APPENDIX 5

CHAPTER 9 WATER OF THE EIAR

Planning and Environmental Consultants

Environmental Impact Assessment Report (EIAR)

Ballydermot Wind Farm, Co. Offaly & Co. Kildare

Chapter 9 Water

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GLOSSARY OF TERMS

Terms	Definition
Karst	A distinct landscape formed by the dissolution of soluble rocks, primarily limestone, dolomite, or gypsum by acidic water.
Piling	Installation of heavy stakes (piles) to support the foundations of the turbine
Hardstanding	Levelled assembly areas comprising of bare soil surface to support plant and machinery

GLOSSARY OF ACRONYMS

Acronym	Definition
AAR	Average Annual Rainfall
AE	Actual Evaporation
AER	Annual Environmental Reports
BOD	Biological Oxygen Demand
CEMP	Construction and Environmental Management Plan
CFRAM	Catchment Flood Risk Assessment and Management Programme
CO2	Carbon Dioxide
COD	Chemical Oxygen Demand
cSAC	Candidate Special Areas of Conservation
DO	Dissolved Oxygen
DWPA	Drinking Water Protected Area
EIAR	Environmental Impact Assessment Report
EQSs	Environmental Quality Standards
ER	Effective Rainfall
FI	Fissured Bedrock
FTC	Fehily Timoney and Company
GSI	Geological Survey of Ireland
GWBs	Groundwater Bodies
GWS	Group Water Schemes
ha	Hectares
HES	Hydro- Environmental Services
IPC	Integrated Pollution Control
IRBD	Irish River Basin District
KCC	Kildare County Council
MADs	Major Accidents and Disasters
NHA	National Heritage Area

NIFM	National Indicative Fluvial Mapping
NOx	Nitrogen Oxides
NSA	Nutrient Sensitive Area
OD	Ordnance Datum
OHL	Overhead Lines
OPW	Office of Public Works
OTE	Over the edge
PCAS	Peatland Climate Action Scheme
PE	Potential Evapotranspiration
pNHA	Proposed National Heritage Area
pp	Poorly productive bedrock
PWS	Public Water Supplies
R	Rainfall
RBMP	River Basin Management Plan
rEIAR	Remedial Environmental Impact Assessment Report
rNIS	Remedial Natura Impact Statement
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SNH	Scottish Natural Heritage
SO2	Sulphur Dioxide
SPA	Special Protected Area
SPC	Specific electrical conductivity
SWB	Surface Water Bodies
WFD	Water Framework Directive
ZOI	Zone of Influence

9. WATER

9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO, on behalf of BnM (the Applicant), to carry out an assessment of the potential likely and significant effects of the Proposed Project on the water aspects (hydrology and hydrogeology) of the receiving environment.

As detailed in Section 1.1.1 in Chapter 1 Introduction, for the purposes of this Environmental Impact Assessment Report (EIAR), the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Enhancement Areas', 'Proposed Construction Haul Routes', 'Proposed Turbine Delivery Route', 'Project Site', 'Proposed Wind Farm', 'Proposed Turbines', 'Proposed Grid Connection', 'Proposed Onsite Substation' and 'Proposed Offsite Substation'.

The chapter also uses 'Proposed Wind Farm site' to refer to the 14 no. Allen Bog Group Bogs which comprise the Proposed Wind Farm, Proposed Enhancement Areas, Proposed Onsite Substation, and 0.5km of Proposed Grid Connection underground electrical cabling route.

The Proposed Project is described in full in Chapter 4 of this EIAR.

This chapter provides a baseline assessment of the environmental setting of the Project Site, as described in Chapter 4, in terms of hydrology and hydrogeology, and discusses the potential likely significant effects that the construction, operation and decommissioning of the Proposed Project will have. Where required, appropriate mitigation measures to avoid any identified significant effects to hydrology and hydrogeology are recommended and the residual effects of the Proposed Project post-mitigation are assessed.

9.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which 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 the HES office is located in Dungarvan, County Waterford.

HES' core areas of expertise and experience include peatland hydrology, hydrogeology, and wind farm drainage design. HES routinely complete impact assessment reports for hydrological and hydrogeological aspects for a variety of project types.

This chapter of the EIAR was prepared by Nitesh Dalal, Conor McGettigan, Adam Keegan and Michael Gill.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 24 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in geological characterisation, peatland morphology and hydrology, and surface water drainage design and SUDs design and surface water/groundwater interactions. Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Ballivor WF, Littleton WF, Croagh WF and over 100 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 6 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 routinely prepares the hydrology and hydrogeology chapters of environmental impact assessment reports for wind farm development. Conor has worked on the EIARs for Ballivor WF, Littleton WF, and over 30 other wind farm related projects across the country.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India and over 1 year's environmental consultancy experience in Ireland. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

Adam Keegan PGeo (B.Sc., M.Sc.) is a hydrogeologist with 7 years environmental consultancy experience in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Fossy WF.

9.1.3 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 2.8 of Chapter 2 of the EIAR. Details of the scoping responses pertaining to hydrology and hydrogeology are listed below and outlined in Chapter 2 of this EIAR. 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
Geological Survey of Ireland (GSI)	GSI provided standard scoping responses in 2021 and 2025 and requested the use of their online geological and hydrogeological databases in the assessment.	Refer to Section 9.2.2 which lists the online sources consulted in the preparation of this EIAR chapter.
Inland Fisheries Ireland (IFI)	IFI note that the Barrow River is an important Spring Salmon and trout fishery and is designated as a Special Area of Conservation (SAC). IFI raised concerns with regard to water quality and habitat/hydro-morphological issues that persist throughout the Figile and Slate River system as a result of peat extraction and of concern is the potential that the proposed development may consolidate these water quality and hydro-morphological issues. Concerns were also raised with respect to impacts on water quality/quantity	As assessment of potential effects on surface water quality and quantity is presented in Section 9.5.2 for the construction phase and Section 9.5.3 for the operational phase of the Proposed Project. Given that peat extraction has ceased at the Proposed Wind Farm site there is no potential for cumulative effects. A cumulative assessment is presented in Section 9.5.7.7 for the Draft Cutaway Bog Decommissioning and Rehabilitation Plans (Draft Rehabilitation Plans) for the bogs comprising the Proposed Wind Farm site.

Consultee	Description	Addressed in Section
	during the construction and operational phases. A meeting was held with IFI and members of the project team on 5th October 2026. Refer to Section 2.9.4.6 of Chapter 2 and Section 6.2.2 of Chapter 6 which details this meeting.	
Irish Peatland Conservation Council (IPCC)	The IPCC raised concerns regarding the potential for the Proposed Project to impact numerous areas of raised bog remnants and biodiversity hotspots of Lullymore Bog and the surrounding areas. IPCC provided an inventory of sites requiring protection which include: › Lodge Bog Nature Reserve › Lullymore West Nature Reserve › Lullybeg Nature Reserve › Lodge Bog Wetlands › Lullymore Wetlands › Ballysooghan North › Aghameelick › Long Derries SAC › Mouds Bog SAC › Pollardstown Fen SAC	The potential hydrological/hydrogeological effects are assessed in Section 9.5.2.22.
Uisce Éireann	Uisce Éireann requested that an assessment need to be presented in the Cumulative Section with regards to the Eastern and Midland Region Water Supply Project (WSP). The WSP is proposed to pass through Codd 2, Glashabaun North, Glashabaun South and Derrybrennan Bogs and will include a proposed water attenuation location adjacent to the Figile River.	A cumulative assessment is presented in Section 9.5.7.6.
Health Service Executive (HSE)	The National Environmental Health Service (NEHS) recommends that a walkover survey of the site is undertaken in addition to a desktop analysis of GSI data in order to identify the location of private wells. All potential significant effects on drinking water sources will be assessed.	An assessment of the potential effects on Public and Group Schemes and local private groundwater well supplies, is presented in Section 9.5.2.16. This assessment is precautionary and assumes that every dwelling has a groundwater well supply.

Consultee	Description	Addressed in Section
	Public and Group schemes need also be identified. Impacts on surface water as a result of the construction of the underground cables will be assessed.	An assessment of the potential effects on surface water abstractions is presented in Section 9.5.2.17. The effects of the Proposed Grid Connection on surface water quality are assessed specifically in Section 9.5.2.9 and 9.5.2.10
Waterways Ireland (WWI)	WI did not provide any comments or suggestions with regards to the Proposed Project	-
Department of Agriculture, Food and the Marine (DAFM)	If the proposed development will involve the felling or removal of any trees, the development must obtain a Felling License. It is noted that when the Forest Service is considering the application to fell trees, that the interaction of the proposed works with the environment locally and more widely, in addition to potential direct and indirect effects on designated sites and water, is assessed.	An assessment of the potential effects from felling is presented in Section 9.5.2.12.
Environmental Protection Agency (EPA)	The assessment will identify, describe and assess the likely direct and indirect significant effects and meet the requirements of the EIA Directive, having regard to EPA guidance documents. The assessment will have regard to the rehabilitation plans required under Condition 10 of the IPC licence.	List of Relevant Legislation complied with in the preparation of this chapter is presented in Section 9.1.4. List of relevant guidance consulted during the preparation of this chapter is included in Section 9.1.5. An assessment of the potential cumulative effects with the Draft Rehabilitation Plans is included in Section 9.5.7.7
Offaly County Council (OCC)	The Environment/Water Services Section of OCC made no specific comments.	-

9.1.4 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 Act 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, as amended, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive (92/43/EEC)) and 79/409/EEC on the conservation of wild birds (the Birds Directive (92/147/EC));
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- S.I. No. 122 of 2010: European Communities (Assessment and Management of Flood Risks) Regulations 2010, as amended, implementing the EU Flood Directive (2007/60/EC);
- 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; Commission Directive 2014/101/EU and Directive 2026/805/EU ("WFD");
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended;
- S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended;
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended;
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations, as amended;
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended; and,
- S.I. No. 419/2024: Water Environment (Abstractions and Associated Impoundments) Regulations 2024.

9.1.5 Relevant Guidance

The water chapter of this EIAR is carried out in accordance with 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 (hereafter referred to as 'IGI Guidance');
- 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 Energy Development Guidelines for Planning Authorities, 2006 (the WEDG 2006) and the Draft Revised Wind Energy Development Guidelines (Draft WEDG 2019);
- 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);
- Wind Farms and Groundwater Impacts: A guide to EIA and Planning considerations (DoE/NIEA, April 2015);

- 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 Methodology

9.2.1 Water Study Area

The study area for the hydrological and hydrogeological impact assessment, i.e. the 'Water Study Area', has been defined having regard to the regional surface water catchments and groundwater bodies within which the Proposed Project is located, and the potential zone of influence (ZOI) of the Proposed Project.

The Water Study Area provides the broader spatial framework for the impact assessment and has been used to identify relevant surface water and groundwater receptors, hydrological pathways and potential zones of influence. The assessment focuses on the Proposed Project and its associated components, including the Proposed Wind Farm, Proposed Grid Connection, Proposed Enhancement Areas and all associated infrastructure. The baseline environment presented in Section 9.3 has due regard to the Water Study Area, with a particular focus on the environment within and surrounding the Proposed Project. Where relevant, the wider context of the Water Study Area is also considered and elaborated on to provide an appropriate understanding of the baseline environment.

The Water Study Area has been defined as follows:

- As detailed in Section 9.3.3, the Proposed Wind Farm site is located primarily in the River Barrow Catchment and is drained by the Figile and Slate rivers. The catchments of the Slate and Figile rivers, as far downstream as the confluence with the Barrow River, is included in the Water Study Area. This catchment has a total area of 622km^2.
- The Proposed Grid Connection is also predominantly drained by the Figile and Slate rivers.
- A small area in the north of the Proposed Wind Farm site lies within the River Boyne Catchment. However, as detailed in Section 9.3.5, there is no outfall (i.e. no surface water connection) from the Proposed Wind Farm site to the River Boyne or its tributaries. Nevertheless, the Boyne_010 and Boyne_020 WFD river sub-basins are included in the Water Study Area for the purposes of a conservative impact assessment. These river sub-basins have a total area of 69km^2.
- A small section of the Proposed Grid Connection underground electrical cabling route and the Proposed Offsite Substation are located in the Liffey and Dublin Bay Catchment. These elements of the Proposed Project are mapped in the Awillyinish Stream_010 WFD river sub-basin which has also been included in the Water Study Area. This river sub-basin has a total area of 28km^2.
- The WFD river sub-basins within which the proposed temporary accommodation works along the Proposed Turbine Delivery Route are located have been included in the Water Study Area. Given the limited scale and nature of the works, inclusion of the wider catchments is not considered to be necessary. The inclusions of these river sub-basins themselves is considered conservative.
- The Proposed Construction Haul Routes have been screened out of the hydrological impact assessment as no excavations, drainage works or activities with the potential to impact surface water quality or surface water flows are proposed along the Proposed

Construction Haul Routes. Therefore, the Proposed Construction Haul Routes are excluded from the Water Study Area.

- Section 9.3.9 details the WFD Groundwater Bodies (GWBs) which underlie the Project Site. As these are large regional GWBs inclusion of their full spatial extent would be disproportionate to the scale and potential ZOI of the Proposed Project. Therefore, only the areas of the GWBs which underlie the relevant surface water catchments and river sub-basins described above are included in the Water Study Area.
- In addition, groundwater receptors, including groundwater abstractions, springs and groundwater-dependent ecosystems, were identified within a 2km buffer of the Project Site in accordance with IGI Guidance.
    - This approach is considered to be appropriate given the hydrogeological setting of the Project Site which is characterised by high rates of surface water runoff and low rates of groundwater recharge. Groundwater flowpaths are restricted and the potential for impacts on the groundwater environment is considered to be low.

The 'Water Study Area' is shown in Figure 9-1 and forms the basis of the impact assessment detailed in Section 9.5. The desk study undertaken for this chapter considers relevant surface and groundwater features both within and beyond the Water Study Area, where appropriate, to provide context for the assessment and to inform an understanding of the wider environment.

For clarity and to maintain an appropriate mapping scale, not all Turbine Delivery Route (TDR) areas are shown on every map. However, the baseline conditions within these areas are described in the text of Section 9.3.

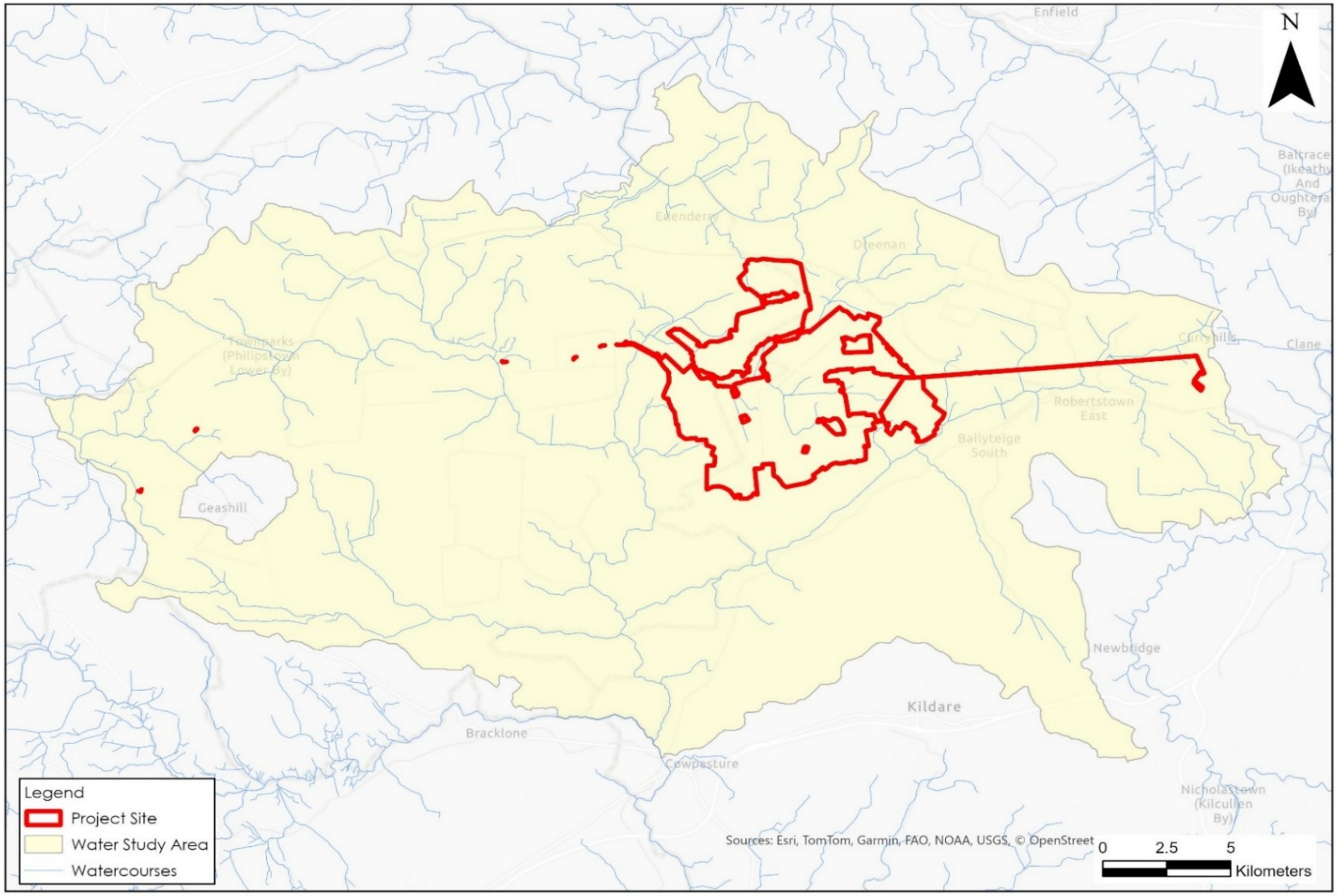


Figure 9-1: Water Study Area

9.2.2 Desk Study

A desk study of the Water Study Area (refer to Section 9.2.1) was completed in early 2021 to collect all relevant hydrological and hydrogeological data. The initial desk study was completed in advance of site walkover surveys and site investigations. The desk study was reviewed in full and updated where required, in September and October 2026. The desk study included consultation with the following data sources:

- Integrated Pollution Control Licence (IPC) Allen Bog Group (Ref: P0503-01) Environmental Protection Agency;
- Annual Environmental Reports 2000-2025 (the AERs can be accessed at https://www.epa.ie/our-services/licensing/licencesearch/);
- IPC Licence P0503-01 Application (Available at EPA Headquarters on request);
- Cutaway Bog Decommissioning and Rehabilitation Plans for the 14 no. Allen Bog Group Bogs forming the Proposed Wind Farm site (Appendix 2-4);
    - Ballydermot Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Barnaran Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Blackriver Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Codd Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Derrybrennan Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Glashabaun Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Killinagh Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Lullybeg Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Lullymore Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Ticknevin Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026); and,
    - Lodge Bog Cutaway Bog Decommissioning and Rehabilitation Plan (2022).
- Inspection of production records at Ballydermot Works;
- BnM Annual Reports (1946 to 2025) which contain information relevant to the bogs within the Allen Bog Group such as peat depth databases and drainage;
- BnM LiDAR data;
- Aerial Maps from 1973 to 2020;
- Environmental Protection Agency databases (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks and Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive “catchments.ie” Map Viewer (www.catchments.ie), including all relevant River Basin Management Plans (RBMPs);
- Bedrock Geology 1:100,000 Scale Map Series, Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping Databases (www.floodinfo.ie);
- Environmental Protection Agency – “Hydrotool” Map Viewer (www.epa.ie);
- Map of Irish Wetlands (https://wetland.maps.arcgis.com);
- Aerial Photography, 1:5,000 and 1:10,560 (6”) base mapping; and,

- Myplan.ie: National Planning Applications Map Viewer (https://myplan.ie/national-planning-application-map-viewer).

9.2.3 Baseline Monitoring and Site Investigations

HES completed site inspections, walkover surveys, drainage mapping, and baseline monitoring/sampling at the Project Site as part of this EIAR and to inform the planning application for the Proposed Project. These site investigations comprised peat probing, geological mapping and drainage mapping completed by HES on 6th, 15th and 22nd October 2020, 5th, 10th, 12th and 18th November 2020, 1st April 2021, 11th December 2025 and 15th May 2026. 3 no. rounds of surface water sampling, field hydrochemistry and surface water flow monitoring were completed on 1st April 2021, 11th December 2025 and 15th May 2026 on the watercourses draining the Project Site.

In addition to the site investigations completed by HES, several additional site investigations have been completed to further inform this EIAR. These site investigations included peat probing completed by MKO and Fehily Timoney and Company (FTC), trial pit excavations by FTC and trial pit excavations and borehole drilling by Irish Drilling Limited (IDL). The logs associated with these site investigations are attached to the Geotechnical and Peat Stability Report (GPSR) (FTC, 2026a) which is included as Appendix 8-1. FTC have also prepared a Peat and Spoil Management Plan (PSMP) for the Proposed Project (FTC, 2026b) (Appendix 4-3).

In summary, site investigations completed to address the water chapter of this EIAR included the following:

- Detailed walkover surveys and hydrological mapping of the Project Site and the surrounding area were undertaken whereby water flow directions and drainage patterns were recorded;
- A total of 1,026 no. peat probes have been completed at the Project Site by HES, MKO and FTC;
- The excavation of 9 no. trial pits by FTC in May 2021, and laboratory analysis of recovered subsoil samples;
- The excavation of 53 no. trial pits by IDL in November 2021 (46 no. within the Proposed Wind Farm site and 7 no. in agricultural lands adjacent to the bogs as part of an investigation into the potential suitability of these lands for a borrow pit – note that the borrow pit was subsequently not progressed as part of the Proposed Project), and laboratory analysis of recovered subsoil samples;
- IDL drilled 1 no. rotary core borehole (RC-BP01) in lands adjacent to the Proposed Wind Farm in November 2021 to investigate the potential suitability for a borrow pit (note that the borrow pit was subsequently not progressed as part of the Proposed Project);
- IDL drilled 2 no. rotary core boreholes in agricultural fields adjacent to the east of the Proposed Wind Farm site in June 2022;
- IDL drilled 6 no. rotary core boreholes across the Proposed Wind Farm site in September 2022 at the Proposed Onsite Substation location and at several turbine locations;
- IDL drilled 3 no. rotary core boreholes in lands adjacent to the Proposed Wind Farm site in December 2022 to investigate the suitability for a proposed borrow pit (note that the borrow pit was subsequently not progressed as part of the Proposed Project);
- Field hydrochemistry measurements (electrical conductivity, pH, dissolved oxygen and temperature) and surface water flow measurements were taken to determine the origin and nature of surface water flows within the watercourses draining the Project Site during 3 no. monitoring rounds (1st April 2021, 11th December 2025 and 15th May 2026); and,

- A total of 45 no. surface water grab samples were taken to determine the baseline water quality of the primary surface waters originating from the Project Site during the 3 no. monitoring rounds.

Site-specific data obtained by HES was supplemented with recent and historic site-specific data supplied by the Applicant. These included LiDAR data of the Allen Bog Group bogs and water quality monitoring from 2000 to 2025 in compliance with the IPC Licence requirements. Site-specific additional information relating to drainage was also provided in the Draft Rehabilitation Plans.

9.2.4 Impact Assessment Methodology

The EPA document '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*' (EPA, 2022), criteria for the assessment of likely significant effects require that likely effects are described with respect to their quality (i.e. negative, positive or neutral), significance, extent, context, probability, duration, frequency and reversibility. The descriptors used in this environmental impact assessment are those set out in the EPA (2022) as shown in Section 1.8.3 of Chapter 1 of this EIAR.

In addition, the importance and 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 and Table 9-3 for hydrology and hydrogeology are used to assess the potential effect that the Proposed Project may have on them.

Table 9-1: 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 regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for 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.

Importance	Criteria	Typical Example
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 9-2: 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. 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.

The impact assessment presented in Section 9.5 is based on the assessment of the magnitude of the predicted impact on the respective hydrological and hydrogeological attributes as detailed in Table 9-4 (hydrology) and Table 9-5 (hydrogeology). Table 9-6 below presents a matrix of significance versus magnitude (NRA, 2008) which allows for the determination of the resulting significance of effects.

Table 9-3: Criteria for Rating Impact Significance – Estimation of Magnitude of Impact on Hydrology Attributes (Source: NRA, 2008)

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

Table 9-4: Criteria for Rating Impact Significance – Estimation of Magnitude of Impact on Hydrogeology Attributes (Source: NRA, 2008)

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

Table 9-5: Rating of Significant Environmental Impacts in an EIS (EIAR) (Source: NRA, 2008)

Importance of Attribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Extremely High	Imperceptible	Significant	Profound	Profound

Importance of Attribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / /Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

9.2.5 Overview of Impact Assessment Process

The conventional source-pathway-target model (see Figure 9-2 below, top) was applied to assess potential effects on downstream environmental receptors (see Figure 9-2 below, bottom as an example) as a result of the Proposed Project.

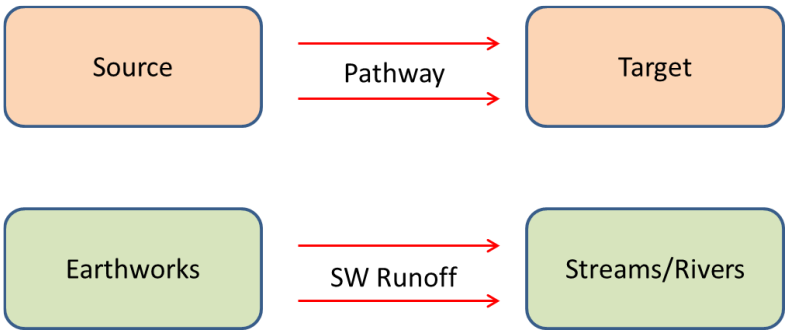


Figure 9-2: Source-Pathway-Target Model

The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Section 1.8.3 of Chapter 1 of this EIAR. The description process clearly and consistently identifies the key aspects of any remedial impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below (Section 9.5), a summary guide is presented in Table 9-7, and this outlines the steps (1 to 7) (derived from EPA 2022 EIAR Guidance) 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 Proposed Project construction, operation and decommissioning activities which have the potential to generate a source of significant adverse impact on the geological and hydrological/ hydrogeological (including water quality) environments.

Table 9-6: Impact Assessment Process Steps (derived from EPA Guidance Document, 2022)

Step 1	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 2	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 a potential impact is generated.
Step 3	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 4	Pre-Mitigation Effect:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	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 6	Post Mitigation Residual Effect	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant residual 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 water chapter of this EIAR.

9.3 Baseline/ Receiving Environment

9.3.1 Site Description and Topography

9.3.1.1 Proposed Wind Farm site

The current topography within the Proposed Wind Farm site ranges between 82 metres above Ordnance Datum (mOD) at its highest point to approximately 68mOD at its lowest point. Topography at the Proposed Wind Farm site has been modified through industrial peat extraction activities and all ancillary works including associated drainage works. Today the highest elevations are found at headlands and remnant peat banks which create a boundary berm, forming a basin effect within the former extraction areas of the bog. These remnant peat banks and headlands provide an approximation (albeit drained and subsided) of the original ground elevations which existed across the Proposed Wind Farm site prior to the commencement of any peat extraction activities.

The Proposed Wind Farm site is accessible via the local road network comprising of the R402 to the north, the R403 to the east, the R401 to the west and the R414 to the south, with the latter cutting through the southeast of the Proposed Wind Farm site.

Current land use within the Proposed Wind Farm site comprises natural recolonisation of cutaway and degraded bog, and public road corridor.

The townlands within which the Proposed Wind Farm site are located are detailed in Table 1-1 in Chapter 1 of this EIAR.

The Proposed Project also includes Proposed Turbine Delivery Route (TDR) accommodation works which are detailed in Section 4.5.2.3 of Chapter 4.

9.3.1.2 Proposed Grid Connection

The Proposed Grid Connection underground electrical cabling will traverse through Allenwood, and Prosperous, Co. Kildare, with infrastructure proposed in the townlands of Lullymore and Killybegs, Co Kildare and adjacent townlands.

The Proposed Onsite Substation and approximately 522m of the Proposed Grid Connection underground electrical cabling are located in Lodge Bog, within the Proposed Wind Farm site (see Section 9.3.1.1 above). Topography within Lodge Bog has been historically modified due to the previous peat extraction activities. Also located completed within Lodge Bog is the enhanced rehabilitation works completed under the Peatland Climate Action Scheme (PCAS).

