-2) in 2004, comprising of trial pits (13 no.) and boreholes (2 no.) has also been used in the preparation of this chapter. In addition, site walkover inspections of the Site were completed by a Geotechnical Engineer from RPS in May 2015 and February 2016.

9.2.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.9 of Chapter 2 of the EIAR. Consultation responses relating to the water environment were received from the Geological Survey of Ireland (GSI) and Uisce Éireann. Matters raised by consultees in their responses with respect to the water environment are summarised in Table 9-1 below.

Table 9-1: Summary of Water Environment Related Scoping Responses

Consultee	Description	Addressed in Section
GSI	The GSI note that site is underlain by a 'Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones' and that groundwater vulnerabilities within the area are variable. The GSI recommend the use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' as any groundwater-surface water interactions would be greatest in these areas	Groundwater vulnerability is discussed in Section 9.3.10.
Uisce Éireann	Standard letter response	Water supplies are detailed in Section 9.3.16.

9.2.4 Impact Assessment Methodology

The guideline criteria (EPA, May 2022) require that the baseline environment is described in terms of the context, character, significance and sensitivity of the existing environment. The description of the baseline environment is Step 5 of the information which must be included in an EIAR as per the guideline criteria (2022).

The assessment of effects follows the description of the baseline environment and is Step 6 of the information which must be included in an EIAR. The guideline criteria for the assessment of effects states that the purpose of an EIAR is to identify, describe and present an assessment of the likely significant effects. The likely effects are described with respect to their quality (positive, neutral or negative), significance (imperceptible to profound), extent (i.e. size of area or number of sites effected), context (is the effect unique of being increasingly experienced), probability (likely or unlikely), duration (momentary to permanent), frequency and reversibility. The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1 of this EIAR.

In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of importance which are defined in Table 9-2 for hydrology and Table 9-3 for hydrogeology are used to assess the potential effect that the Proposed Project may have on them.

Table 9-2: Estimation of Importance of Hydrology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
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	River, wetland or surface water body ecosystem protected by national legislation – NHA status.

Importance	Criteria	Typical Example
	regional or national scale	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 a 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.
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.

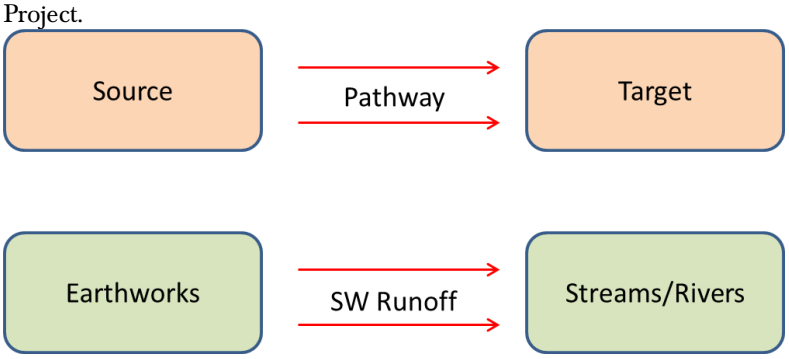
Table 9-3: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
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.
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.

Importance	Criteria	Typical Example
		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.

9.2.5 Overview of Impact Assessment Process

The conventional source-pathway-target model (see below, top) was applied to assess potential effects on downstream environmental receptors (see below, bottom as an example) as a result of the Proposed Project.



Where potential effects are identified, the classification of effects in the assessment follows the descriptors provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Environmental Protection Agency (May 2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

The description process clearly and consistently identifies the key aspects of any potential effect source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

The assessment of effects is Step No. 6 of 7 in the EIAR process. In order to provide an understanding of the stepwise impact assessment process applied below (Sections 9.4.2 to 9.4.4), a summary guide is presented below in Table 9-4, which defines the steps (Steps 6a to 6g) taken in each element of the impact assessment process. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all wind farm construction, operation and decommissioning activities (including the substation and grid connection) which have the potential to generate a source of significant adverse impact on the geological and hydrological/ hydrogeological (including water quality) environments.

Table 9-4: Impact Assessment Process Steps

Step 6a	Identification and Description of Potential Impact Source This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described.	
Step 6b	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which potential impacts are generated.
Step 6c	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.
Step 6d	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 6e	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. In relation to this type of development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by (engineering) design.
Step 6f	Post-Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place.
Step 6g	Significance of Effects:	Describes the likely significant post-mitigation effects of the identified potential impact source on the receiving environment.

9.2.6 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Hydrology and Hydrogeology Chapter of the EIAR.

9.2.7 Study Area

The study area for the hydrological and hydrogeological impact assessment is defined by the regional surface water catchments and groundwater bodies within which the Site and the Proposed Offsetting lands are located.

A regional hydrology map showing WFD surface water catchments and sub-catchments is included as Figure 9-1. The relevant surface water catchments within which the Site and the Proposed Offsetting lands are located are detailed in Section 9.3.3. Meanwhile, the bedrock aquifers and groundwater bodies which underlie the Site and the Proposed Offsetting lands are detailed in Section 9.3.8.

9.3 Receiving Environment

9.3.1 Site Description and Topography

9.3.1.1 Taurbeg Wind Farm

The Site is located 3.5km south of Rockchapel and 10.5km northwest of Newmarket, Co. Cork. The Site is located in the townlands of Taurbeg, Glasheenanargid, Foiladaunand Taurmore. The Site has a total area of ~112hectares (ha).

The Site is located in an upland setting and is situated on the southern foothills of the Mullaghareirk Mountain range. Topography within the Site ranges from ~302metres above Ordnance Datum (mOD) in the northeast to ~405mOD in the southwest. The lowest elevations are found in the northeast of the Site, at the existing entrance to Taurbeg Wind Farm. Topography rises to the west and there are three local peaks within the Site, one standing at an elevation of ~392mOD in the north, with two local peaks standing at ~405mOD further south.

The Site is drained by several streams which ultimately drain to the Feale or Blackwater rivers. The land use within the Site comprises of a mixture of renewable energy production, peat bogs, coniferous forestry and transitional woodland scrub.

The existing Taurbeg Wind Farm is accessed via the wind farm site entrance off the L5005 local road, in the townland of Taurbeg and is served by a network of existing wind farm access roads.

9.3.1.1.1 *Existing Infrastructure*

The existing development footprint of Taurbeg Wind Farm is ~3.76ha, representing ~3% of the Site (~112ha).

Taurbeg Wind Farm comprises of 11 no. existing wind turbines, with an estimated installed capacity of 25.3 Megawatt (MW). The total footprint of the turbines and their associated hardstands is ~3,891m^2. The turbine base elevations range from 330mOD (T7) to 401mOD (T11). Each wind turbine is secured to a reinforced concrete foundation. No piled foundations have been installed at the Site. The existing foundations are circular in plan with an average area of 100m^2. The existing hardstand areas around each turbine comprise of levelled and compacted hardcore. The existing hardstand areas vary slightly at each of the 11 no. turbines, with an average area of 722m^2.

During the initial construction of the existing wind farm, existing tracks were upgraded and new access roads were constructed to provide access within the Site and to connect wind turbines and associated infrastructure. Site roads were constructed of consolidated gravel with an average running width of 5.5m and a total length of 8.4km. The current footprint of the existing roads at the Site is 32,230m^2.

Each turbine is connected to the on-site electricity substation through underground medium voltage (MV) electricity and communications cabling. Multicore fibre-optic cabling connects each wind turbine to the wind farm control building. The electricity and fibre-optic cabling run in trenches below the ground surface, along the sides of or underneath the internal roadways. The routes of the cabling ducts follow the access tracks to each turbine location.

The existing substation compound measures ~1,428m^2. A 38kV underground cable runs between the onsite substation and a mast at the south of the Site. A 38kV overhead line runs from the mast to the existing Glenlara 100kV Substation.

There are no changes proposed to the existing Taurbeg Wind Farm infrastructure or grid connection as part of the Proposed Lifetime Extension.

9.3.1.1.2 *Proposed Offsetting Measures*

The Proposed Offsetting lands are located in townlands of Coom and Knockatee, Co. Kerry, ~12km west/southwest of the existing Taurbeg Wind Farm. The Proposed Offsetting lands consist of 4 no. parcels of land proposed for hen harrier habitat creation, 3 in the townland of Coom (Areas 1, 2 and 4) and 1 no. further north in the townland of Knockatee (Area 3). The Proposed Offsetting Measures comprise the permanent removal of c. 105.5 ha of coniferous plantation forestry and the restoration of c.17.7 ha of farmland for the benefit of hen harrier. The total area of the Proposed Offsetting lands is ~123.2ha.

The Proposed Offsetting lands are located on the slopes of Mount Eagle which stands at an elevation of 431mOD. Topography within the Proposed Offsetting lands is steeply sloping and ranges from ~200 to ~380mOD.

The Proposed Offsetting lands are located in an area dominated by coniferous forestry plantations. The northwestern Proposed Offsetting lands (~17.7ha) (Area 3) are located in an agricultural field whilst the remaining lands (~105.5ha) are located in coniferous forestry plantations (Areas 1, 2 and 4).

9.3.2 Water Balance

9.3.2.1 Taurbeg Wind Farm

Long term rainfall and evaporation data were sourced from Met Éireann. The 30-year annual average rainfall (AAR) recorded at the Newmarket Garda Station, located ~7.6km southeast of the Site are presented in Table 9-5. The long-term AAR at Newmarket Garda Station is 1,198mm/year.

However, the AAR at Newmarket Garda Station may underestimate the actual AAR at the Site due to the elevation difference (the highest elevations at the Site (~405mOD) are ~250m higher than the elevation of Newmarket Garda Station (~157mOD).

Met Éireann also provide a grid of AAR for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the Site ranges from 1,698 to 1,744mm/year. The AAR is 1,721mm/yr (this is considered to be the most accurate estimate of AAR from the available sources).

Table 9-5 Local Average long-term Rainfall Data (mm)

Station		X-Coord		Y-Coord		Ht (MAOD)		Opened		Closed		
Newmarket G.S		131,800		107,400		157		1944		1986		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
144	107	97	72	81	68	65	85	98	123	124	137	1,198

The closest synoptic station where the average potential evapotranspiration (PE) is recorded is at Shannon Airport, ~50km northeast of the Site. The long-term average PE for this station is 562.6mm/yr. This value is used as the best estimate of the Site PE. Actual Evaporation (AE) at the Site is estimated as 534mm/yr (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Site is calculated as follows:

Effective rainfall (ER) = Average Annual Rainfall (AAR) – Actual Evaporation (AE)

= 1,721mm/yr – 534mm/yr

ER = 1,187mm/yr

Groundwater recharge coefficient estimates are available from the GSI (www.gsi.ie). Within the Site recharge coefficients range from 4% in areas of blanket peat to 85% in areas where rock is close to or at the ground surface.

An estimate of ~48mm/year average annual recharge is given for the Site. This calculation is based on a recharge coefficient of 4%. A recharge coefficient of 4% at the lower end of the GSI scale was chosen due to the coverage of blanket peat, the sloping nature of the local area and the low permeability of the underlying bedrock aquifer. This means that the hydrology of the Site is characterised by high surface water runoff rates and relatively low groundwater recharge rates. This is supported by on-site observations made during the site walkover surveys whereby a high density of surface water drainage features were recorded within the Site.

Therefore, conservative annual recharge and runoff rates for areas of the Site which are covered in peat are estimated to be ~48mm/yr and ~1,139mm/yr respectively.

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann. The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of ~20%. In total the projected annual reduction in rainfall near the Site is ~8% under the medium-low emission scenario and ~6% under the high emissions scenario. As stated above the local average long term rainfall data for the Site is estimated to be ~1,721mm/yr. Under the medium-low emissions scenario this may reduce to ~1,583mm/yr, while under the high emissions scenario this figure may reduce to ~1,618mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. A summary of various return periods and duration rainfall depths for the Site are presented in Table 9-6.

Table 9-6 Return Period Rainfall Depths (mm)

Return Period (Years)				
Storm Duration	1	5	30	100
5 mins	3.9	5.9	8.9	11.6
15 mins	6.4	9.6	14.6	19
30 mins	8.7	12.8	19	24.3
1 hour	11.8	17	24.8	31.3
6 hours	25.9	35.4	48.9	59.7
12 hours	35	47	63.6	76.7
24 hours	47.5	62.4	82.7	98.5
2 days	62.5	80.1	103.2	120.8

9.3.2.2 Proposed Offsetting Measures

In relation to the Proposed Offsetting lands, the AAR (1991-2020) is mapped by the GSI to range from 1,668 to 1,732mm/yr, with an average of 1,700mm/yr. Recharge coefficients in this area are typically

mapped by the GSI as 22%. Based on the above, and the AE at Shannon Airport, the annual recharge and runoff rates for the Proposed Offsetting lands are ~257 and 1,443mm/yr respectively.

9.3.3 Regional and Local Hydrology

9.3.3.1 Taurbeg Wind Farm

Regionally, the Site is located in 2 no. regional surface water catchments. The vast majority of the Site, including 10 of the 11 no. existing turbines associated with the Taurbeg Wind Farm are located in the Tralee Bay-Feale surface water catchment within Hydrometric Area No. 23 of the Shannon River Basin District. Meanwhile, the south of the Site, including 1 no. existing turbine, is mapped within the Blackwater (Munster) surface water catchment within Hydrometric Area No. 18 of the South Western River Basin District.

The Tralee Bay-Feale Regional Surface Water Catchment includes the area drained by the River Feale and all streams entering tidal water in Tralee Bay and between Clogher Head and Kilconly Point, Co. Kerry, draining a total area of 1,784km^2. Within this regional surface water catchment, the Site is located in the Feale_SC_010 WFD river sub-catchment. The Feale River rises in the Mullaghareirk Mountains and flows to in a south westerly direction, ~2.7km north of the Site.

More locally, within the Feale_SC_010 WFD river sub-catchment, the Site is located in 2 no. WFD river sub-basins. 8 no. turbines and the existing substation location are mapped in the Feale_010 WFD river sub-basin whilst 2 no. turbines are mapped in the Glenacarney_010 WFD river sub-basin to the west. The EPA also map several watercourses in the area of the Site. Within the Feale_010 WFD river sub-basin, 2 no. 1st order streams[1] emerge from within the Site. These watercourses are referred to by the EPA as the Knockahorrea East and the Glennaknockane streams. These streams flow to the east and merge to the east of a local road on the boundary between the townlands of Taurbeg and Glennaknockane. This watercourse then flows to the north and discharges into the Feale River at Rockchapel, ~3.2km to the north. Meanwhile, within the Glenacarney_010 WFD river sub-basin, the EPA map a 1st order stream, referred to as the Glasheenanargid stream, to flow to the west and discharges into the Glenacarney River ~600m west of the Site. The Glenacarney River flows to the north and discharges into the Feale River ~3.8km to the northwest. The Feale River continues to flow to the northwest and discharges into the Feale Estuary to the west of Listowel.

Meanwhile, the Blackwater (Munster) Regional Surface Water Catchment includes the area drained by the River Blackwater and all streams entering tidal water between East Point and Knockaverry, Youghal, Co. Cork, draining a total area of 3,310km^2. Within this regional surface water catchment, the Site is located in the Dalua_SC_010 WFD river sub-catchment. The Dalua River flows to the south ~5km east of the Site.

More locally within the Dalua_SC_010 WFD river sub-catchment, the Site is mapped within the Owenkeal_010 and Glenlara_010 WFD river sub-basins. No infrastructure associated with the existing Taurbeg Wind Farm is located in the Owenkeal_010 WFD river sub-basin, while 1 no. turbine (T10) is located in the Glenlara_010 WFD river sub-basin. 2 no. 1st order streams are mapped by the EPA to flow to the southeast from the Site. These streams merge and discharge into the Glenlara River ~2.5km to the southeast. The Glenlara River continues to flow to the southeast and discharges into the Dalua River to the west of Newmarket Town. The Dalua River discharges into the Allow River at Kanturk, ~16km to the southeast.

A regional hydrology map is shown in Figure 9-1, while Figure 9-2 presents a local hydrology map.

[1] A 1st order stream is the smallest of streams and consist of small tributaries. There 1st order stream feed larger streams but do not generally have any tributaries themselves. These streams form in upland areas and slow quickly downstream. 1st and 2nd order streams are also referred to as headwater streams.

9.3.3.2 Proposed Offsetting Measures

The Proposed Offsetting lands are located in 2 no. regional surface water catchments. In the west, the Proposed Offsetting lands are located in the Laune-Maine-Dingle Bay regional surface water catchment (Hydrometric Area 22) while the southeast is mapped in the Tralee Bay Feale regional surface water catchment (Hydrometric Area 23).