Ground elevations along the Proposed Grid Connection underground electrical cabling range from approximately 76mOD in the vicinity of the Proposed Onsite Substation to approximately 96mOD along the local road (L6002) to the south of Prosperous Co. Kildare. At the Proposed Offsite Substation local topography slopes gently to the southwest with ground elevations ranging from approximately 96mOD adjacent the L6002 in the east to approximately 85mOD in the southwest.

9.3.2 Water Balance

9.3.2.1 Proposed Wind Farm site

Long term Average Annual Rainfall (AAR) and evaporation data were sourced from Met Éireann (www.met.ie).

The closest rainfall station to the Proposed Wind Farm site is located at Lullymore (AGR.RES.STN) situated adjacent to Lullymore Bog. The data from this rainfall station indicates an AAR of 834mm (for the years between 1963 and 1990).

Met Éireann also provides 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 30-year AAR (1991-2020) assigned to location E267000, N226000 (close to the centre of the Proposed Wind Farm site) is 880mm/yr. This data is considered to be the most accurate estimate of AAR at the Proposed Wind Farm site. The monthly modelled rainfall data for this location are presented in Table 9-8.

Table 9-7: Local Average long-term Rainfall Data (mm)

Location: Proposed Wind Farm						X-Coord: 267000				Y-Coord: 226000		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
80	65	60	60	58	69	72	78	70	91	91	86	880

The closest synoptic station where the average Potential Evapotranspiration (PE) is recorded is at Mullingar, approximately 30km northwest of the Proposed Wind Farm site. The long-term average PE for this station is 445.8mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the Proposed Wind Farm site is estimated as 423.5mm/yr (which is 0.95 × PE).

The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Proposed Wind Farm site is calculated as follows:

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

= 880 mm/yr – 423.5mm/yr

ER = 456.5mm/yr

Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie), the Proposed Wind Farm site has a groundwater recharge coefficient of 4%. This means that the hydrology of the Proposed Wind Farm site is characterised by very high surface water runoff rates and very low groundwater recharge rates. This is supported by observations made during site walkover surveys with the Proposed Wind Farm site and the surrounding area containing a high density of surface water features (field drains and main bog drains within the Proposed Wind Farm site and streams in the surrounding lands). Therefore, conservative annual recharge and runoff rates for the Proposed Wind Farm site are estimated to be 18.26mm/yr and 438.24mm/yr respectively.

Met Éireann's Translate Project (https://www.met.ie/science/translate) provides projections for a range of future climate change scenarios, as Ireland's future climate will depend on global greenhouse gas emissions reductions. The severity of any future climate change will depend on the degree of future warming. In a 1.5°C world, average winter and summer precipitation rates are projected to be 3.08mm/day and 2.23mm/day respectively in Co. Offaly. Meanwhile, in a 4°C world, the average winter and summer precipitation rates in Co. Offaly are projected to be 3.37mm/day and 2.02mm/day respectively. In a 1.5°C world, average winter and summer precipitation rates are projected to be 2.78mm/day and 2.07mm/day respectively in Co. Kildare. Meanwhile, in a 4°C world, the average winter and summer precipitation rates in Co. Kildare are projected to be 3.03mm/day and 1.89mm/day respectively.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. Table 9-9 presents return period rainfall depths for the area of the Proposed Wind Farm site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year and 100-year).

Table 9-8: Return Period Rainfall depths (mm) for the Proposed Wind Farm site

	Return Period (Years)			
Storm Duration	1	5	30	100
5 mins	4.4	8	14.9	21.9
15 mins	6.4	11.2	19.8	28.3
30 mins	8.1	13.8	23.8	33.3
1 hour	10.3	17	28.5	39.1
6 hours	19.3	29.4	45.4	59.4
12 hours	24.5	36.3	54.3	69.8
24 hours	31.2	44.8	65.1	82
2 days	37.6	52.7	74.5	92.3

9.3.2.2 Proposed Grid Connection

The Proposed Onsite Substation is located within Lodge Bog and overlaps with the Proposed Wind Farm site. Therefore, the Proposed Onsite Substation is discussed in Section 9.3.2.1 above.

The AAR along the Proposed Grid Connection underground electrical cabling route ranges from 878mm/yr in the west to 858mm/yr in the east near Prosperous, Co. Kildare. The average AAR along the Proposed Grid Connection underground electrical cabling route is 868mm/yr.

Groundwater recharge estimates from the GSI along the Proposed Grid Connection underground electrical cabling route range from 4 to 80%. The area of low groundwater recharge corresponds with the areas mapped to be covered by peat soils/subsoils which are located predominantly in the west of the Proposed Grid Connection underground electrical cabling route. Recharge rates are mapped as 60% near Allenwood, Co. Kildare due to the presence of moderate permeability subsoils overlain by well drained soils. Recharge rates near Prosperous, Co. Kildare, including the location of the Proposed Offsite Substation, are mapped as 22% due to moderate permeability subsoil and poorly drained gley soils. A very small area to the west of Allenwood, Co. Kildare is mapped as having high recharge rates (85%) due to the presence of a sand and gravel aquifer.

In the west of the Proposed Grid Connection underground electrical cabling route, where recharge is low (4%), the split between groundwater recharge and runoff is 35mm/yr and 833mm/yr respectively. Meanwhile, in the east recharge is estimated to be between 22% and 60%, the split between groundwater recharge and runoff is 191mm/yr and 677mm/yr respectively (22% recharge) and 521mm/yr and 347mm/yr (60% recharge).

9.3.3 Regional and Local Hydrology

Due regard is given to the hydrology within the Water Study Area, with particular focus on the baseline hydrological environment in the vicinity of the Proposed Project. Where relevant, the wider hydrological context of the Water Study Area is also considered and described in detail.

9.3.3.1 Proposed Wind Farm site

Within the Water Study Area the vast majority of the Proposed Wind Farm site is located in the River Barrow surface water catchment within Hydrometric Area 14 of the South-Eastern River Basin District.

A small area in the north of Ticknevin Bog is located in the River Boyne surface water catchment within Hydrometric Area 07 of the Eastern River Basin District.

Regionally, within the River Barrow surface water catchment, the Proposed Wind Farm site is located in 3 no. river sub-catchments. The majority of the Proposed Wind Farm site is located within the Figile_SC_010 river sub-catchment, the southwest is located within the Figile_SC_020 river sub-catchment and the south/southeast is located within the Slate_SC_010 river sub-catchment.

Within the Figile_SC_010 river sub-catchment, the Proposed Wind Farm site is mapped in 3 no. WFD river sub-basins: the Abbeylough_010, Figile_020 and Figile_030 WFD river sub-basins.

- Within the Abbeylough_010 WFD river sub-basin, the Abbeylough Stream (EPA Code: 14A01) flows to the west along the northern boundary of Derrybrennan Bog where it discharges into the Figile River (EPA Code: 14F01).
- Within the Figile_020 WFD river sub-basin, the Figile River flows to the west, between Glashabaun South and Glashabaun North bogs. A tributary of the Figile River, referred to by the EPA as the Lullymore East Stream (EPA Code: 14L11) is mapped to flow to the west from the western boundary of Lodge Bog. This stream dissects the northern sections of Lullymore and Lullybeg bogs and forms the boundary between Blackriver Bog to the west and Glashabaun South Bog to the east before it discharges into the Figile River. A smaller stream, referred to by the EPA as the Lullybeg Stream (EPA Code: 14L13), flows around the eastern, southern and western perimeter of Lullybeg Bog before it discharges into the Lullymore East Stream. Another stream, assigned the same name (Lullybeg) on the EPA database, flows from south to north through the western section of Blackriver Bog before it discharges into the Figile River.
- Within the Figile_030 WFD river sub-basin, the Figile River flows to the northwest, separating Codd 1 in the south from Codd 2 in the north. A small tributary of the Figile River, the Clonbrown Stream (EPA Code: 14C32) is mapped to flow to the north along the eastern boundary of Ballydermot North Bog before it discharges into the Figile River close to the east of Codd 1 Bog. The EPA also map a stream referred to as the Cloncant Stream (EPA Code: 14C41) to flow to the southwest, dissecting Codd 2 Bog before discharging into the Figile River. Further north, Ticknevin Bog is drained by 2 no. streams which merge at its southern boundary to form the Codd Stream (EPA Code: 14C44). The Codd Stream flows to the south, along the northwestern boundary of Glashabaun North before it flows to the west and discharges into the Ballyleakin Stream (EPA Code: 14B22). This stream discharges into the Figile River to the northwest of Codd 1 Bog.

Within the Figile_SC_020 river sub-catchment, the Proposed Wind Farm site is mapped within the Figile_050 WFD river sub-basin. Within this WFD river sub-basin Figile River is mapped to flow to the south approximately 2km west of the Proposed Wind Farm site. Several streams are mapped to originate at the western boundary of the Proposed Wind Farm site. The Clonbullogue Stream (EPA Code: 14C53) to the west of Ballydermot North Bog and the Ballygarrett Stream (EPA Code: 14B30) to the west of Ballydermot South Bog. These streams merge just upstream of their confluence with the Figile River.

Within the Slate_SC_010 river sub-catchment, the Proposed Wind Farm site is mapped within the Slate_050 and Slate_060 WFD river sub-basins. Within the Slate_050 WFD river sub-basin, the Killinagh Upper Stream (EPA Code: 14K17) is mapped to flow along the southeastern boundary of Lodge Bog before it discharges into the Slate River (EPA Code: 14S01). A second tributary of the Slate River is mapped to originate at the western boundary of Lodge Bog, referred to by the EPA as the Drumsru Stream (EPA Code: 14D19). The Slate River flows to the southwest, approximately 80m from the south of Lodge Bog. Within the Slate_060 WFD river sub-basin, the Slate River is located approximately 1km south of Barnaran Bog. There are no watercourses mapped in the immediate vicinity of the Proposed Wind Farm site within this WFD river sub-basin.

Further downstream, the Slate River flows through Rathangan and confluences with the Figile River approximately 6.6km southwest of the Proposed Wind Farm site. The Figile River continues to flow to the south before it discharges into the River Barrow to the north of Monasterevin.

Within the River Boyne surface water catchment, the Proposed Wind Farm site is located within the Boyne_SC_010 river sub-catchment and the Boyne_010 WFD river sub-basin. The Clonkeen Stream (EPA Code: 07C36) is mapped to flow along the northern boundary of Ticknevin Bog before it flows to the northwest and discharges into the River Boyne (EPA Code: 07B04) approximately 2km north of the Proposed Wind Farm site. The River Boyne continues to flow to the northwest before it veers to the northeast close to its confluence with the Yellow River (approximately 7km northwest of the Proposed Wind Farm site).

The proposed accommodation works along the Proposed Turbine Delivery Route are located in the Figile_010, Figile_020 and Tullamore_010 river sub-catchments. The Proposed Turbine Delivery Route accommodation works are generally distant from any EPA mapped watercourses and outside of the 50 hydrological buffer zones. However, a works area is located ~30m southeast of the EPA mapped Rathvilla or Rathclonbrackan Stream (EPA Code: 14R12). All other works areas are located in excess of 50m from natural watercourses.

For the purposes of this EIAR chapter, the names of rivers and streams correspond to those assigned in the EPA database. It is noted that some watercourses are identified by different names on local basemaps and OSI Discovery Series mapping. For example, the Figile River is referred to as the Cushaling River along the section of river flowing between Glashabaun North and Glashabaun South bogs. Similarly, the Lullybeg Stream which flows around the perimeter of Lullybeg Bog, is also known as the Crabtree River, while the Lullybeg Stream within Blackriver Bog is referred to as the Black River. The EPA nomenclature is used throughout this chapter as it represents the most up to date and authoritative hydrological database available within Ireland.

9.3.3.2 Proposed Grid Connection

Within the Water Study Area the vast majority of the Proposed Grid Connection underground electrical cabling route and the Proposed Onsite Substation are located in the River Barrow surface water catchment (refer to Section 9.3.3.1 above). A small area in the east of the Proposed Grid Connection, including the Proposed Offsite Substation, is located in the Liffey and Dublin Bay surface water catchment within Hydrometric Area 09 of the Eastern River Basin District.

Within the Water Study Area, within the River Barrow surface water catchment, the majority of the Proposed Grid Connection is located in Slate_SC_010 river sub-catchment with a very small area in the west mapped within the Figile_SC_010 river sub-catchment. Within the River Liffey and Dublin Bay surface water catchment, the Proposed Grid Connection is located in Liffey_SC_050 river sub-catchment.

Within the Slate_SC_010 river sub-catchment, the Proposed Grid Connection is mapped in 5 no. WFD river sub-basins: the Slate_010, Slate_020, Slate_030, Slate_040 and Slate_050 WFD river sub-basins. There are a total of 11 no. watercourse crossings within this sub-catchment (7 no. crossings over EPA mapped watercourses, 1 no. crossing under the Grand Canal and 3 no. crossings over unmapped watercourses). These crossings are detailed in Section 4.9.2.7 of Chapter 4. The crossings are listed below.

- Within the Slate_050 WFD river sub-basin, the Proposed Grid Connection underground electrical cabling route crosses the EPA mapped Killinagh Upper Stream (EPA Code: 14K17) along the R414 at an existing stone arch bridge. This stream flows to the south before discharging into the Slate River (EPA Code: 14S01).
- Within the Slate_050 WFD river sub-basin, the Proposed Grid Connection underground electrical cabling route is mapped to cross the Grand Canal Main Line East (Barrow)

approximately 200m to the west of Shee Bridge. The proposed crossing will utilise Horizontal Directional Drilling (HDD) and will not interact with Shee Bridge.

- Within the Slate_040 WFD river sub-basin, the Proposed Grid Connection underground electrical cabling route crosses the Upper Ballynakill Stream (EPA Code: 14U09) to the east of Allenwood along the R403 at an existing clear span bridge.
- There is an additional stone arch bridge crossing over a watercourse which is not included in the EPA database within the Slate_040 WFD river sub-basin. This crossing is located approximately 700m east of the Upper Ballynakill Stream along the R403.
- Within the Slate_020 WFD river sub-basin, the Proposed Grid Connection underground electrical cabling route crosses the Slate River (EPA Code: 14S01) along the R403 at Quigley's Bridge (Stone Arch Bridge).
- There are also an additional 2 no. EPA mapped crossings over the Slate River to the east of Quigley's Bridge (Whilst these crossings are mapped by the EPA – no crossings were recorded during surveys of the Proposed Grid Connection underground electrical cabling route. The crossings are assumed to be piped or culvert crossings).
- There is also a crossing over the feeder canal for the Ballynafagh Lake SAC/pNHA to the east of Quigley's Bridge. This crossing is a pipe or culvert crossing along the R403.
- Within the Slate_010 WFD river sub-basin, the Proposed Grid Connection underground electrical cabling route crosses the Brockagh Stream (EPA Code: 14B73) at Dagwelds Cross. This stream flows north where it discharges into the Slate River (EPA Code: 14S01). This is an existing pipe or culvert crossing along the R403 (no crossing was recorded during surveys).
- There is also a crossing over a non EPA mapped watercourses, located approximately 630m to the east of the EPA mapped Brockagh Stream along the R403 to the west of Prosperous, Co. Kildare. This is an existing culvert crossing.
- Within the Slate_010 WFD river sub-basin, the Proposed Grid Connection underground electrical cabling route crosses the Temp Stream (EPA Code: 14A46) at Black Stick Cross Roads in Prosperous, Co. Kildare. This is a pipe or culvert crossing along the R403.

Within the Figile_SC_010 river sub-catchment, the Proposed Grid Connection underground electrical cabling route is mapped in Figile_020 WFD river sub-basin. There are no crossings over EPA mapped watercourses within this WFD river sub-basin.

Within the Liffey_SC_050 river sub-catchment, the Proposed Grid Connection is mapped within the Awillyinish Stream_010 WFD river sub-basin. There are no crossings proposed over EPA mapped watercourses within this sub-catchment. The closest EPA mapped watercourse to the Proposed Offsite Substation is the Goatstown Stream (EPA Code: 09G16), mapped approximately 970m to the south. A small drain is located approximately 10m to the southwest of the Proposed Offsite Substation. This feature is not included in the EPA blueline database but is shown on the OSI Discovery Series Mapping and text on local 6" base mapping also indicates a streambed at this location. Site surveys revealed that this feature is heavily vegetated, contains little water and is separated from the Proposed Offsite Substation by an existing hedgerow.

Table 9-10 summarises the location of the Proposed Project infrastructure with respect to the WFD catchments, sub-catchments and river sub-basins. A regional hydrology map showing the WFD catchments and sub-catchments is shown as Figure 9-3. A local hydrology map showing the WFD river sub-basins is included as Figure 9-4 below.

Table 9-9: WFD Catchments, sub-catchments and river-basins and Proposed Project infrastructure

Catchment	Sub-Catchment	River Sub-Basin	Proposed Project Infrastructure
Barrow (14)	Slate_SC_010	Slate_010	Proposed Grid Connection underground electrical cabling route
		Slate_020	Proposed Grid Connection underground electrical cabling route
		Slate_030	Proposed Grid Connection underground electrical cabling route
		Slate_040	Proposed Grid Connection underground electrical cabling route
		Slate_050	Proposed Grid Connection underground electrical cabling route and Proposed Enhancement Areas
		Slate_060	8 no. Proposed Turbines, 2 no. construction compounds, access roads, peat and spoil areas, and Proposed Enhancement Areas
	Figile_SC_010	Abbeylough_010	1 no. Proposed Turbine, 1 no. construction compound, access roads, peat and spoil areas, and Proposed Enhancement Areas
		Figile_020	16 no. Proposed Turbines, 2 no. construction compounds, Proposed Onsite Substation, site access roads, met mast, Proposed Grid Connection underground electrical cabling route, peat and spoil areas and Proposed Enhancement Areas
		Figile_030	19 no. Proposed Turbines, 4 no. construction compounds, access roads, relay mast, met mast, peat and spoil areas, Proposed Enhancement Areas and Proposed Turbine Delivery Route accommodation works
	Figile_SC_020	Figile_040	Proposed Turbine Delivery Route accommodation works
		Figile_050	2 no. Proposed Turbines, access roads, peat and spoil areas and Proposed Enhancement Areas
Boyne (07)	Boyne_SC_010	Boyne_010	Access roads
Liffey and Dublin Bay (09)	Liffey_SC_050	Awillyinish Stream_010	Proposed Grid Connection underground electrical cabling route, Proposed Offsite Substation, access roads and associated construction compound
Lower Shannon Catchment (25A)	Tullamore_SC_010	Tullamore_020	Proposed Turbine Delivery Route accommodation works

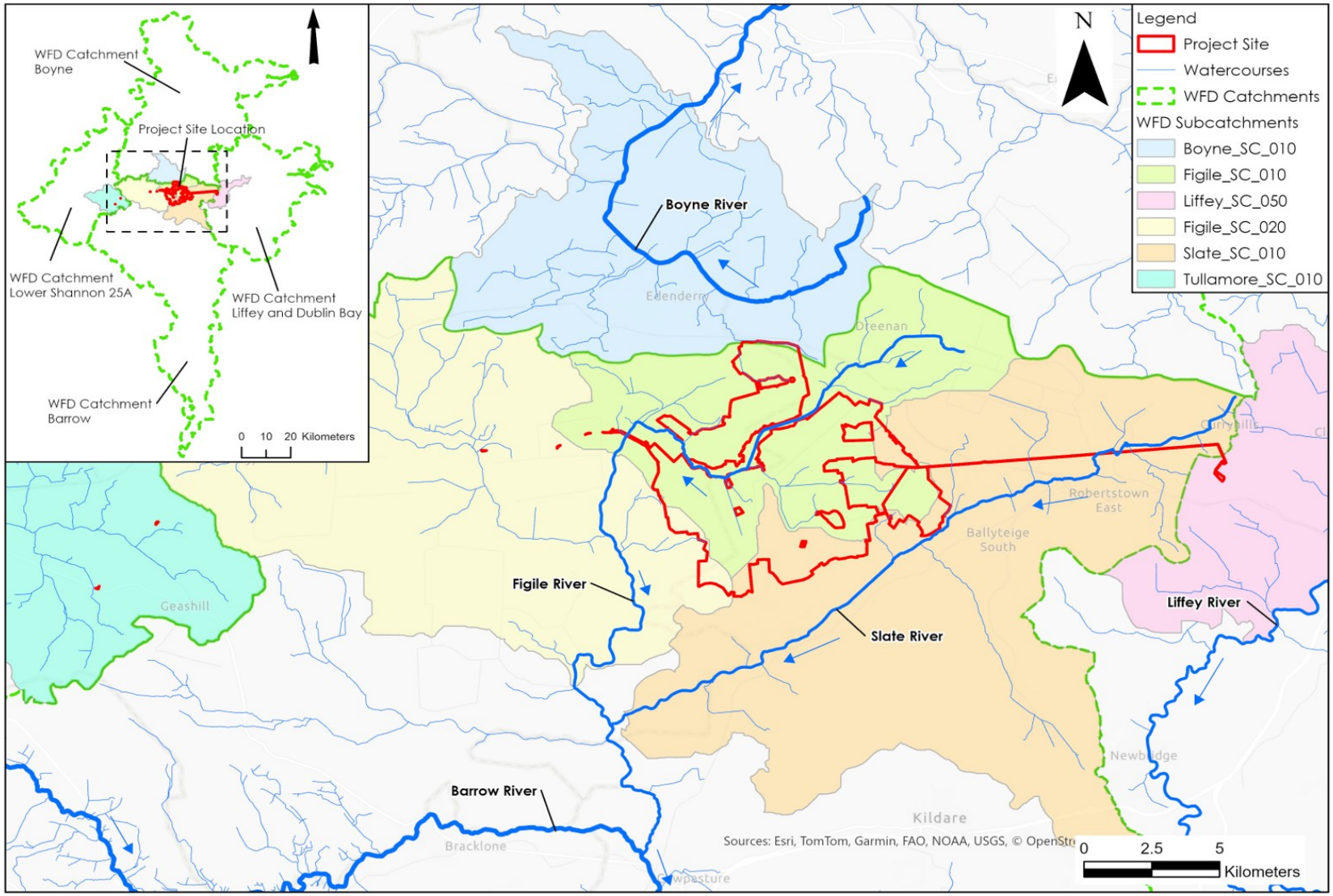


Figure 9-3: Regional Hydrology Map

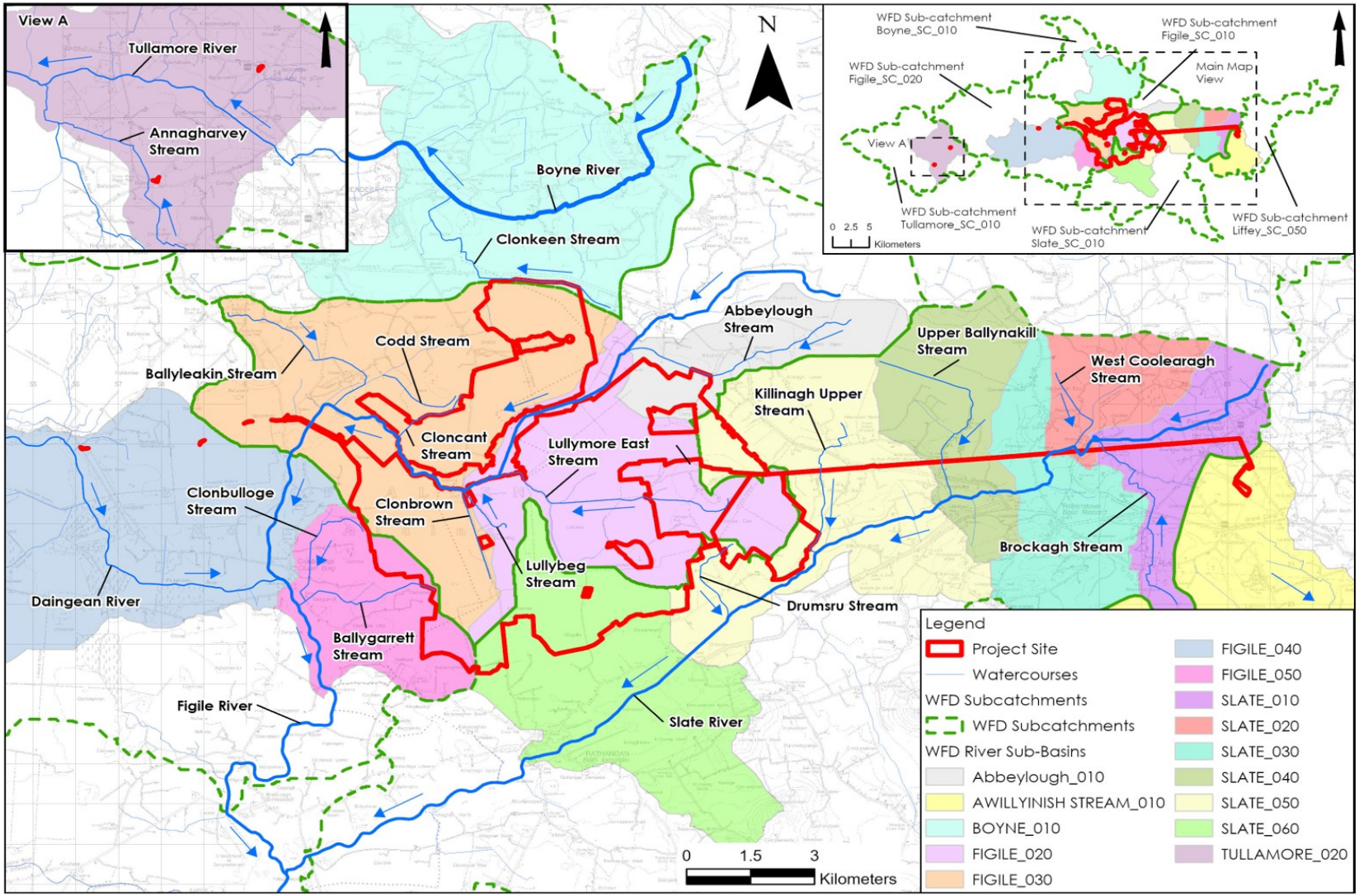


Figure 9-4: Local Hydrology Map

9.3.4 Surface Water Flows

Data on volumetric flow exceedance was acquired from OPW gauging stations (www.waterlevel.ie) for the Figile and Slate rivers within the Water Study Area (Table 9-10). The nearest downstream OPW gauging station located on Slate River is at Rathangan (Station ID: 14011). The 95%tile (percentile) flow at this location is estimated to be 0.401m^3/s. A 95%tile flow relates to the flow which will be exceeded within the river 95% of the time *i.e.* a 95%tile flow of 0.401m^3/s would indicate that 95% of the time, the flow in that river is at or above 0.401m^3/s (401 l/sec). The nearest OPW gauging station downstream of the Proposed Wind Farm on the Figile River is located at Clonbullogue (Station Number: 14004). The 95% tile flow at this location is estimated to be 0.712m^3/s.

Table 9-10: Flow Volumes recorded at OPW Gauging Stations

Station No	Flows equalled or exceeded for a given percentage of time (m^3/s) (Data derived for the period 1972 to 2026)						
	1%	10%	25%	50%	75%	90%	95%
14004 (Clonbullogue)	16.154	8.135	4.961	3.084	2.045	1.447	0.712
14011 (Rathangan)	8.744	4.503	2.608	1.331	0.799	0.489	0.401

Given that no OPW gauging stations are located on the smaller watercourses in the immediate vicinity of the Proposed Wind Farm site, the EPA's Hydrotool database, available on www.catchments.ie, was consulted. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. The 95%tile flow volumes on the Killinagh Upper Stream (Node: 14_587) and the Lullybeg Stream (Node: 14_1733) are estimated to be 0.041m^3/s and 0.035m^3/s respectively. These flows are considerably smaller than the flows in the Slate and Figile rivers. Similar flows are also expected in the other tributaries of the Slate and Figile Rivers which drain the Proposed Wind Farm site and the Proposed Grid Connection. Further downstream, the flows increase significantly in the Slate and Figile rivers. The 95%tile flow in the Figile River at Clonbullogue (Node: 14_996) is estimated to be 0.762m^3/s whilst the 95%tile flow in the Slate River downstream of Rathangan (Node: 14_1000) is estimated to be 0.406m^3/s. The 95%tile flow in the River Barrow at Monasterevin (Node: 14_1611) is estimated to be 2.264m^3/s.

The flow duration curve is presented for the EPA Hydrotool dataset in Figure 9-5.

Meanwhile, the flow volumes at the bog outfalls from the Proposed Wind Farm site range from 0.01 – 0.1m^3/s. Therefore, based on the above, the waterbodies in the vicinity of the Proposed Wind Farm site, with smaller flow volumes, would have had the greatest potential to be impacted by the Proposed Project. The potential for effects decreases progressively downstream due to the dilution effect associated with increasing flow volumes and larger upstream catchment areas. However, the Proposed Project does not rely upon the dilution or assimilative capacity of any downstream watercourse. The mitigation measures described in Section 9.5 are designed to ensure the protection of all watercourses.

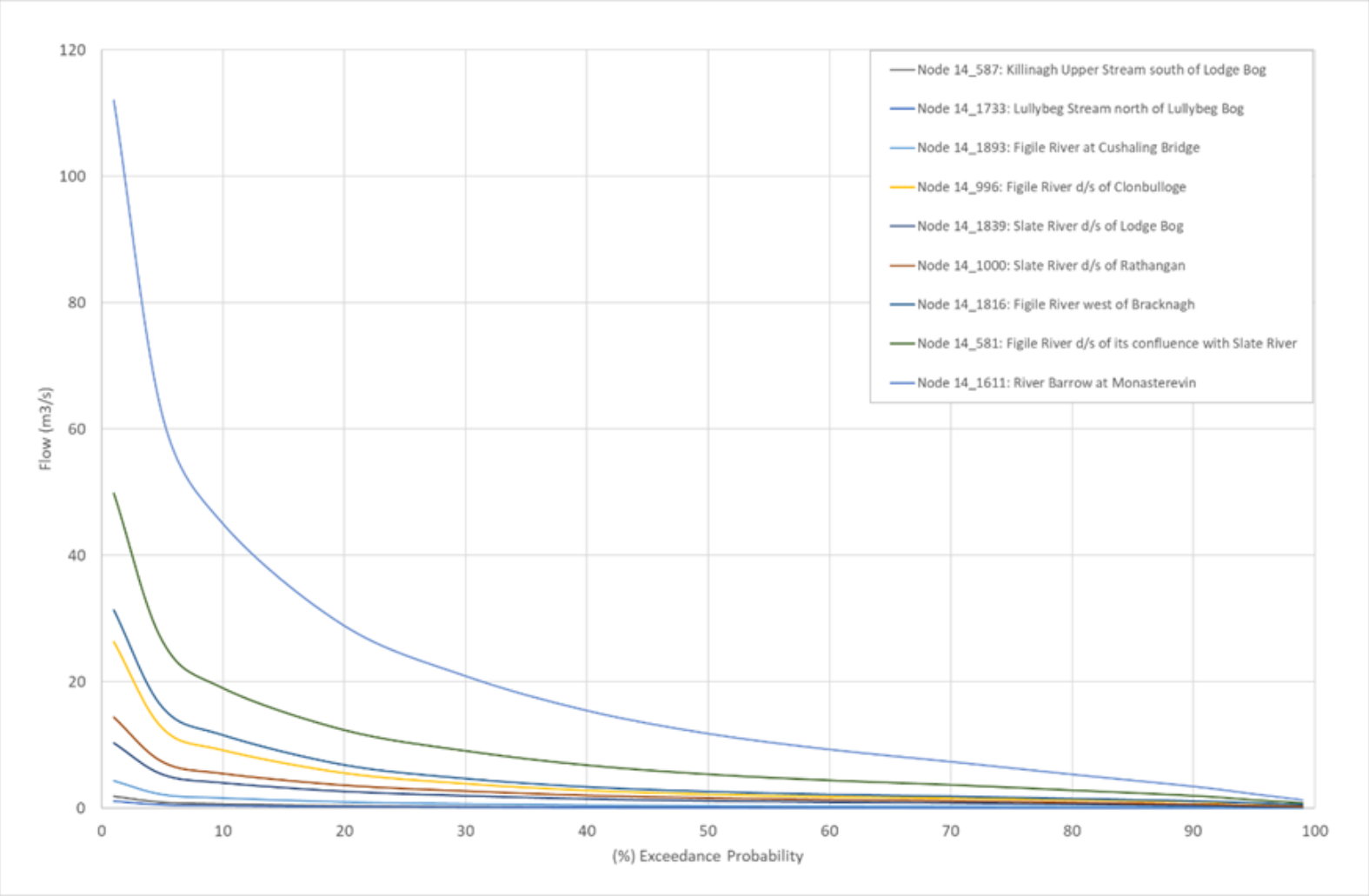


Figure 9-5: Flow Duration Curve for Watercourses Downstream of the Proposed Wind Farm site

HES completed 3 no. rounds (1st April 2021, 11th December 2025 and 15th May 2026) of surface water flow monitoring on the main watercourses draining the Proposed Wind Farm site (SW1-SW15) and the results are shown in Table 9-11 below. These locations are the same locations which are shown in Figure 9-12 below with regards to surface water quality sampling. Additional flow monitoring was also completed at SW16, SW17 and SW18 for the Proposed Grid Connection underground electrical cabling route and Proposed Offsite Substation on 15th May 2026. The measured flows vary depending on the nature of the waterbody being monitored. The greatest flows were recorded at SW17 on the Slate River and SW13 on the Figile River. The flows in the other watercourses, small streams, were small and typically ranged from 2-50l/s.

Table 9-11: Surface Water Flow Monitoring (01/04/2021 to 15/05/2026)

Location	Easting (ITM)	Northing (ITM)	Watercourse (EPA Name)	Flow Volume (l/s)
SW1	665752	729939	Unnamed EPA Mapped Stream	4-8
SW2	666703	729707	Unnamed EPA Mapped Stream	4-8
SW3	664971	728225	Cloncant Stream	20-40
SW4	664505	725903	Bog outfall to the Figile River	2-5
SW5	665667	725037	Lullybeg Stream	approximately 50
SW6	661446	724415	Clonbullogue Stream	approximately 10
SW7	661707	727918	Figile River	approximately 250
SW8	670821	724188	Drumsru Stream	approximately 20
SW9	670341	725594	Lullymore East Stream	approximately 10
SW10	670260	721699	Slate River	>5000
SW11	665876	726225	Figile River	approximately 200
SW12	661324	723098	Ballygarrett Stream	approximately 20
SW13	660915	723532	Figile River	>2,500
SW14	667755	724100	Lullybeg Stream	approximately 20
SW15	665134	725914	Figile River	approximately 200
SW16	676231	726586	Upper Ballynakill Stream	approximately 50
SW17	678792	726796	Slate River	approximately 50

Location	Easting (ITM)	Northing (ITM)	Watercourse (EPA Name)	Flow Volume (l/s)
SW18	683348	725758	Unmapped	approximately 2-5

9.3.5 Proposed Wind Farm – Existing Site Drainage

Due to the historic peat extraction activities within the Allen Bog Group, the bogs comprising the Proposed Wind Farm site have been artificially drained in order to lower the peat water table. The timing of the initial site preparation works (vegetation clearance and drainage insertion) varied across the Proposed Wind Farm site. The site preparation works, which involved vegetation clearance and drainage insertion, were first completed in 1935 at Lullymore, Lullybeg and Killina bogs, whilst the last bogs which underwent site preparation works were Ticknevin and Codd 2 bogs in 1973 (estimated date based on available aerial imagery).

Currently surface water (or runoff water) is drained from the Proposed Wind Farm site via a network of field drains typically spaced at 15 to 20m intervals, piped drains, main drains, headland drains, and silt ponds. Much of the Proposed Wind Farm site is drained by gravity however there are 10 no. existing pumping stations located around the bogs. These include pumping stations in each of the following bogs; Ticknevin Bog, (P37-010), Glashabaun North Bog (P37-008), Codd 1 Bog (P37-012), Ballydermot South (P37-011) and Blackriver Bog (P37-007) (refer to Table 9-14). Several of these locations contain more than 1 no. pump. Pumping stations have also been decommissioned at Lodge (P37-013) and Codd 1 (P37-014) (refer to Table 9-14). Following peat extraction activities, drainage by gravity in these areas of the Proposed Wind Farm site was no longer feasible as the water level in the surrounding streams were higher than the water level within the bogs. The field drains discharge to main drains which flow via gravity, or are pumped, towards the perimeter of the site where they discharge to larger headland drains. These headland drains eventually discharge to large silt (settlement) ponds (IPC licence settlement ponds). The silt ponds are used to trap sediment and prevent elevated levels of suspended sediment arising in effluent from the drained peatland. Treated surface water is then discharged at outfall points where the effluent flows into off-site drainage channels which in turn discharge into the local stream and river network.

Drainage of the bogs which comprise the Proposed Wind Farm site, as well as Lodge Bog within which the Proposed Onsite Substation is located, is currently operating under and Integrated Pollution Control (IPC) licence from the EPA (P0503-01). The drainage system is operating in accordance with this existing IPC licence, with all drainage water from the bogs being discharged via an appropriately designed silt pond treatment arrangement. A flow diagram for the existing drainage system is shown as Figure 9-6 and the flowpaths from each bog to downstream watercourses are shown in Figure 9-8.

There are a total of 26 no. surface water discharge locations from the Proposed Wind Farm site (Table 9-12). These discharge locations are situated downstream of the IPC licence settlement ponds, with the treated and attenuated water from the bog drainage system being discharged to outfall drains which in turn discharge to local watercourses. All bogs comprising the Proposed Wind Farm site discharge into the Figile River or its tributaries. A section of Lodge Bog also discharges to a tributary of the Slate River. Downstream of the Proposed Wind Farm site, the Slate River discharges into the Figile River. Therefore, all surface waters from the Proposed Wind Farm site eventually end up in the Figile River, and the River Barrow further downstream. The flowpath length between the outfall locations and closest downstream watercourse is included in Table 9-12.

Table 9-12 also presents the elevation of the respective bog outfalls. Outfalls generally discharge into outfall drains with the flowpaths along these outfall drains to the nearest EPA mapped watercourse ranging from 15m to 1.32km. Several of the EPA mapped watercourses have been integrated into the existing bog drainage system. The EPA map natural watercourses upstream of several IPC licence settlement ponds. These sections of the streams have been altered and integrated into the existing bog

drainage system, upstream of the settlement ponds. Note that SW68, SW69 and SW70 in Ticknevin Bog are located along EPA mapped watercourses. These watercourses have been integrated into the existing bog drainage system. Similarly, SW65 and SW65A in Blackriver Bog are located in close proximity (15-20m) to the EPA mapped Lullybeg 14 Stream. Note that this stream is mapped to extend into the bog and has also been integrated into the existing bog drainage system, upstream of these outfall locations.

Table 9-12 Drainage from the Proposed Wind Farm site

Outfall	Easting	Northing	Outfall Elevation (mOD)	Bog Name	Receiving EPA Mapped Watercourse	Length of Flowpath from Outfall to Watercourse (m)
SW45	663527.78	726653.71	66.16	Codd South	Figile River	95
SW45A	662256.19	726971.90	68.40	Codd South	Figile River	1,325
SW47	669131.73	728060.14	72.70	Glashabaun South	Figile River	780
SW48	668758.20	728217.78	71.12	Glashabaun South	Figile River	1,040
SW49	668988.62	728084.73	71.94	Glashabaun South	Figile River	1,190
SW50	669212.32	727966.35	72.47	Glashabaun South	Figile River	1,300
SW51	666403.40	726805.68	67.45	Glashabaun South	Figile River	320
SW52	666465.51	726531.67	67.30	Glashabaun South	Lullymore East Stream	380
SW53	666612.12	726351.97	67.63	Glashabaun South	Lullymore East Stream	240
SW56	668389.31	725645.95	68.36	Lullybeg	Lullymore East Stream	20
SW60	673194.35	724739.05	72.46	Lodge	Killinagh Upper Stream	140
SW61	673091.43	724411.58	72.43	Lodge	Killinagh Upper Stream	55
SW62	667936.06	723654.44	67.94	Barnaran	Lullybeg Stream	480
SW65	665875.07	724954.12	67.0	Blackriver	Lullybeg Stream	15

Outfall	Easting	Northing	Outfall Elevation (mOD)	Bog Name	Receiving EPA Mapped Watercourse	Length of Flowpath from Outfall to Watercourse (m)
SW65A	665458.68	725293.01	66.54	Blackriver	Lullybeg Stream	20
SW67	664392.87	725678.79	66.91	Codd South	Figile River	450
SW67A	664442.55	723287.69	67.50	Ballydermot South	Ballygarrett Stream	140
SW68	666729.17	729690.42	70.66	Ticknevin	Temp Stream	0
SW69	666201.27	729620.71	71.64	Ticknevin	Temp Stream	0
SW70	665703.89	729959.63	69.58	Ticknevin	Temp Stream	0
SW71	664995.88	728219.88	69.26	Glashabaun North	Cloncant Stream	25
SW72	664234.47	727749.54	68.22	Codd North	Cloncant Stream	20
SW73	663537.72	727291.52	66.42	Codd North	Cloncant Stream	40
SW74	663647.75	726742.12	65.91	Codd North	Figile River	55
SW75	663766.63	726597.55	65.91	Codd North	Figile River	130
SW76	664406.66	726320.81	65.59	Codd North	Figile River	140

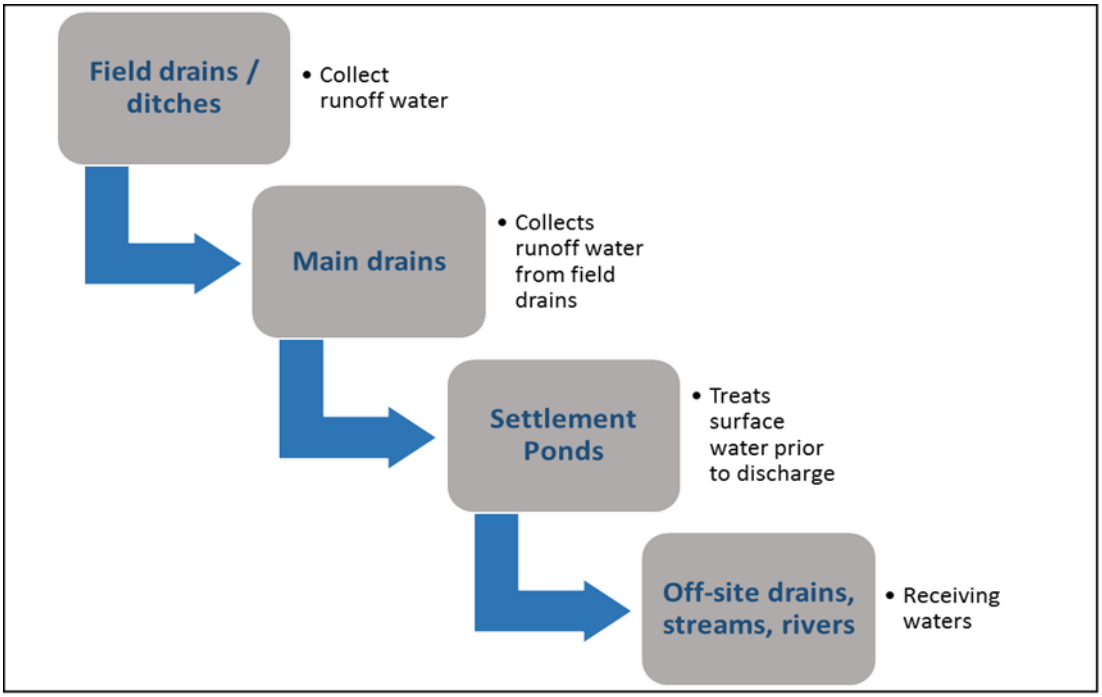


Figure 9-6: Process Flow Diagram for the Existing Drainage System

Table 9-13: Pumping Stations at the Proposed Wind Farm site

Pump Station ID	No. Pumps	Easting	Northing	Bog Name	Year of Installation	Status
P37/014	2	663656	726455	Codd 1	Unknown	Decommissioned
P37/007	2	666025	724944	Blackriver	Unknown	Existing
P37/008	2	665251	728217	Glashabaun North	Pre July 1988	Existing
P37/010	2	666212	729630	Ticknevin	Unknown	Existing
P37/011	2	664498	723400	Ballydermot South	Pre July 1988	Existing
P37/012	2	665029	725617	Boundary of Codd 1 and Ballydermot North	Unknown	Existing
P37/013	2	673081	724538	Lodge	Unknown	Decommissioned

As stated above in Section 9.3.3.1, the EPA map several watercourses within the Proposed Wind Farm site. The EPA mapped watercourse network has been reviewed in conjunction with site walkover surveys and BnM drainage mapping. Given the extensive historic peat extraction within the Proposed Wind Farm site, a number of the EPA mapped watercourses have been modified and now form part of the existing peatland drainage network, including locations where settlement ponds have been constructed along the watercourses. Existing site drainage maps showing the locations of the watercourses, silt ponds, pumping stations and outfall locations are presented in Figure 9-7 below.

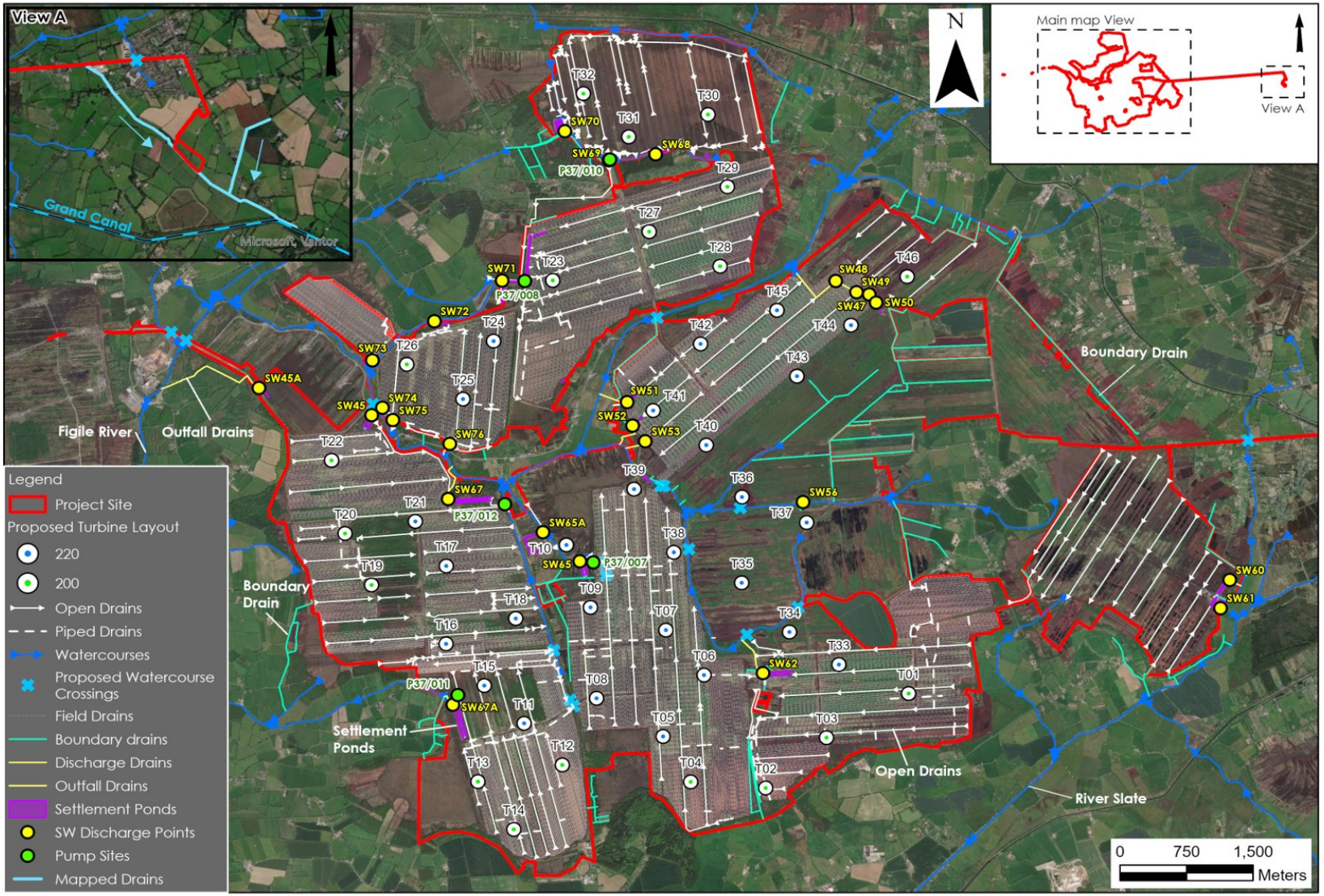


Figure 9-7: Existing Bog Drainage, Pumping Stations, Silt Ponds and Outfall Locations

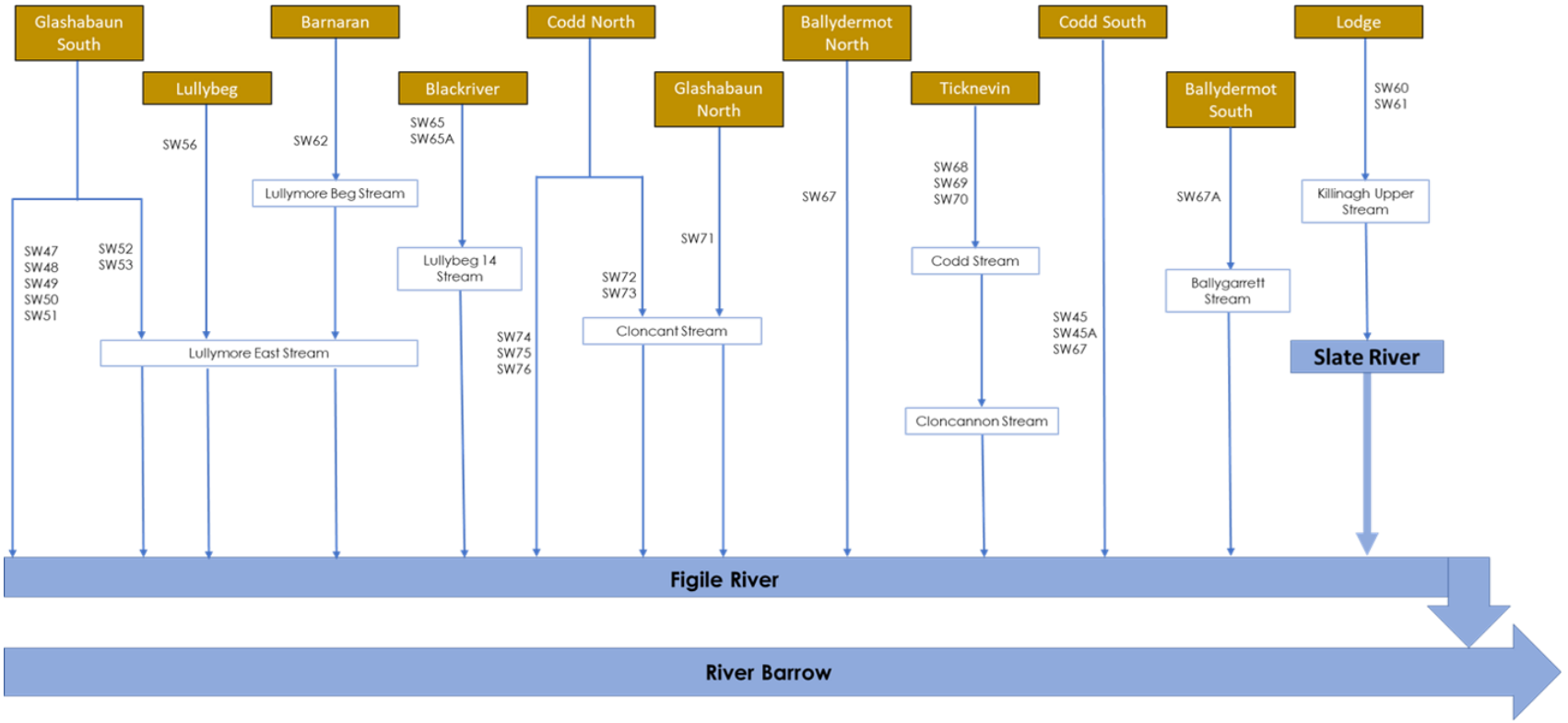


Figure 9-8: Flow Pathways from Bog Comprising the Proposed Wind Farm site

9.3.6 Baseline Assessment of Runoff

This section undertakes a long-term water balance assessment and surface water runoff assessment for the baseline conditions at the Proposed Wind Farm site.

The rainfall depths used in this water balance assessment are long-term averages and are not used in the design of the sustainable drainage system for the Proposed Wind Farm or the Proposed Onsite Substation. The extreme rainfall depths shown in Table 9-8 above will be the basis of the Proposed Project drainage design which is described in Section 9.4.

The water balance calculations are carried out for the month with the highest average recorded rainfall minus evapotranspiration for the current baseline conditions at the Proposed Wind Farm site (Table 9-14). It represents, therefore, the long-term average wettest monthly scenario in terms of volumes of surface water runoff from the site pre-wind farm development. The surface water runoff co-efficient is estimated to be 96% based on the predominant peat coverage (refer to Section 9.3.2).

The highest long-term average monthly rainfall as per the grid provided by Met Éireann (refer to Section 9.3.2.1) at the centre of the Proposed Wind Farm site over 30 years occurred in the month of October and November, at 91mm. The average monthly evapotranspiration for the synoptic station at Mullingar, Co. Offaly over the same period in October and November was 16.2mm and 2.2mm. The water balance presented in Table 9-15 indicates that a conservative estimate of surface water runoff during the highest rainfall month is 3,750,498m^3/month or 120,984m^3/day in October and 4,410,221m^3/month or 147,007m^3/day in October for the Proposed Wind Farm site.

Table 9-14: Water Balance and Baseline Runoff Estimates for Wettest Month (October and November)

Water Balance Component	Depth (m) – October	Depth (m) – November
Average Rainfall (R)	0.091	0.091
Average Potential Evapotranspiration (PE)	0.0162	0.0022
(AE = PE x 0.95)	0.0154	0.0021
Effective Rainfall (ER = R - AE)	0.0756	0.0889
Recharge (4% of ER)	0.0030	0.0036
Runoff (96% of ER)	0.0726	0.0854

Table 9-15: Baseline Runoff for the bogs associated with the Proposed Wind Farm site and the Proposed Onsite Substation

Bogs Associated with the Proposed Wind Farm and Proposed Onsite Substation	Approx. Area (ha)	Baseline Runoff per Wettest month (m^3)	Baseline Runoff per day (m^3) in wettest month
Proposed Wind Farm site (October)	5,139	3,581,677	115,537
Proposed Wind Farm site (November)	5,139	4,213,157	135,908

9.3.7 Flood Risk Assessment

2 no. Site-Specific Flood Risk Assessments (SSFRAs) have been prepared for the Proposed Project, one for the Proposed Wind Farm and the Proposed Onsite Substation (included as Appendix 9-1) and one for the Proposed Grid Connection and the Proposed Offsite Substation (included as Appendix 9-2). The Proposed Onsite Substation was included in the SSFRA for the Proposed Wind Farm due to its location within Lodge Bog, within the Proposed Wind Farm site. The following sections provide a summary of the findings of these SSFRAs in terms of the existing baseline environment.

9.3.7.1 Proposed Wind Farm and Proposed Onsite Substation

To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood map (www.floodinfo.ie), CFRAM maps (www.floodinfo.ie) and historical mapping (i.e. 6" and 25" base maps) were consulted.

No instances of historical flooding were identified on the available historical 6" or 25" mapping for the Project Wind Farm site. Text on local base maps indicates that the areas along the Figile River are liable to flood in the vicinity of the Proposed Wind Farm site.