Within the Tralee Bay Feale regional surface water catchment, the Proposed Offsetting lands are mapped in the Feal_SC_030 WFD river sub-catchment and the Clydagh (Feale)_010 WFD river sub-basin. Within this sub-basin, the Proposed Offsetting lands are drained by the Glengarriff River which in the vicinity of the Proposed Offsetting lands is referred to by the EPA as the Tooreennascarty Stream. This stream flows to the northwest, to the east of Area 4 before it veers to the northeast. A tributary stream flows between 2 no. Proposed Offsetting lands (Area 1 and Area 4) before it discharges into the Glengarriff River. This river, also referred to by the EPA as the Clydagh River, continues to flow to the northeast, before it discharges into the Feale River near Clydagh Bridge, ~10.5km northeast of the Proposed Offsetting lands.

Within the Laune-Maine-Dingle Bay regional surface water catchment, the Proposed Offsetting lands are mapped in the Maine_SC_010 WFD river sub-catchment and the Shanowen (Maine)_010 WFD river sub-basin. Within this WFD river sub-basin a 2nd order stream, referred to as the Knockatee Stream is mapped to flow to the south along the western border of the agricultural field which is included in the Proposed Offsetting lands (Area 3). Meanwhile, the Croaghane Stream is mapped to flow to the west, ~30m to the south of Area 3. These 2 no. streams merge to form the Croaghane River. Further to the south, the Proposed Offsetting lands are drained by the Cloone (Shanowen) River. The Cloone and Croaghane rivers flow to the west and merge to form the Shanowen River ~5.3km west of the Proposed Offsetting lands near Fairfield Bridge. The Shanowen River discharges into the Maine River near Castleisland.

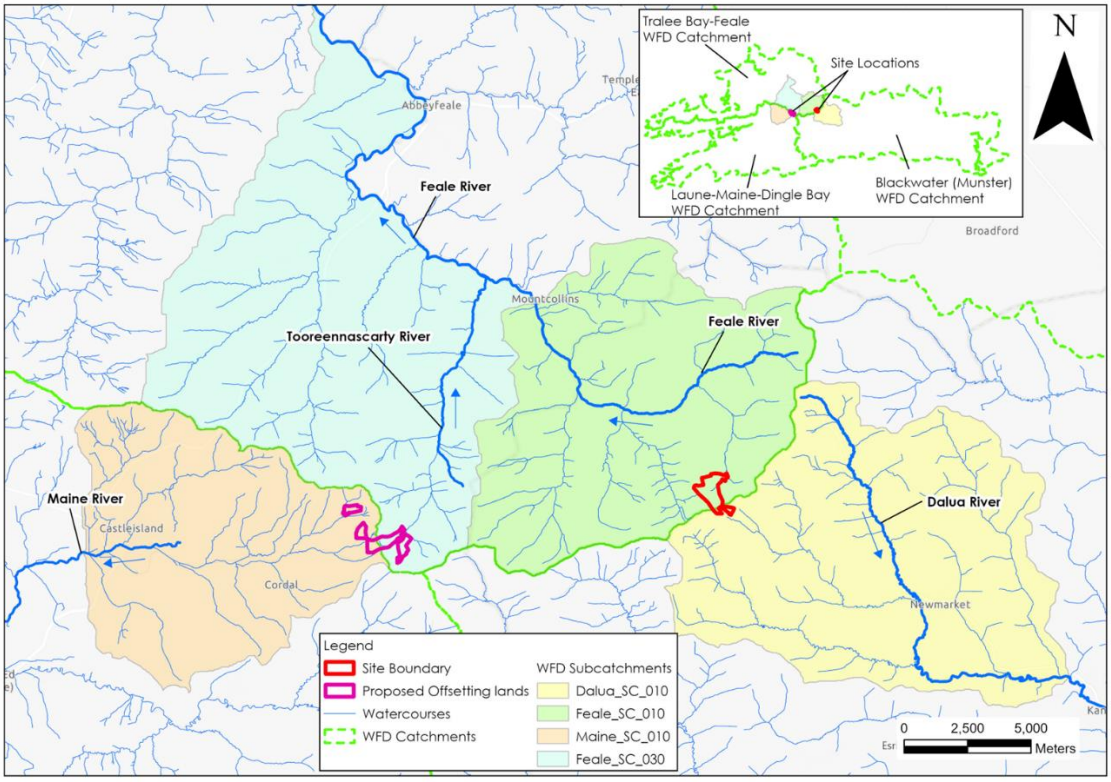


Figure 9-1: Regional Hydrology Map

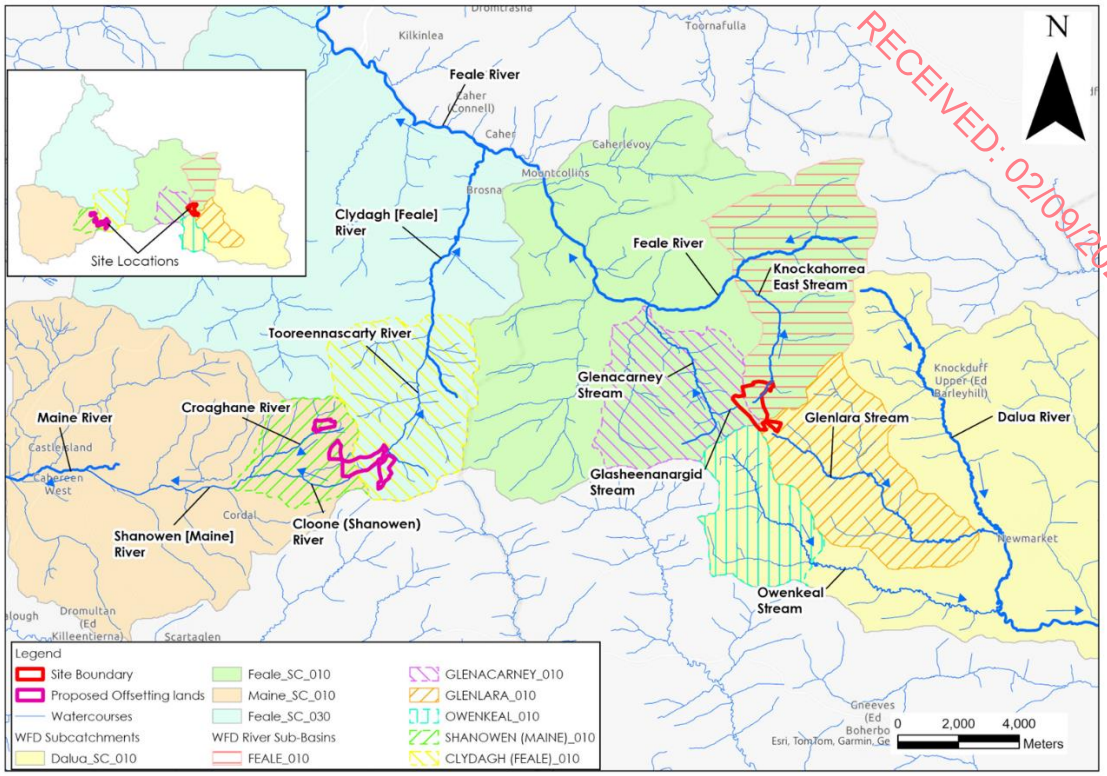


Figure 9-2: Local Hydrology Map

9.3.3.3 Surface Water Flows

There are no OPW gauging stations located immediately downstream of the Site in either the Tralee Bay Feale or Blackwater (Munster) regional surface water catchments for which flow data is available (www.waterlevel.ie). Therefore, the EPA's hydrotool, available on www.catchments.ie, was consulted in order to estimate baseline flow volumes in the local area. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. Several nodes were consulted in the vicinity and downstream of the Site.

A 95 percentile (%ile) flow relates to the flow which will be exceeded within the river 95% of the time. For example, the 95%ile flow at Node 23_1040 on the Knockahorrea East stream (within the Feale_010 WFD river sub-basin) in the immediate vicinity of the Site is estimated to be 0.028m^3/s (28l/s). This indicates that 95% of the time, the flow at this location is estimated to be at or above 0.028m^3/s. The 95%ile flow at Node 23_1963 on the Glenacarney River is estimated to be 0.022m^3/s (22l/s). Due to the increased catchment size, the 95%ile flow at the nodes downstream along the River Feale are significantly larger. For example, at Node 21_160, the 95%ile flow in the River Feale is estimated to be 0.222m^3/s (222l/s). The progressively increasing flow volumes downstream of the Site are associated with the increased upstream catchment of the respective waterbodies. Figure 9-3 below presents the estimated flow duration curves for each of the consulted Hydrotool Nodes.

Within the Blackwater (Munster) catchment, flow volumes on the Glenlara River downstream of the Site are representative of a small local river with the 95%ile flow being 0.019m^3/s (19l/s) at Node 18_879. As seen in Figure 9-4, flow volumes are significantly larger in the Dalua River further downstream.

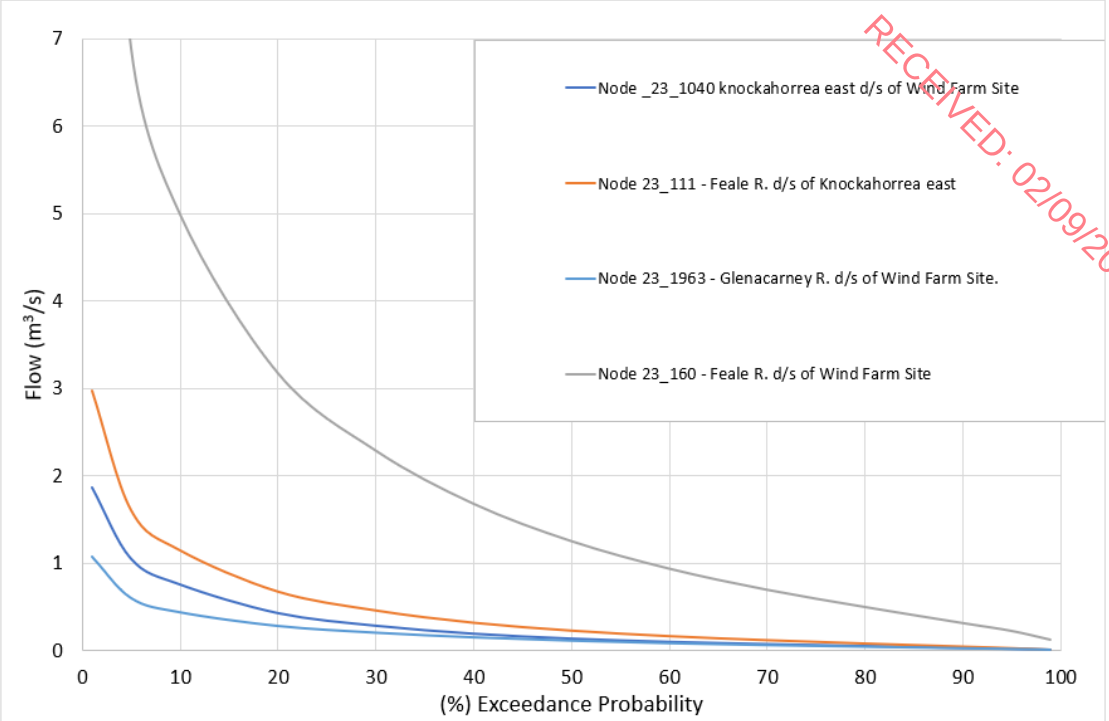


Figure 9-3: EPA HydroTool Node Flow Duration Curves in the Feale River Catchment

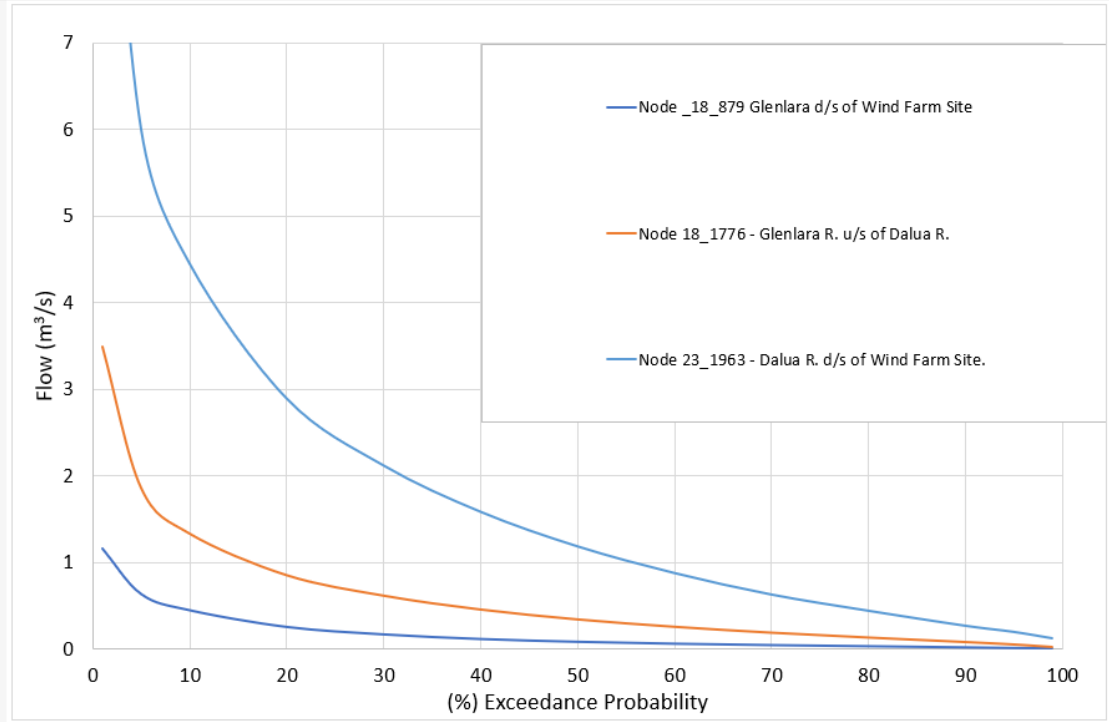


Figure 9-4: EPA HydroTool Node Flow Duration Curves in the Dalua River Catchment

9.3.4 Existing Site Drainage

9.3.4.1 Taurbeg Wind Farm

The topography of the Site is mountainous, with protruding ridges of bedrock outcrop. Ground elevations slope in all directions and range from ~302 to 405mOD. Due to the local topography, the

coverage of peat and low permeability of the underlying bedrock aquifer (refer to Section 9.3.7), the hydrology of the Site is characterised by a high density of surface water features.

The Site is drained by several 1st and 2nd order streams. Several natural watercourses originate within the Site and flow downslope before eventually discharging into the Feale River, to the north, and the Dalua River to the southeast. These watercourses include the Knockahorrea East stream in the east, the Glasheenanargid stream in the west and the Glenlara stream in the southeast

In places the natural drainage is further facilitated by a network of manmade drains. These manmade drains are concentrated within the areas of coniferous forestry and along sections of the existing wind farm access roads.

Several of the hardstand areas have adopted an "over the edge" drainage approach (where no drains are located alongside hardstand areas) in conjunction with sections of roadside drainage swales. Site drainage measures installed during the construction phase (i.e. silt traps settlement and ponds) have since been removed as the Site has naturally revegetated overtime.

The on-site roadways are constructed of permeable crushed stone and are cambered to direct runoff to roadside drains which run along the sides of the roads. This ensures that drainage channels have not formed on the roads, have not eroded the roadways and caused excessive sedimentation downstream. The roadside drains contain check-dams at regular intervals which reduce runoff rates. The roadside drains discharge to several outfall points which are designed in such a way that the natural hydrology of the area remained undisturbed.

Surface water flow monitoring (5 no. locations) of the main watercourses emerging from the Site were carried out on 2 no. occasions and this data is presented in Table 9-7 below. The locations of these monitoring points are shown on Figure 9-6. During the first monitoring round, the recorded flow volumes ranged from 1.5 to 3l/s which are typical of seasonal flows for 1st and 2nd order streams. Meanwhile, during the 2nd monitoring round, many of these upland streams contained little or no flow. No flow was recorded at SW1 or SW2a. For this reason, additional monitoring was completed at SW2b and SW5. The largest flow volume of ~10l/s was observed at SW5.

Table 9-7: Surface Water Flow Monitoring

Location	Round 1 (l/s) 26/03/2024	Round 2 (l/s) 14/08/2024
SW1	1.5	Dry
SW2a	Not included in Round 1	1.5
SW2b	1.5	Dry
SW3	2	0.5
SW4	3	0.5
SW5	Not included in Round 1	10

Within the Site there are also numerous manmade drains that are in place predominately to drain the local forestry plantations. The current internal forestry drainage pattern is influenced by the topography, peat subsoils, layout of the forest plantation and by the existing road network. The forest plantations, are generally drained by a network of mound drains which generally run perpendicular to the

topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains and ploughed ribbon drains are generally spaced approximately every 15m and 2m respectively. As illustrated in Figure 9-5 below, interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. Interceptor drains are also located up-gradient of forestry access roads. Culverts are generally located at stream crossings and at low points under access roads which drain runoff onto down-gradient forest plantations.