No recurring or historic flood incidents were identified within the Proposed Wind Farm site from the OPW's Past Flood Events Map. However, there are a few recurring flood events and a past flood event mapped in the lands surrounding the Proposed Wind Farm site. These are listed below and further details are provided in Appendix 9-1:

- Recurring flood event (Flood ID: 1486) at Cloncumber Pluckerstown is mapped approximately 2km south of Lodge Bog and the Proposed Onsite Substation;
- Recurring flood event (Flood ID: 1485) at Slate Cloncurry is mapped approximately 1.8km south of the Proposed Wind Farm site (Barnaran Bog);
- Recurring flood event (Flood ID: 1484) at Slate Rathangan is mapped approximately 1.9km south of the Proposed Wind Farm site (Blackriver Bog);
- Recurring flood event (Flood ID: 2772) at Figile Derrygarran is mapped approximately 1.9km southwest of the Proposed Wind Farm site (Ballydermot South Bog);
- Recurring flood event (Flood ID: 2769) at Figile Clonbullogue is mapped approximately 2.2km west of the Proposed Wind Farm site (Ballydermot North Bog);
- Past flood event (Flood ID: 10599) at Philipstown Clonbullogue on 16th August 2008 is mapped approximately 1.9km west of the Proposed Wind Farm site (Ballydermot North Bog);
- Recurring flood event (Flood ID: 2785) at Blundell Aqueduct, Edenderry is mapped approximately 1.9km northwest of the Proposed Wind Farm site (Ticknevin Bog);
- Past flood event (Flood ID: 2786) at Grand Canal, Edenderry on 1st January 1989 is mapped approximately 2.2km northwest of the Proposed Wind Farm site (Ticknevin Bog); and,
- Recurring flood event (Flood ID: 1280) at Killinagh is mapped approximately 1.8km east of the Proposed Wind Farm site (Killina Bog).

The GSI Historical 2015/2016 flood map shows historic surface water flood extents in some areas of the Proposed Wind Farm site. These historic flood zones are located in the west of Glashabaun North Bog, in the north/northeast of Codd I Bog, in the north and east of Ballydermot North Bog and towards the centre of Lodge Bog. These historic flood zones correspond with some of the lower lying peat fields within the Proposed Wind Farm site.

CFRAM maps for the local area do not show any fluvial flood zones within the Proposed Wind Farm site or at the Proposed Onsite Substation. Widespread flood zones are mapped downstream of the Proposed Wind Farm site and the Proposed Onsite Substation on the Slate and Figile rivers.

The National Indicative Fluvial Flood Mapping records the presence of surface water flooding along the Figile River and its tributaries in the area of the Proposed Wind Farm site. Some of these fluvial flood zones encroach upon the Proposed Wind Farm site. The flooding is likely to be a combination of fluvial and pluvial flooding due to the flat low-lying nature of the Proposed Wind Farm site and the low permeability of the soils and subsoils.

No NIFM and CFRAM Flood Extents are mapped in the vicinity of the Proposed Turbine Delivery Route accommodation work areas.

9.3.7.2 Proposed Grid Connection underground electrical cabling route and Proposed Offsite Substation

A flood risk identification study was undertaken to identify existing potential flood risks associated with the Proposed Offsite Substation and the Proposed Grid Connection underground electrical cabling route.

No instances of historical fluvial flooding were identified from historic OS maps along the Proposed Grid Connection underground electrical cabling route or at the Proposed Offsite Substation.

No recurring or historic flood events are mapped by the OPW in the local area or immediately downstream of the Proposed Offsite Substation or along the Proposed Grid Connection underground electrical cable route.

The GSI Historic Surface Water Flood Map does not record any historic flood zones in the area of the Proposed Offsite Substation or along the Proposed Grid Connection underground electrical cable route.

Some CFRAM and NIFM fluvial flood zones are mapped along the Proposed Grid Connection underground electrical cable route, refer to Appendix 9-2. These occur at existing watercourse crossings along the R403.

CFRAM mapping has not been completed in the area of the Proposed Offsite Substation. The NIFM does not indicate any fluvial flood zones in the area of the Proposed Offsite Substation. The Proposed Offsite Substation is mapped in Flood Zone C and is considered to be at low risk of flooding. A small drain is present to the west of the Proposed Offsite Substation, however, site surveys revealed that this feature is heavily vegetated and has negligible flow and does not pose a significant flood risk.

9.3.8 Surface Water Quality

9.3.8.1 EPA Water Quality Monitoring

The Biological 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 0-1 (Poor) to 4-5 (Good/High). Biological Q-rating data for EPA monitoring points on the Figile, Slate, Liffey and Boyne rivers are shown in Table 9-16 below.

Within the Figile_SC_010 river sub-catchment, the Figile River achieved a Q2-3 rating (Poor Q-status) upstream of the Proposed Wind Farm site at Ticknevin Bridge (Station Code: RS14F010050) and a Q3-4 rating (Moderate Q-status) downstream at Cushaling Bridge (Station Code: RS14F010100) and at Kilcumber Bridge (Station ID: RS14F010200) in 2023.

Within the Figile_SC_020 river sub-catchment, the Figile River achieved a Q3 rating (Poor Q-status) downstream of the Proposed Wind Farm site in Clonbullogue (Station Code: RS14F010300) in 2024 and also at Derrygarran Bridge (Station ID: RS14F010400) in 2023.

Within the Slate_SC_010 river sub-catchment, the Slate River achieved a Q3 rating (Poor Q-status) upstream of the Proposed Wind Farm site and downstream of the Proposed Grid Connection underground electrical cabling route at Quigley's Bridge (Station Code: RS14S010020) and at Ford Bridge (Station ID: RS14S010050). Further downstream, the Slate River achieved a Q3-4 rating (Moderate Q-status) at Agar Bridge (Station Code: RS14S010100), at a bridge opposite the church in Rathangan (Station ID: RS14S010150), 100m downstream of Spencer Bridge (Station ID: RS14S010210) and upstream of its confluence with the Figile River (Station ID: RS14S010300) in 2023.

Within the Boyne_SC_010 river sub-catchment, the River Boyne achieved a Q3-4 rating (Moderate Q-status) downstream of the Proposed Wind Farm site at Boyne Bridge (Station Code: RS07B040200) and at Kinnafad Bridge (Station ID: RS07B040300) in 2024. There is no discharge from the Proposed Wind Farm site to the River Boyne or any of its tributaries.

Within the Liffey_SC_050 river sub-catchment, the closest downstream EPA Q-monitoring station to the Proposed Offsite Substation with recent data available is located at Clane (Station Code: RS09L011500). Here the River Liffey achieved a Q4 rating (Good Q-status) in 2025.

With respect to the Proposed Turbine Delivery Route accommodation works, detailed consideration of EPA Q-values is not considered necessary due to the minor and localised nature of the proposed works.

A map of EPA monitoring locations is shown as Figure 9-12.

Table 9-16: Most Recent (2023-2024) Q-ratings within the Water Study Area

River	Station ID	Location	EPA Q-Rating (Year)	Q-Value Status
Figile_SC_010 river sub-catchment				
Figile River	RS14F010050	Bridge S of Ticknevin Bridge	2023	Q2-3 (Poor)
Figile River	RS14F010100	Cushaling Bridge	2023	Q3-4 (Moderate)
Figile River	RS14F010200	Kilcumber Bridge	2023	Q3-4 (Moderate)
Figile_SC_020 river sub-catchment				
Figile River	RS14F010300	Figile - Bridge in Clonbullogue	2024	Q3 (Poor)
Figile River	RS14F010400	Derrygarran Bridge	2023	Q3 (Poor)
Slate_SC_010 river sub-catchment				
Slate River	RS14S010020	Quigley's Bridge	2023	Q3 (Poor)
Slate River	RS14S010050	Ford Bridge	2023	Q3 (Poor)
Slate River	RS14S010100	Agar Bridge	2023	Q3-4 (Moderate)
Slate River	RS14S010150	E Bridge Rathangan (Opp Church)	2023	Q3-4 (Moderate)
Slate River	RS14S010210	Slate - 100 m d/s Bridge near Spencer Br	2023	Q3-4 (Moderate)
Slate River	RS14S010300	River Bridge	2023	Q3-4 (Moderate)
Boyne_SC_010 river sub-catchment				
Boyne River	RS07B040200	Boyne Bridge	2024	Q3-4 (Moderate)
Boyne River	RS07B040300	Kinnafad Bridge	2024	Q3-4 (Moderate)
Liffey_SC_050 river sub-catchment				
Liffey River	RS09L011500	Alexandra Br Clane	2025	Q4 (Good)

9.3.8.2 HES Hydrochemical Monitoring (2021 – 2026)

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at 15 no. surface water sampling locations (SW1-SW15) downstream of the Proposed Wind Farm site on 1st April 2021, 11th December 2025 and 15th May 2026. An additional 3 no. locations (SW16, SW17 and SW18) along the Proposed Grid Connection underground electrical cabling route and in the vicinity of the Proposed Offsite Substation were sampled on 15th May 2026.

The results of the field hydrochemistry are listed in Table 9-18. The monitoring locations cover a range of watercourses, from bog outfalls and drainage channels to larger watercourses such as the Slate and Figile rivers and are shown on Figure 9-12.

The surface water samples indicate a basic "type" surface water, with pH ranging from 7.02 to 8.15. Dissolved oxygen ranged from 5.76 to 13.39mg/L, specific electrical conductivity ranged from 169 to 801µS/cm, turbidity ranged from <0.01 to 90.1NTU and temperature ranged from 7.7 to 11.7°C.

Table 9-17: Field Parameters - Summary of Surface Water Chemistry Measurements (01/04/2021, 11/12/2025 and 15/05/2026)

Location ID	Temp °C	DO (mg/L)	SPC (µS/cm)	pH	Turbidity
SW1	8.5 – 11.3	8.72 – 13.39	286 – 572	7.8 - 8.1	1.97 – 8.54
SW2	9 – 10	8.75 – 12.39	589 – 776	7.5 - 8.1	<0.01 – 2.85
SW3	8.4 – 11.3	10.24 – 11.08	287.3 – 542	7.81 – 8.02	0.96 – 23.3
SW4	7.8 – 8.6	10.21 – 10.94	288 – 478	7.55 - 7.71	0.73 – 6.4
SW5	8.4 – 11.6	9.25 – 10.31	277 – 534	7.72 – 7.88	1.33 – 4.7
SW6	8.7 – 10	8.2 – 10.52	321 – 712	7.56 - 7.77	1.4 – 5.07
SW7	9.2 – 11.7	9.48 – 10.1	263 – 637	7.47 – 7.93	0.87 – 6.03
SW8	8.9 – 10.5	5.76 – 9.9	299 – 569	7.36 - 7.61	2.54 – 90.1
SW9	9.1 – 9.8	6.4 – 10.78	667 – 801	7.45 - 7.65	4.71 – 38.1
SW10	9.1 – 10.8	8.18 – 10.89	578 – 710	7.31 – 8.14	1.77 – 13.9
SW11	9.1 – 10.6	7.87 – 10.37	169.1 – 638	7.02 – 7.99	1.29 – 7.3
SW12	8.7 – 9.7	8.23 – 10.42	475 – 719	7.54 – 7.84	2.5 – 8.75
SW13	8.3 – 12.1	9.7 – 9.81	472 – 702	7.77 – 8.07	2.73 – 6.52
SW14	8.2 – 10.5	7.74 – 9.8	304 – 521	7.24 – 7.45	4.2 – 6.42
SW15	8.8 – 10.6	9.59 – 11	449 – 725	7.94 – 8.05	0.99 – 4.41
SW16(+)	9.6	9.6	574	7.91	2.93
SW17(+)	9.6	10.85	747	8.15	5.59
SW18(+)	10.7	10.68	785	7.73	8.95

(+) Only 1 no. round of sampling was completed at these locations on 15th May 2026.

Surface water grab samples were also taken at the 15 no. locations in the vicinity of the Proposed Wind Farm site for laboratory analysis on the 1st April 2021, 11th December 2025 and 15th May 2026. Grab sampling for laboratory analysis was also completed at SW16, SW17 and SW18 in the vicinity of the Proposed Grid Connection on the 15th May 2026. Results of the laboratory analysis are shown alongside relevant water quality regulations in Table 9-18. The laboratory reports are included as Appendix 9-3.

The laboratory results were screened against the applicable Environmental Quality Standards (EQS) and water quality standards set out in relevant legislation. BOD, orthophosphate and ammonia concentrations were assessed against the applicable EQS for inland surface waters specified in the

European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009), as amended. Suspended solids concentrations were assessed against the standard of ≤25 mg/L specified in the European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293/1988). S.I. 272/2009 does not provide any standard with respect to suspended solids.

Suspended solid concentrations ranged from <5 to 420mg/L. Suspended solid concentrations were below the S.I 293/1988 threshold limit of 25mg/L in all samples except for SW1, SW4 and SW8 on 1st April 2021 and SW4, SW8 and SW14 on 15th May 2026. The elevated levels of suspended solids in these samples can be attributed to disruption of the streambed during sampling, and/or due to the preceding heavy rainfall, which occurred prior to the May 2026 sampling.

A total of 24 of the 48 no. samples (50%) achieved 'High' status with respect to ammonia concentrations (i.e. ≤0.04mg/L). Meanwhile, 8 no samples (approximately 16%) were below the 'Good' status threshold (i.e. ≤0.065mg/L). Biological Oxygen Demand (BOD) achieved 'Good' status, in 6 no. samples, with regards to the threshold of ≤1.5mg/L. 41 no. samples (approximately 85%) achieved 'Good' status with respect to ortho-phosphate (≤0.035mg/L). Nitrate concentrations ranged from <5.0- 59.3mg/L. Chloride concentrations ranged from 10.5 to 66.2mg/L.

Elevated ammonia and BOD concentrations are considered to reflect the natural hydrochemical characteristics of the peatland catchments drained by these watercourses. Peatlands are typically rich in organic matter and dissolved organic carbon, and the decomposition of peat under waterlogged conditions can result in elevated background concentrations of ammonium and oxygen-demanding substances within receiving waters.

Table 9-18: Laboratory Data (01/04/2021, 11/12/2025 and 15/05/2026)

Location ID	Suspended Solids (mg/L)	BOD_5 (mg/L)	Orthophosphate (mg/L)	Nitrate (mg/L NO_3)	Ammonia (mg/L)	Chloride (mg/L)
Environmental Quality Standards (EQS)	**≤25([1])**	**≤ 1.3 to ≤ 1.5([2])**	**-≤ 0.035 to ≤0.025([2])**	-	**-≤0.065 to ≤0.04([2])**	-
SW1	<5 – 40	2 - 4	<0.02 – 0.02	<5 – 7	<0.02 – 0.2	12 - 12.9
SW2	<5 – 12	1 – 8	<0.02 – 0.03	<5.0 – 17.8	0.03 – 0.2	14 – 66.2
SW3	<5 – 18	2 – 4	<0.02 – 0.02	<5 – 23.8	0.07 – 0.12	11.1 – 15.2
SW4	<5 – 420	<5 – 10	<0.10 – 0.33	<5.0 – 6.6	0.03 – 0.07	10.8 – 18.4
SW5	<5 - 15	2 - 9	<0.02 – 0.02	<5 – 24.6	<0.02 – 0.12	9.1 – 18.6
SW6	<5 – 21	1 – 9	0.02 – 0.03	<5 – 32.9	0.02 – 0.11	17.6 – 18.6
SW7	5 – 8	2 – 5	0.02 – 0.03	<5.0 – 11.5	0.02 – 0.23	13.6 – 17.6
SW8	<5 – 347	2 – 24	<0.02 – 0.03	<5.0 – 6.3	0.12 – 0.58	9.1 – 13.2
SW9	<5 – 9	<5 – 8	0.02 – 0.24	5.3 – 59.3	0.08 – 1.16	12.3 – 27.6
SW10	<5 – 14	<2 - 2	<0.02 – 0.03	6.1 – 14.2	<0.02 – 0.39	22.5 – 26.4
SW11	<5 - 6	2 - 4	<0.02 – 0.03	<5.0 – 12.4	0.03 – 0.12	13.6 – 16.6
SW12	<5 – 12	1 – 4	<0.02 – 0.03	<5 – 11.9	0.04 – 0.11	12 – 23.2
SW13	<5 – 7	2 – 4	<0.02 – 0.04	7.8 – 14.2	0.03 – 0.12	17.2 – 34.2
SW14	<5 – 27	2 – 4	<0.02 – 0.3	<5.0 – 16.4	0.03 – 0.56	13 – 27

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

Location ID	Suspended Solids (mg/L)	BOD_5 (mg/L)	Orthophosphate (mg/L)	Nitrate (mg/L NO_3)	Ammonia (mg/L)	Chloride (mg/L)
SW15	<5 – 6	1 – 5	<0.02 – 0.02	10.2 – 13.3	<0.02 – 0.06	15.6 – 16.6
SW16	<5	4	0.04	<5	0.06	14.7
SW17	5	2	0.02	11.5	0.03	32.4
SW18	21	7	0.03	6.6	0.02	18.3

(+) S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.
(*) S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended).

9.3.8.3 IPC Licence Monitoring (2000 – 2025)

BnM has been conducting monitoring of emissions to water from the Allen Bog Group from 2000 to the present as set out in IPC Licence P0503-01. Annual monitoring was not completed at the Proposed Wind Farm site as the monitoring was rotated between the different bogs which comprise the larger Allen Bog Group. However, a summary of the relevant monitoring data is presented in Table 9-19.

Stormwater (i.e. rainwater run-off from roof and non-process areas such as carparks) derived on-site is released into a local waterbody following basic treatment. The IPC licence requires that stormwater (from roof and non-process areas such as carparks) is managed to ensure that no pollutants are released into the receiving environment. Where run-off comprises only roof water it is directed directly to a drain. Runoff from other areas such as carparks is passed through a hydrocarbon interceptor before discharge. Discharges (from roof and non-process areas such as carparks) are inspected and sampled on a monthly basis. The primary treatment criteria used to define adequate treatment of stormwater is Chemical Oxygen Demand (COD) mg/L. Monthly sampling was completed with results being generally well below the COD trigger levels. Occasionally elevated concentrations occurred when machinery had been washed down immediately prior to sampling and subsequent results returned to satisfactory levels.

The IPC licence has also required that wastewater be managed to ensure no pollution results when wastewaters were discharged into local surface waterbodies. Two types of wastewaters were produced: process wastewater from the activities associated directly with peat extraction operations, and sanitary wastewater from toilets and canteens. All process wastewater from peat extraction areas were treated via a silt pond drainage system which has been inspected and maintained in accordance with Condition 6 of the IPC Licence (P0503-01). Treated wastewater is released into the Ballygarrett, Cloncant, Lullybeg, Killinagh Upper and an unnamed stream. IPC Licence requirements comprise of quarterly grab samples on a select number of silt pond outlets across the Allen Bog Group.

A total of 226 no. grab samples have been taken at the outfalls from the bogs associated with the Proposed Wind Farm site (between Q4 2000 and Q2 2025). These samples have been analysed for COD, pH, Ammonia, Total Phosphorous, Suspended Solids, Total Solids and Colour. The Emission Limit Values (ELVs) are 35mg/L suspended solids, 3mg/L total ammonia, and 100mg/L COD as set out in the IPC Licence P0503-01.

As shown in Figure 9-9, 3 no. exceedances have been recorded above the IPC Licence ELV of 3mg/L total ammonia from the available data. Concentrations of ammonia ranged from 0.017 to 3.7mg/L, with an average of 0.96mg/L.

As shown in Figure 9-10, the concentrations of suspended solids ranged from 2 to 92mg/L, with an average concentration of 9.54mg/L. A total of 5 no. exceedances are reported for the period from 2000-2025 which comprised a total of 226 no. samples. However, these exceedances are outliers with 97.34% of all data being well below the 35mg/L ELV.

As shown in Figure 9-11, 9 no. exceedances of COD have been recorded in outfalls. The mean concentration of COD lies below the ELV of 100mg/L. The mean concentration of COD was 75.42mg/L. Reduced flow and increased temperature can influence COD concentrations.

Other parameters recorded during the sampling included phosphorous and pH. Total phosphorus remained relatively stable across the monitoring period and with concentrations ranging from 0.05 to 0.19mg/L. pH values were generally within the recommended 6 – 9 range. No pH values were outside of this range. pH values emanating from peat extraction areas remain relatively constant and in line with background levels.

Incidents Reporting

The EPA Leap Database (https://leap.epa.ie/licence-profile/P0503) records a total of 6 no. incidents relating to surface water quality at the Proposed Wind Farm site between 2019 and 2025. 5 no. of these incidents related to the exceedance of the 100mg/L trigger level for COD. The exceedances were recorded at Ballydermot Bog (116mg/L in February 2019), Glashabaun South (SW49 – 125mg/L in September 2020), Glashabaun South (SW51 and SW52 – 102 and 106mg/L in April 2022) and Codd South (SW45 – 228mg/L in January 2024). There was also an incident reported with respect to the breaching of the 3mg/L trigger level for ammonia at Lullybeg Bog (SW56 – 3.9mg/L) in February 2019. These incidents are all categorised as "minor" with the cause of the incidents listed as being either unknown or due to adverse weather. The impact on the environment is listed on the Leap database as "no impact". No additional significant incidents or contamination events were recorded in the AERs.

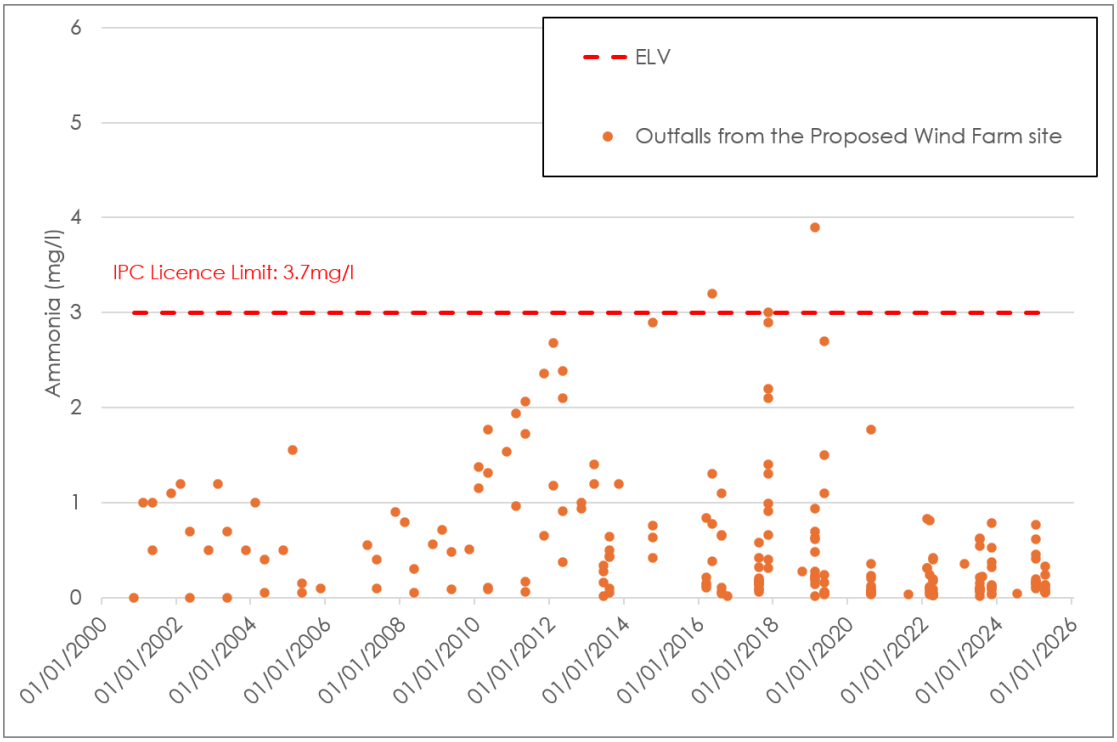


Figure 9-9: BnM Ammonia Monitoring (2000-2026)

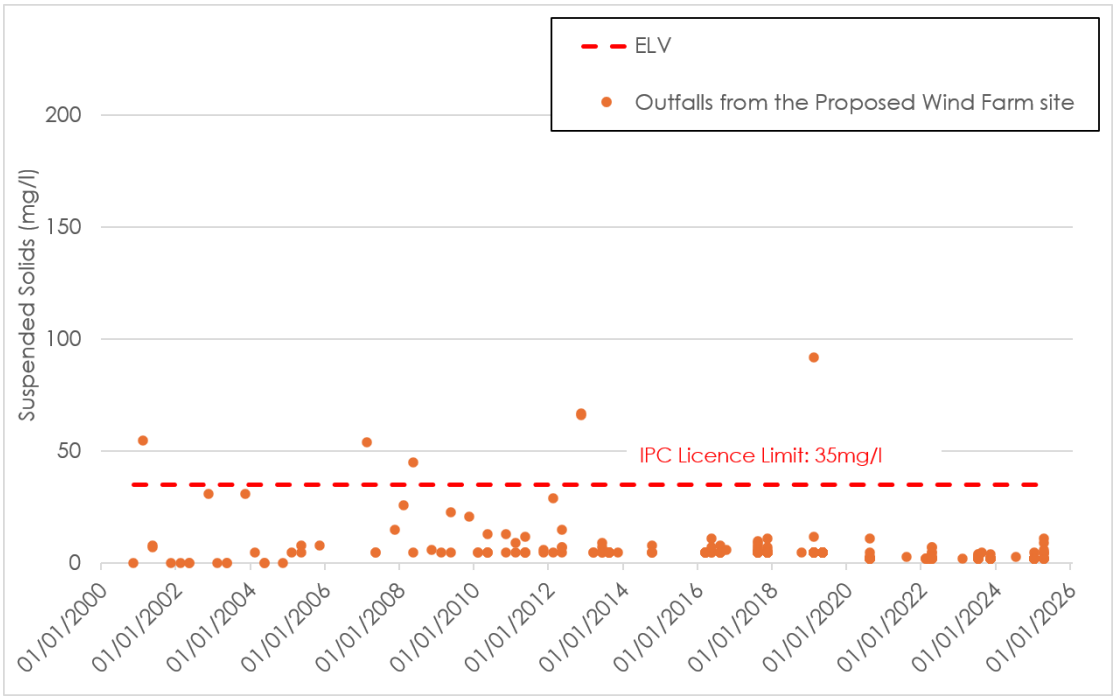


Figure 9-10: BnM Suspended Solids Monitoring (2000-2026)

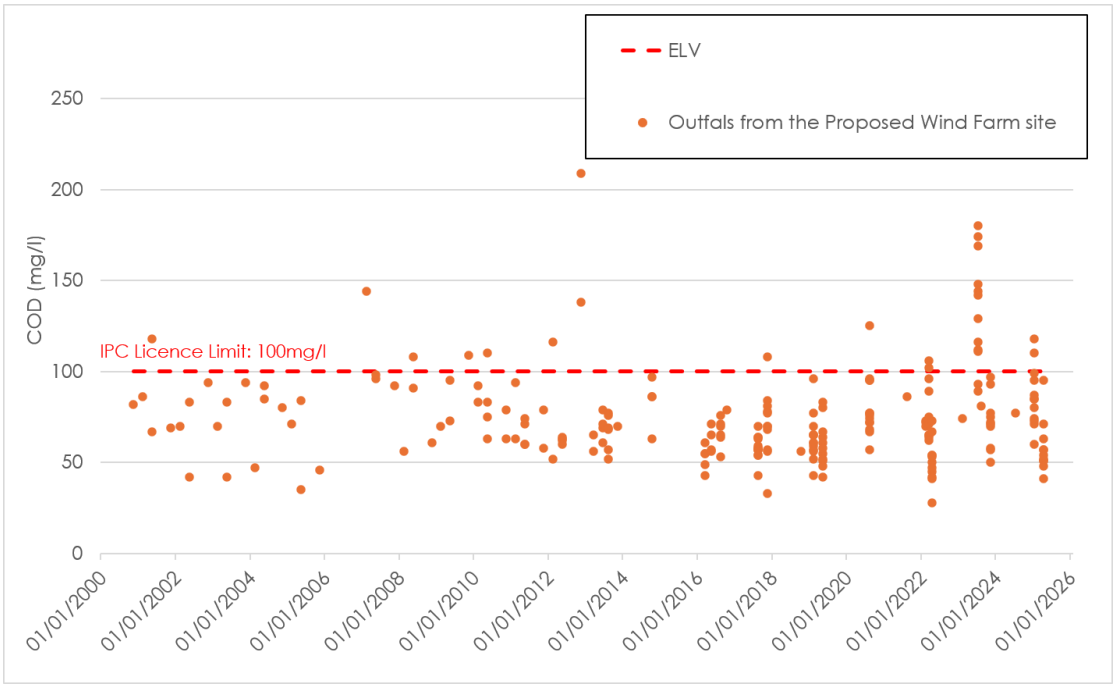


Figure 9-11: BnM COD Monitoring (2000-2026)

Table 9-19: BnM water quality monitoring data (2000-2025)

Proposed Wind Farm site	COD (mg/L)	pH [H^+]	Ammonia (mg/L)	Total Phosphorous (mg/L)	Suspended Solids (mg/L)
	Range	Range	Range	Range	Range
Range	22 - 228	6.2 – 8.8	0.017 – 3.7	0.05 – 0.19	2 – 92
IPC Licence Limit	**100mg/L**	**6 – 9**	**3mg/L**	-	**35mg/L**
n - (number of sample results)	226	226	226	226	226
No. Exceedances	9	0	3	N/A	5
% Compliant	96.02%	100%	98.67%	N/A	97.35%

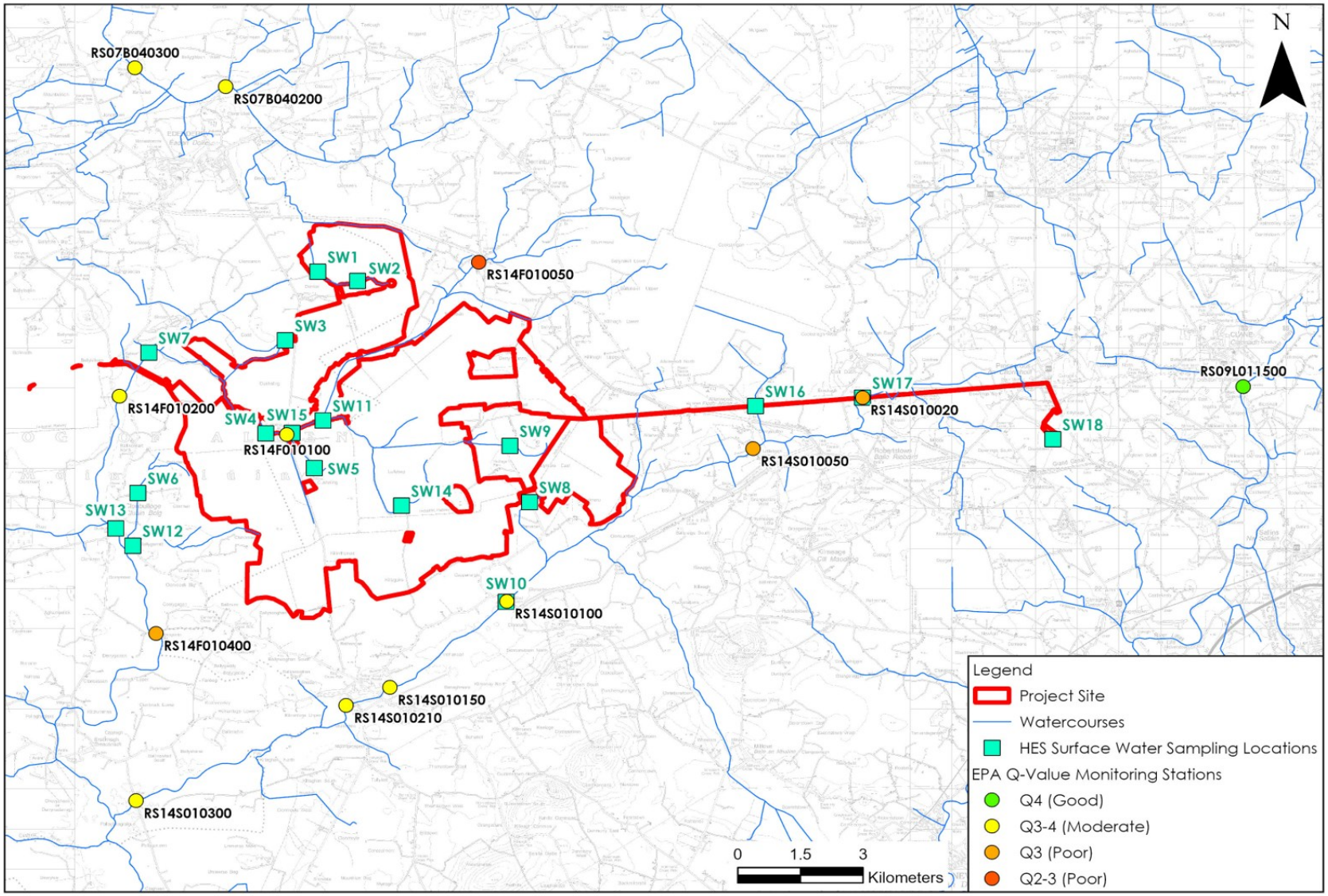


Figure 9-12: EPA Monitoring Locations and HES Surface Water Sampling Locations

9.3.9 Hydrogeology

Due regard is given to the hydrogeology of the Water Study Area, with particular focus on the baseline hydrogeological environment in the vicinity of the Proposed Project. Where relevant, the wider hydrogeological context of the Water Study Area is considered and described in detail.

9.3.9.1 Proposed Wind Farm site

As stated in Section 8.3.4 of Chapter 8 – Land, Soils and Geology, the Proposed Wind Farm site is underlain by several mapped bedrock geological formations including the Lucan Formation, Ballyadams Formation, Allenwood Formation, Waulsortian Limestones and Boston Hill Formation. The Lucan Formation is classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (LI). The Ballyadams Formation is classified as Regionally Important Aquifer - Karstified (diffuse) (Rkd) and the Waulsortian Limestones and the Boston Hill Formation are classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (LI). A bedrock aquifer map is included as Figure 9-13.

In terms of GWBs, the Proposed Wind Farm site is mapped to be underlain by a total of 4 no. GWBs. The western section of the Proposed Wind Farm site is mapped within the Cushina GWB (IE_SE_G_048), the centre is mapped within the Bagenalstown Upper GWB (IE_SE_G_153), the east is mapped within the Kildare GWB (IE_SE_G_077) and the north is mapped within the Trim GWB (IE_EA_G_002).

The GSI's GWB Characterisation Reports were consulted to provide additional information for each of the underlying GWBs. These reports are available as https://www.gsi.ie/programmes-projects/groundwater/groundwater-activities/understanding-irelands-groundwater/groundwater-bodies/.

The GSI's Cushina GWB Characterisation Report (GSI, 2003) states that this GWB is located in eastern Co. Offaly but also extends into counties Laois and Kildare. The topography in the area is extremely low lying to the north with some small hills in the south. In general, the land surface slopes to the centre and south of the body towards the River Figile. The boundaries of this GWB are defined by the extent of the Calp and Ballyadams Formations in this area. The boundary to the north is the topographic boundary between the South-Eastern and Eastern River Basin Districts. The GWB is composed primarily of low permeability rocks, although localized zones of enhanced permeability do occur. It appears likely from investigation that the pure bedded limestones can be encountered beneath the Calp. Recharge occurs diffusely through the subsoils and via outcrops. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Most flow in this aquifer will occur near the surface. In general, the effective thickness of this aquifer is likely to be about 10m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes in more isolated faults/ fractures can be encountered at 50-70mbgl. Regional groundwater flow is from north to south, but on a local scale, groundwater discharges to the streams and rivers crossing the aquifer. Flow path lengths are variable and will depend on the degree of karstification of the limestone and hence its purity. Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps.

The GSI's Bagenalstown GWB Characterisation Report (GSI, 2003) states that the Barrow Valley has been divided into three areas (Daly & Wright 1979): (i) A recharge area along the slopes of the Castlecomer Plateau where the water table is 15 – 30mbgl. and there is an annual water level fluctuation of 10-20m. (ii) An intermediate area where the aquifer is covered by extensive till deposits of 10-20m thickness, the water table is usually within 5-15m of the surface with an annual fluctuation of less than 7.5m. Both confined and unconfined conditions exist here, depending on the subsoil. (iii) A discharge zone occurs where the aquifer comes in contact with the Barrow River either directly or through the overlying sands and gravels. Here the water table is within 5m of the surface and fluctuations will be less than 2.5m and mostly controlled by the levels in the river.

The GSI's Kildare GWB Characterisation Report (GSI, 2003) states that this aquifer is located northwest of Kildare town. The area is defined by the South-Eastern River Basin District – Eastern River Basin District boundary to the northeast and elsewhere by the extent of the Waulsortian and Boston Hill formations. Recharge to the GWB will be highest in exposed areas and there may also be some flow of groundwater into the aquifer from adjacent groundwater bodies. Groundwater flow will be through a poorly developed karstic system over most of the area (i.e. the karst network is poorly connected and there are no well-developed karst conduits). The extent of the karstic development will depend partly on the nature and thickness of the overlying strata. There are numerous hydrogeological settings in the area due to the variation in subsoil (bog, till, outcrop and major gravel aquifers), the degree of structural deformation (from intense faulting in the area of Allenwood to little or none in the south) and the variety of rock type and hence aquifer types. Such variations make broad statements fallible and individual site investigation will be essential to understanding any given location of interest.

The GSI's Trim GWB Characterisation Report (GSI, 2003) states that this GWB extends from northeast Offaly through Meath and narrows towards Navan and Slane. The area is generally low-lying with some hillier areas to the southeast. The aquifers are classified as Locally important aquifer which is generally moderately productive (Lm) and there are small areas of Regionally important karstified aquifer dominated by diffuse flow (Rkd), Locally important aquifer which is moderately productive only in local zones (LI) and Poor aquifer which is generally unproductive except for local zones (PI) aquifers. The Lm aquifer comprises the Edenderry Oolite and the Lucan Formation. The boundaries of the GWB are defined by the extent of the Calp, which is classified as Lm, which is in turn determined by the location of a region of higher structural deformation (Dumphy 1993). The variety in the structural deformation of the rock increases the complexity of the conceptual model for the area. Firstly, the area northeast of Navan including the highly fractured Lucan formation will have a different groundwater flow system than the low-lying aquifer, which comprises the remainder of the GWB. This difference in geological structure can be seen in all aspects of the conceptual model i.e. recharge, groundwater flow and discharge. The intense structural deformation in the northeast of the GWB has given rise to the development of karstic groundwater flow systems. Although karst features can be expected throughout the GWB, it is in the northeast with the more fractured bedrock where karstification will be greatest. Both point and diffuse recharge occur over the area of this GWB. Point recharge is known to occur at the contact between the non-calcareous rocks and the limestones. This form of recharge is most likely to occur over the cleaner and more fractured limestones. Diffuse recharge is a more widespread process occurring over the entire area of the GWB. This will be the main recharge process in the large lowland areas of this GWB. Groundwater flow will be from local areas of high recharge e.g. areas of thin subsoils in the uplands, to the main surface water bodies overlying the aquifer, such as the Boyne. Where overlying quaternary deposits consist of thick limestone tills, they can act as a confining layer, thus producing artesian supplies. This occurs, for example at Kilmoon, Dunshaughlin and Longwood public water supplies in County Meath. Discharge from the aquifer is also varied. Water will leave the aquifer in a diffuse nature as baseflow along riverbeds and also as point source at springs. The development of a karstic groundwater system has a key influence on the transportation of pollutants to receptors. Groundwater flow will be faster and more concentrated along karstic conduits.

Table 9-20 below presents the location of the Proposed Project infrastructure with respect to the underlying GWBs.

The Proposed Turbine Delivery Route accommodation works are underlain by Locally Important Bedrock Aquifers, and the Geashill and Rhode GWBs. Given the minor and localised nature of the Proposed Turbine Delivery Route accommodation works, and the limited depth and extent of excavation anticipated, the works are not expected to result in significant interaction with the underlying groundwater regime. Accordingly, detailed site-specific assessment of the underlying aquifer and groundwater body at each accommodation works location is not considered necessary.

9.3.9.2 Proposed Grid Connection

As stated in Section 8.3.4 of Chapter 8 – Land, Soils and Geology, the Proposed Grid Connection is underlain by Waulsortian Limestones, Boston Hill Formation, Allenwood Formation and Feighcullen

Formation. The Boston Hill Formation and the Feighcullen Formation are classified as Locally Important Aquifers - Bedrock which is Moderately Productive only in Local Zones (Ll). The Waulsortian Limestones in this area are classified as a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones. The Allenwood Formation is classified as a Locally Important Aquifer – Karstified and is mapped to underlie approximately 2.27km of the Proposed Grid Connection underground electrical cabling route near Allenwood. Approximately 2.37km of the Proposed Grid Connection underground electrical cabling route is also mapped to be underlain by a Locally Important Robertstown Gravel Aquifer (Lg) to the east of Allenwood.

Within the Water Study Area the majority of the Proposed Grid Connection is mapped within the Kildare GWB (IE_SE_G_077) with some areas in the east mapped within the Dublin GWB (IE_EA_G_008).

Details from the GSI's Initial Characterisation Report for the Kildare GWB are provided above.

The GSI's Dublin GWB Characterisation Report (GSI, 2003) states that this GWB occupies a large area extending across the County Dublin from Malahide to Blackrock west across the whole county and extending into Kildare and Meath as far as Kilcock. The area is mostly low-lying with very little surface topography. The GWB is composed of moderate permeability karstified limestone. Very small areas of low permeability impure limestones are incorporated with this GWB, since they are isolated and do not alter significantly the flow system. The boundaries of this GWB are defined to the south by the contact with the Granites and Lower Paleozoic rocks, to the west and north by the extent of the Liffey catchment to the east by the coast. Groundwater flow occurs along fractures, joints and major faults. There are a number of warm springs located within this GWB, which suggest deep groundwater circulation is possible. Recharge occurs diffusely through the subsoils and via outcrops. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Most flow in this aquifer will occur near the surface. In general, the effective thickness of this aquifer is likely to be about 10 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes are commonly found in more isolated faults/ fractures at depths of 30 – 50 mbgl. Flow path lengths are not considered to be on a regional scale and are typically less than 1km in length. Groundwater discharges to the numerous streams and rivers crossing the aquifer, and to the springs and seeps towards the coast.

Table 9-20: WFD Groundwater Bodies and Proposed Project Infrastructure

GWB	Proposed Project Infrastructure
Cushina	14 no. Proposed Turbines, Access Roads, Peat and Spoil Areas, 4 no. Construction compounds and Proposed Enhancement Areas
Bagenalstown Upper	28 no. Proposed Turbines, Access Roads, Peat and Spoil Areas, 5 no. Construction compounds and Proposed Enhancement Areas
Trim	3 no. Proposed Turbines, Access Roads, Peat and Spoil Areas and Proposed Enhancement Areas
Kildare	1 no. Proposed Turbine, Access Roads, Peat and Spoil Areas, Proposed Onsite Substation, Proposed Grid Connection underground electrical cable route, and Proposed Enhancement Areas
Dublin	Proposed Grid Connection underground electrical cable route, Proposed Offsite Substation, steel masts and associated hardstands for the OHL

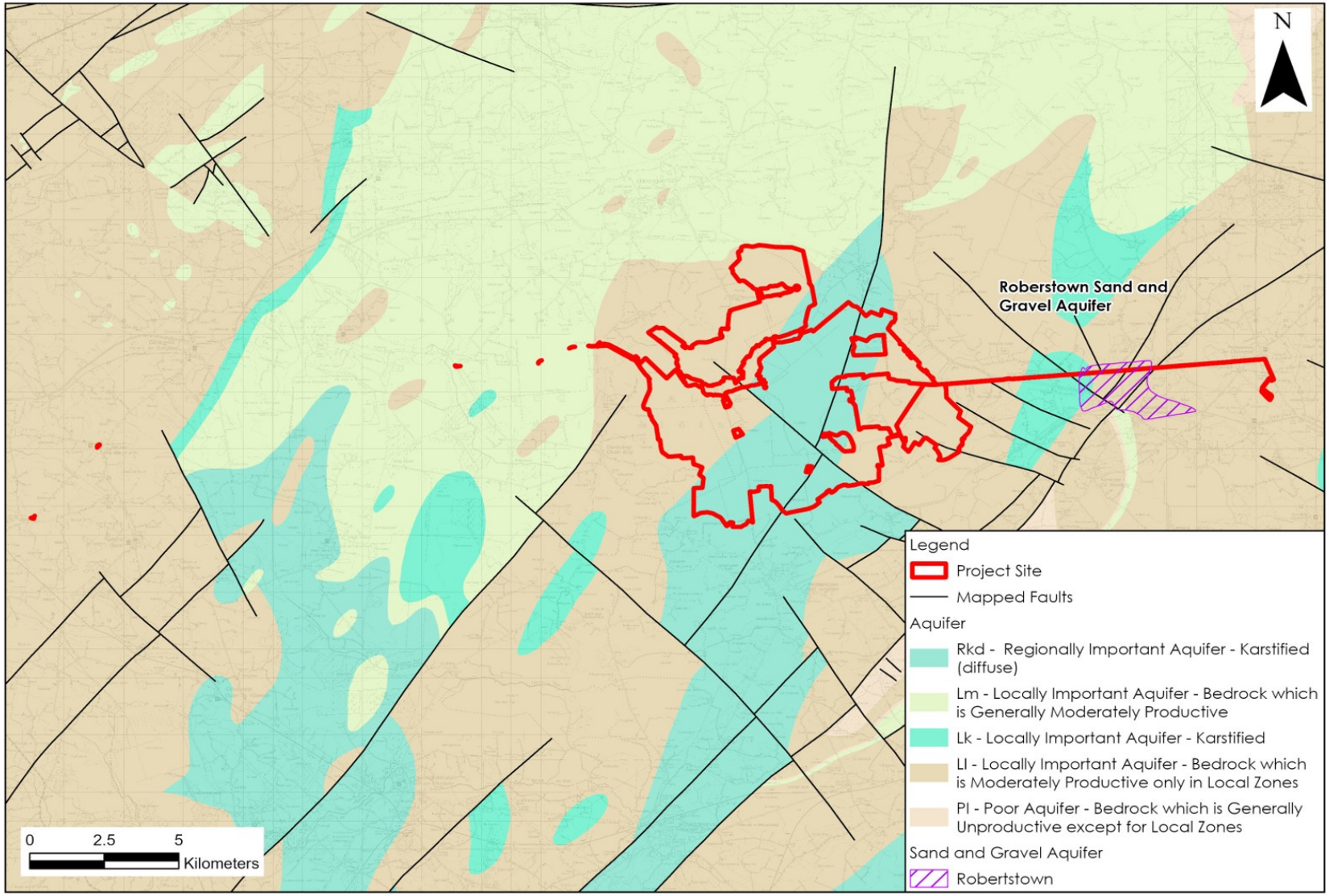


Figure 9-13: Bedrock and Overburden Aquifer Map

9.3.10 Groundwater Vulnerability

9.3.10.1 Proposed Wind Farm site

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 GSI mapped groundwater vulnerability rating of the bedrock aquifers underlying Proposed Wind Farm site ranges from 'Low' to 'High'. The vast majority of the Proposed Wind Farm site is mapped as having 'Low' and 'Moderate' groundwater vulnerability. Meanwhile, a very small, isolated pocket of 'High' groundwater vulnerability is mapped in the centre and northeast of the Proposed Wind Farm site within the Lullybeg, Lullymore, Glashabaun South and Derrybrennan bogs.

The majority of the Proposed Wind Farm infrastructure (wind turbines, construction compounds etc) avoids the areas mapped as having 'High' groundwater vulnerability (refer to Figure 9-14). 28 no. Proposed Turbines, 5 no. temporary construction compounds and 1 no. met mast are mapped in areas of low groundwater vulnerability. 18 no. Proposed Turbines, 3 no. temporary construction compounds and 1 no. met mast are mapped in areas of moderate groundwater vulnerability. The only Proposed Wind Farm infrastructure mapped in areas of high groundwater vulnerability comprises approximately 720m of access road between T40 and T43, approximately 110m access road between T43 and T44 and approximately 170m access road to the south of T45.

Based on site walkover surveys and site investigations (1,026 no. peat probes and 46 no. trial pit excavations at the Proposed Wind Farm site and an additional 7 no. trial pits and 3 no. boreholes in land adjacent to Codd 1 Bog), the Proposed Wind Farm site is overlain by peat deposits with an average thickness of 1.61m. The peat is predominantly underlain by lacustrine clay described as gravelly SILT/CLAY with some cobbles and boulders. Bedrock was not encountered in any of the trial pit excavations completed at the Proposed Wind Farm site which extended to a maximum depth of 4.7m. Given the presence of low permeability peat at the surface of Proposed Wind Farm site which is in turn underlain by low permeability lacustrine clay, the groundwater vulnerability at the Proposed Wind Farm site is considered to be predominantly 'Low'. Some local areas of 'Moderate' or 'High' groundwater vulnerability may occur where the overburden deposits are thin (refer to Table 9-21).

The Proposed Turbine Delivery Route accommodation work areas are mapped in areas of low to high groundwater vulnerability.

Table 9-21: Groundwater Vulnerability Classes (EPA, 2008)

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.

9.3.10.2 Proposed Grid Connection

The vast majority of the Proposed Grid Connection underground electrical cabling route, the Proposed Onsite Substation and the Proposed Offsite Substation are mapped in areas of 'Low' and 'Moderate' groundwater vulnerability. Only approximately 1.76km of the Proposed Grid Connection underground electrical cabling route along the R403 to the east of Allenwood is mapped in an area of 'High' groundwater vulnerability. This area corresponds to the area mapped by the GSI to be underlain by the Locally Important Roberstown Gravel Aquifer (refer to Figure 9-13).

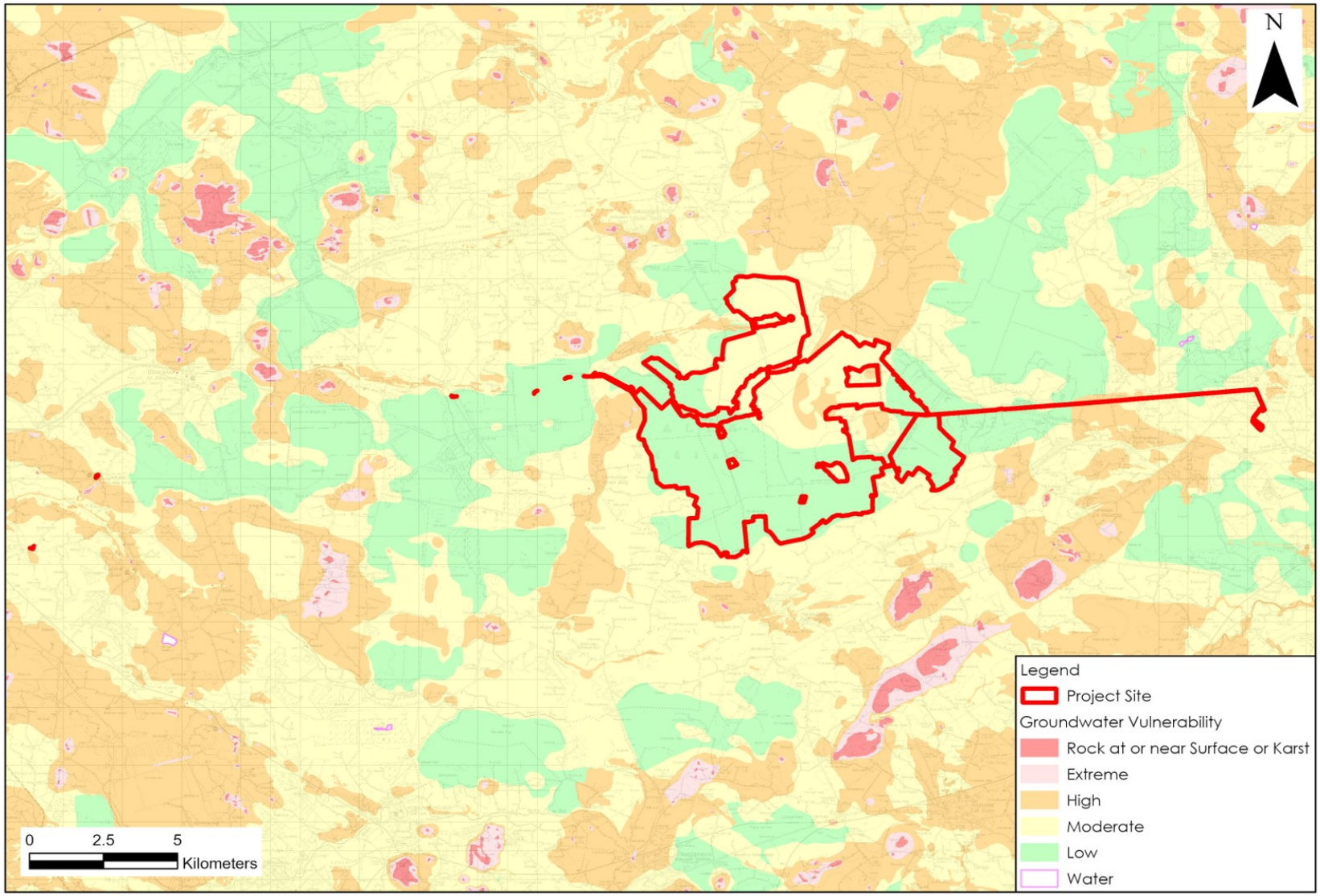


Figure 9-14: GSI Groundwater Vulnerability Map

9.3.11 Karst Features

9.3.11.1 Proposed Wind Farm site

Karst features are mapped by the GSI and available through the GSI online viewer (www.gsi.ie).

Groundwater vulnerability is extremely high in karst areas due to the high degree of interconnection between surface and groundwaters in these areas. A large area of the Proposed Wind Farm site is mapped to be underlain by a Karst Aquifer - including areas of Ballydermot North, Ballydermot South, Blackriver, Barnaran, Lullybeg, Lullymore, Killina, Derrybrennan, Glashabaun North and Glashabaun South bogs. In terms of the Proposed Wind Farm infrastructure a total of 28 no. Proposed Turbines are mapped to be underlain by a Karst Aquifer.

However, the GSI do not map the presence of any karst features within the Proposed Wind Farm site. There are 2 no. mapped karst features to the southwest of the Proposed Wind Farm site in the townlands of Clonbullogue and Clonkeen. The closest mapped karst feature is a spring mapped approximately 2.3km west of the Proposed Wind Farm site (Ballydermot North Bog). Superficial solution features are also mapped approximately 2.8km west of the Proposed Wind Farm site (Ballydermot North Bog). Local GSI mapped karst features are shown in Figure 9-15.

As outlined, no karst features are mapped (by the GSI) within the Proposed Wind Farm site. In addition to GSI mapping, we also present the following site-specific information:

- No evidence of karst features has been identified within the Proposed Wind Farm site. This is supported by the extensive site investigation data collected for the Proposed Wind Farm site and the surrounding area, including:
    - Extensive site walkover surveys and geological mapping;
    - Completion of 1,026 no. peat probes;
    - Excavation of 55 no. trial pits at the Proposed Wind Farm site;
    - Completion of 6 no. rotary core boreholes at the Proposed Wind Farm site; and,
    - Excavation of an additional 7 no. trial pits and 3 no. boreholes to the west of Codd 1 Bog.
- A review of available desk study information has not identified the presence of karst features at the Proposed Wind Farm site:
    - The GSI Karst Features database (www.gsi.ie) does not record the presence of any karst features at the Proposed Wind Farm site;
    - Historic 6" or 25" base mapping does not record any karst-related features at the Proposed Wind Farm site; and,
    - Inspection of recent and historic aerial imagery has not identified any features indicative of karst development at the Proposed Wind Farm site.
- BnM's LiDAR data for the Proposed Wind Farm site has been reviewed, and it does not indicate the presence of depressions, sinkholes or other topographical anomalies that may be associated with karstification;
- Site investigations have demonstrated that the Proposed Wind Farm site is overlain by low permeability peat and lacustrine clay. These soils/subsoils significantly restrict groundwater recharge and protect the underlying bedrock aquifers;
- A total of 3 no. rotary core boreholes have been drilled in areas mapped to be underlain by a Regionally Important Karst Aquifer at T07, T12 and T46. These rotary core boreholes encountered rock at depths of 10.4 to 15.8mbgl and the bedrock was described as strong to extremely strong, thinly bedded, slightly bioclastic fine to coarse grained limestone. There was no evidence of karstification or water bearing conduits during the drilling of these boreholes;

- An expansive surface water drainage system was installed by BnM to facilitate historic peat extraction. On each bog that drainage system is observed to be linear, it is consistent, and it is repeated. There is no evidence that it avoids sinkholes, low points, or dolines, or any such feature as they don't exist; and,
- Therefore, the groundwater table in the peat is perched and isolated from the deeper regional groundwater system in the bedrock, limiting the potential for interaction.

There are no karst features mapped at the Proposed Turbine Delivery Route accommodation works areas.

9.3.11.2 Proposed Grid Connection

According to GSI mapping (www.gsi.ie) approximately 2.27km of the Proposed Grid Connection underground electrical cabling route is mapped to be underlain by a Locally Important Karst Aquifer along the R403 near Allenwood. The Proposed Offsite Substation and the Proposed Onsite Substation are not mapped to be underlain by a karst aquifer and no evidence of karst features were recorded during the walkover surveys or the site investigations completed at these locations. The borehole drilled at the Proposed Onsite Substation encountered overburden to 11.8mbgl, over weathered bedrock to 16.5mbgl over very strong dolomitised LIMESTONE. There was no evidence of karstification.