The forestry drains are the primary drainage routes towards the natural streams on the Site, but the flows in the higher elevated drains are generally very low or absent most of the time.

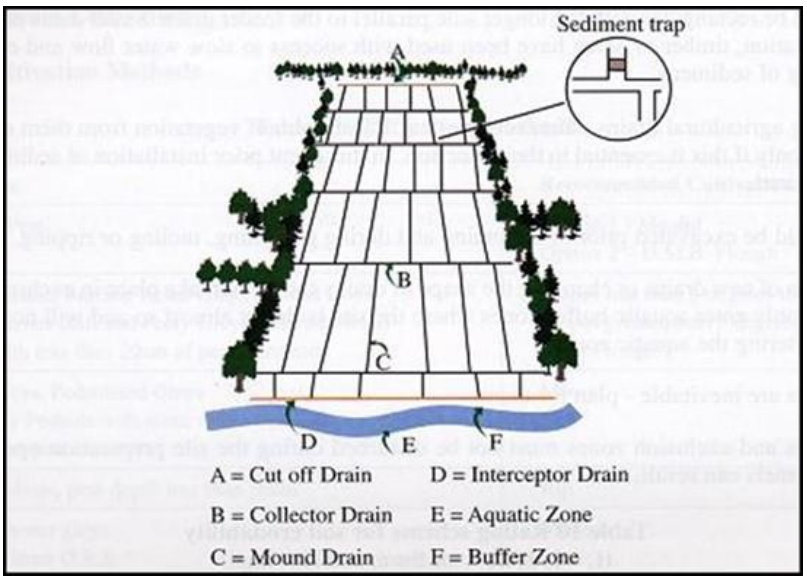


Figure 9-5: Schematic of Existing Forestry Drainage

9.3.4.2 Proposed Offsetting Measures

Proposed Offsetting Areas, 4 and the eastern section of Area 1 are drained by the Glengarriff River and its tributaries, one of which flows between Areas 1 and 4. Meanwhile, the western section of Area 1 and Area 2 are drained by the EPA named Fulacht Fia Coom stream which is a tributary of the Cloone River. These lands comprise of coniferous forestry plantations and are drained by typical forestry drainage consisting of mound and collector drains as detailed above and in Figure 9-5. The forestry drainage regime provides a direct hydrological linkage to the downstream natural watercourses.

Meanwhile, Area 3 is comprised of agricultural pastures. No significant drainage features were recorded in this area, with a manmade agricultural drain located along the northern boundary. This drain connects to the EPA named Knockatee stream to the west. No drain was noted along the southern boundary of Area 3 which is bounded by coniferous forestry.

9.3.5 Summary Flood Risk Assessment

9.3.5.1 Taurbeg Wind Farm

A Flood Risk Assessment of the Site has been carried out by HES, the findings of which are presented in full in Appendix 9-1 and are summarised below.

To identify those areas as being at risk of flooding, the OPW's Past Flood Events Maps, the National Indicative Fluvial Mapping, CFRAM River Flood Extents, historical mapping (i.e. 6" and 25" base

maps) and the GSI Groundwater Flood Maps were consulted. These flood maps are available to view at Flood Maps - Floodinfo.ie.

The OPW Past Flood Events Maps have no records of recurring or historic flood instances within the Site. Similarly, identifiable text on local available historical 6" or 25" mapping does not identify any lands that are "liable to flood".

Within the Tralee Bay Feale catchment the closest mapped historic flood event is ~5km downstream of the Site at the confluence of the Knockahorrea East stream and the Feale River at Rockchapel. This event was recorded in August 1986 (Flood ID: 2414).

Within the Blackwater (Munster) catchment, a recurring flood event is mapped ~7km downstream of the Site along the R578 on the Glenlara River, near its confluence with the Dalua River. According to the Area Engineer Notes for Newmarket, the R578 road flooding occurs along a stretch of ~1km, resulting from high flows in River Dalua (Flood ID: 5153).

The GSI Winter 2015/2016 Surface Water Flood Map shows surface water flood extents for this winter flood event. The Winter 2015/2016 flood event is recognised as being the largest flood event on record in many areas. The flood map for the Winter 2015/2016 flood event does not record any flood zones along the streams and watercourses which drain the Site.

CFRAM mapping has not been completed for the area of the Site. The closest CFRAM mapping to the Site has been completed along the Dalua River to the southeast of Newmarket town, ~11km southeast of the Site.

The National Indicative Flood Mapping (NIFM) for the Present Day Scenario shows flooding along the Knockahorrea East stream and the Glenacarney River in the Tralee Bay Feale catchment downstream of the Site. Fluvial flood zones are also mapped along the Owenkeal and Glenlara Rivers that drain the south of the Site. However, the medium (1% AEP, 1 in 100yr) and low (0.1% AEP, 1 in 1,000yr) probability flood zones do not encroach upon the Site. The Mid-Range and High-End scenarios model potential flood zones associated with climate change and an increase in rainfall of 20% and 30% respectively. These modelled flood zones do not differ significantly from the Present Day Scenario with flooding limited to the immediate vicinity of river channels.

Furthermore, the Site is not mapped within any historic or modelled groundwater flood zones.

The main risk of flooding at the Site is via pluvial flooding. This risk is limited to local flat areas within the Site due to the mountainous nature of the wider area. Surface water ponding/pluvial flooding may occur in some local flat areas due to the presence of low permeability peat at the surface. Mostly the risk of pluvial flooding is low.

In general, the risk of flooding at the Site is very low due to the elevated and sloping nature of the area and the high density of mountain streams which flow rapidly downslope. The existing wind farm drainage system, comprising of natural vegetation filter, interceptor drains, roadside drains and swales.

9.3.5.2 Proposed Offsetting Measures

With regards to the Proposed Offsetting lands, there is no text on local available historical 6" or 25" mapping and it does not identify any lands that are "liable to flood" in the local area. The OPW Past Flood Events Maps have no records of recurring or historic flood instances in the vicinity of the Proposed Offsetting lands. The GSI Winter 2015/2016 Surface Water Flood Map does not record any flood zones along the streams and watercourses which drain the Proposed Offsetting lands.

CFRAM mapping has not been completed for this area. The closest CFRAM mapping has been completed along the River Maine at Castleisland. Furthermore, no NIFM flood zones are mapped in the immediate vicinity of the Proposed Offsetting lands. The closest mapped flood zones are located

along the Glengarriff River (Clydagh River), ~900m downstream of the Proposed Offsetting lands, and along the Croaghane River, ~2.2km west of the Proposed Offsetting lands.

Furthermore, the Proposed Offsetting lands are not mapped within any historic or modelled groundwater flood zones.

The main risk of flooding at the Proposed Offsetting lands is via pluvial flooding. This risk is limited to local flat areas within the Site due to the mountainous nature of the wider area. Surface water ponding/pluvial flooding may occur in some local flat areas due to the presence of low permeability peat at the surface. Mostly the risk of pluvial flooding is low.

In general, the risk of flooding is very low.

9.3.6 Surface Water Quality

9.3.6.1 EPA Biological Q-Rating Data

9.3.6.1.1 *Taurbeg Wind Farm*

Biological Q-rating data for EPA monitoring points on the watercourses in the vicinity and downstream of the Site are shown in Table 9-8 below. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from Q1 (Bad) to 4-5 (High).

Within the Tralee Bay-Feale Regional Surface Water Catchment Q-ratings are not available for the watercourses in the immediate vicinity of the Site. Further downstream at the bridge at Rockchapel (Station Code: RS23F010020), the River Feale achieved an EPA Q-rating of Q4 in the 2023 EPA monitoring round. Meanwhile, the Glenacarney River achieved a Q4-5 rating upstream of its confluence with the River Feale (Station Code: RS23G060300).

Within the Blackwater (Munster) Regional Surface Water Catchment, the Glenlara River achieved a Q3-4 rating in the 2020 EPA monitoring round, just upstream of its confluence with the Dalua River (Station Code: RS18G080500). Meanwhile, the Owenkeal River achieved a Q-rating of Q4-5 at Long Bridge upstream of its confluence with the Dalua River (Station Code: RS18O060600).

A map of local EPA monitoring stations is attached as Figure 9-6 below.

Table 9-8: Latest EPA Water Quality Monitoring Q-Rating Values (2020-2022) Downstream of the Site

Watercourse	Station ID	Easting	Northing	Year	EPA Q-Rating Status
Tralee Bay-Feale catchment					
Feale River	RS23F010020	122000	115914	2023	Q4 (Good)
Glenacarney River	RS23G060300	119114	114914	2020	Q4-5 (High)
Blackwater (Munster) catchment					
Glenlara River	RS18G080500	129880.24	107460.81	2020	Q3-4 (Moderate)
Owenkeal River	RS18O060600	129820.73	104865.69	2020	Q4-5 (High)

9.3.6.1.2 *Proposed Offsetting Measures*

Biological Q-rating data for EPA monitoring points on the watercourses in the vicinity and downstream of the Proposed Offsetting lands are shown in Table 9-9 below.

Within the Laune-Maine-Dingle Bay, the Croaghane River achieved a Q-rating of Q4 in 2022 at Sheheree Bridge (Station Code: RS22C090100). Further downstream, the Shanowen River also achieved a Q4 rating downstream of the confluence Croaghane and Cloone rivers (Station Code: RS22S010020).

Meanwhile, within the Tralee Bay-Feale Regional Surface Water Catchment the Clydagh River achieved a Q4-5 rating at Scalp Bridge (Station Code: RS23C030200) in 2023. Further downstream and upstream of its confluence with the Feale River, the Clydagh River achieved a Q4 rating (Station Code: RS23C030500).

Table 9-9: Latest EPA Water Quality Monitoring Q-Rating Values (2020-2022) Downstream of the Proposed Offsetting Lands

Watercourse	Station ID	Easting	Northing	Year	EPA Q-Rating Status
Laune-Maine-Dingle Bay					
Croaghane River	RS22C090100	106366	109827	2022	Q4 (Good)
Shanowen	RS22S010020	105463	108955	2022	Q4 (Good)
Tralee Bay-Feale					
Clydagh	RS23C030200	112022	114614	2023	Q4-5 (High)
Clydagh	RS23C030500	113705	119999	2023	Q4 (Good)

9.3.6.2 Historical Water Quality Monitoring

No surface water sampling was conducted at the time of the original planning application and therefore, comparisons to the pre-construction baseline water quality at the Site is not possible.

Furthermore, there is no routine surface water quality monitoring carried out for the operational Taurbeg Wind Farm.

9.3.6.3 Contemporary Water Quality Monitoring

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) along with turbidity (NTU) were taken at 4 no. surface water sampling locations over 2 no. monitoring rounds completed on 26th March and 14th August 2024 within surface watercourses draining and directly downstream of the Site. The results are listed in Table 9-10. The monitoring locations were typically in small mountainous streams and the monitoring locations are shown in Figure 9-6 below.

Note that during the August monitoring round no flow was recorded at SW2a or SW1. Therefore, the sampling was moved further downstream to SW2b and SW5 respectively.

Electrical conductivity values at the monitoring locations ranged between 81 and 149µS/cm, with an average conductivity value of 112µS/cm. Turbidity ranged from 1.8 to 10.4NTU. The highest turbidity value of 10.4NTU was recorded at SW3 on 14th August 2024. Dissolved Oxygen ranged from 8.4 to 10.5mg/l. The pH values were generally slightly basic, ranging between 7.8 and 8.9, with an average pH of 8.3.

Table 9-10: Field Parameters - Surface Water Chemistry Measurements (26/03/2024 and 14/08/2024)

Location ID	Temp °C	DO (mg/l)	SPC (µS/cm)	pH	Turbidity (NTU)
SW1	12.3	8.7	114	7.8	4.9
SW2	10.8 – 12.9	8.4 – 8.5	123 - 149	7.9 – 8.2	1.8 - 2.7
SW3	10.9 - 11.7	10.1 - 10.5	81 - 95	8.3 - 8.5	3.4 - 10.4
SW4	11.7 – 15.5	9.2 - 9.3	101 - 116	8.1 - 8.9	3.8 – 4.3
SW5	13.7	10	119	8.6	2.2

Surface water grab samples were also taken at these locations for laboratory analysis. Results of the laboratory analysis are shown alongside relevant water quality regulations in Table 9-11 and Table 9-12 below. Original laboratory reports are attached as Appendix 9-2.

Suspended solid concentrations ranged from <5 to 55mg/l. Suspended solid concentrations were below the S.I 293 (of 1988) threshold limit of 25 mg/l in 7 of the 8 no. samples. The 1 no. exceedance was recorded at SW3 on 14th August 2024. This exceedance occurred as there was very little flow in this stream during this sampling event and sediment at the bottom of the streambed was disturbed during the sampling. Note that the suspended solids concentration at this monitoring location was <5mg/l in the previous monitoring round undertaken on 26th March 2024. Therefore, the exceedance at SW3 can be attributed to disturbance of the streambed during the sampling and is not reflective of naturally high concentrations of suspended solids in this watercourse.

Ammonia was found to be at or below the level of detection of the laboratory (0.02mg/l) in 7 of the 8 no. samples. There was only 1 no. exceedance of the threshold value for High status (≤0.04 mg/l) as set out in SI 272 of 2009. All samples were below the Good status threshold value of ≤0.065mg/l.

BOD ranged between <1 and 2 mg/l. A total of 5 no. samples were of High status (≤1.3mg/l) while 3 no. samples exceeded the good status threshold value of ≤1.5mg/l. The 3 no. exceedances with respect to BOD were recorded on 26th March 2024. This sampling event was preceded by very heavy rainfall which may have contributed to elevated BOD concentrations. Note that BOD achieved 'High' status at all sampling locations in the subsequent sampling (14th August 2024).

Nitrate concentrations were found to be below the level of detection of the laboratory in 7 no. samples. Meanwhile, chloride concentrations ranged from 5.3 to 18.4mg/l.

Table 9-11: Laboratory Results (26/03/2024)

Location ID	Suspended Solids (mg/l)	BOD_5 (mg/l)	Orthophosphate (mg/l)	Nitrate (mg/l NO_3)	Ammonia (mg/l)	Chloride (mg/l)
EQS	**≤25([2])**	**≤ 1.3 to ≤ 1.5([3])**	**-≤ 0.035 to ≤0.025([2])**	**-**	**-≤0.065 to ≤ 0.04([2])**	**-**
SW1	<5	2	<0.02	<5	0.02	9.2
SW2a	<5	2	<0.02	5.6	<0.02	5.3
SW3	<5	1	<0.02	<5	0.02	5.8
SW4	<5	2	<0.02	<5	0.02	9.5

Table 9-12: Laboratory Results (14/08/2024)

Location ID	Suspended Solids (mg/l)	BOD_5 (mg/l)	Orthophosphate (mg/l)	Nitrate (mg/l NO_3)	Ammonia (mg/l)	Chloride (mg/l)
EQS	**≤25([4])**	**≤ 1.3 to ≤ 1.5([5])**	**-≤ 0.035 to ≤0.025([2])**	**-**	**-≤0.065 to ≤ 0.04([2])**	**-**
SW2b	<5	<1	0.04	<5	0.06	18.4
SW3	55	<1	<0.02	<5	<0.02	11.5
SW4	17	<1	<0.02	<5	<0.02	14
SW5	<6	<1	<0.02	<5	0.02	14.7

[2] *S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations*

[3] *S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).*

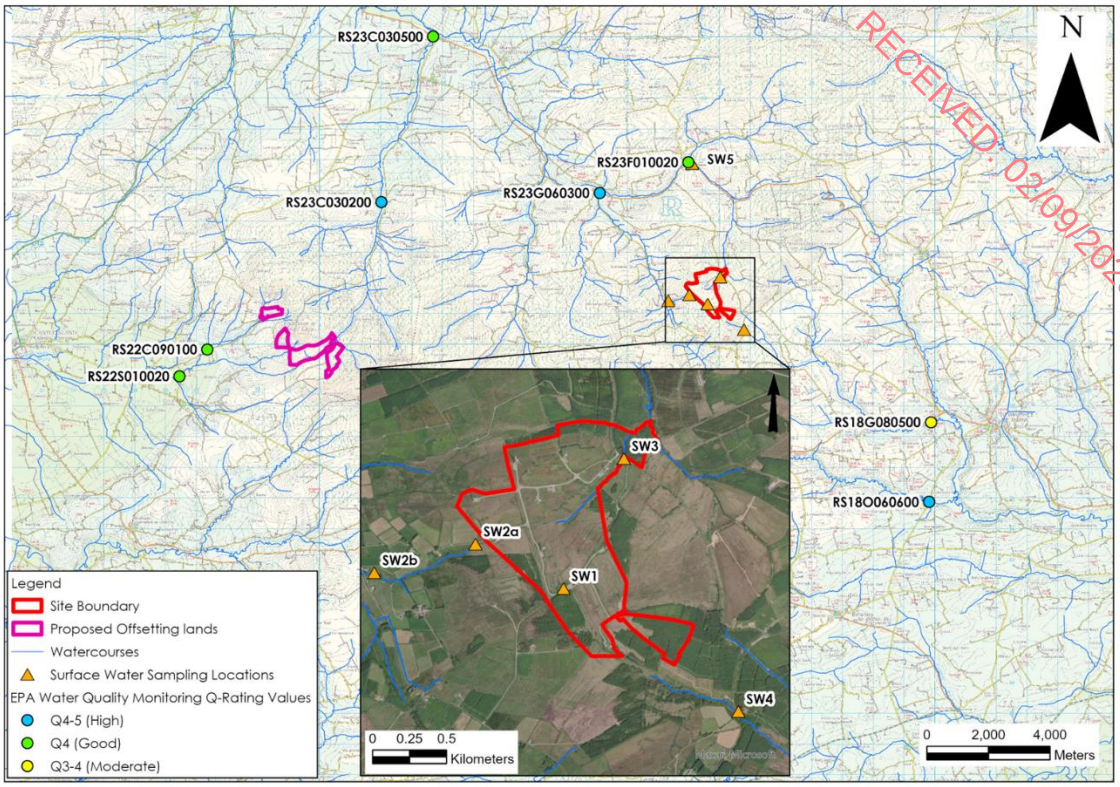


Figure 9-6: Map of EPA Monitoring Stations and HES Sampling Locations

9.3.7 Hydrogeology

9.3.7.1 Taurbeg Wind Farm

The bedrock geology underlying the Site is mapped by the GSI as comprising of Namurian shales in the north and Namurian sandstones in the south. The bedrock is classified by the GSI as being a Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones (www.gsi.ie). A bedrock geology aquifer map is attached as Figure 9-7.