There are no GSI mapped karst features in the vicinity of the Proposed Grid Connection or in the surrounding lands. The closest GSI mapped karst features are located to the west of the Proposed Wind Farm at Clonbullogue. These are located approximately 12km from the Proposed Grid Connection underground electrical cabling route.

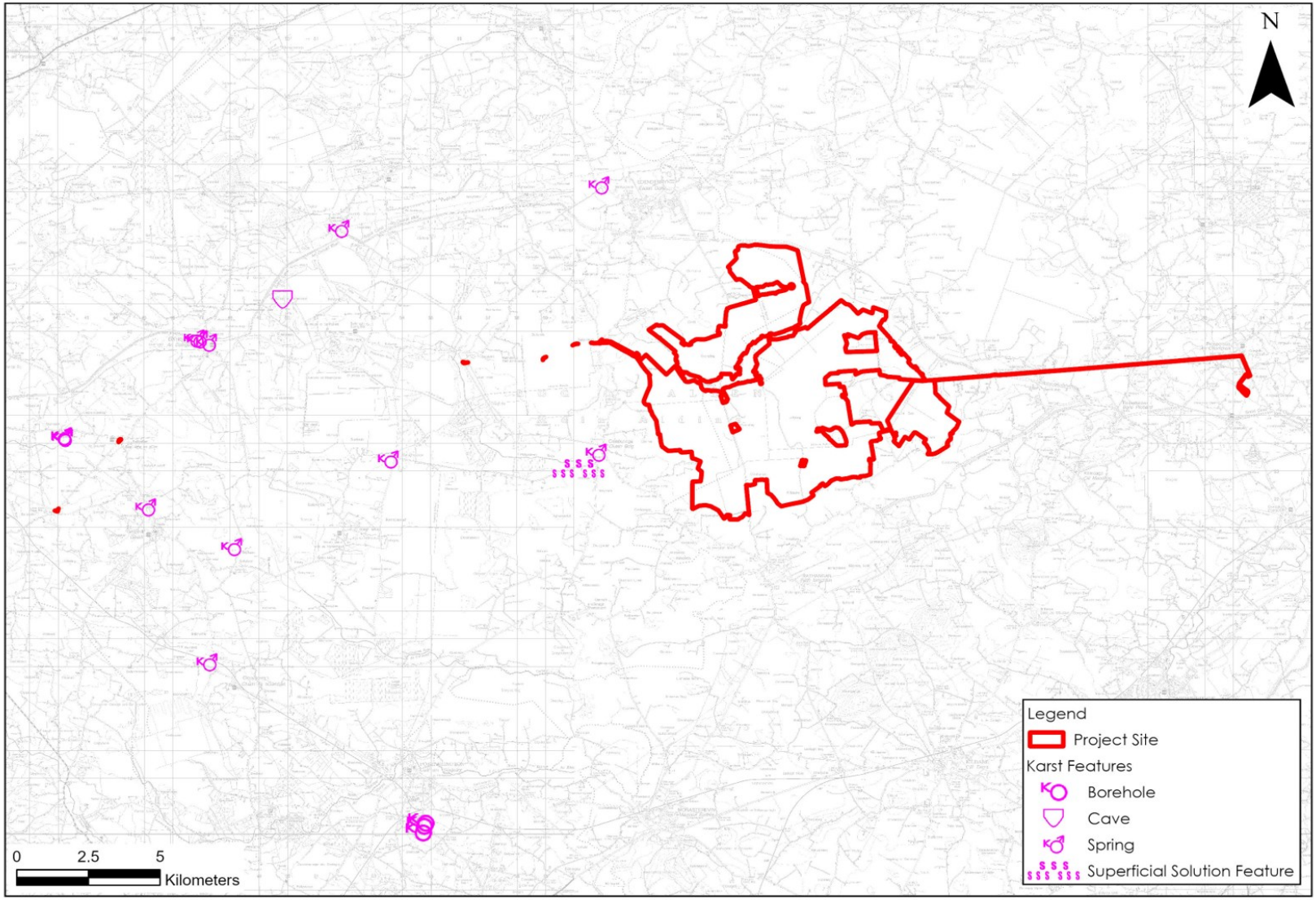


Figure 9-15: Local Karst Features

9.3.12 Groundwater Hydrochemistry

9.3.12.1 Proposed Wind Farm site

There is no groundwater quality data for the aquifers underlying the Proposed Wind Farm site. Groundwater sampling would generally not be undertaken as part of the baseline studies as groundwater quality impacts would not be anticipated. The Proposed Wind Farm infrastructure and associated construction activities will be relatively shallow and are not expected to significantly interact with the underlying groundwater regime. In addition, the presence of low-permeability soils and subsoils is expected to limit groundwater recharge and reduce the potential for contaminants to migrate to underlying aquifers.

The GSI's GWB characterisation reports were consulted to provide information on regional groundwater hydrochemistry.

The GSI's Cushina GWB Characterisation Report (GSI, 2003) states that the groundwater samples from the Lough Public Water Supply (PWS) indicate a hard (350-400mg/L $CaCO_3$) water with a calcium bicarbonate hydrochemical signature. This reflects the fact that the groundwater feeding the boreholes has passed through limestone rock and limestone (Wright 2000).

The GSI's Bagenalstown GWB Characterisation Report (GSI, 2003) states that the bedrock strata of this aquifer are calcareous.

The GSI's Kildare GWB Characterisation Report (GSI, 2003) states that there are both siliceous and calcareous bedrock strata in this GWB. The few details available show elevated electrical conductivity levels.

The GSI's Trim GWB Characterisation Report (GSI, 2003) states that the Durov Plot for this GWB shows that monitored sources consistently show a calcium bicarbonate hydrochemical signature. Values for electrical conductivity throughout the GWB range from 500 to 800µS/cm, with moderately hard to very hard waters with alkalinities between 150 to 350mg/L. Spring waters may be softer, as throughput can be quicker with less time for the dissolution of minerals into the groundwater. Like hardness, groundwater alkalinity is variable, but is often high. Typical groundwater electrical conductivities are high, but may be lower if there is rapid infiltration of surface water and then quick throughput to a spring.

9.3.12.2 Proposed Grid Connection

As stated above in Section 9.3.9.2, the Proposed Grid Connection is underlain by the Kildare and Dublin GWBs.

Details regarding the hydrochemistry of the Kildare GWB are provided above in Section 9.3.12.1.

The GSI's Dublin GWB Characterisation Report (GSI, 2003) states that the hydrochemical analyses of groundwater from the area indicates a very hard water (350-480mg/L ($CaCO_3$)), with a high alkalinity (300 - 350mg/L ($CaCO_3$)). Conductivities are also very high, ranging 550-900 µS/cm. This groundwater is a calcium bicarbonate water.

9.3.13 Water Framework Directive Water Body Status & Objectives

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU, 2014/101/EU and 2026/805/EU ("WFD"), was established to ensure the protection of the water

environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003).

The Water Action Plan 2024[3] was published in September 2023 and is Ireland's 3rd River Basin Management Plan. Its objectives include the following:

- Ensure full compliance with relevant EU legislation;
- Build on the achievements of the 2nd Cycle;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at restoring impacted waters and protecting waters from deterioration.

The Water Framework Directive requires the protection of all surface water bodies, irrespective of their current ecological or chemical status. The Proposed Project must not cause deterioration in the status of any waterbody and must not compromise the achievement its WFD objectives. Accordingly, waterbodies with less than Good status are afforded the same level of protection as those currently achieving Good or High status.

9.3.13.1 Groundwater Body Status

Local GWB status and risk results are available from (www.catchments.ie) and are summarised in Table 9-22 below. This status is defined based on the quantitative status and chemical status of each GWB.

Within the Water Study Area all GWBs underlying the Project Site achieved 'Good' status in latest three WFD cycles (2013-2018, 2016-2021 and 2019-2024). The Cushina, Bagenalstown and Kildare GWBs have been deemed to be "not at risk" of failing to meet their respective WFD objectives. The Trim GWB is "at risk" whilst the risk status of the Dublin GWB is currently under review. No significant pressures have been identified to be impacting upon the Cushina, Bagenalstown, Kildare or Dublin GWBs. The Trim GWB is listed to be under significant pressure from agriculture, anthropogenic and domestic wastewater.

[3] https://www.gov.ie/en/department-of-housing-local-government-and-heritage/policy-information/river-basin-management-plan-2022-2027/

Table 9-22: Summary WFD Information for Groundwater Bodies within the Water Study Area

Groundwater body	Status 2013-2018	Status 2016-2021	Status 2019-2024	WFD 3rd Cycle Risk Status	WFD Pressures
Cushina	Good	Good	Good	Not at risk	None
Bagenalstown Upper	Good	Good	Good	Not at risk	None
Kildare	Good	Good	Good	Not at risk	None
Trim	Good	Good	Good	At risk	Agriculture, Anthropogenic and Domestic Waste water
Dublin	Good	Good	Good	Under review	None

9.3.13.2 Surface Water Body Status

A summary of the WFD status and risk result of Surface Water Bodies (SWBs) within the Water Study Area and downstream of the Project Site are shown in Table 9-23. Local SWB status and risk results and associated pressures are available from www.catchments.ie.

A full WFD Compliance Assessment Report is attached as Appendix 9-4.

Proposed Wind Farm site

Within the Figile_SC_010 river sub-catchment, the status of the Abbeylough_010 SWB improved from "Poor" (2013-2018) to "Moderate" status (2016-2021 and 2019-2024). The status of the Figile_010 SWB was "Poor" in all WFD cycles. The Figile_020 and Figile_030 SWBs have remained at "Moderate" status across all WFD cycles. These SWBs are 'at risk' of failing to achieve their respective WFD objectives. Peat drainage and extraction is identified as significant pressure on the Abbeylough_010, Figile_020 and Figile_030 SWBs. Hydromorphology, industry, urban wastewater and peat drainage and extraction are identified as the significant pressures on the Figile_010 SWB.

Within the Figile_SC_020 river sub-catchment, the status of Figile_040 SWB has declined from "Moderate" (2013-2018 and 2016-2021) to "Poor" (2019-2024). The Figile_050 SWB declined from "Good" (2013-2018) to "Poor" (2016-2021 and 2019-2024) status whilst the status of the Figile_060 SWB was "Good" in all WFD cycles. The Figile_040 and the Figile_050 SWBs are 'at risk' of failing to meet their respective WFD objectives while the Figile_060 SWB is 'not at risk'. Peat drainage and extraction is identified significant pressure on Figile_040 SWB. Agriculture and peat drainage and extraction are identified as the significant pressures on the Figile_050 SWB (www.catchments.ie).

Within the Slate_SC_010 river sub-catchment, the Slate_050 to 070 SWBs achieved "Moderate" status in the 3 no. latest WFD cycles and are 'at risk' of failing to achieve their respective WFD objectives. Hydromorphology and peat drainage and extraction are identified as the significant pressures on the Slate_050 SWB, urban run-off is the identified significant pressure on the Slate_060 SWB and agriculture, hydromorphology, urban wastewater and peat drainage and extraction are the identified significant pressures on the Slate_070 SWB.

Within the Boyne_SC_010 river sub-catchment, the status of the Boyne_010 SWB declined from "Moderate" to "Poor" status in the latest cycle. The status of the Boyne_020 SWB declined from "Moderate" (2013-2018) to "Poor" (2016-2021) before it improved to "Moderate" in the latest cycle (2019-2024). The status of the Boyne_030 SWB improved from "Moderate" (2013-2018) to "Good" (2016-2021 and 2019-2024). The Boyne_010 and Boyne_020 SWBs are 'at risk' of failing to achieve their WFD objectives while the Boyne_030 SWB is 'not at risk'. Domestic wastewater, hydromorphology and peat drainage and extraction are identified significant pressures on the Boyne_010 SWB. Agriculture, hydromorphology and urban run-off are identified significant pressures on the Boyne_020 SWB.

In terms of Heavily Modified Waterbodies (HMWBs) in the vicinity of the Proposed Wind Farm site, the Grand Canal Main Line (Boyne), Grand Canal Main Line East (Barrow) and the Grand Canal Barrow Line all achieved Good Ecological Potential in the three recent WFD cycles. The Grand Canal Main Line (Boyne) and the Grand Canal Main Line East (Barrow) are 'not at risk' whilst the risk status of the Grand Canal Barrow Line is 'under review'.

Proposed Grid Connection

Along the Proposed Grid Connection underground electrical cabling route, the Slate River is generally of "Poor" Status (Slate_010, Slate_020, Slate_030 and Slate_040 SWBs). The Slate_050 SWB in the vicinity of Lodge Bog achieved "Moderate" status in the latest WFD cycle. These SWBs are all deemed to be 'at risk' of failing to meet their respective WFD objectives. The significant pressures are listed in Table 9-23.

The Proposed Offsite Substation is mapped in the Awillyinish Stream_010 WFD river sub-basin. This SWB is of "Moderate" status whilst the Liffey_100 SWB further downstream achieved "Good" status. No significant pressures are listed to be impacting these SWBs.

The Proposed Onsite Substation is mapped in the Figile_020 WFD River sub-basin. This SWB achieved "Moderate" status in the latest WFD cycle.[4]

Table 9-23: Summary WFD Information for Surface Water Bodies downstream of the Project Site

River Waterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	Status 2019-2024	3rd Cycle Risk Status	WFD Pressures
Figile_SC_010 river sub-catchment						
Abbeylough_010	Unassigned	Poor	Moderate	Moderate	At Risk	Peat Drainage and Extraction
Figile_010 (Upstream of Proposed Wind Farm)	Poor	Poor	Poor	Poor	At Risk	Hydromorphology, Industry, Urban Wastewater and Peat Drainage and Extraction
Figile_020	Moderate	Moderate	Moderate	Moderate	At Risk	Peat Drainage and Extraction
Figile_030	Moderate	Moderate	Moderate	Moderate	At Risk	Peat Drainage and Extraction
Figile_SC_020 river sub-catchment						

[4] www.catchments.ie

Figile_040	Moderate	Moderate	Moderate	Poor	At Risk	Peat Drainage and Extraction
Figile_050	Good	Good	Poor	Poor	At Risk	Agriculture and Peat Drainage and Extraction
Figile_060	Good	Good	Good	Good	Not at Risk	None
Slate_SC_010 river sub-catchment						
Slate_010	Unassigned	Moderate	Poor	Poor	At risk	Hydromorphology, anthropogenic and urban runoff
Slate_020	Poor	Poor	Poor	Poor	At risk	Agriculture and urban wastewater
Slate_030	Unassigned	Poor	Poor	Poor	At risk	Agriculture and forestry
Slate_040	Poor	Poor	Poor	Poor	At risk	Hydromorphology and Peat Drainage and Extraction
Slate_050	Moderate	Moderate	Moderate	Moderate	At Risk	Hydromorphology and Peat Drainage and Extraction
Slate_060	Moderate	Moderate	Moderate	Moderate	At Risk	Urban run-off
Slate_070	Good	Moderate	Moderate	Moderate	At Risk	Agriculture, Hydromorphology, Urban Wastewater and Peat Drainage and Extraction
Boyne_SC_010 river sub-catchment						
Boyne_010	Moderate	Moderate	Moderate	Poor	At Risk	Domestic Wastewater, Hydromorphology and Peat Drainage and Extraction
Boyne_020	Moderate	Moderate	Poor	Moderate	At Risk	Agriculture, Hydromorphology and Urban Run-off
Boyne_030	Good	Moderate	Good	Good	Not at Risk	None
Liffey_SC_050 river sub-catchment						
Awillyinish Stream_010	Unassigned	Unassigned	Moderate	Moderate	Under review	None

Liffey_100	Moderate	Moderate	Good	Good	Not at risk	None
Heavily Modified Waterbodies						
Grand Canal Main Line (Boyne)	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Not at risk	None
Grand Canal Main Line East (Barrow)	Unassigned	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Not at risk	None
Grand Canal Barrow Line	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Under review	None

9.3.14 Designated Sites and Habitats

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

9.3.14.1 Proposed Wind Farm site

Within the Water Study Area the closest designated site to the Proposed Wind Farm site is the Long Derries, Edenderry SAC and pNHA (Site Code: 000925). The Long Derries, Edenderry SAC/pNHA is located in the lands between Glashabaun North and Ticknevin bogs. This SAC/pNHA is located outside of the Proposed Wind Farm site and no infrastructure associated with the Proposed Wind Farm is located within the SAC. T29 and T31 are the closest Proposed Turbines to the SAC/pNHA, located approximately 230m and approximately 424m from the SAC/pNHA boundary respectively. Ticknevin Bog outfalls to the EPA named Codd Stream which flows through this SAC/pNHA, therefore providing a direct hydrological connection between the Proposed Wind Farm site and the SAC/pNHA.

The Grand Canal pNHA (Site Code: 002104) is mapped adjacent to the north of Ticknevin Bog. The Proposed Wind Farm site does not encroach upon the mapped extent of this pNHA. The Canal is located above and is hydraulically isolated from the EPA mapped Clonkeen Stream which flows to the north of Ticknevin Bog.

The River Barrow and River Nore SAC (Site Code: 002162) is located approximately 9.8km southwest of the Proposed Wind Farm site. This SAC is located downstream and downgradient of the Proposed Wind Farm (on the lower reaches of the Figile River upstream of the River Barrow). The length of the hydrological flowpath between the Proposed Wind Farm site and the SAC is approximately 20km.

The River Boyne and River Blackwater SAC (Site Code: 002299) and SPA (Site Code: 004232) is located approximately 9.8km to the north of the Proposed Wind Farm. This SAC/SPA is downstream of the Proposed Wind Farm along the River Boyne. The length of the hydrological flowpath between the boundary of the Proposed Wind Farm site and the SAC/SPA is approximately 22km. However, it is noted that there is no surface water outfall from Ticknevin Bog within this catchment. All water from Ticknevin Bog is directed to the south and discharges via several settlement ponds to the Codd Stream, a tributary of the Figile River.

Other designated sites within 10km of the Proposed Wind Farm site are as follows:

- Carbury Bog NHA (Site Code: 001388), approximately 4.2km to the north of Ticknevin Bog. This NHA is located upstream and upgradient of the Proposed Wind Farm;
- Ballina Bog pNHA (Site Code: 000390), approximately 9.9km north of Ticknevin Bog. There is no hydrological connection between the Proposed Wind Farm and this pNHA;
- Black Castle Bog NHA (Site Code: 000570), approximately 6.2km northwest of Ticknevin Bog. There is no hydrological connection between the Proposed Wind Farm and this NHA;
- Hodgestown Bog NHA (Site Code: 001393), approximately 7.8km east of Derrybrennan Bog. There is no hydrological connection between the Proposed Wind Farm and this NHA;
- Ballynafagh Lake SAC and pNHA (Site Code: 001387), approximately 9.4km east of the Killina Bog. This SAC and pNHA is located upstream and upgradient of the Proposed Wind Farm;
- Ballynafagh Bog SAC and pNHA (Site Code: 000391), approximately 8.1km east of the Lodge Bog. This SAC and pNHA is located upstream and upgradient of the Proposed Wind Farm;
- Mouds Bog SAC and pNHA (Site Code: 002331), approximately 5.9km southeast of the Lodge Bog. There is no hydrological connection between the Proposed Wind Farm and this SAC and pNHA;
- Pollardstown Fen SAC and pNHA (Site Code: 000396), approximately 7.6km south of the Lodge Bog. This SAC and pNHA is located upstream and upgradient of the Proposed Wind Farm; and,
- Curragh (Kildare) pNHA (Site Code: 000392), approximately 8.5km southeast of the Lodge Bog. There is no hydrological connection between the Proposed Wind Farm and this SAC and pNHA.

Overall, the majority of the designated sites are not hydrologically connected to the Proposed Wind Farm site. The principle local hydrological pathway identified relates to drainage from Ticknevin Bog to the Codd Stream which flows through the Long Derries, Edenderry SAC/pNHA. At a regional scale, the Proposed Project is also hydrologically connected to the River Barrow and River Nore SAC.

There are no designated sites mapped in the vicinity of the Proposed Turbine Delivery Route accommodation works.

A map of local designated sites is shown as Figure 9-16.

9.3.14.2 Proposed Grid Connection

The Proposed Grid Connection underground electrical cabling route is mapped to cross the Grand Canal pNHA to the west of Allenwood along the R414. The proposed crossing is located approximately 200m west of the existing crossing at Shee Bridge.

Further to the east a small section of the Proposed Grid Connection underground electrical cabling route is mapped to cross the Ballynafagh Lake SAC (Site Code: 001387). An existing road bridge crossing, along the R403, over the Blackwood Feeder canal, which connects Ballynafagh Lake to the Grand Canal, already exists at this location. The works will be located entirely within the road corridor.

The Proposed Grid Connection underground electrical cabling route is mapped approximately 146m to the south of Ballynafagh Bog SAC/pNHA (Site Code: 000391). The Proposed Grid Connection is also hydrologically connected to the SAC/pNHA via the Temp Stream, which discharges into the Slate River which flows along the southern boundary of the SAC/pNHA.

Hodgestown Bog NHA (Site Code: 001393) exists approximately 2km to the north of the Proposed Grid Connection underground electrical cabling route. There are no hydrological connections between the Proposed Grid Connection and this NHA.

There are no other designated sites within 5km of the Proposed Grid Connection.

Hydrological connectivity to designated sites is summarised in Table 9-24.

Table 9-24: Summary of Distances and Connectivity to Designated Sites

Designated Site	Minimum Distance to Site from Project Site	Hydrological connectivity to Designated/European Sites	Groundwater connectivity to Designated / European Sites
Long Derries, Edenderry SAC/pNHA	Adjacent to the Project Site between Ticknevin and Glashabaun North bogs	Yes – outfalls from Ticknevin Bog discharge to the Codd Stream which flows through the SAC/pNHA	Limited – SAC/pNHA comprises a gravel ridge and is designated for orchid rich calcareous grasslands. This hydrogeological regime is separate from the peat bog.
Grand Canal pNHA	Adjacent to the Project Site north of Ticknevin Bog Proposed Grid Connection underground electrical cabling route crosses the pNHA to the west of Shee Bridge	No connection to the Proposed Wind Farm Hydrological connection to the Proposed Grid Connection underground electrical cabling route	Yes - due to the proximity to the Proposed Grid Connection underground electrical cabling route
River Barrow and River Nore SAC	Approximately 9.8km to the southwest of the Proposed Wind Farm site	Yes – The Proposed Wind Farm site outfalls to the Slate and Figile River which are connected to the Barrow River (flowpaths lengths ranges from 20 – 33km)	None – Separation distance and presence of rivers in the intervening lands
River Boyne and River Blackwater SAC/SPA	Approximately 9.8km to the north of the Proposed Wind Farm site	No – there are no outfalls from the Proposed Wind Farm site within the Boyne catchment	None – Separation distance and presence of rivers in the intervening lands
Ballynafagh Lake SAC	Proposed Grid Connection underground electrical cabling route crosses the SAC	No connection to the Proposed Wind Farm Hydrological connection to the Proposed Grid Connection underground	Yes - due to proximity to the Proposed Grid Connection underground electrical cabling route.

Designated Site	Minimum Distance to Site from Project Site	Hydrological connectivity to Designated/European Sites	Groundwater connectivity to Designated / European Sites
		electrical cabling route	
Ballynafagh Bog SAC/pNHA	Approximately146m to the north	Hydrological connection via the Temp Stream and the Slate River	None – Slate River acts as a hydraulic barrier
Hodgestown Bog NHA	Approximately 200m to the north of the Proposed Grid Connection underground electrical cabling route	None – Upgradient of the Project Site	None – Upgradient of the Project Site and presence of rivers in the intervening lands
Carbury Bog NHA	>5km from the Project Site	None	None – Distant from the Project Site and the presence of rivers and streams in the intervening lands which act as hydraulic barriers
Ballina Bog pNHA			
Black Castle Bog NHA			
Hodgestown Bog NHA			
Mouds Bog SAC/pNHA			
Pollardstown Fen SAC/pNHA			
Curragh (Kildare) pNHA			

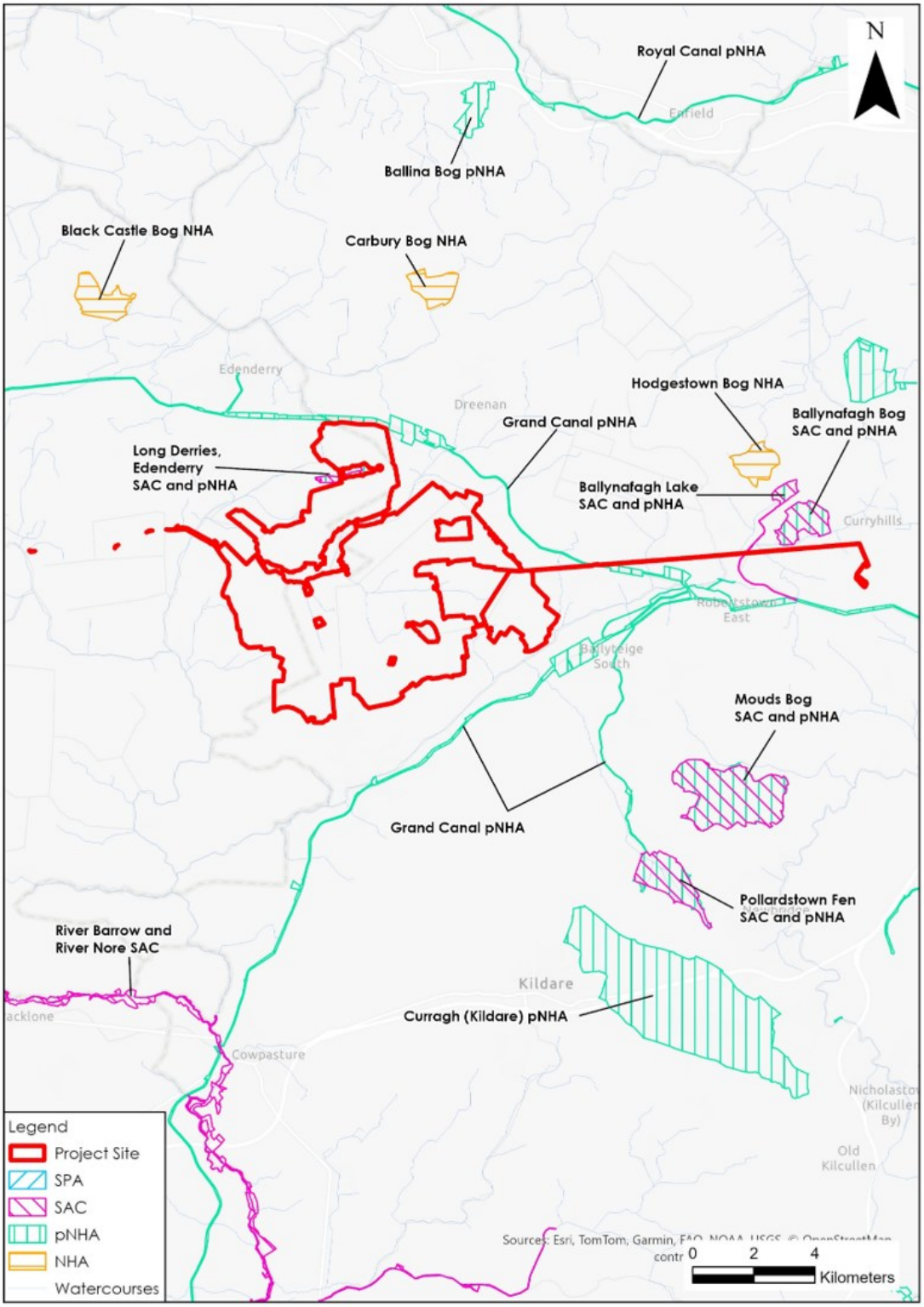


Figure 9-16: Designated Sites Map

9.3.15 Water Resources

9.3.15.1 Groundwater Resources

Proposed Wind Farm site

There are no mapped Public Water Supplies (PWS) or Group Water Schemes (GWS) within the Proposed Wind Farm site. Local groundwater resources are shown on Figure 9-17.