The majority of the Site, including 10 no. existing turbines, is underlain by the Abbeyfeale Groundwater Body (GWB) which is characterized by poorly productive bedrock. The Site is located on the southeastern margin of this GWB. According to the GSI's GWB Characterisation Report, the Abbeyfeale GWB is comprised of rocks that are devoid of intergranular permeability; groundwater flow occurs in fractures and faults. Generally, groundwater levels are 0-6 m below ground level, and follow the topography. Shallow groundwater flow paths are short (30-300 m), with groundwater discharging to the streams and small springs. Artesian conditions and deep inflow levels indicate that there are lower parts of the aquifer that are confined by low permeability layers in the rock succession. Due to the shallow groundwater flow in this aquifer the groundwater and surface waters are closely linked.

Meanwhile, the south of the Site is underlain by the Rathmore West GWB which is also characterised by poorly productive bedrock. This GWB is also comprised of rocks with low transmissivity and storativity. Flow occurs along fractures, joints and major faults. Flows in the aquifer are generally concentrated in a thin weathered zone at the top of the rock. Due to the low permeability of the rock and the sloping topography, a high proportion of effective rainfall will runoff and discharge rapidly to surface watercourses.

Based on observations at the Site, groundwater baseflow contribution to local streams is expected to be very low all year round. This is due to low groundwater recharge rates and the localised groundwater flow pattern below the peat.

Overall, the hydrology of the Site is dominated by surface water runoff on the bog surface and within the existing drainage channels.

9.3.7.2 Proposed Offsetting Measures

The Proposed Offsetting lands are mapped by the GSI to be underlain by Namurian Shales and Namurian Sandstones. These rocks are classified by the GSI as being a Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones.

In terms of GWBs, the eastern areas are underlain by the Abbeyfeale GWB (described above). Meanwhile, the western areas are underlain by the Scartaglin GWB which is characterised by poorly productive bedrock.

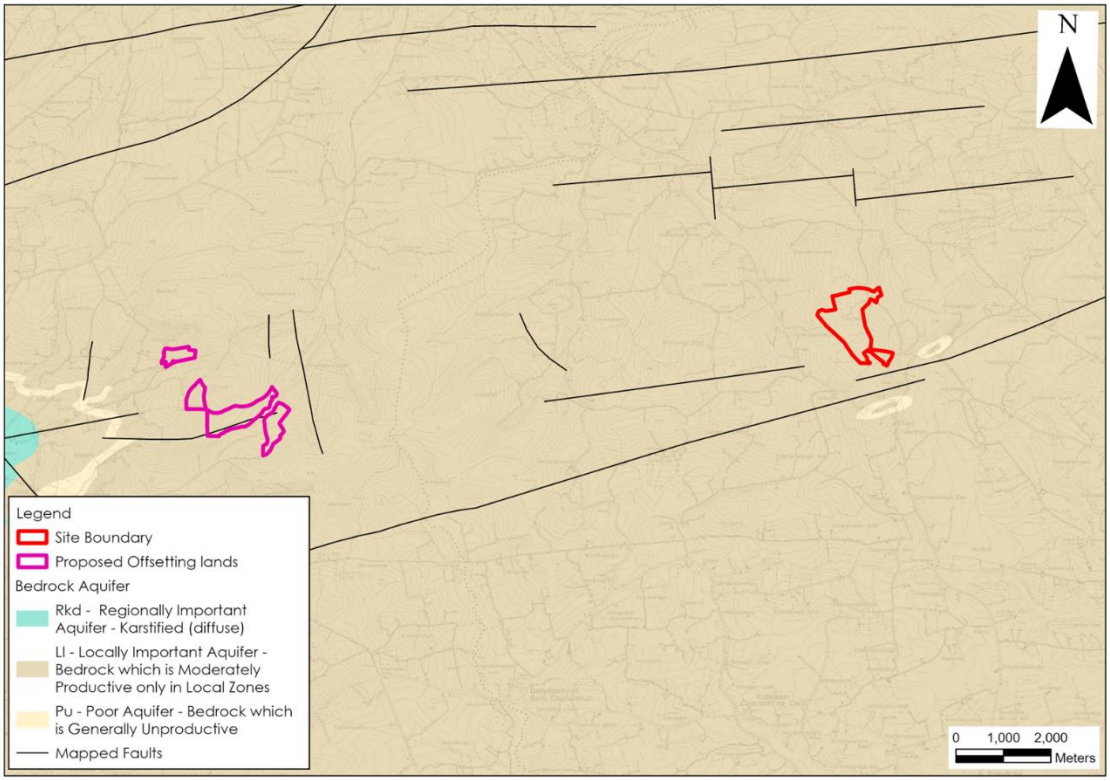


Figure 9-7: Bedrock Geology Aquifer Map

9.3.8 Groundwater Vulnerability

9.3.8.1 Taurbeg Wind Farm

The GSI describe groundwater vulnerability as a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability embodies the characteristics of the intrinsic geological and hydrogeological features at a site that determine the ease of groundwater contamination. Groundwater vulnerability is related to recharge acceptance, whereby in areas where recharge occurs more readily, a higher quantity of contaminants will have access to groundwater.

The mapped vulnerability rating of the bedrock aquifer underlying the Site ranges from Low to Extreme. The areas of Extreme vulnerability are mapped in areas where rock is mapped at or near the ground surface, typically in the vicinity of watercourses. Groundwater vulnerability is mapped as Moderate across the majority of the Site due to the presence of peat soils and subsoils. Based on the site investigations completed at the Site, the depth to rock ranged from 0.86 and 5.1mbgl, with the

soils/subsoils comprising of low permeability peat and clay. Therefore, based on site-specific data, the groundwater vulnerability at the Site ranges from Extreme to Moderate in accordance with Table 9-13.

However, due to the low permeability nature of the Namurian bedrock aquifer underlying the existing wind farm site, groundwater flowpaths are likely to be short (30 – 300m), with recharge emerging close by at seeps and surface streams. This means there is a low potential for groundwater dispersion and movement within the aquifer, therefore local surface watercourses are more vulnerable (to contamination from human activities) than groundwater in this area.

Table 9-13: Groundwater Vulnerability and Subsoil Permeability and Thickness (www.gsi.ie)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

9.3.8.2 Proposed Offsetting Measures

The Proposed Offsetting lands are mapped in areas of Moderate to Extreme groundwater vulnerability. However, due to the low permeability of the underlying bedrock, and the dominance of low permeability peat soils/subsoils, local watercourses are more vulnerable in this area.

9.3.9 Groundwater Hydrochemistry

9.3.9.1 Taurbeg Wind Farm

There are no groundwater quality data for the Site and groundwater sampling would not be undertaken for an existing wind farm, as groundwater quality impacts are extremely unlikely. There are also no wastewater discharges to ground as all wastewater (at the control/substation building) is contained in a holding tank and removed from the Site.

The WFD status for the Abbeyfeale and Rathmore West GWBs in terms of water quality is 'Good' and therefore this is assumed to be the baseline condition for groundwater in the Site.

The GSI's Initial Characterisation Report for the Abbeyfeale GWB (GSI, 2004) states that no hydrochemical data is currently available for this GWB. Groundwaters sampled in the adjacent Ballylongford GWB are moderately hard (120-270 mg/l $CaCO_3$) and have moderate alkalinities (170-240 mg/l $CaCO_3$). Measured electrical conductivity ranges from ~440-560 µS/cm.

The GSI's Initial Characterisation Report for the Rathmore West GWB (GSI, 2004) states that groundwater emanating from the Namurian rocks is generally slightly hard, with an average total hardness of about 110 mg/l. There are variable water type classifications, varying from calcium-magnesium-sodium bicarbonate to sodium bicarbonate, reflecting the high ion exchange capacity of the rocks The main groundwater quality problems due to the natural conditions in the ground and the natural chemistry of groundwater are caused by iron (Fe). A high proportion of wells in the Namurian

rocks have high iron concentrations (more than 20 mg/l (total Fe) in places) and to a lesser extent manganese (Mn) (up to 0.53 mg/l).

9.3.9.2 Proposed Offsetting Measures

There is no groundwater quality data for the Proposed Offsetting lands and groundwater sampling would not be undertaken due to the shallow nature of the proposed works.

9.3.10 Water Framework Directive Water Body Status & Objectives

The River Basin Management Plan was adopted in 2018 and has amalgamated all previous river basin districts into one national river basin management district. The Water Action Plan 2024 is Ireland's third River Basin Management Plan and it outlines the measures the Government and other sectors are taking to improve water quality in Ireland's groundwater, rivers, lakes, estuarine and coastal waters, and provides sustainable management of our water resources. The Water Action Plan 2024 enhances and builds upon the work of the first and second-cycle plans. The Water Action Plan objectives, include the following:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration
- Meet the water standards and objectives for designated protected areas;
- Protect high-status waters; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (i) targeting waterbodies close to meeting their objectives and (ii) addressing more complex issues that will build knowledge for future cycles.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all. Furthermore, any development must not in any way prevent a waterbody from achieving at least good status by 2027.

Strict mitigation measures (refer to Section 9.5.2 and 9.5.3) in relation to maintaining a high quality of surface water runoff from the development and groundwater protection will ensure that the status of both surface water and groundwater bodies in the vicinity of the Site will be at least maintained (see below for WFD water body status and objectives) regardless of their existing status.

9.3.11 Groundwater Body Status

Local Groundwater Body (GWB) and Surface Water Body (SWB) status reports are available for view from (www.catchments.ie).

The Abbeyfeale and Rathmore West GWBs achieved 'Good' status in all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021) (refer to Table 9-14). In terms of risk status, these GWBs have been deemed to be 'not at risk' of failing to meet their respective WFD objectives. No pressures have been identified for the GWBs underlying the Site.

Furthermore, the Scartaglin GWB underlying the western section of the Proposed Offsetting lands achieved "Good" status in all 3 no. WFD cycles. This GWB is also "not at risk" and no significant pressures have been identified.

Table 9-14: WFD Groundwater Body Status (Site and Proposed Offsetting Lands)

GWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Abbeyfeale	Good	Good	Good	Not at risk	None
Rathmore West	Good	Good	Good	Not at Risk	None
Scartaglin	Good	Good	Good	Not at risk	None

9.3.12 Surface Water Body Status

9.3.12.1 Taurbeg Wind Farm

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) in the vicinity and downstream of the Site are shown in Table 9-15 below.

As stated above, the vast majority of the Site is located in the Tralee Bay-Feale surface water catchment. The Feale_010 SWB which drains the majority of the Site achieved 'High' status in the latest WFD cycle (2016-2021). This was an improvement on 'Good' status which this SWB achieved in the previous cycles. The Glenacarney_010 SWB drains the northwest of the Site and this SWB is of 'Good' status. Further downstream the Feale_020 and Feale_030 SWBs also achieved 'Good' status in all 3 no. WFD cycles.

In terms of risk status these SWBs have been deemed to be 'not at risk' of failing to meet their respective WFD objectives. No significant pressures have been identified to be impacting these SWBs.

The south of the Site is located in the Munster (Blackwater) surface water catchment. In this area of the site the Owenkeal_010 SWB achieved 'Good' status in the last 2 no. WFD cycles (2013-2018 and 2016-2021). Note that no infrastructure associated with the existing Taurbeg Wind Farm is located in the Owenkeal_010 WFD river sub-basin. Meanwhile, 1 no. turbine is mapped in the Glenlara_010 river sub-basin. This SWB achieved 'Moderate' status in all 3 no. WFD cycles. Further downstream the Dalua_020 and Dalua_030 SWBs are of 'Good' status.

In terms of risk status the Dalua_020 and Owenkeal_010 SWBs are 'not at risk'. The Glenlara_010 and Dalua_030 SWBs are deemed to be 'at risk' of failing to meet its WFD objectives. The Glenlara_010 SWB has been identified to be under significant pressure to the forestry activities and hydromorphological stresses while the Dalua_030 SWB has been identified to be under other pressures.

Table 9-15: Summary WFD Information for Surface Water Bodies Downstream of the Site

River Waterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Tralee Bay-Feale Catchment					
Feale_010	Good	Good	High	Not at risk	None
Glenacarney_010	Good	Good	Good	Not at risk	None
Feale_020	Good	Good	Good	Not at risk	None
Feale_030	Good	Good	Good	Not at risk	None
Blackwater (Munster) Catchment					
Owenkeal_010	High	Good	Good	Not at risk	None
Glenlara_010	Moderate	Moderate	Moderate	At risk	Forestry & Hydromorphology
Dalua_020	Good	Good	Good	Not at risk	None
Dalua_030	Good	Good	Good	At risk	Other

9.3.12.2 Proposed Offsetting Measures

Within the Laune-Maine-Dingle Bay regional surface water catchment, the Shanowen (Maine)_010 SWB in the vicinity of the Proposed Offsetting lands achieved "Good" status in all 3 no. WFD cycles. Further downstream the Maine_010 SWB achieved 'Moderate' status in the latest WFD cycle (2016-2021). This was a deterioration from the 'Good' status which this SWB achieved previous WFD cycles. The Maine_010 SWB is deemed to be at risk of failing to meet its WFD objectives and is listed as being under significant pressure from hydromorphological impacts.

Within the Tralee Bay-Feale regional surface water catchment, the Clydagh (Feale)_010 and _020 SWBs downstream of the Proposed Offsetting lands achieved 'High' status in the latest WFD cycle (2016-2021). This was an improvement in status from the 'Good' status which these SWBs achieved in the 2013-2018 cycle. These SWBs are not at risk of failing to meet their WFD objectives. A summary of the WFD status and risk result for Surface Water Bodies (SWBs) in the vicinity and downstream of the Proposed Offsetting lands are shown in Table 9-16 below.

Table 9-16: Summary WFD Information for Surface Water Bodies Downstream of the Proposed Offsetting Lands

River Waterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Tralee Bay-Feale Catchment					
Clydagh (Feale)_010	Good	Good	High	Not at risk	None
Clydagh (Feale)_020	Moderate	Good	High	Not at risk	None
Laune-Maine-Dingle Bay					
Shanowen (Maine)_010	Good	Good	Good	Not at risk	None
Maine_010	Good	Good	Moderate	At risk	Hydromorphology

9.3.13 Designated Sites and Habitats

9.3.13.1 Taurbeg Wind Farm

Within the Republic of Ireland, designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

The Site is located within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161). All of the existing infrastructure apart from the existing wind farm site entrance, T7 and T6, are mapped within this SPA. This SPA is designated due to the presence of Hen Harrier.

Within the Tralee Bay-Feale surface water catchment, the Lower River Shannon SAC (Site Code: 002165) is located downstream of the Site via the Knockahorrea East Stream. The length of the hydrological pathway between the Site and the SAC is ~2.2km. The Lower River Shannon SAC is designated due to the presence of several water dependent species and habitats which are listed in Annex I/II of the E.U. Habitats Directive.

Within the Blackwater (Munster) surface water catchment the Blackwater River (Cork/Waterford) SAC (Site Code: 002170) is located downstream of the Site. The length of the hydrological flowpath between the Site and the SAC is ~6.5km via the Glenlara River. The Blackwater River (Cork/Waterford) SAC is designated due to the presence of several water dependent species and habitats which are listed in Annex I/II of the E.U. Habitats Directive.

There are no other designated sites within 5km of the Site.

A map of local designated sites is attached as Figure 9-8 below.

9.3.13.2 Proposed Offsetting Measures

The Proposed Offsetting lands are also mapped within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. This SPA is a very large site centred on the borders between Cork, Kerry and Limerick. The SPA consists of a variety of upland habitats, through almost half is afforested. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Hen Harrier. It is a conservation objective to restore the extent and quality of both open heath and bog habitats within the SPA as these habitats can provide important nesting and foraging resources.

The Proposed Offsetting lands are also located immediately adjacent to the Mount Eagle Bogs NHA (Site Code: 002449). This NHA consists of four areas of blanket big adjacent to Mount Eagle and includes the summits of Mount Eagle, Knockfeha and Knockanefune. The Proposed Offsetting lands are located topographically downgradient of this NHA (no surface water connections via rivers or streams existing between the Proposed Offsetting lands and this NHA).

Within the Tralee Bay-Feale regional surface water catchment, the Proposed Offsetting lands are also located immediately upstream of the Lower River Shannon SAC (Site Code: 002165), the length of the hydrological flowpath between the Proposed Offsetting lands and the SAC is ~2km along the Glengarriff River.

Within the Laune-Maine-Dingle Bay regional surface water catchment, the Proposed Offsetting lands are located ~28km northeast (straight line distance) of the Castlemaine Harbour SAC (Site Code: 000343).

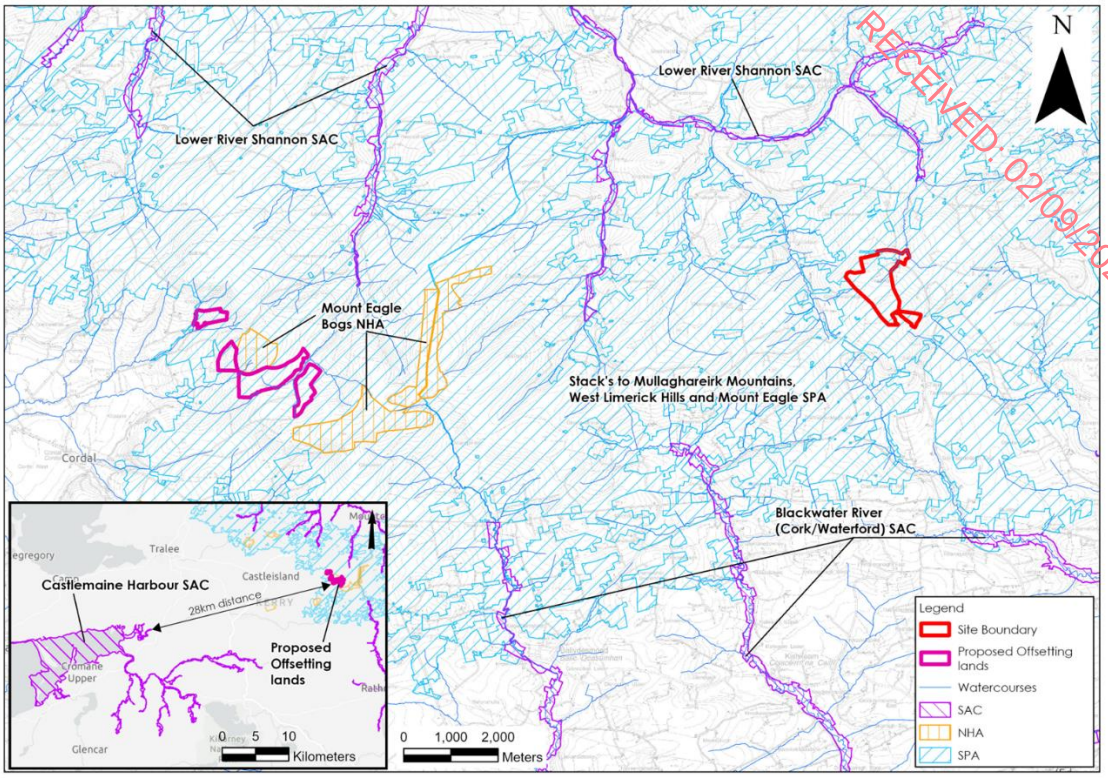


Figure 9-8: Designated Sites

9.3.14 Water Resources

9.3.14.1 Groundwater Resources

9.3.14.1.1 *Taurbeg Wind Farm*

The GSI do not map the presence of any registered Group Water Schemes (GWS) or Public Water Schemes (PWS) or associated source protection areas within the Site (www.gsi.ie).

There are no PWS or GWS within 10km of the Site. The closest mapped GWS is the Kileedy GWS. The source protection area associated with this GWS is mapped ~11km to the northeast of the Site.

A search of private well locations (wells with location accuracy of 1–100m were only sought) was undertaken using the GSI well database (www.gsi.ie). 2 no. wells (GSI Name: 1111SWW041 and 1111SWW040) are located to the northeast of the Site in the townland of Glennakeel South. These wells are mapped ~1.4 and 1.9km northwest of T3 and are listed as having agricultural and domestic uses. According to the GSI (www.gsi.ie) these wells have a moderate yield class of 16.4m^3/day.

A map of local wells identified by the GSI is attached as Figure 9-9.

9.3.14.1.2 *Proposed Offsetting Measures*

There are no PWS or GWS in the vicinity of the Proposed Offsetting lands. The GSI map several local private wells/boreholes in the lands to the west of the Proposed Offsetting lands. These wells are used for agricultural and domestic purposes and are listed as having a poor to moderate yield class.

9.3.14.2 Surface Water Resources

9.3.14.2.1 *Taurbeg Wind Farm*

The closest downstream surface water abstraction in the Tralee Bay -Feale surface water catchment is located on the Feale River (Feale_050 DWPA – Drinking Water Protected Area). This Uisce Éireann abstraction is for the Abbeyfeale Public Water Supply. It is ~20km downstream of the Site, and it has an estimated maximum abstraction volume of ~3,010m^3/day.

Meanwhile, within the Blackwater (Munster) surface water catchment the closest downstream surface water abstraction point is located in the Blackwater River downstream of Mallow (Blackwater (Munster)_150) SWB. This abstraction is for Uisce Éireann's Zone 4 Mallow Scheme. It is ~52km downstream of the Site, and it has an estimated maximum daily abstraction rate of ~453m^3/day.

9.3.14.2.2 Proposed Offsetting Measures

The Clydagh (Feale)_020 SWB downstream of the Proposed Offsetting lands is listed as a DWPA. According to the EPA, abstraction register this DWPA is associated with the Brosna/Knocknagoshel PWS which has an estimated maximum daily abstraction rate of 1,806m^3/day. The length of the hydrological flowpath between the Proposed Offsetting lands and this SWB is ~5km along the Glengarriff River.

There are no surface water abstractions located downstream of the Proposed Offsetting lands in the Laune-Maine-Dingle Bay regional surface water catchment.

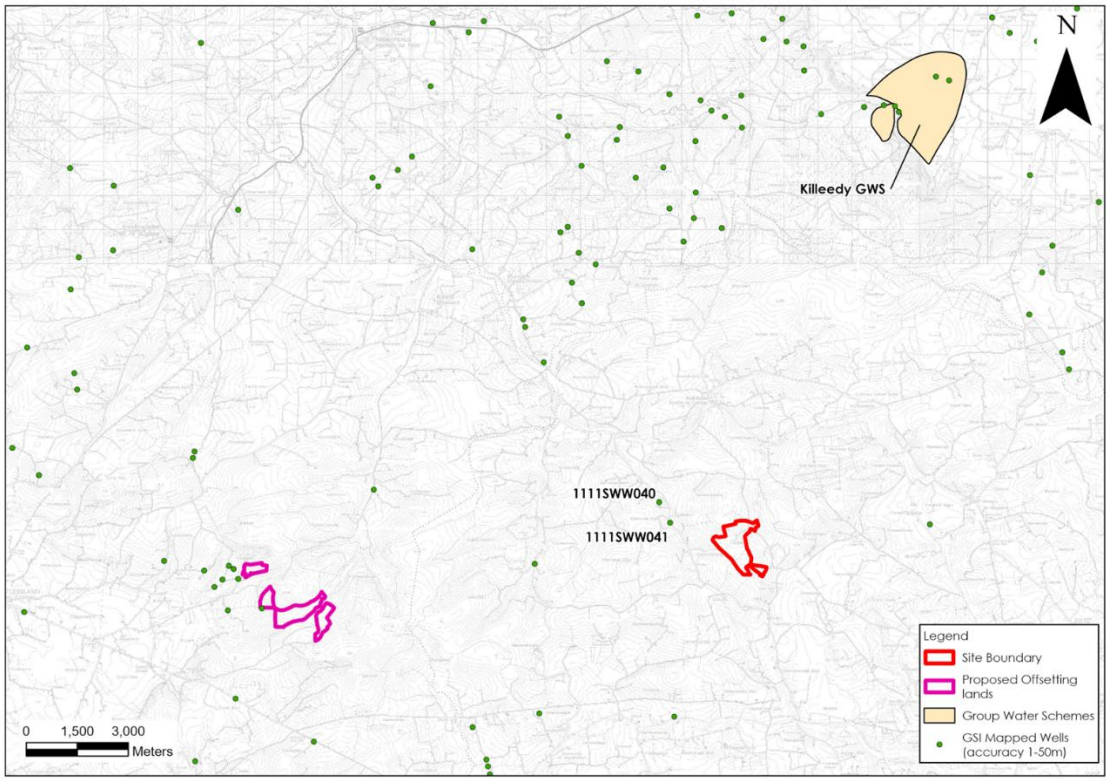


Figure 9-9: Map of Groundwater Wells (www.gsi.ie)

9.3.15 Receptor Sensitivity

The greatest potential for impacts on the hydrological and hydrogeological environment associated with wind farm developments occurs during the construction phase of the development as this is the phase when earthworks and excavations would be undertaken. However, there are no construction requirements associated with the Proposed Lifetime Extension and therefore the risk to downstream sensitive receptors is significantly reduced.

The primary risks to the water environment during the extended operational phase are from hydrocarbon spillage/leakages along with surface water runoff and potential erosion issues (sediment entrainment) arising from the existing hardstand areas.

Similar potential impacts can occur on all developed sites including industrial, commercial and farmyards. All potential contamination sources are to be carefully managed at the Site during the Proposed Lifetime Extension and mitigation measures are proposed below (Section 9.5) to deal with these minor potential effects.

With regards to the potential impacts associated with the Proposed Offsetting Measures, due to the near surface nature of the activities (i.e. deforestation and restoration of farmland) effects on groundwater are generally negligible and surface water is the main sensitive receptor to be assessed. The primary risk to groundwater at the Proposed Offsetting lands would be from hydrocarbon spillage and leaks. This is a common potential effect on all construction/forestry sites. The greatest risk to surface waters will come from elevated concentrations of suspended sediment and nutrient releases during deforestation. Comprehensive surface water mitigation and controls are detailed to ensure the protection of all downstream receiving waters.

9.3.15.1 Aquifers/Groundwater Bodies

The Proposed Lifetime Extension maintenance works have the potential to contaminate groundwaters with hydrocarbons being used at the Site. The following sensitive groundwater receptors are identified for impact assessment associated with the Proposed Lifetime Extension:

- The Locally Important Aquifers underlying the Site. These aquifers can be considered to be of Medium Importance in accordance with Table 9-3;
- The WFD status of the GWBs (Abbeyfeale and Rathmore West GWBs) underlying the Site; and,
- The local private groundwater abstractions in the lands surrounding the Site.

Additionally, the following receptors are identified for impact assessment associated with the Proposed Offsetting Measures:

- The Locally Important Aquifers underlying the Proposed Offsetting lands, and;
- The WFD status of the GWBs (Abbeyfeale and Scartaglin GWBs) underlying the Proposed Offsetting lands.

9.3.15.2 Surface Waters

Surface waters are the main sensitive receptors associated with the Proposed Project due to the local hydrological regime which is characterised by high runoff rates and low rates of groundwater recharge.

The quantification of flow volumes presented in Section 9.3.4.1 indicates that the watercourses in the immediate vicinity of the Site will be most susceptible to potential effects. The larger regional waterbodies such as the Allow River in the Blackwater (Munster) surface water catchment and the Feale River in the Tralee Bay-Feale surface water catchment will be less susceptible to effects due to the larger flow volumes and the associated dilution effect of these increased flows. The potential for effects to occur will decrease progressively further downstream of the Site.

The following surface water receptors are identified for impact assessment associated with the Proposed Lifetime Extension:

- The local surface waters downstream of the Site in the Tralee Bay-Feale surface water catchment, including the Glenacarney and Knockahorrea East tributaries of the

Feale. These watercourses can be considered to be of Very High Importance based on their Q-ratings (refer to Table 9-2); and,
- The WFD status of the SWBs in the vicinity and downstream of the Site.

The downstream surface water abstractions along the River Feale at Abbeyfeale and the River Blackwater at Mallow have been screened out of the impact assessment due to the length of the hydrological pathways between these drinking water protected areas and the Site (~20km and ~52km respectively). Furthermore, the increasing volumes of water within the Feale and Blackwater rivers will provide a significant dilution effect. There is no potential for the Proposed Lifetime Extension to impact these surface water abstractions.

With regards to the Proposed Offsetting Measures, the following surface water receptors are identified for impact assessment:

- The local surface watercourses downstream of the Proposed Offsetting lands including the Glengarriff River in the Tralee Bay-Feale surface water catchment and the Shanowen River in the Laune-Maine-Dingle Bay surface water catchment; and,
- The WFD status of these SWBs in the vicinity and downstream of the Proposed Offsetting lands.

Furthermore, the downstream abstraction on the Clydagh (Feale)_020, associated with the Brosna/Knocknagoshel PWS, will be included in the impact assessment as this DWPA is located ~5km downstream of the Proposed Offsetting lands.

9.3.15.3 Designated Sites

The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA will be included in the impact assessment as the Site is located within this designated site. Whilst the SPA does not contain any water-dependent qualifying interest, deterioration in the water environment may impact the overall condition of the SPA.

The only other designated sites with the potential to be affected by the Proposed Project are located downstream of the Site along the Glenlara River and the tributaries of the Feale River (i.e. Knockahorrea East stream and the Glenacarney River).

Based on the above, the following designated sites are identified for impact assessment associated with the Proposed Lifetime Extension:

- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA;
- Lower River Shannon SAC; and,
- Blackwater River (Cork/Waterford) SAC.

Furthermore, the following designated sites are identified for impact assessment associated with the Proposed Offsetting Measures:

- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA;
- Mount Eagle Bogs NHA; and,
- Lower River Shannon SAC;

9.4 Characteristics of the Proposed Project

Planning permission is being sought for the Proposed Lifetime Extension of Taurbeg Wind Farm as permitted by Cork County Council under planning regulation ref N/2002/3608, for a further period of 10 years from the date of expiry (2026) as per Condition no. 7 of the original planning consent issued, with decommissioning of the wind farm at the end of the proposed extension period.

The Proposed Project is described in full in Chapter 4 of this EIAR and related to the extended operation of all elements of the existing wind farm and the enhancement and management of lands for the purposes of hen harrier mitigation.

There are no alterations proposed to the existing wind farm infrastructure, therefore, there are no requirements for construction works or reinstatement works for the Proposed Lifetime Extension.

Typically, daily operational phase maintenance traffic will consist of four-wheel drive vehicles or vans with no off-road requirements.

During the Proposed Lifetime Extension, occasionally vehicles or plant may be necessary for maintenance of access roads, drainage networks and hardstands along with some minor landscaping works.

Small amounts of granular material may be imported to maintain access tracks and hardstands during the Proposed Lifetime Extension which will place intermittent minor demand on local quarries.

The Proposed Offsetting lands consist of 4 no. parcels of land proposed for hen harrier habitat creation, 3 in the townland of Coom (Areas 1, 2 and 4) and 1 no. further north in the townland of Knockatee (Area 3). It is proposed to permanently remove c. 105.5 hectares of plantation forestry which will create more biodiverse upland habitats suitable for foraging hen harrier. Approximately 10ha of this land will be permanently removed offsite, with the remaining 95.5 ha of felled material being stacked into windrows on site. Regarding the farmland area (c.17.7 ha), this land will be permanently restored for the benefit of hen harrier through restoration measures such as planting and restoring of hedgerow, implementation of a rotational grazing scheme, linear wildlife crop sowing, cease on fertiliser application and predator fencing. The total area of the Proposed Offsetting lands is ~123.2ha. Full details of the Proposed Offsetting Measures are also outlined in Chapter 4 and Appendix 7-7.

9.5 Likely Significant Effects and Associated Mitigation Measures

9.5.1 Do -Nothing Scenario

If the Proposed Project were not to proceed, the existing Taurbeg Wind Farm will be decommissioned, as per the existing permission.