Several GWSs and PWSs are mapped by the GSI in the lands surrounding the Proposed Wind Farm site. The delineated source protection areas for these GWSs and PWSs do not overlap with the Proposed Wind Farm site:

- The source protection area associated with the Ballykilleen GWS is located approximately 2.2km west of Proposed Wind Farm site (Ticknevin Bog);
- The outer source protection area associated with the Clonbullogue PWS is located approximately 0.5km west of Proposed Wind Farm site (Codd 1 Bog). The inner source protection area is mapped approximately 2.1km from the Proposed Wind Farm site close to the centre of Clonbullogue village;
- The outer source protection area associated with the Edenderry PWS is located approximately 2.4km northwest of Proposed Wind Farm site (Ticknevin Bog). The inner source protection area is approximately 2.5km from the Proposed Wind Farm site;
- The source protection area associated with the Bracknagh Rech GWS is mapped approximately 0.6km south of Proposed Wind Farm site (Ballydermot South Bog);
- The inner source protection area associated with the Rathangan PWS is mapped approximately 3.3km to the south of Proposed Wind Farm site (Blackriver Bog). The outer source protection area extends to the south, away from the Proposed Wind Farm site; and,
- The outer source protection area associated with the Robertstown PWS is mapped approximately 5.7km to the east of Proposed Wind Farm site (Lodge Bog).

A search of private well locations (wells with location accuracy of 1–50m were only sought) was undertaken using the GSI well database (www.gsi.ie). There are 33 no. wells mapped within 1km of the Proposed Wind Farm site with a locational accuracy of the less than 50m. Out of these 33 wells, 18 no. wells are used for agriculture and domestic purposes, 8 no. wells are used for Public Supplies and Group Schemes and 7 no. wells are used for unknown purposes. The wells identified as being for public and group schemes correspond with the GSI mapped GWSs and PWSs in the lands surrounding the Proposed Wind Farm site (described above).

To overcome the poor accuracy problem of other GSI mapped wells, a precautionary approach has been adopted for the purposes of the impact assessment. It is assumed, for the purpose of assessment only, that every private dwelling in the area has a well supply. Wells may or may not exist at each property. However, under a theoretical precautionary approach, it is assumed that a well could exist at each downgradient property and to assess the potential impacts of the Proposed Wind Farm on these assumed wells, rather than omit the assessment and later discover that groundwater wells are in fact present.

An information request was submitted to Uisce Éireann (UÉ) for the location of all UÉ groundwater abstraction locations within 5km of the Proposed Wind Farm site was submitted. A total of 13 no. UÉ groundwater abstraction points were identified within 5km of the Proposed Wind Farm site:

- An abstraction point is mapped at the centre of the GSI's Edenderry PWS mapped inner source protection area. According to the UÉ database this abstraction is associated with the Kisawanny scheme but is currently out of service.
- An additional 2 no. UÉ abstraction points are located at the south eastern boundary of the GSI's Edenderry PWS outer source protection area. These boreholes are referred to on the

UÉ database as Edenderry Borehole 1 and 2 and are listed as being in service, supplying the Edenderry PWS.
- An additional 2 no. UÉ abstraction points, listed as being out of service, are mapped to the northwest of the Proposed Wind Farm, in the Edenderry area.
- An abstraction point is mapped within the GSI's Clonbullogue PWS mapped inner source protection area. According to the UÉ database this abstraction, referred to as the Figile River Well, is in service, supplying the Clonbullogue PWS.
- 7 no. UÉ abstraction points are located within the GSI's Rathangan PWS inner source protection area. According to the UÉ database all 7 of these boreholes are in service (Rathangan 1 – 7).

There are no GSI mapped PWS or GWS in the vicinity of the Proposed Turbine Delivery Route accommodation works areas.

Proposed Grid Connection

No GSI mapped source protection area associated with any PWS or GWS overlaps with the Proposed Grid Connection. Local groundwater resources are shown in Figure 9-17.

The closest delineated source protection area is associated with the Robertstown PWS, mapped approximately 0.9km south of the Proposed Grid Connection underground electrical cabling route.

The GSI well database was also consulted to identify well located along the Proposed Grid Connection. The GSI database records several wells along the Proposed Grid Connection underground electrical cabling route. The wells are generally used for domestic or agricultural purposes. The GSI do map a decommissioned public supply well (GSI Well ID: IE_GSI_GW_Well_1190) to the north of the Proposed Grid Connection underground electrical cabling route in the townland of Allenwood Middle. The GSI database states that this well has been decommissioned. A decommissioned public supply well (GSI Well ID: IE_GSI_GW_Well_12034) is also mapped immediately to the south of the Proposed Grid Connection underground electrical cabling route in the townland of Blackwood.

There are no GSI mapped wells in the vicinity of the Proposed Offsite Substation.

9.3.15.2 Surface Water Resources

Proposed Wind Farm site

There are no Drinking Water Protected Areas (DWPAs) identified within or in the immediate vicinity of the Proposed Wind Farm site. The nearest DWPA mapped downstream of the Proposed Wind Farm site is the Barrow_130 DPWA. This DWPA is associated with UÉ's abstraction for the Barrow Water Supply. The maximum daily abstraction volume is 40,850m^3/day. The length of the hydrological flowpath between the Proposed Wind Farm site and this DWPA is approximately 35km.

Proposed Grid Connection

There are no DWPAs in the vicinity of the Proposed Grid Connection within the Barrow Catchment.

Within the Liffey Catchment, the closest downstream DWPA is the Liffey_150 DWPA at Celbridge. This DWPA is located approximately 15km to the northeast of the Proposed Offsite Substation.

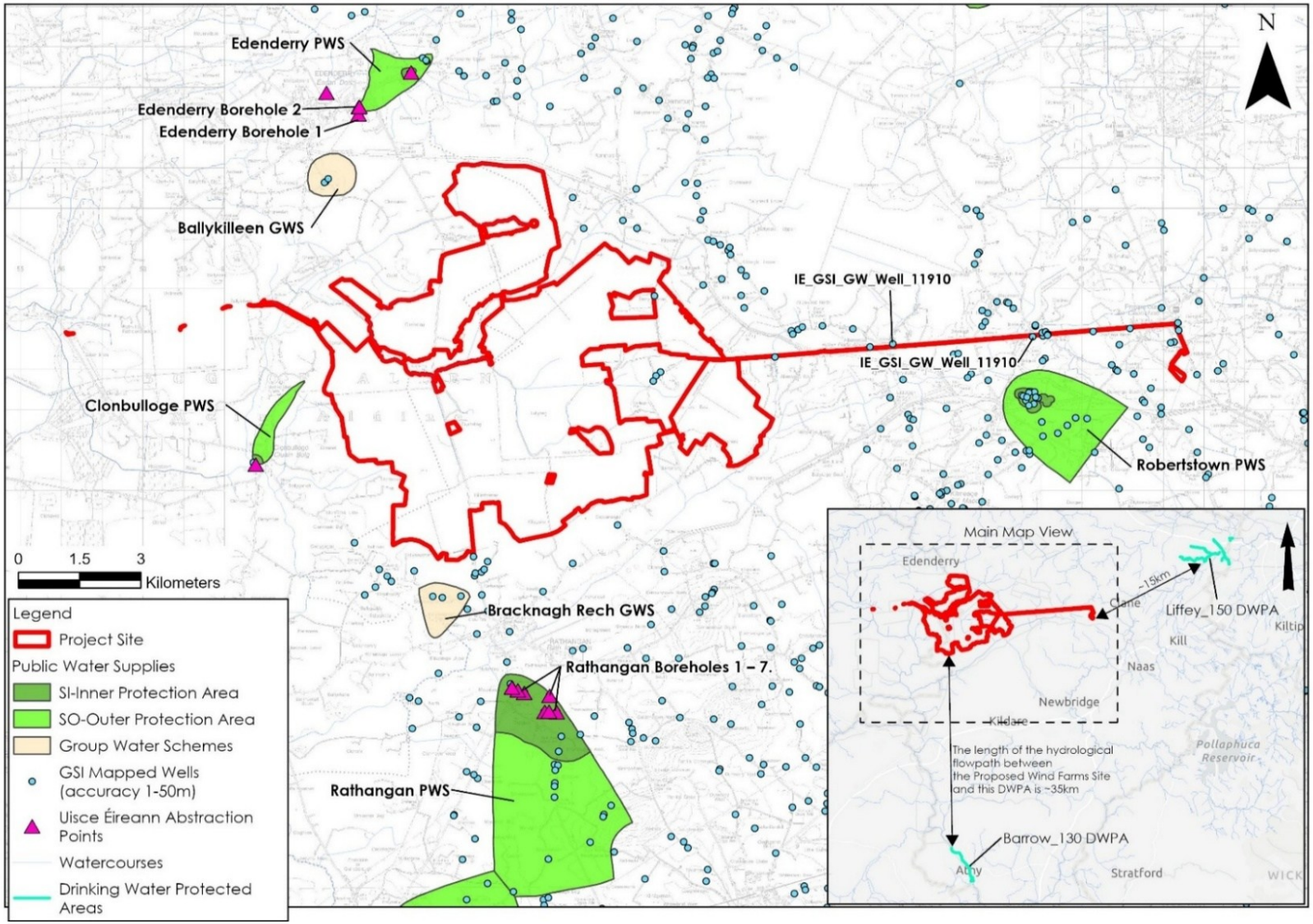


Figure 9-17: Ground Water Resource Map

9.3.16 Wetlands

The Irish Wetlands Map identifies a number of potential wetland areas within and adjacent to the Project Site (refer to Figure 9-18). These sites correspond with the locations raised in the IPCC scoping response (refer to Table 9-1). Many of these sites are also listed in the Kildare County Development Plan (2023-2029). These areas were considered during the ecological baseline surveys and are assessed in detail in Chapter 6 (Biodiversity). The majority of the IPCC mapped wetland sites within the Proposed Wind Farm site comprise modified cutaway peatlands associated with historic peat extraction.

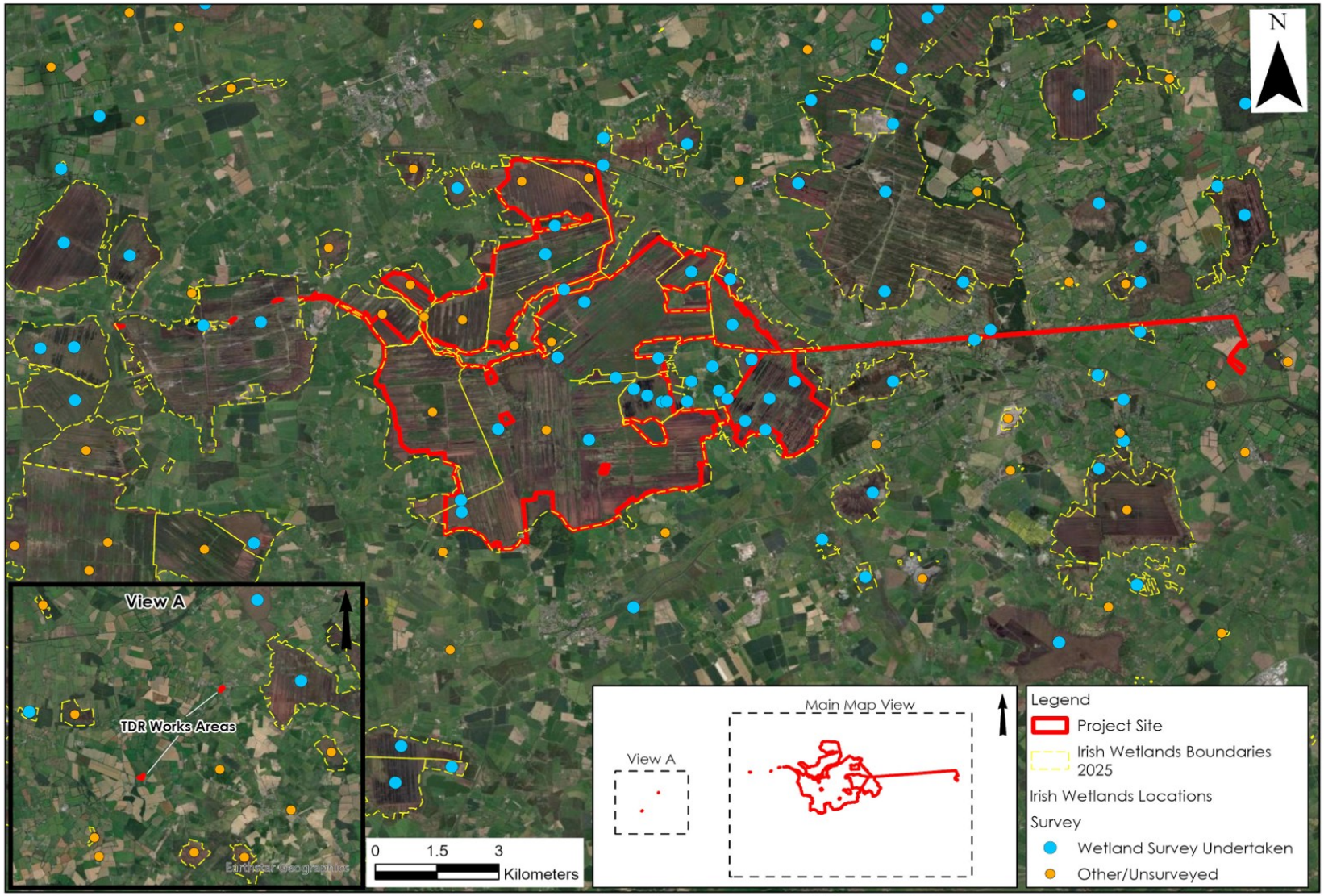


Figure 9-18: Map of Wetlands

9.3.17 Receptor Sensitivity and Importance

Due to the nature of wind farm developments being near surface construction activities (i.e. shallow excavations and foundations), surface water is generally the main sensitive receptor assessed during water impact assessments. Piling works are proposed for foundations at the Proposed Wind Farm, and therefore, in this instance, the underlying groundwater aquifers are also identified as sensitive receptors.

Based on the criteria set out in Table 9-2 above, the Regionally and Locally Important Aquifers underlying the Proposed Wind Farm can be classed as being of Very High and Medium Importance respectively. The primary risks to groundwater during construction works would be from hydrocarbon spillage and leakages from construction plant and from the proposed piling works. The Proposed Wind Farm is covered in cutover peat which in turn is underlain by lacustrine clay and/or silt dominated glacial deposits and these layers act as a protective cover to the underlying bedrock aquifers. The glacial deposits are not mapped as an aquifer in this area, but they are likely to be used locally as a water supply and therefore they can also be classed as sensitive to groundwater pollution. However, due to the presence of the peat and silt/clay layers (which have low permeability and act as a barrier to infiltration), any contaminants which may be accidentally released on-site are more likely to travel to nearby streams within surface runoff.

Furthermore, the Locally Important Aquifers underlying the Proposed Grid Connection can be classified as being of Medium Importance.

For the purposes of a conservative assessment the following groundwater receptors are included in the impact assessment:

- The Locally and Regionally Important Bedrock Aquifers underlying the Project Site;
- The WFD status of the underlying Cushina, Bagenalstown Upper, Kildare, Trim and Dublin GWBs;
- The Ballykilleen and Bracknagh GWSs and the Clonbullogue, Robertstown, Edenderry and Rathangan PWSs; and,
- All private groundwater wells supplies in the lands surrounding the Project Site.

Surface waters are the main sensitive receptors given that the bogs comprising the Proposed Wind Farm site and Proposed Onsite Substation discharges via several surface water outfalls to the Figile and Slate rivers and their associated tributaries. The hydrogeological regime is characterised by high rates of surface water runoff and low rates of groundwater recharge. The primary potential contamination downstream surface waters is via elevated concentrations of suspended solids and nutrient enrichment. These rivers can be considered as being of High to High/Very High Importance based on their Q-rating values (refer to Table 9-1).

The following surface water receptors are included in the impact assessment:

- The Figile River and its tributaries, including the Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams, downstream of the Proposed Wind Farm;
- The Slate River and its tributaries, including the Killinagh Upper and Drumsru streams, downstream of the Proposed Wind Farm;
- The Slate River and its tributaries, including the Killinagh Upper, Upper Ballynakill and Brockagh streams, downstream of the Proposed Grid Connection;
- The Liffey River and its tributaries downstream of the Proposed Grid Connection underground electrical cabling route and the Proposed Offsite Substation;
- The River Boyne downstream of the Proposed Wind Farm (this is included for the purposes of a conservative impact assessment. As detailed in Section 9.3.5 there are no outfalls from Ticknevin Bog with the Boyne Catchment);

- Watercourses in the vicinity of the Proposed Turbine Delivery Route accommodation works areas; and,
- The WFD status of all receiving SWBs downstream of the Project Site.

In terms of designated sites, the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA, the Ballynafagh Lake SAC and Ballynafagh Bog SAC are included due to their proximal location to the Proposed Project. The River Barrow and River Nore SAC is also included in the impact assessment given the hydrological connectivity which exists between the Project Site and this SAC via the Figile and Slate rivers. All other designated sites have been screened out of the impact assessment given their distant location and the lack of hydrological or hydrogeological connectivity with the Project Site.

The River Boyne and River Blackwater SAC/SPA is screened out of the impact assessment due to its distance from the Project Site and the lack of any surface water emission points from Ticknevin Bog within the catchment to the River Boyne. Any shallow groundwater flow within the bog will be intercepted by the existing bog surface water drainage network and will be directed to the Figile River sub-catchment. The Proposed Grid Connection is not mapped in the River Boyne catchment.

The surface water abstractions associated with the Barrow_130 and the Liffey_150 DWPAs have been screened out of the impact assessment due to their distant location from the Project Site. There is no potential for the Proposed Project to impact these abstractions, located approximately 35km downstream and approximately 15km away respectively.

9.3.18 Likely Future Receiving Environment

This section identifies the future receiving environment relating to hydrology and hydrogeology likely to exist at the Proposed Wind Farm site at the commencement of the construction phase. In accordance with the approach set out in Section 1.8.4 of Chapter 1, the likely future receiving environment has been established having regard to the existing hydrology and hydrogeology baseline presented in Section 9.3 and uses observed change over the survey period (i.e., 2020 to 2026) to inform the likely future receiving environment.

The likely future receiving environment has been established having regard to:

- The existing hydrology and hydrogeology baseline described in Section 9.3;
- The relevant findings of Chapter 8 (Land Soils and Geology);
- Observed environmental change during site specific surveys covering the period April 2020 to March 2026, including natural revegetation;
- Available BnM site records and environmental data, including management and monitoring undertaken under IPC Licence Reg. No. P0503-01 included within the Annual Environment Reports (AERS) for the Allen Bog Group;
- Published guidance and scientific reports pertaining to hydrology and hydrogeology as detailed in Section 9.1.5 above.

The Project Site is located predominantly on former industrial peat extraction lands within the Allen Bog Group. Industrial peat extraction ceased in June 2020. Since then, the hydrological regime of the Proposed Wind Farm site has been monitored in accordance with the IPC Licence P0-503-01 including ongoing site management, decommissioning activities and environmental monitoring. The existing hydrological regime is strongly influenced by the artificial drainage network established during industrial peat extraction. This existing drainage infrastructure, including field drains, main drains, headland drains, silt (settlement) ponds and pumping infrastructure, therefore remains an important component of the hydrological regime present within the Proposed Wind Farm site. The existing site drainage network is described in Section 9.3.5 below.

At the commencement of construction, the likely future receiving environment is anticipated to remain materially comparable to the existing hydrological baseline. The existing drainage network and associated water management infrastructure will continue to influence surface water drainage patterns,

flow pathways and discharge arrangements. Ongoing site management and natural revegetation may result in localised changes to surface conditions, but these are not anticipated to materially alter the overall hydrological regime prior to construction.

The rehabilitation works completed at Lodge Bog under the PCAS will form part of the likely future receiving environment. The remaining Draft Rehabilitation Plans are anticipated to be implemented following the Proposed Project construction phase, as described in Section 1.8.4 of Chapter 1.

Similarly, the hydrogeological environment at the commencement of construction is anticipated to remain materially comparable to the existing baseline. Groundwater recharge and flow conditions will continue to be influenced by the existing peat, subsoil and bedrock characteristics and the established drainage network. No material changes to the wider groundwater regime are anticipated prior to construction.

As such, the hydrological and hydrogeological conditions described in Section 9.3 are considered representative of the likely future receiving environment at the commencement of the Proposed Project construction phase. The assessment of likely significant effects presented in Section 9.5.2 has therefore been undertaken against these conditions.

9.3.18.1 Future Environmental Trends

This section identifies the future environment trends relating to hydrology and hydrogeology likely to exist at the Proposed Wind Farm site throughout the operational phase.

This section identifies the future environment trends relating to hydrology and hydrogeology likely to exist at the Proposed Wind Farm site following implementation of targeted rehabilitation within the Draft Rehabilitation Plans throughout the operational phase.

Continued natural revegetation, ongoing site management, decommissioning works and environmental monitoring, together with implementation of the Draft Rehabilitation Plans, are anticipated to facilitate the progressive rehabilitation of peatland across the Proposed Wind Farm site. The rehabilitation measures will include the blocking or modification of existing field drains and other targeted hydrological management measures. These works are expected to alter local drainage pathways, reduce drainage efficiency and increase water retention within areas subject to rehabilitation. The extent and magnitude of these changes will depend on local topography, peat characteristics, existing drainage arrangements and the specific rehabilitation measures implemented.

The rehabilitation measures will also result in improvements in surface water quality including reducing the mobilisation of suspended solids and nutrients. The reduction in exposed peat surface, the stabilisation of peat by vegetation and the blocking of drains, will all contribute to a reduction in suspended solids concentrations in the discharge from the bogs.

Existing drainage infrastructure required for the operation of the Proposed Project will be retained and maintained. However, the Proposed Project will not require the continuation of the existing bog-wide drainage regime, and field drains outside the operational drainage requirements of the Proposed Project may be blocked or modified as part of the Draft Rehabilitation Plans.

The influence of the Proposed Project drainage infrastructure will be predominantly localised to the infrastructure footprint and its immediate receiving environment. The Proposed Project infrastructure footprint of approximately 152 ha represents approximately 2.9% of the total bog area, with the majority of the wider cutover bog remaining available for rehabilitation. If required, local hydrological isolation measures, including cell bunding, will be incorporated to minimise interactions between the operational drainage system and adjacent rehabilitation areas.

In summary, the future environmental trends will move towards a progressively rehabilitated peatland with enhanced retention of surface water, and improved water quality in comparison to the existing

baseline conditions. These future environmental trends are detailed in Section 9.4.3.1.1 below and has been brought through the impact assessment contained in Section 9.5.3 below.

The wider hydrogeological environment is not anticipated to undergo material changes as a consequence of rehabilitation. However, local changes in shallow groundwater levels, peat moisture conditions and groundwater–surface water interaction may occur in areas where drainage is modified or blocked.

Accordingly, the future environmental trends for hydrology and hydrogeology are expected to comprise localised changes in drainage patterns and water retention associated with rehabilitation, improvements in water quality, and the Proposed Project drainage system will remain operational and integrated with the existing drainage network. These changes are not anticipated to result in a material alteration of the wider hydrological or hydrogeological setting of the Proposed Wind Farm site.

The continuation of the aforementioned activities in the absence of the Proposed Project is considered in the Do-Nothing Scenario in Section 9.5.1 and in the cumulative assessment in Section 9.5.7

9.4 Characteristics of the Proposed Project

The Proposed Project is described in full in Chapter 4 of this EIAR.

The main characteristics of the Proposed Project that could affect the hydrological and hydrogeological environment are:

- Establishment of the 10 no. temporary construction compounds which will comprise of temporary site offices, staff welfare facilities, storage areas and car-parking. These compounds will be constructed using founded or floated techniques as appropriate. Runoff these construction areas have the potential to affect surface water quality. In addition, welfare facilities will be provided at the temporary construction compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licenced contractor.
- Construction of the Proposed Onsite Substation will be completed using founded techniques. The Proposed Onsite Substation construction will require the excavation of approximately 67,900m^3 of peat and 12,000m^3 of non-peat (spoil) material (FTC, 2026b). Welfare facilities will be provided at the Proposed Onsite Substation. Wastewater effluent will be collected in an underground concrete holding tank and periodically emptied by a licensed contractor for the operational phase of the Proposed Project. These works have the potential to affect both surface water and groundwater quality.
- Construction of the Proposed Offsite Substation will be completed using founded techniques. The Proposed Offsite Substation construction will require the excavation of approximately 1,500m^3 of peat and 13,300m^3 of non-peat (spoil) material (FTC, 2026b). These works have the potential to affect both surface water and groundwater quality.
- The construction of new excavated roads, new floating roads and the upgrade of existing floated roads will require the removal of 25,300m^3 of peat (FTC, 2026b). Due to the peat depth, internal roads will generally be constructed using the floated technique. Construction methodologies are provided in the PSMP attached as Appendix 4-3.
- Construction of the Proposed Turbine hardstands and 46 no. Proposed Turbines will be completed using either piled foundations, bored foundations or a gravity foundation. These works will require the removal of approximately 636,200m^3 of peat and 112,200m^3 of spoil (FTC, 2026b). The movement of large volumes of peat and spoil has the potential to affect surface water quality. Construction of the Proposed Turbine foundations will be completed using piled foundations and there is the potential groundwater quality effects. Large volumes of concrete could affect surface water and groundwater quality.

- The construction of the 2 no. met masts and 1 no. relay mast is estimated to require the excavation of approximately 1,900m^3 of peat and 600m^3 of spoil (FTC, 2026b). The met mast foundations will likely comprise gravity type foundation, with the foundation to be founded on a competent stratum below the peat. These works have the potential to impact surface water quality.
- Construction of the internal 33kV underground electrical cable trench which will connect the 46 no. Proposed Turbines to the Proposed Onsite Substation. This will involve the excavation of a shallow trench (approximately 1m deep), placement of ducting and backfilling with aggregate, lean-mix concrete and excavated material, as appropriate (depending on the location of the cable trench). The ground will be reinstated once the works are completed. These works have the potential to affect surface water quality.
- Construction of the Proposed Grid Connection underground electrical cable trench and works at associated watercourse crossings. These works have the potential to affect surface water quality.
- The construction of the steel masts and associated hardstand areas for the OHL, and the associated crane pads, will be completed using a mixture of gravity and piled foundations and will require the excavation of peat and spoil.
- Temporary construction phase settlement ponds where constructed for the Proposed Project will be volume neutral, i.e. all material excavated will be used to form side bunds and landscaping around the ponds. There will be no excess material from settlement pond construction. The material will also be reinstated during decommissioning.

9.4.1 Proposed Drainage Management (Construction Phase)

Runoff control and drainage management are key elements in terms of mitigation measures to reduce potential effects on downstream surface water bodies. Drainage management within the Project Site will be risk based, and will employ various SuDs methods, building on the existing drainage systems within the Proposed Wind Farm site where available and appropriate. The main tenet of the proposed drainage plan is ensuring to 'keep clean water clean' by avoiding unnecessary or significant disturbance to existing drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas through the construction of interceptor drains. Where possible (depending on orientation), existing field drains can be used as interceptors drains, otherwise, new interceptor drains will be excavated locally, and new drains will outfall to existing field drains downstream of the works areas.

The second method involves collecting any construction area drainage waters (from turbine base/hardstand areas, temporary construction compounds, and the substations) and routing that water through new Proposed Project settlement ponds (or stilling ponds) prior to controlled release into the existing drainage network (field drains or main drains as required/available). There will be no discharges to the existing drainage network without prior treatment.

Within the Proposed Wind Farm site, the majority of the roads will be constructed using a floated technique. In these sections, and depending on intermediate topography, a collector drain (dirty water system as described above) will be used during construction phase, or over the edge (OTE) drainage will occur. OTE drainage allows runoff from access tracks to flow overland and onwards into local field drains and be managed via the existing site drainage system. OTE drainage will only occur where topography allows, and it is only proposed in areas of low risk and remote from outfall locations (at least 150m from bog outfall locations). Silt traps and check dams will be installed in existing field drains downstream of OTE drainage areas, and these will provide attenuation and treatment of dirty water.

During the construction phase, all runoff from works areas (i.e., dirty water) will be attenuated and treated prior to being released within the Project Site. All drainage outfall from the bogs associated with

the Proposed Wind Farm and the Proposed Onsite Substation is routed through existing IPC licence settlement ponds that will remain in-situ. Drainage systems will also be put in place at the Proposed Offsite Substation to ensure that there is no discharge of untreated or unattenuated water.

9.4.2 Development Interaction with the Existing Bog Drainage Network

The Proposed Wind Farm and Proposed Onsite Substation drainage will not significantly alter the existing drainage regime within the bogs. Moreover, the proposed drainage system will be fully integrated into the existing bog drainage systems.