During decommissioning of the wind farm, it is intended to limit groundworks other than to rehabilitate constructed areas such as turbine bases and hardstanding areas. This will be done by covering with topsoil to encourage vegetation growth and reduce run-off and sedimentation. The turbines will be removed and transported off-site and the turbine concrete bases will remain in the ground and backfilled.

A Decommissioning Plan is proposed as part of the Proposed Lifetime Extension. This is presented in Appendix 4-3 of this EIAR.

With regards to the Proposed Offsetting lands, areas 1, 2 and 4 would continue to function as a coniferous forestry plantation and would be felled and replanted several times in the future. Area 3 would continue as agricultural land.

9.5.2 Proposed Offsetting Measures - Likely Significant Effects and Mitigation Measures

There are no proposed construction works associated with the Proposed Lifetime Extension.

The only works associated with the Proposed Project relate to the Proposed Offsetting Measures. These works are assessed in terms of their potential to impact the hydrological and hydrogeological environment below.

9.5.2.1 Potential Effects from Deforestation of Coniferous Plantation

Deforestation is a component of the Proposed Offsetting Measures with ~105.5ha of coniferous forestry proposed for deforestation.

Potential effects during deforestation occur mainly from:

- Exposure of soil and subsoils due to vehicle tracking, compaction and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface watercourses;
- Entrainment of suspended sediment in watercourses due to vehicle tracking through watercourses;
- Damage to forest roads resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface watercourses;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

These effects have the potential to affect the water quality and fish stocks of downstream water bodies. Potential effects on all watercourses downstream of the Proposed Offsetting lands could be significant if not mitigated.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface water quality in rivers and streams draining the Proposed Offsetting lands including the Glengarriff River, the Cloone River and the Croaghane River and associated dependent ecosystems.

Pre-Mitigation Potential Effect: Negative, significant, indirect, temporary, likely effect on surface water quality and dependent aquatic ecosystems.

Proposed Mitigation Measures:

Forestry operations will conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and DAFM guidance documents, including the specific guidelines listed below, to ensure that deforestation and other forestry operations result in minimal potential negative effects to the receiving environment. These mitigation measures are tried and tested, best practice mitigation measures which are implemented at forestry sites across the country. The guidance documents include:

- Forestry Standards Manual (Forest Service, 2015)
- Environmental Requirements for Afforestation (Forest Service, 2016a)
- Land Types for Afforestation (Forest Service, 2016b)
- Forest Protection Guidelines (Forest Service, 2002)
- Forest Operations and Water Protection Guidelines (Coillte, 2013)
- Forestry and Water Quality Guidelines (Forest Service, 2000b)
- Forestry and the Landscape Guidelines (Forest Service, 2000c)
- Forestry and Archaeology Guidelines (Forest Service, 2000d)
- Forest Biodiversity Guidelines (Forest Service, 2000e)
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018)
- Coillte Planting Guideline SOP
- A Guide to Forest Tree Species Selection and Silviculture in Ireland (Horgan et al., 2003)
- Management Guidelines for Ireland's Native Woodlands. Jointly published by the National Parks & Wildlife Service (Cross and Collins, 2017)
- Native Woodland Scheme Framework (Forest Service, 2018)
- Code of Best Forest Practice (Forest Service, 2000)

Mitigation by Avoidance:

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" will be implemented during the deforestation activities.

The following buffer zones will be implemented:

- No disturbance to ground will occur within 5m of a relevant watercourse or within 10-20m for aquatic zones.
- In areas of higher sensitivity or where silt movement is more likely this zone will increase to 20m;
- In these sensitive areas, there will be no machines crossing any natural watercourse;
- Refuelling and maintenance of machines will occur at least 50m from watercourses. It is proposed that refuelling will only be completed at the existing entrance to Area 2. This location is distant from any watercourses;
- Use natural buffer zones to filter water from mound drains;
- Short, stepped mound drains to be used in moderately sloped areas; and,
- No drainage on very steep slopes, within delineated aquatic or buffer zones.

The setback distance from sensitive hydrological features means that adequate room is maintained for the proposed mitigation measures (discussed below) to be properly installed and operate effectively. The buffer/setback zone will:

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and the associated release of sediment;
- Avoid peat/soil disturbance and compaction within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from works into watercourses; and,
- Avoid the entry of suspended sediment from the drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

In addition to the application of buffer/setback zones, the following supplementary mitigation measures will be employed during deforestation works:

Mitigation by Design:

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out as follows:

- The deforestation coupes are carefully planned to ensure no unnecessary water crossings will be required.
- Machine combinations will be chosen which are most suitable for ground conditions at the time of deforestation, and which will minimise soils disturbance. The harvester and the forwarder are designed specifically for the forest environment and are low ground pressure machines;
- All machinery will be operated by suitably qualified personnel;
- Checking and maintenance of forest roads and culverts will be on-going through any deforestation operations. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during deforestation works;
- These machines will traverse the site along specified off-road routes (referred to as brash mats);
- The location of brash mats will be chosen to avoid wet and potentially sensitive areas;
- Brash mats will be placed to support the vehicles on soft ground, reducing peat and mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Silt fences will be installed at the outfalls of existing drains downstream of deforestation areas. No direct discharge of such drains to watercourses will occur. Sediment traps and silt fences will be installed in advance of any deforestation works and will provide surface water settlement for runoff from work areas and will prevent sediment from entering downstream watercourses. Accumulated sediment will be carefully disposed of at pre-selected peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion it will be necessary to install double or triple sediment traps and increase buffer zone width. These measures will be reviewed on site during the Proposed Offsetting works;
- Double silt fencing will also be put down slope of deforestation areas which are located in close proximity to streams and/or relevant watercourses;
- Drains and silt traps will be maintained throughout all deforestation works, ensuring that they are clear of sediment build-up and are not severely eroded;

- Timber will be stacked in dry areas, and outside watercourse buffer zones. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water runoff;
- Refuelling will occur at a designated refuelling area at the existing entrance to Area 2. This refuelling area is remote from all watercourses. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Deforestation will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Drain Inspection and Maintenance:

The following items shall be carried out during inspection before deforestation and after:

- Communication with forestry operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During inspections prior to deforestation, the main drainage ditches shall be identified. Ideally the inspection shall be carried out during rainfall;
- Following deforestation, all main drains shall be inspected to ensure that they are functioning;
- Extraction tracks near drains need to be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site will be unblocked; and,
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring:

In line with standard forestry practice, and in combination with the above, grab sampling will be completed at additional sampling locations downstream of deforestation areas before, during (if the operation is conducted over a protracted time) and after the deforestation activity. The ‘before’ sampling should be conducted within 4 weeks of the deforestation activity, preferably in medium to high water flow conditions. The “during” sampling will be undertaken once a week or after rainfall events. The ‘after’ sampling will comprise as many sampling events as necessary to demonstrate that water quality has returned to pre-activity status (*i.e.* where an effect has been shown).

Criteria for the selection of water sampling points include the following:

- Avoid man-made ditches and drains, or watercourses that do not have year round flows, i.e. avoid ephemeral ditches, drains or watercourses;
- Select sampling points upstream and downstream of the forestry activities;
- It is advantageous if the upstream location is outside/above the forest in order to evaluate the effect of land-uses other than forestry;
- Where possible, downstream locations should be selected: one immediately below the forestry activity, the second at exit from the forest, and the third some distance from the second (this allows demonstration of no effect through dilution effect or

contamination by other land-uses where impact increases at third downstream location relative to second downstream location); and,

- The above sampling strategy will be undertaken for all on-site sub-catchments streams where deforestation is proposed.

Post Mitigation Residual Effects: Deforestation operations pose a risk to surface water quality in downstream receptors due to the release of suspended sediments and nutrient enrichment. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be - Negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on the surface water quality will occur.

9.5.2.2 Potential Effects from Deforestation and Nutrient Release to Surface Waters

The afforestation of the Proposed Offsetting lands would have required an initial one-off application of a phosphate based fertiliser when the trees were replanted. Phosphate application was required due to the presence of peat soils which are strongly acidic and contain low levels of available nutrients. In these acidic soils, phosphorus is one of the major limiting factors of primary productivity and phosphate, typically in the form of rock phosphate, is applied when the trees are planted to ensure that the plantations have sufficient phosphorous for sustainable growth. Typically, only one application of the phosphate is required, as once the trees are growing phosphate recycles naturally and run-off is not an issue. Total phosphorus may increase in response to fertiliser applications, but such increases are temporary and have no impact on downstream river ecological status.

However, deforestation operations disrupt the forestry nutrient cycle and there is the potential for phosphorous to be released into downstream watercourses resulting in nutrient enrichment i.e. eutrophication.

Following deforestation, there are 2 sources of phosphorus. Firstly, phosphorus is released from the forest floor and root system, due to needle decomposition and disruption to nutrient cycling by the trees. The second source is the brash material that is left on site, as it degrades and leaches into adjoining watercourses.

Therefore, the proposed deforestation operations have the potential to release nutrients into nearby watercourses which will have a potential negative short-term impact on downstream surface water quality.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface water quality in rivers and streams draining the Proposed Offsetting lands including the Glengarriff River, the Cloone River and the Croaghane River and associated dependent ecosystems.

Pre-Mitigation Potential Effect: Negative, significant, indirect, short-term, likely effect on surface water quality and dependent aquatic ecosystems.

Proposed Mitigation Measures:

The most effective way to manage deforestation and the potential risks to water quality is to implement a strict and best practice mitigation system when carrying out the deforestation operations.

Best practice, tried and tested methods provided in the EIAR relate to water incorporated into the forestry management and water quality protection measures were derived from:

- Forestry Commission (2003) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) Forest Operations & Water Protection Guidelines;
- Coillte (2009) Methodology for Clear Felling Harvesting Operations;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford; and,
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

As stated above in Section 9.5.2.1, mitigation measures from best practice Forestry Service Guidelines along with the Freshwater Pearl Mussel (FPM) requirements will be applied and will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses. These measures are set out above. The FPM presence also requires that the project site is independently assessed prior to work commencement.

The primary mitigation measures in relation to phosphorus are the implementation of aquatic buffer zones.

Phosphorus is highly mobile, and studies have shown that phosphorus is absorbed quickly by riparian buffer zones which are effective in mitigating against phosphorus runoff following deforestation. It is well established forestry best practice to implement vegetative buffer zones adjacent to watercourses, allowing the vegetation in the buffer zone to absorb the phosphorous before it enters the watercourse.

Impact Assessment:

The mitigation measures set out above will not completely prevent the release of nutrients to downstream watercourses. The release of phosphate into the environment is an unavoidable consequence of deforestation. However, the Proposed Offsetting Measures, will remove a significant source of nutrients at the Proposed Offsetting lands (i.e. the existing commercial forestry). This will have a positive long-term effect with regards to nutrient concentrations in local and adjacent watercourses.

Post Mitigation Residual Effects: Deforestation operations pose a risk to surface water quality in downstream receptors due to nutrient enrichment. Best practice measures, including the implementation of riparian buffer zones, will help protect surface water quality throughout the Proposed Offsetting Measures however nutrient release is an unavoidable consequence of deforestation. The short-term residual effect is considered to be - negative, indirect, slight to moderate, likely effect on downstream water quality and aquatic habitats. As stated above, the Proposed Offsetting Measures only propose 1 no. round of deforestation in comparison to the Do Nothing Scenario in which the Proposed Offsetting lands would be felled and replanted several times. Therefore, the long-term residual effect is considered to be - positive, indirect, moderate, likely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on the surface water quality will occur.

9.5.2.3 Potential Effects from the Release of Hydrocarbons

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons can cause significant pollution risk to groundwater, surface water and associated aquatic ecosystems, and to terrestrial ecology. In addition, the accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-

organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Pathway: Groundwater flowpaths and site drainage network.

Receptor: Surface water quality in rivers and streams draining the Proposed Offsetting lands including the Glengarriff River, the Cloone River and the Croaghane River and associated dependent ecosystems and local groundwater quality.

Pre-Mitigation Potential Effect: Negative, indirect, slight, short term, likely effect on local groundwater quality in the peat bog. Indirect, negative, significant, short-term, unlikely effect to surface water quality.

Proposed Mitigation Measures:

There will be no fuels or herbicides stored within 50m of an aquatic zone or within 20m of all other water features.

- All vehicles will be refuelled at a designated refuelling location at the existing entrance to Area 2;
- This on-site refuelling will be undertaken using a double skinned bowser with spill kits kept on site for accidental leakages or spillages;
- The bowser will be refilled by the fuel truck and absorbent materials and pads will be available in the event of accidental spillages;
- Only designated trained operatives will be authorised to refuel plant at the designated refuelling station;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- Fuels storage will be minimised. All storage areas will be bunded appropriately for the duration of the Proposed Offsetting Measures. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The plant used during Proposed Offsetting Measures will be regularly inspected for leaks and fitness for purpose; and,
- An emergency response plan for the Proposed Offsetting Measures to deal with accidental spillages will be contained within the Operational Environmental Management Plan.(OEMP).

Post Mitigation Residual Effect: The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, temporary, unlikely effect on groundwater quality within the peat bog and surface water quality in down-gradient rivers.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on surface water or groundwater quality will occur.

9.5.2.4 Potential Effects on Designated Sites

The Proposed Offsetting lands are located within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. It is recognised that the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA does not contain any designated water dependent species/habitats, However, any deterioration in water quality could impact the overall environment

within the SPA and for this reason, the SPA has been included in the water impact assessment. Furthermore, within the Tralee Bay Feale regional surface water catchment, the Proposed Offsetting lands are hydrologically connected with the Lower River Shannon SAC (Site Code: 002165) via the Glengarriff River (length of this hydrological flowpath is ~2km). The River Shannon SAC contains several water dependent species and habitats.

The Proposed Offsetting Measures aims to permanently remove c. 105.5 ha of commercial forestry and restore c. 17.7 ha of farmland habitat both for the benefit of hen harrier. During the Proposed Offsetting Measures, and in the absence of mitigation measures, there may be a short-term negative impact on water quality within the SPA and the downstream SAC associated with the proposed deforestation and the potential water quality effects associated with such works (entrainment of suspended solids in surface waters, nutrient release and the accidental release of hydrocarbons). However, once the deforestation works have been completed, the Proposed Offsetting Measures will have a positive effect on downstream surface water quality associated with the removal of nutrient sources (coniferous trees) and the return to a more natural drainage regime.

Mount Eagles Bogs NHA is also located immediately adjacent to the Proposed Offsetting areas 1 and 4. The NHA is located topographically upgradient of the Proposed Offsetting lands, and there is no potential for surface water quality effects. However, given the close proximity of the works to the NHA, any disturbance to the local hydrological/hydrogeological regime would have the potential to impact the NHA (i.e. peat water levels in the NHA).

Pathway: Surface water flowpaths.

Receptor: Down-gradient water quality in local rivers including the Glengarriff River (Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA and the Lower River Shannon SAC). Bog/Peat water levels in the lands adjoining the Proposed Offsetting lands including the Mount Eagle Bogs NHA.

Pre-Mitigation Potential Effect: Negative, significant, indirect, short-term, likely effect on downstream designated sites (Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA and Lower River Shannon SAC). Negative, slight, indirect, short-term, likely effect on local bog hydrogeology including the bogs comprising the Mount Eagle Bog NHA.

Impact Assessment / Mitigation Measures:

Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA

The Proposed Offsetting Measures will have no potential to significantly affect the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA for the following reasons:

- The SPA does not contain any water dependent species or habitats – it is designated for Hen Harrier;
- The Proposed Offsetting Measures target replacing forestry and agricultural lands with lands suitable for hen harrier which is in line with the conservation objectives of the SPA;
- The proposed works comprise of deforestation and detailed mitigation measures have been prescribed to protect surface water quality during deforestation operations are outlined in Sections 9.5.2.1 and 9.5.2.2; and,
- Furthermore, detailed mitigation measures for the control of hydrocarbons during deforestation works are outlined in Section 9.5.2.3.

Lower Shannon SAC

The Proposed Offsetting Measures will have no potential to affect the Lower Shannon SAC for the following reasons:

- The proposed works comprise of deforestation and detailed mitigation measures have been prescribed to protect surface water quality during deforestation operations are outlined in Sections 9.5.2.1 and 9.5.2.2;
- Furthermore, detailed mitigation measures for the control of hydrocarbons during deforestation works are outlined in Section 9.5.2.3; and,
- The length of the hydrological connection (~1.8km) between the Site and the Lower River Shannon SAC.

Mount Eagle Bogs NHA

- Detailed mitigation measures to protect surface water quality during deforestation operations are outlined in Sections 9.5.2.1 and 9.5.2.2;
- Detailed mitigation measures for the control of hydrocarbons during deforestation works are outlined in Section 9.5.2.3;
- No significant excavation works or earthworks are proposed which would dewater the bogs adjoining the Proposed Offsetting lands.

Implementation of these best-practice and tried and tested mitigation measures will ensure the protection of water quality in receiving waters.

At this point it is also worth reiterating that whilst the Proposed Offsetting Measures do involve deforestation of ~105.5ha of forestry, deforestation will only occur on 1 no. occasion and no replanting and subsequent deforestation will occur. There will only be 1 no. mitigated release of nutrients associated with deforestation at the Proposed Offsetting lands. In the case of the Do-Nothing Scenario, whereby these lands would continue to function as a coniferous plantation with numerous cycles of felling and replanting in the future, there would be several nutrient release events. Therefore, by limiting the number of deforestation events at the Proposed Offsetting lands, and with the implementation of the prescribed best practice mitigation measures, the Proposed Offsetting will have a long-term positive effect on downstream water quality with regard to future nutrient concentrations.

Poat Mitigation Residual Effects: Activities at the Proposed Offsetting lands pose a threat to designated sites hydrologically linked with the Proposed Offsetting lands. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the Proposed Offsetting lands will be equivalent to baseline conditions and will therefore have no effect on the status or ecology of the protected species and habitats within any designated site. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on designated sites including the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lower River Shannon SAC and Mount Eagle Bogs NHA.

Significance of Effects: For the reasons outlined above, no significant effects on any designated sites will occur.

9.5.2.5 Potential Effects on Downstream Surface Water Abstractions

Within the Tralee Bay Feale regional surface water catchment, the Proposed Offsetting lands are hydrologically connected with the Clydagh (Feale)_020 DWPA via the Glengarriff River (flowpath length of ~5km). Any potential water quality effects (entrainment of suspended solids in surface waters, nutrient release and the accidental release of hydrocarbons) could potentially affect this water supply.

Pathway: Surface water flowpaths.

Receptor: Clydagh (Feale)_020 DWPA.

Pre-Mitigation Potential Effect: Indirect, negative, slight, temporary, likely effect on the Clydagh (Feale)_020 DWPA.

Impact Assessment / Mitigation Measures:

No significant effects will occur for the following reasons:

- Detailed mitigation measures to protect surface water quality during deforestation operations are outlined in Sections 9.5.2.1 and 9.5.2.2;
- Detailed mitigation measures for the control of hydrocarbons during deforestation works are outlined in Section 9.5.2.3; and,
- The length of the hydrological flowpath between the Proposed Offsetting lands and the DWPA which is ~5km in length.

The implementation of these best practice mitigation measures during the Proposed Offsetting Measures will ensure that there are no effects on the downstream surface water abstraction.

Post Mitigation Residual Effects: Activities at the Proposed Offsetting lands pose a threat to downstream surface water abstractions hydrologically connected with the Proposed Offsetting lands. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the Proposed Offsetting lands will be equivalent to baseline conditions and will therefore have no effect on downstream surface water abstractions. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on the Clydagh (Feale)_020 DWPA.

Significance of Effects: For the reasons outlined above, no significant effects on any designated sites will occur.

9.5.2.6 Potential Effects on WFD Status

The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised.

The WFD status for GWBs and SWBs underlying and downstream of the Proposed Offsetting lands are defined in Section 9.3.11 and Section 9.3.12.2 respectively.

A detailed WFD Compliance Assessment Report has been completed in combination with this EIAR Chapter and is included in Appendix 9-3.

Pathway: Surface water flowpaths.

Receptor: WFD status of downstream surface water bodies and underlying GWBs.

Pre-Mitigation Potential Effect: Indirect, negative, imperceptible, short term, likely effect on surface water and groundwater bodies.

Proposed Mitigation Measures:

Mitigation measures relating to the protection of surface water drainage regimes and surface water quality within the Proposed Offsetting lands have been detailed in Section 9.5.2.1 (deforestation), Section 9.5.2.2 (nutrient release) and Section 9.5.2.3 (hydrocarbons).

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed in Section 9.5.2.3 (hydrocarbons). No impacts on groundwater quantity/levels will occur due to the surface nature of the Proposed Offsetting Measures.

The implementation of these best practice mitigation measures during the Proposed Offsetting works will ensure the qualitative and quantitative status of the receiving surface waters will not be altered by the Proposed Offsetting Measures.

Post-Mitigation Residual Effects: Mitigation for the protection of surface and groundwater during the Proposed Offsetting works will ensure the qualitative and quantitative status of the receiving waters will not be significantly altered by the Proposed Offsetting Measures.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Offsetting Measures. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

No residual effect on GWB WFD status will occur.

No residual effect on SWB WFD status will occur.

As such, the Proposed Offsetting Measures are compliant with the requirements of the Water Framework Directive (2000/60/EC).

Significance of Effects: For the reasons outlined above, no significant effects on WFD GWB and SWB status, risk or future objectives will occur as a result of the Proposed Offsetting Measures.

9.5.2.7 Potential Effects on Downstream Flood Risk

The current forestry drainage system in the Proposed Offsetting lands (Areas 1, 2 and 4) was designed to lower the local peat water table in order to facilitate forestry activities within these areas. Meanwhile, no significant drainage features were recorded in Area 3 with an agricultural field drain located along the northern boundary of this area.

The Proposed Offsetting Measures comprise the permanent removal of c. 105.5 ha of coniferous plantation forestry and the restoration of c.17.7 ha of farmland for the benefit of hen harrier. No further works such as drain blocking or re-wetting of peatland are proposed which would have the potential to alter the existing hydrological regime. The proposed deforestation and farmland restoration works do not include the alteration of the existing hydrological regimes which will remain undisturbed and there will be no increase in the downstream flood risk.

Pathways: Water volume, and flow volumes in local watercourses.

Receptors: Downstream properties.

Pre-Mitigation Potential Effect: Negligible effect on downstream flood risk.

Mitigation Measures:

No specific mitigation measures are required in relation to downstream flood risk. The Proposed Offsetting Measures do not include drain blocking or any other measures which would alter the existing hydrological regime.

All Proposed Offsetting Measures will be done in accordance with 'best practice' procedures and the mitigation measures in relation to the protection of surface and groundwater quality are detailed elsewhere.

Post Mitigation Residual Effect: No effect on the downstream flood risk.

Significance of the Effect: For the reasons outlined above, we consider that the Proposed Offsetting Measures will not have a significant effect on the downstream flood risk.

9.5.3 Extended Operational Phase – Likely Impacts and Mitigation Measures

9.5.3.1 Potential Hydromorphological and Flood Risk Effects due to Increased Site Runoff Potential

Replacement of the peat or vegetated surface with less permeable surfaces can potentially result in an increase in the volume or flow rate of surface water runoff reaching the surface water drainage network. This may have potentially increased runoff from the Site thereby potentially negatively affecting hydromorphology and flood risk downstream of the development. A quantified assessment of this risk is presented below.

In reality, the existing access roads and hardstand areas have a higher permeability than the underlying peat. However, it is conservatively assumed in this assessment that the access roads and hardstands are fully impermeable.

During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems.

However, visual inspections on watercourses carried out as part of this EIAR assessment identified no notable erosion or hydromorphological effects within the Site.

Pathway: Site drainage network.

Receptor: Surface waters (Glenlara River, Glenacarney River and the Knockahorrea East stream) and water-dependent ecosystems.

Pre-Mitigation Potential Effect: Negative, imperceptible, indirect, long term, likely effect on downstream surface watercourses.

Effects Assessment / Mitigation Measures

The below calculations are carried out for the month with the highest average recorded rainfall (i.e. January) versus evapotranspiration, for the current baseline site conditions, in terms of hardstand coverage. Refer back to Section 9.3.6 for Greenfield site runoff estimates.

The presence of the total development footprint associated with the Taurbeg Wind Farm (total 3.76 ha) results in an average total site increase in surface water runoff of approximately 185m^3/month.

This represents a potential increase of approximately 0.1% in the average daily/monthly volume of runoff from the site area in comparison to the Greenfield pre-development site runoff conditions (refer to Table 9-17).

This is a very small increase in average runoff and results from the naturally high surface water runoff rates and the relatively small area of the site developed, the total development footprint being ~3.76ha, representing ~3% of the Site Boundary area of 112ha.

Table 9-17: Greenfield Site Runoff V Development Runoff

Site Baseline Runoff/wettest month (m^3)	Baseline Runoff/day (m^3)	Permanent Hardstanding Area (m^2)	Hardstanding Area 100% Runoff (m^3)	Hardstanding Area 96% Runoff (m^3)	Net Increase/month (m^3)	Net Increase/day (m3)	% Increase from Baseline Conditions (m^3)
146,720	4,733	33,700	4,852	4,650	202	6.5	0.1

The small additional volume is very low due to the fact that the runoff potential from the Site is naturally high (94%). Also, the calculation assumes that the hardstanding areas are impermeable which is not the case as they are constructed of permeable stone aggregate.

The increase in runoff from the Site (in comparison to the Greenfield pre-development site conditions) is therefore imperceptible and no additional drainage mitigation is proposed above what is already present as outlined below:

- Natural vegetation filters are used regularly across the Site where the local drainage and topography allow attenuation of surface water runoff;
- Interceptor drains are installed up-gradient of infrastructure to collect clean surface runoff in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It is now directed to areas where it can be re-distributed onto natural vegetation;
- Swales/roadside drains are used to collect runoff from access roads and turbines hardstanding areas of the site, likely to have entrained suspended sediment, and channel it onto natural vegetation filters;
- The existing drainage system at the site provides flood attenuation and has not resulted in any increased in the downstream flood risk.

Post Mitigation Residual Effects: With the implementation of the existing drainage measures as detailed above, and based on the existing hydrological regime at the Site, we consider that residual effects are - Negative, imperceptible, direct, long-term, likely effect on all downstream surface water bodies.

Significance of Effects: No significant effects on downstream flood risk or hydromorphology will occur during the Proposed Lifetime Extension.

9.5.3.2 Potential Effects from Runoff Resulting in Suspended Solids Entrainment in Surface Waters

During the Proposed Lifetime Extension, some minor maintenance works may be completed, such as maintenance of site entrance, internal roads and hardstand areas. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

These minor activities could, however, result in a brief release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects are not likely to be significant even if not mitigated against.

Pathways: Drainage and surface water discharge routes.

Receptors: Down-gradient watercourses (Glenlara River, Glenacarney River and the Knockahorrea East stream) and associated water-dependent ecosystems.

Pre-Mitigation Potential Effect: Negative, slight, indirect, brief, likely effect on downstream surface watercourses.

Mitigation Measures:

The existing drainage measures (as outlined in Section 9.3.5 above) have been effective in removing any silt generated during routine maintenance works. This has been reflected in the surface water sampling conducted at the site.

In addition to the above, temporary check dams and silt fencing arrangements will be placed along sections of access roads where maintenance works are being undertaken. Check dams will be constructed from a 4/40mm non-friable crushed rock.

Temporary blocking of drains downstream of works area can also be undertaken if roadside swales are absent.

Post Mitigation Residual Effects: With the implementation of the existing wind farm drainage measures as outlined above, along with some additional temporary control measures, we consider that residual effects are - negative, imperceptible, indirect, long term, likely effect on downstream water quality.

Significance of Effects: For the reasons outlined above, no significant effects on the surface water quality will occur.

9.5.3.3 Potential Effects from the Release of Hydrocarbons

Accidental spillage during refuelling of plant and equipment with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

However, due to the small volumes of oils and fuels that will be present on-site during the Proposed Lifetime Extension in the form of a fuel truck, no significant effects will occur.

Pathway: Groundwater flowpaths and site drainage network.

Receptor: Groundwater (Abbeyfeale and Rathmore West GWBs) and surface watercourses (Glenlara River, Glenacarney River and the Knockahorrea East stream).

Pre-Mitigation Potential Effect:

Indirect, negative, slight, short term, likely effect to local groundwater quality.

Indirect, negative, moderate, short term, likely effect to surface water quality.

Proposed Mitigation Measures:

Any plant and equipment used during the Proposed Lifetime Extension will require refuelling during the works. Appropriate management of fuels will be required to ensure that incidents relating to refuelling are avoided. The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Road-going vehicles will be refuelled off site wherever possible;
- On-site refuelling will be carried out at designated refuelling areas at various locations throughout the site. Machinery will be refuelled directly by a fuel truck that will come to site as required;
- Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Fuel volumes stored on site will be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume;
- The plant used will be regularly inspected for leaks and fitness for purpose;
- An emergency plan for the extended operational phase to deal with accidental spillages will be developed. Spill kits will be available to deal with accidental spillage in and outside the refuelling area;
- A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the lifetime extension; and,
- Adherence to Operational and Environmental Management Plan (refer to Appendix 4-2 of the EIAR).

Post Mitigation Residual Effect: The potential for the release of hydrocarbons to groundwater and surface water receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be – negative, imperceptible, indirect, short term, unlikely effect to local groundwater quality. Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality will occur.

9.5.3.4 Potential Effects on WFD Status

The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised. The WFD status for GWBs and SWBs underlying and downstream of the Site are defined in Section 9.3.11 and Section 9.3.12.1 respectively.

All GWBs (Abbeyfeale and Rathmore West) underlying the Site are of 'Good' status.

In terms of SWBs, the majority of the Site drains to the Feale_010 SWB which achieved 'High' status in the latest WFD cycle. This was an improvement in status in comparison to the previous cycles. Existing infrastructure associated with the Taurbeg Wind Farm is mapped in the Glenacarney_010 and Glenlara_010 WFD river sub-basins. These SWBs achieved 'Good' and 'Moderate' status respectively and their status has remained unchanged across all 3 no. WFD cycles. Meanwhile, the Owenkeal_010 SWB has experienced a reduction in status from 'High' in 2010-2015 to 'Good' in subsequent cycles. However, no infrastructure associated with the wind farm is present within this WFD river sub-basin.

A detailed WFD Compliance Assessment Report has been completed in combination with this EIAR Chapter and is included in Appendix 9-3.

Pathways: Drainage and surface water discharge routes.

Receptors: WFD status.

Pre-Mitigation Potential Effect: No effect.

Impact Assessment / Proposed Mitigation Measures:

There is no direct discharge from the Site to downstream receiving waters. Mitigation for the protection of surface water during the extended operational phase will ensure the qualitative status of the receiving SWBs will not be altered by the Proposed Lifetime Extension.

Similarly, there is no direct discharge to groundwaters associated with the extended operational phase. Mitigation for the protection of groundwater during the extended operational phase will ensure that the qualitative status of the receiving GWB will not be altered by the Proposed Project.

It is worth noting that there has been no deterioration in the status of the SWBs in the vicinity of the Site during the operational phase to date. Indeed, the status of the Feale_010 SWB which drains the majority of the Site has improved in status during the lifetime of the Taurbeg Wind Farm. Therefore, the existing drainage controls and mitigation measures being implemented are effective. These will continue to be implemented during the Proposed Lifetime Extension.

Post-Mitigation Residual Effects:

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Lifetime Extension. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

No residual effect on Groundwater Body WFD status will occur.
No residual effect on Surface Water Body WFD status will occur.

As such, the Proposed Project is compliant with the requirements of the Water Framework Directive (2000/60/EC).

Significance of Effects: For the reasons outlined above, no significant effects on WFD GWB and SWB status, risk or future objectives will occur as a result of the Proposed Lifetime Extension.

9.5.3.5 Potential Effects on Designated Sites

The Site is located within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. This designated site does not contain any water-dependent special conservation interests. The sole special conservation interest is Hen harrier.

The Site is also hydrologically connected to the Lower River Shannon SAC and the Blackwater River (Cork/Waterford) SAC.

Due to physical, hydrological and hydrogeological separation all other designated sites have no potential to be affected by the Proposed Lifetime Extension.

Due to there being no proposed construction works, the potential for effects on these designated sites is very limited. However, during minor and infrequent maintenance works there is the potential for the release of suspended solids and hydrocarbons to the surface water environment. These effects could have the potential to impact downstream designated sites.

Pathway: Surface water flowpaths, and groundwater levels.

Receptor: Down-gradient water quality Lower River Shannon SAC and the Blackwater River (Cork/Waterford) SAC.

Pre-Mitigation Potential Effect: Negative, slight, indirect, short term, likely effect on the Lower River Shannon SAC and the Blackwater River (Cork/Waterford) SAC.

Proposed Mitigation Measures:

Lower Shannon SAC

The Proposed Lifetime Extension will have no potential to effect the Lower Shannon SAC for the following reasons:

- No proposed construction works;
- The only proposed works comprise of maintenance works which pose the same risks to water quality as all agricultural sites;
- The maintenance works will be of a small scale and will be infrequent in nature;
- The existing drainage system which utilises buffered outfalls, check dams and roadside swales;
- The length of the hydrological connection (~1.8km) between the Site and the Lower River Shannon SAC; and,
- Mitigation measures have been proposed in relation to hydrocarbons and suspended solids which will ensure that there will be no effects on downstream water quality.

Blackwater River (Cork/Waterford) SAC

The Proposed Lifetime Extension will have no potential to effect the Blackwater River (Cork/Waterford) SAC for the following reasons:

- No proposed construction works;
- The only proposed works comprise of maintenance works which pose the same risks to water quality as all agricultural sites;
- The maintenance works will be of a small scale and will be infrequent in nature;
- The existing drainage system which utilises buffered outfalls, check dams and roadside swales;
- The length of the hydrological connection (~6.5km) between the Site and the Blackwater River (Cork/Waterford) SAC; and,
- Mitigation measures have been proposed in relation to hydrocarbons and suspended solids which will ensure that there will be no effects on downstream water quality.

Post Mitigation Residual Effects: Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the Site will be equivalent to baseline conditions and will therefore have no impact on downstream surface water quality and/or the status or ecology of the protected species and habitats within the designated sites. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on the Lower River Shannon SAC and the Blackwater River (Cork/Waterford) SAC.

Significance of Effects: For the reasons outlined above, no significant effects on any designated sites will occur.

9.5.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential impacts associated with decommissioning of the existing Taurbeg Wind Farm will be similar to those associated with construction but of a much-reduced magnitude. A description of the decommissioning works is contained in Chapter 4 of this EIAR and in the Decommissioning Plan (Appendix 4-3).

During decommissioning, it will be possible to reverse or at least reduce some of the potential effects caused during construction, and to a lesser extent operation, by rehabilitating constructed areas such as turbine bases and hard standing areas. This will be done by covering with vegetation to encourage vegetation growth and reduce run-off and sedimentation.

Upon decommissioning of the existing Taurbeg Wind Farm, the wind turbines will be disassembled. All above-ground turbine components will be separated and removed off-site. It is proposed to leave turbine foundations in place underground and to cover them with soil and reseed as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option as excavation works can be avoided.

It is proposed to leave access roads in-situ, as these are in use by the participating landowners to access their lands and as existing walking trails. It is proposed to leave underground cables in place where they are below a level likely to be impacted by typical agricultural works.

During decommissioning, it will be possible to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine bases, hard standing areas. This will be done by covering hardstand areas with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation.

The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the wind farm site.

Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is, therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the operational phase mitigation measures.

No significant effects on the hydrological and hydrogeological environment will occur during the decommissioning phase of Taurbeg Wind Farm.

9.5.5 Risk of Major Accidents and Disasters

The main risk of Major Accidents and Disasters (MADS) at upland peatland sites is related to peat stability. Due to there being no construction activities with regard the Proposed Lifetime Extension, no peat stability assessment has been carried out at the Site.) There have been no reported ground instability or peat slides during the operational phase of Taurbeg Wind Farm.

Flooding can also result in downstream Major Accidents and Disasters. However, due to the small scale of the Proposed Lifetime Extension footprint and with the implementation of the proposed mitigation measures, the increased flood risk associated with the Proposed Project is negligible/none (refer to Section 9.5.3.1).

In relation to the Proposed Offsetting Measures, the greatest risk of MADS would be associated with a peatslide and the significant negative effects that such an event would have on downstream surface

water quality. A Peat Stability Risk Assessment (PSRA) has been completed for the Proposed Offsetting lands and concludes that the Proposed Offsetting lands predominantly have an acceptable margin of safety and are suitable for the Proposed Offsetting Measures. The PSRA states that due to the high factors of safety and negligible risk of peat landslides identified on site, it is not anticipated that peat failure will occur on site. However, in the event of peat failure (e.g. tension cracking, surface toppling, sliding), the following measures will be implemented by the contractor:

- All members of the project team will be alerted immediately or as it is safe to do so;
- All site works will be ceased with immediate effect, and all available resources will be used for the management and mitigation of the risks posed by the event;
- Localised peat slides that do not present a risk to watercourses will be stabilised where possible by rock infill and granular material. The area will then be assessed by competent engineers, and further stabilisation measures will be implemented where necessary;
- The key initial activity will be to prevent displaced materials from reaching any watercourses or sensitive environments. Given the terrain of the Proposed Offsetting lands, the key risk is the development of a propagation landslide or slip within topographic valleys and watercourses. Where possible, catch ditches on land or within these topographic valley and watercourses will be constructed to prevent further run out of the disturbed peat or spoil material; and,
- The contractor will be responsible for providing suitable contingencies during deforestation works. The contractor will additionally need to carry out a construction stage PSRA.

9.5.6 Assessment of Health Effects

Potential health effects arise mainly through the potential for surface and groundwater contamination which may have negative effects on public and private water supplies. There are no mapped public or group water scheme groundwater protection zones in the area of the Site. Notwithstanding this, the Proposed Lifetime Extension design and mitigation measures ensures that the potential for effects on the water environment will not be significant.

Flooding of property can cause inundation with contaminated flood water. Flood waters can carry waterborne disease and contamination/effluent. Exposure to such flood waters can cause temporary health issues. However, the assessment presented in Section 9.5.3.1 shows that the Proposed Project has very little potential to increase the downstream flood risk.

No effects on human health will occur as a result of the Proposed Project.

9.5.7 Cumulative Effects

This section presents an assessment of the potential cumulative effects associated with the Proposed Project and other developments (existing and/or proposed) on the hydrological and hydrogeological environment.

The main likelihood of cumulative effects is assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the hydrogeological setting of the Site and the Proposed Offsetting lands (i.e. low permeability peat overlying a locally important bedrock aquifer), cumulative effects with regard groundwater quality or quantity arising from the Proposed Project are assessed as not likely.

The primary potential for cumulative effects associated with a wind farm development would generally occur during the construction phase. However, no construction works are proposed and there will be no excavations or earthworks at the Site. The potential for cumulative effects during the Proposed Lifetime Extension will be significantly reduced in comparison to a construction phase as there will be

no exposed excavations, there will be no sources of sediment to reach watercourses, there will be no use of cementitious materials and fuels/oil will be kept to a minimum at the site. During the decommissioning phase, the potential cumulative effects are similar to the construction phase, but to a lesser degree with less ground disturbance.

Separate hydrological cumulative study areas have been delineated for the Site and for the Proposed Offsetting lands. These cumulative study areas are shown in Figure 9-10**.** There will be no potential for cumulative effects beyond these cumulative study areas due to increases in flow volumes (as the catchment area increases) and increasing distance from the Site and the Proposed Offsetting lands.

The cumulative hydrological study area for the Site has a total area of 234km^2 and has been delineated as follows:

- The north of the Site is located in the Tralee Bay Feale Catchment. A quantitative analysis using flow volumes derived from the EPA Hydrotool database shows that there is no potential for effects on the Feale River downstream of EPA Hydrotool Node: 23_1771 (Total Upstream Catchment Area of ~95km^2); and,
- The south of the Site is located in the Blackwater (Munster) Catchment. A quantitative analysis using flow volumes derived from the EPA Hydrotool database shows that there is no potential for effects downstream of EPA Hydrotool Node: 18_2469 on the Glenlara River. This Node is located ~2km upstream of the confluence of the Glenlara and Allow Rivers. In order to be conservative and for completeness, the cumulative study area extends downstream as far as Node 18_1756 which includes the entire catchment of the Glenlara River (Total Upstream Catchment Area of ~139km^2)

Given, the nature of the Proposed Lifetime Extension and the lack of any significant groundworks, the delineated cumulative hydrological study area associated with the Site is considered to be very conservative.

The cumulative hydrological study area for the Proposed Offsetting lands has a total area of 74km^2 and has been delineated as follows:

- The Shanowen (Maine)_010 and the Clydagh (Feale)_010 WFD river sub-basins are included in the cumulative study areas as these are the river sub-basins within which the Proposed Offsetting lands are located. For the purposes of a conservative assessment the Maine_010 and Clydagh (Feale)_020 WFD river sub-basins further downstream are also included in the cumulative study area.

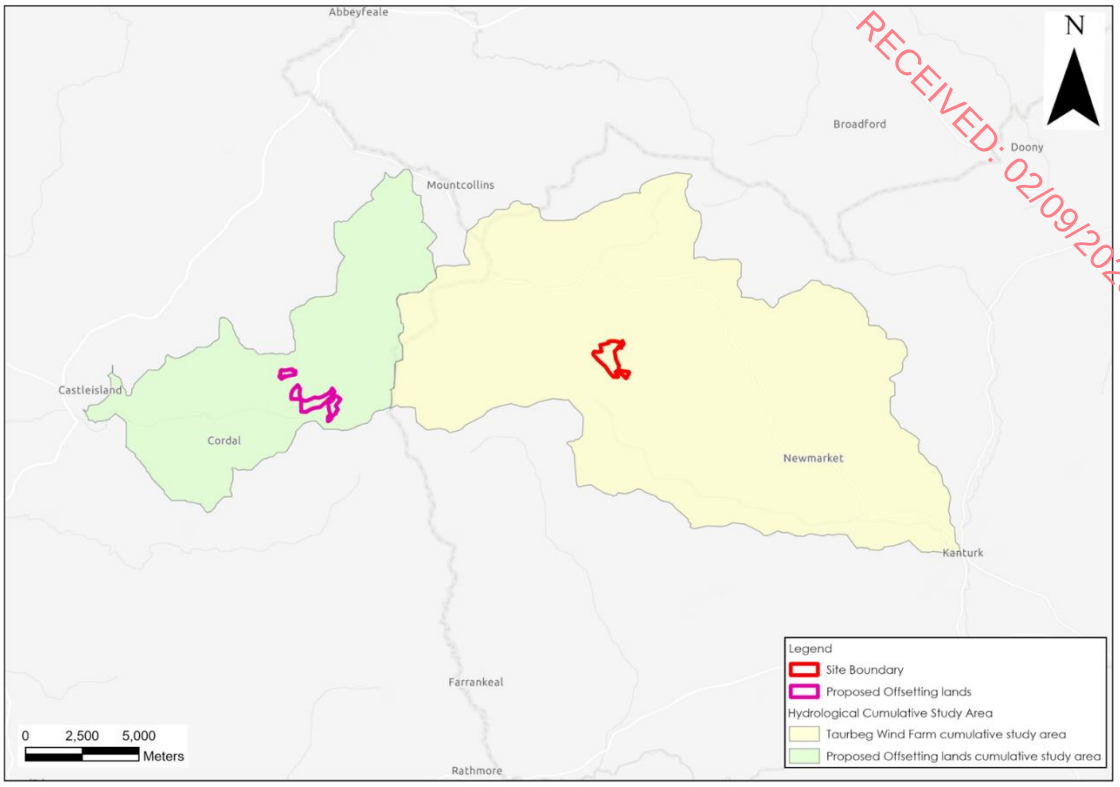


Figure 9-10: Cumulative Hydrological/Hydrogeological Study Area

9.5.7.1 Cumulative Effects with Commercial Forestry

Taurbeg Wind Farm

The Site is situated in an upland area which contains peat bogs and forested areas.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment, and impacts from acidification. Forestry may also give rise to modified stream flow regimes caused by associated land drainage.

Due to the close proximity of several forested areas to the Site and given that they drain to the same watercourses, the potential cumulative effects on downstream water quality and quantity need to be assessed.

However, given the nature of the Proposed Lifetime Extension, the lack of any significant groundworks and the prescribed mitigation measures for the proposed extended operational phase, there will be no effects on downstream surface water quality.

For these reasons we consider that there will not be a significant cumulative effect associated with commercial forestry activities.

Proposed Offsetting Measures

Forestry activities will continue in the lands adjacent to the Proposed Offsetting lands. Typical downstream water quality issues arising from forestry activities include elevated concentrations of suspended solids and nutrient enrichment. However, the Proposed Offsetting Measures involves the deforestation of ~105.5ha of coniferous forestry which will result in improved surface water quality and attenuation. This will improve local surface water quality in the vicinity of the Proposed Offsetting lands in comparison to the existing baseline condition where forestry operations are ongoing.

9.5.7.2 Cumulative Effects with Agriculture

Taurbeg Wind Farm

The cumulative study area associated with the Site includes agricultural areas surrounding Newmarket and Rockchapel.

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative effect on local and downstream surface water quality.

Due to the close proximity of several forested areas to the Site and given that they drain to the same watercourses, the potential cumulative effects on downstream water quality and quantity need to be assessed.

However, given the nature of the Proposed Project, the lack of any significant groundworks and the prescribed mitigation measures for the Proposed Project, there will be no effects on downstream surface water quality.

For these reasons it is considered that there will not be a significant cumulative effect associated with agricultural activities.

Proposed Offsetting Measures

The cumulative study area associated with the Proposed Offsetting lands includes agricultural areas to the east of Castleisland. Agricultural practices can have negative effects on water quality associated with nutrient losses and the entrainment of suspended solids in surface waters.

However, the Proposed Offsetting Measures involves the deforestation of ~105.5ha of coniferous forestry which will result in improved surface water quality. This will improve local surface water quality in the vicinity of the Proposed Offsetting lands in comparison to the existing baseline condition where forestry operations are ongoing.

9.5.7.3 Cumulative Effects with Other Developments

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within the cumulative assessment areas described above for both Taurbeg Wind Farm and the Proposed Offsetting lands.

These applications are generally for new dwellings or renovations of existing dwellings, as well as for the erection of farm buildings. There is also a planning permission for the construction of 67 no. dwellings at Cahereen West, Killarney Road, Castleisland (Planning Ref Number: 201198). These developments are typically small scale and localised in nature and impacts on water quality or flows (surface water or groundwater) are not expected. Therefore, hydrological cumulative impacts with respect to the Proposed Project will not occur.

9.5.7.4 Cumulative Effects with Other Wind Farms

Taurbeg Wind Farm

A total of 3 no. existing wind farms have been identified within the hydrological cumulative study area for the wind farm. These include the Coolegrean, Glentane and Knockacummer Wind Farms. These existing wind farms identified within the cumulative study area have already been constructed and are currently in the operational phase of development and are generating electricity. Given that the wind

farms have already been constructed, the potential for cumulative hydrological effects to occur is very limited. The EIARs for the above existing wind farm developments detail potential hydrological and hydrogeological issues relating to the operation and decommissioning phases of these developments and propose a suite of best practice mitigation measures designed to ensure that the developments do not in any way have a negative effect on downstream surface water quality and quantity. There is also a single existing wind turbine at Newmarket which also lies within the hydrological cumulative study area.

The proposed Gooseberry Hill Wind Farm in Co. Cork is also located in the hydrological cumulative study area. This wind farm is currently in the design phase, with 18 no. turbines currently proposed. If this wind farm was to be granted planning permission, it would be accompanied by an EIAR which would prescribe strict mitigation measures for the protection of surface water quality and quantity during the construction, operation and decommissioning phases of this wind farm development.

The mitigation and best practice measures proposed in this EIAR chapter will ensure that the Proposed Project does not have the potential to result in significant effects on the hydrological/hydrogeological environment.

Therefore, there will be no cumulative effects associated with the extended operational or decommissioning phases of the Proposed Project and other wind farms within the cumulative study area.

Proposed Offsetting Measures

The existing Mount Eagle Wind Farm, Coolegrean Wind Farm and Cordal Wind Farm are located within the cumulative study area associated with the Proposed Offsetting Measures. These wind farms are currently in operation. The EIARs for these wind farm developments detail potential hydrological and hydrogeological issues relating to the operation and decommissioning phases and propose a suite of best practice mitigation measures designed to ensure that the developments do not in any way have a negative effect on downstream surface water quality and quantity. Similarly, the mitigation and best practice measures proposed in this EIAR chapter will ensure that the Proposed Offsetting Measures do not have the potential to result in significant effects on the hydrological/hydrogeological environment.

Therefore, there will be no cumulative effects associated with the Proposed Offsetting Measures and other wind farms within the cumulative study area.

9.5.7.5 Cumulative Effects with Wastewater Treatment Plants

Taurbeg Wind Farm

A total of 3 no. urban Wastewater Treatment Plants (WwTPs) are located within the hydrological cumulative study area. These include the Meelin, Newmarket and Rockchapel urban WwTPs. In addition, the WwTP associated with Newmarket Co-operative Creameries Ltd (P0793) is located within the hydrological cumulative study area. The discharge of wastewater to local watercourses and could potentially result in cumulative effects with the Proposed Project. However, these WwTPs discharge treated wastewater and discharge limits have been assigned to the effluent to ensure that the treated wastewater does not have any significant effects on the receiving surface water quality. The available Annual Environmental Reports (AERs) have been reviewed and the WwTPs are largely compliant with respect to the discharge limits.

The mitigation and best practice measures proposed in this EIAR chapter will ensure that the Proposed Project does not have the potential to result in significant effects on the hydrological/hydrogeological environment.

Therefore, there will be no cumulative effects associated with the extended operational or decommissioning phases of the Proposed Project and the WwTPs within the cumulative study area.

Proposed Offsetting Measures

The Brosna WwTP is located in the cumulative study area with wastewater being discharged into the Clydagh River. This WwTP discharges treated wastewater and discharge limits have been assigned to the effluent to ensure that the treated wastewater does not have any significant effects on the receiving surface water quality. There is no potential for cumulative effects.

9.5.8 Post Consent Monitoring

No monitoring is required.