Existing field drains and main drains will be routed under/around access tracks using culverts or diversion drains as required.

Runoff from access tracks, turbine bases, and developed areas (construction compounds, Proposed Onsite Substation, met mast) will be collected and treated in local silt traps and settlement ponds, which will be implemented as part of the proposed drainage and mitigation measures, and then discharged to existing peat field drains. From there, this water will flow towards the relevant bog boundaries in existing field drains and main drains and then be treated further in the existing main IPC settlement ponds prior to discharge from the bogs.

One of the proposed ecological aspects of the drainage design is to re-wet the Proposed Wind Farm site in certain areas, where possible, to create wet areas such as wetland features which are good for overall site biodiversity (refer to Section 9.5.2.19 for an assessment of the proposed enhancement measures). Ponding would occur in these areas to a very shallow depth, and only intermittently following heavy rainfall. No large open bodies of water are proposed, and where intermittent ponding occurs this will be broken up into small areas using peat berms.

9.4.3 Operational Phase Drainage

The construction phase drainage infrastructure, including collector drains and Proposed Project settlement ponds will be retained and maintained during the operational phase drainage system. However, in some areas local construction settlement ponds may become redundant.

As the part of the Proposed Project drainage design, it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed silt traps/settlement ponds and vegetated buffer areas prior to release into the existing drainage network. The proposed drainage measures will then create significant additional attenuation to what is already present. The operational phase drainage system will include the following:

- Interceptor drains (for collecting and redistributing clean water) will be installed up-gradient of proposed infrastructure to intercept clean surface water runoff and minimise the volume of runoff entering construction areas where suspended sediment could become entrained. Intercepted clean water will be directed around the works and redistributed to downstream field drains. Where practicable, existing field drains will be utilised for this purpose; otherwise, new interceptor drains will be installed;
- Collector drains will be installed downstream of works areas to collect runoff from access roads, Proposed Turbine hardstands and other construction areas where suspended sediment may become entrained. This runoff will be conveyed to local settlement ponds for treatment and settlement of suspended sediment prior to discharge to the nearest downstream field drain or main drain;
- On steeper sections of access road, transverse drains ('grips') will be installed, where appropriate, within the road surface to intercept runoff and divert it to adjacent roadside collector drains;

- Check dams will be installed along sections of access road collector drains, where appropriate, to reduce flow velocities and promote the settlement of suspended sediment. Check dams will be constructed using 4/40 mm non-friable crushed rock and will be installed at 25 m or 50 m intervals, depending on the local gradient;
- Settlement ponds, emplaced downstream of access road sections and at Proposed Turbine locations, will buffer volumes of runoff discharging from the existing drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing downstream field/main drains; and,
- Finally, all surface water runoff from the Proposed Project will have to pass through the existing IPC licence settlement ponds at the existing bog outfall locations prior to onward flow to surround streams and rivers.

9.4.3.1.1 *Interaction of Operational Phase Drainage and the Future Environmental Trends*

The existing baseline condition represents the hydrological environment at the time of this assessment (October 2026); however, this condition is not expected to remain static over the operational lifetime of the Proposed Wind Farm. The 14 no. bogs comprising the Proposed Wind Farm site are subject to decommissioning and rehabilitation in accordance with the IPC licence. Therefore, over the operational lifetime of the Proposed Project, the environmental characteristics of the bogs will change.

The Proposed Project infrastructure footprint is relatively small in the context of the Proposed Wind Farm site. The Proposed Project infrastructure footprint of approximately 152 ha within the Proposed Wind Farm site represents approximately 2.9% of the total area of the Proposed Wind Farm site. The majority of the cutover bog will therefore remain available for rehabilitation, and the presence and operation of the Proposed Wind Farm will not preclude the implementation or achievement of rehabilitation objectives across the wider bog area. Figure 9-19 below presents an aerial photograph of Cloncreen Wind Farm within a BnM bog to highlight the minimal footprint of the wind farm, and its associated drainage, in terms of the bog area.

The Proposed Project drainage system has been designed to minimise interference with the existing drainage regime and to provide appropriate control, attenuation and discharge of runoff from the Proposed Project infrastructure. Consequently, the drainage associated with the Proposed Project is not expected to result in a significant alteration of the hydrological regime across the wider residual cutover bog. To illustrate the proposed drainage approach, a schematic Conceptual Site Model (CSM) is included in Appendix 9-5, providing a visual representation of how the proposed drainage infrastructure will interact with the wider bog drainage system. The potential for interaction between the Proposed Project drainage and future peatland rehabilitation is considered below.

- The influence of the Proposed Project drainage infrastructure will be primarily associated with the Proposed Project infrastructure footprint and its immediate receiving environment.
- The relatively limited spatial extent of the infrastructure footprint means that the majority of the Proposed Wind Farm site will remain available for rehabilitation, including areas located within the same surface water drainage areas as the Proposed Project infrastructure.
- The existing physical characteristics of the cutover bog, including the presence of field drains, main drains, peat facebanks, local topographic undulations and areas of intervening peat and spoil, provide a degree of hydrological separation and limit the potential for drainage effects to extend across large areas of the Proposed Wind Farm site.
- Therefore, the introduction of the Proposed Project drainage infrastructure will not result in a continuous or widespread modification of drainage conditions across the Proposed Wind Farm site. Alterations to surface water runoff and drainage patterns will be localised.

- If required, local hydrological isolation measures will be incorporated into the drainage design. These may include cell bunding to limit the lateral propagation of drainage effects away from the Proposed Project infrastructure.
- Rehabilitation measures for the cutover bog are likely to include the blocking of existing field drains. The Proposed Project drainage infrastructure will remain as a discrete drainage system serving the Proposed Project infrastructure and will not require the wider cutover bog to remain drained in accordance with the existing baseline drainage regime.
- The progressive rehabilitation of the wider cutover bog can therefore proceed without compromising the operational drainage requirements of the Proposed Project.
- Residual raised bog areas are typically located towards the margins of the cutover bog and are generally separated from the Proposed Project infrastructure by a combination of distance, elevation differences, intervening topography and existing drainage infrastructure (field drains and main drains). Consequently, significant hydrological effects on these areas of remnant high bog as a result of the Proposed Project drainage are not anticipated.
- Experience from other completed peatland rehabilitation projects within the BnM landholding demonstrates that rehabilitation measures can be implemented in proximity to existing drainage features, including deep perimeter drains (e.g. Bracklin Bog) and drains associated with residual railway infrastructure (e.g. Carranstown Bog), where the rehabilitation design takes account of the local drainage configuration. These completed rehabilitation examples provide relevant evidence that the presence of existing drainage infrastructure does not, in itself, prevent the successful rehabilitation of adjacent peatland.

Based on the above, the Proposed Project will not compromise the rehabilitation potential of the wider cutover bog or prevent the achievement of the objectives of the IPC License Condition 10. Any interaction between the operational drainage system and future rehabilitation is expected to be predominantly localised and can be managed through the proposed drainage design and, if required, local hydrological isolation measures.

Figure 9-20 below presents an example of where drainage infrastructure associated with a railbed at Carranstown Bog has not prevented the rehabilitation and PCAS works in the bog to the east.



Figure 9-19: Example of a Wind Farm footprint with Cloncreen Bog



Figure 9-20: Examples of peatland rehabilitation adjacent to existing drainage infrastructure within the BnM landholding: at Carranstown Bog – rehabilitation adjacent to residual railway drainage infrastructure.

9.4.4 Decommissioning Phase Drainage

The drainage requirements during the decommissioning phase will be broadly similar to those identified for the construction phase, as decommissioning will involve a period of temporary works associated with the removal of infrastructure, and reinstatement of areas disturbed by decommissioning activities.

Decommissioning works will be planned and undertaken having regard to the prevailing drainage and hydrological conditions at that time, including the condition of the operational drainage infrastructure, the status of peatland rehabilitation measures and the condition and connectivity of existing surface water drainage pathways.

A decommissioning plan will be agreed with both Offaly County Council and Kildare County Council prior to decommissioning of the Proposed Project. A decommissioning plan is included as Appendix 4-7 to Chapter 4 and further details are provided in Section 9.5.4 below.

9.5 Likely Significant Effects and Associated Mitigation Measures

9.5.1 Do -Nothing Scenario

If the Proposed Project were not to proceed, the potential for effects to Water would be removed. An alternative to developing a renewable energy project at the Project Site would be to leave the site unchanged, with current land-use practices continuing. Under a 'Do-Nothing' scenario, the proposed wind farm site would continue to be managed as per the requirements of the IPC licence as detailed in Chapter 4, Section 4.6.7.

If the Proposed Project were not to proceed, the Proposed Wind Farm site would continue to be managed under the requirements of the IPC licence (P0503-01) and therefore the ongoing decommissioning activities, site management and environmental monitoring would continue. The lands required for the Proposed Project not located within lands under IPC Licences or under PCAS (i.e. the Proposed Grid Connection underground electrical cabling route and the Proposed Offsite Substation), would continue to function, with no changes to the current land-use.

In the absence of the Proposed Project, natural revegetation processes would continue across the Proposed Wind Farm site. Areas of bare peat would progressively revegetate and transition through successional stages, potentially developing into heath communities, scrub or bog woodland over time, depending on local hydrological conditions. Therefore, the existing baseline of the landscape will transition from a predominantly industrial cutover peatland landscape, with open exposed peat surfaces and drainage features, to a more natural mosaic landscape of cutaway peatland, wetland and regenerating bog habitats.

The Draft Rehabilitation Plans aim to rehabilitate the bog as much as possible by placing the existing peatland environments on a path towards becoming naturally functioning peatlands. Certain targeted management techniques such as drain blocking would aim to alter the current baseline hydrology and hydrogeology of the bogs, establishing conditions more suitable for colonisation by more typical bog communities. In addition to improving the local bog hydrogeological regime by raising the peat water table, the measures contained within the Draft Rehabilitation Plans will also have an indirect effect on downstream surface water quality as rehabilitated peatlands are associated with surface water quality improvements linked to reduced concentrations of suspended solids and nutrients in runoff from rehabilitated bogs. Rehabilitation of the bogs will also provide improved surface water attenuation, thereby reducing the flood risk downstream. These rehabilitation works are mandatory and will proceed irrespective of whether the Proposed Project is permitted, in order to ensure compliance with the IPC Licence.

If the Proposed Project were not to proceed, the opportunity to further significantly reduce emissions of greenhouse gases, including carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2) from fossil fuels to the atmosphere would be lost. The opportunity to capture a significant part of County Offaly's and Ireland's valuable renewable energy resources would be lost, as would the opportunity to contribute to meeting Government and EU Targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost. This would be a long-term, slight, negative effect and is Not Significant.

9.5.2 Construction Phase - Likely Significant Effects and Mitigation Measures

The likely significant effects of the construction phase of the Proposed Project and mitigation measures that will be put in place to eliminate or reduce them are established in this section. The main potential

effects on the hydrological and hydrogeological environments will occur during the construction phase. The assessment considers the Proposed Wind Farm, the Proposed Grid Connection, the proposed accommodation works along the Proposed Turbine Delivery Route and the works at the Proposed Enhancement Areas.

9.5.2.1 Potential Effects from Earthworks Resulting in Suspended Solids Entrainment in Surface Waters

Pre-Mitigation Effect

Construction phase activities including internal road construction, turbine base/hardstanding construction, temporary construction compound construction, met mast construction, substation construction, cable route excavations, amenity track construction, peat and spoil areas, relay mast, Proposed Grid Connection works (steel masts, gantry structures, crane hardstands and associated hardstands), site entrance / amenity car parks construction, and the works at the Proposed Enhancement Areas will require varying degrees of earthworks resulting in excavation of peat and mineral subsoil where present. It is estimated that construction works will require the excavation of approximately 870,900m^3 of peat and non-peat materials which will be a significant potential source of sediment laden water. Potential sources of sediment-laden water include:

- Drainage and seepage water resulting from excavations;
- Stockpiled excavated material providing a point source of exposed sediment; and,
- Erosion of sediment from emplaced site drainage channels.

These activities can result in the 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 on all watercourses downstream of the Project Site could be significant if not mitigated against.

Pathways: Drainage and surface water discharge routes.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The Slate River and its tributaries downstream of the Proposed Grid Connection underground electrical cabling route.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.
- The River Boyne downstream of the Proposed Wind Farm site.

Description of Effects:

Negative, significant, indirect, temporary, likely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. There is the potential for significant effects on these watercourses in the absence of mitigation measures.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flowpath (approximately 20 - 33km) between the Project Site and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. However, the

Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne as there are no surface water outfalls from the Proposed Wind Farm site to the River Boyne or its tributaries.

Proposed Mitigation Measure

Proposed Mitigation by Avoidance

The key mitigation measure during the construction phase is the avoidance of sensitive hydrological features where possible, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). The majority of the Proposed Project development areas are located away from the delineated 50m watercourse buffer zones with the exception of the upgrading of the existing watercourse crossing, new drain crossing and upgrades to existing site access tracks and the small hydrological feature to the southwest of the Proposed Offsite Substation. Works within the hydrological buffer zones comprise of new and proposed watercourse crossings, sections of access roads to the south of T37 (930m of access road) and in the south of Lodge Bog (130m access road) and crane hardstands associated with T36 and T38. Additional mitigation measures are prescribed for these areas, see below.

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

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase 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, and as outlined above, the drainage systems for the Proposed Wind Farm and Proposed Onsite Substation will connect into the existing bog drainage network. Runoff will be conveyed through the existing field drains and main drains to the existing large IPC licenced settlement ponds, where it will undergo further settlement and attenuation prior to discharge from the bog. The nearest IPC licenced settlement pond is located ~160m from the nearest turbine. As such, there is significant distance for wind farm related surface water to travel before it actually reaches the edge of the bogs and joins any receiving waters outside of the overall bog boundaries.

Proposed Mitigation by Design

There is an extensive network of drains already existing at the Proposed Wind Farm site. The existing drainage infrastructure is operating in accordance with IPC licence requirements, with environmental monitoring and silt control measures being implemented. The existing drainage system at the bogs will be maintained and expanded locally as required for use within the Proposed Project drainage system. The key elements are the upgrading and improvements to water treatment elements, such as in-line controls and treatment systems, including wind farm related silt traps and settlement ponds.

The elements of interaction with existing drains will be as follows:

- Interceptor drains will convey clean runoff water around works areas to the existing downstream drainage system (field drains and main drains). Where required, interceptor drains will be installed in advance of any construction works commencing. This will ensure that clean water is kept clear by diverting surface water flow around excavations,

construction areas and temporary storage areas. Where possible (depending on orientation), existing field drains can be used as interceptors drains;
- Collector drains will be used to intercept and collect runoff from construction areas (from turbine base/hardstand areas, construction compounds, and the substation). During the construction phase temporary settlement ponds will be used to attenuate and treat runoff from the construction areas (from turbine base/hardstand areas, construction compounds, and the Proposed Onsite Substation) and treated water will then discharge into existing field drains and main drains. Temporary settlement ponds will be removed at the end of the construction phase (end of high risk period), and operating wind farm runoff will discharge into existing field drains and main drains;
- During the construction phase, temporary silt traps (silt fences) will be used as an additional water protection measure around the existing bog drainage network, particularly where works are proposed within 50m of a natural watercourse. The silt fences will be placed in the existing drains downstream of construction works, and the associated construction area run-off water will be diverted into proposed interceptor drains, or culverted under/across the works area;
- During the construction phase, dewatering silt bags will also be used as required. They can be used downgradient of Proposed Turbine bases, where temporary pumping is required. Discharge from dewatering silt bags will flow into settlement ponds and treated water from settlement ponds will outfall to existing field drains and main drains;
- With regards to the proposed floating roads, and depending on intermediate topography, a collector drain (dirty water system as described above) may be used during construction stage, or over the edge (OTE) drainage will occur. OTE drainage allows runoff from access tracks to flow into local field drains and be managed via the existing site drainage system. OTE drainage will only occur where topography allows, and it is only proposed in areas of low risk and remote from outfall locations (at least 150m from bog outfall locations. Silt traps and check dams will be installed in field drains downstream of OTE drainage areas, and these will provide attenuation and treatment of dirty water; and,
- Culverts will be required where site roads and proposed hardstands cross the main bog drainage networks. These will be installed with a minimum gradient to reduce the entrainment of suspended solids. All culverts will be inspected regularly and maintained where appropriate. Culverts will remain in-situ during the operational phase of the Proposed Project.

Water Treatment Drain:

If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster®' or similar equivalent treatment train (sequence of water treatment processes)) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This will apply for all of the construction phase.

Silt Fences:

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to the existing drainage network of sand and gravel-sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Regular inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.

Silt Bags:

Silt bags will be used where small to medium volumes of water need to be pumped from excavations (e.g. the proposed underpass locations). As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through.

Pre-emptive Site Drainage Management:

The works programme for the construction stage of the development will also take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of peat/subsoil or peat stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily/weekly basis, as required, to allow site staff to direct proposed and planned construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Éireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Éireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Éireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow planned works to be safely executed (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Earthworks will be suspended if forecasting suggests any of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to earthworks being suspended the following control measures will be completed:

- Secure all open peat/spoil excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

Management of Runoff from Peat and Spoil Areas:

All excavated peat and overburden will be placed/spread alongside the excavations for the infrastructure elements. Excavated peat and spoil will be transported immediately on excavation to designated peat and spoil areas alongside the hardstands and access roads or used for landscaping. During the initial placement of peat and spoil, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from the storage areas as required. Interceptor and collector drains will be used at storage areas. 'Siltbuster' or similar equivalent treatment trains will be employed if previous treatment is not to a high quality.

Timing of Site Construction Works:

Construction of the onsite drainage system 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. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.

Proposed Drainage and Water Quality Monitoring

An inspection and maintenance plan for the onsite drainage system will be prepared in advance of commencement of any works and will be included in the CEMP (Construction and Environmental Management Plan) (Appendix 4-4). Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels at dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature will be removed.

During the construction phase field testing (visual, supplemented with pH, electrical conductivity, temperature, dissolved oxygen and turbidity monitoring), sampling and laboratory analysis of a range of parameters[5] with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event-based). The data will be processed and analysed and works will cease if elevated turbidity concentrations are recorded. In this event, all upstream silt traps and drainage routes will be inspected to identify the cause of the elevated turbidity levels. Works will not recommence until any issues have been resolved and the turbidity concentrations have returned to background concentrations.

Works within Buffer Zones

The following additional mitigation measures will also be implemented:

- Double or triple silt fences will be placed downgradient of all work locations within the hydrological buffer zones;
- All works will be completed during the dry weather periods and works will be postponed in the event of rainfall; and,
- The hedgerow separating the small hydrological feature to the southwest of the Proposed Offsite Substation will be retained. This feature is not shown on the EPA databases but was recorded during site surveys. The features was described as being heavily vegetated and with a low flow. Retaining the hedgerow will acts as an additional protection measure to this features.

Residual Effects

The proposed mitigation measures will prevent the mobilisation and transport of suspended solids from construction areas to downstream watercourses. The combination of buffer zones, drainage controls, settlement and silt treatment measures, weather management and water quality monitoring will provide multiple levels of sediment control and treatment. With the implementation of these measures, the potential for effects on downstream surface water quality and aquatic habitats within the Figile and Slate River catchments and their associated tributaries will be significantly reduced. The potential for effects on the River Barrow and River Boyne remains negligible due to the hydrological characteristics (distance from the Project Site) and the lack of hydrological connectivity, respectively.

[5] *example suite: pH (field measured), Electrical Conductivity (field measured), temperature (field measured), Dissolved Oxygen (field measured), Turbidity (NTU) (sonde measured), Flow (m/s), Total Suspended Solids (mg/L), Ammonia, Nitrite (NO_2) (mg/L), Ortho-Phosphate (P) (mg/L), Nitrate (NO_3) (mg/L), Phosphorus (unfiltered) (mg/L), Chloride (mg/L), and BOD (mg/L).*

The residual effect is a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality (Figile and Slate Rivers and their associated tributaries) and aquatic habitats. Following the implementation of the proposed mitigation measures, the residual effect is anticipated to remain imperceptible.

Significance of Effects

For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on downstream surface water quality will occur.

9.5.2.2 Potential Effects on Groundwater Levels During Excavation Works

Pre-Mitigation Effects

The Proposed Project does not include any borrow pits or deep excavations which may require any significant dewatering.

Small scale temporary dewatering may occur at some excavations (i.e. Proposed Turbine bases, cable trenches), and these have the potential to affect local groundwater levels. However, temporary reductions in groundwater levels by temporary dewatering will be very localised and of small magnitude due to the nature and permeability of the local peat and subsoil geology, which comprises moderate to low permeability lacustrine and glacial deposits.

Any minor water level impacts will be temporary and are unlikely to be significant beyond 50m from any excavation.

Pathway: Groundwater flow paths.

Receptor: Groundwater levels (private groundwater well supplies and public and group water schemes).

Description of Effects:

Imperceptible, direct, negative, temporary, unlikely effect on local groundwater levels. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures

No specific mitigation measures are required. The assessment has taken account of the nature of the Proposed Project and the characteristics of the local hydrogeological environment. These factors limit the extent and magnitude of any potential groundwater drawdown.

- There are large separation distances between the Proposed Turbine locations and local houses. All local houses are remote, and in excess of 880m, from the Proposed Turbine locations;
- The proposed internal 33kV underground cable trench is designed to be shallow and will only be approximately 1.0m in depth. At this depth, it will only potentially interact with shallow perched water within the peat profile. No interaction with deeper regional groundwater will occur. Therefore, no effects on the local groundwater table or flows will occur from this element of the Proposed Project;
- The construction of the Proposed Grid Connection (i.e., Proposed Onsite Substation, Proposed Offsite Substation, 2 no. steel masts, 2 no. gantry structure, 2 no. telecommunications towers, and access roads) will be relatively shallow and will only have the potential to interact with the shallow perched water table. No interaction with

the deeper regional groundwater regime will occur. Therefore, no impacts on the local groundwater table or flows will occur; and,
- The potential effect of the proposed piling works on groundwater is assessed separately in Section 9.5.2.7.

Therefore, due to large separation distances between proposed works and potential groundwater wells and local streams and rivers, the relatively shallow nature of the proposed works, and the prevailing geology of the Project Site, the potential for water level drawdown impacts at receptor locations is negligible.

Residual Effects

The residual effect is an imperceptible, direct, temporary, unlikely effect on local groundwater levels.

Significance of Effects

For the reasons given above, no significant effects on groundwater levels will occur.

9.5.2.3 Potential Effects on Surface Water Quality from Excavation Dewatering

Pre-Mitigation Effect

Groundwater seepages will likely occur in turbine base, substation and construction compound excavations, and these will create additional volumes of water to surface water (i.e. rainfall water) to be treated by the drainage management system. Groundwater inflows will likely be small however inflows may be more significant where lenses of sand and gravel are intercepted within the glacial till deposits.

Inflows will likely require management and treatment to reduce suspended sediments. No contaminated land was noted at the Proposed Wind Farm site and therefore pollution issues are not anticipated in this respect. The main potential significant effects relate to increases in turbidity and suspended solids on downstream surface water receptors. Poor water quality in downstream streams and rivers has the potential to affect aquatic habitats and species (e.g. fish and invertebrates).

With respect to the Proposed Grid Connection, some minor groundwater/surface water seepages will also occur in shallow trench excavations, the excavations for the Proposed Onsite Substation or the Proposed Offsite Substation, and this will create additional volumes of water to be treated by the drainage management system. Inflows will require management and treatment to reduce suspended solids. No contaminated land was noted along the Proposed Grid Connection therefore pollution issues are not anticipated in this respect.

Pathway: Groundwater pumped into the site drainage network.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.
- The River Boyne downstream of the Proposed Wind Farm site.

The potential for the release of suspended solids to surface water receptors is a risk to water quality of these receptors.

Description of Effects:

Negative, significant, indirect, temporary, unlikely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. There is the potential for significant effects on these watercourses in the absence of mitigation measures.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flowpath (approximately 20 – 33 km) between the Project Site and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. However, the Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne as there are no surface water outfalls from the Proposed Wind Farm site to the River Boyne or its tributaries.

Proposed Mitigation Measures

Management of excavation seepages and subsequent treatment prior to discharge into the drainage network will be undertaken for excavation works across the Project Site, as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent the build-up of groundwater in the excavation;
- The interceptor drainage will be discharged to the existing drainage system or onto natural vegetated surfaces within the Project Site and not directly to any natural watercourse;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a “Siltbuster®” unit;
- There will be no direct discharge to the existing drainage network and therefore no risk of hydraulic loading or contamination will occur; and,
- Daily monitoring of excavations and the water treatment system by a suitably qualified person (EnvCoW) will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped, and a geotechnical assessment will be undertaken.

Proven and effective measures to minimise the levels of sediment from the Project Site have been proposed above and will maximise the drainage pathway length between the potential sources and the receptor.

Residual Effects

The residual effect is an imperceptible, indirect, temporary, unlikely effect on local surface water quality within the receiving streams and down gradient rivers (Figile and Slate Rivers and their associated tributaries). Following the implementation of the proposed mitigation measures, the residual effect will remain imperceptible.

Following the implementation of the proposed mitigation measures, the residual effect on the River Barrow and River Boyne will remain negative, imperceptible, indirect, and short-term.

Significance of Effects

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

9.5.2.4 Potential Effects Associated with Leaks or Spills of Hydrocarbons

Pre-Mitigation Effect

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons can cause significant pollution risk to groundwater, surface water and associated 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 are 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.

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.

Pathway: Groundwater flowpaths and site drainage network.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.
- The River Boyne downstream of the Proposed Wind Farm site.
- Groundwater quality in the underlying bedrock aquifers.

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.

Description of Effects:

Negative, significant, indirect, short-term, likely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. There is the potential for significant effects on these watercourses in the absence of mitigation measures.

Negative, imperceptible, indirect, short-term, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flow path (approximately 20 – 33km) between the Project Site and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. However, the Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, short-term, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne as there are no surface water outfalls from the Proposed Wind Farm site to the River Boyne or its tributaries.

Negative, indirect, slight, short-term, unlikely effect on local groundwater quality. In the absence of mitigation measures there is no potential for significant effects on local groundwater quality due to the hydrogeological regime at the Proposed Wind Farm site and the Proposed Grid Connection which is characterised by high rates of surface water runoff and low rates of groundwater recharge.

Proposed Mitigation Measures

- Refuelling and maintenance of construction vehicles and plant will, where practicable, be undertaken off-site at controlled, designated fuelling facilities. Where refuelling or maintenance is required on-site, it will be undertaken at designated areas in accordance with the CEMP and appropriate pollution prevention procedures;
- On-site re-fuelling will be undertaken using a double skinned bowser or a refuelling truck with spill kits kept onboard;
- Only designated trained operatives will be authorised to refuel plant on-site;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. 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 by the appointed EnvCoW for leaks and signs of damage;
- The Proposed Onsite Substation and the Proposed Offsite Substation will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency response plan for the construction phase to deal with accidental spillages is contained within the CEMP (which is contained in Appendix 4-4).

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.

Residual Effect

The residual effect is a negative, imperceptible, indirect, temporary, unlikely effect on groundwater and surface water quality in the receiving streams and down gradient rivers (Figile and Slate Rivers and their associated tributaries). Following the implementation of the proposed mitigation measures, the residual effect on the River Barrow and River Boyne will remain negative, imperceptible, indirect, and short-term.

Significance of Effects

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

9.5.2.5 Potential Effects Associated with the Release of Cement-Based Products

Pre-Mitigation Effect

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can

physically damage fish by burning their skin and blocking their gills. A pH range of ≥ 6 ≤ 9 is set in S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to water quality.

Peat ecosystems are dependent on low pH hydrochemistry. They are extremely sensitive to introduction of high pH alkaline waters into the system. Batching of wet concrete on-site and washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution.

Pathway: Site drainage network.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.
- The River Boyne downstream of the Proposed Wind Farm site.
- Peat water hydrochemistry and underlying groundwater chemistry.

The potential for the release of cement-based products or cement truck wash water 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.

Description of Effects:

Negative, moderate, indirect, short-term, likely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. There is no potential for significant effects on these watercourses in the absence of mitigation measures.

Negative, imperceptible, indirect, short-term, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flow path (approximately 20 – 33km) between the Project Site and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. The Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, short-term, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne as there are no surface water outfalls from the Proposed Wind Farm site to the River Boyne or its tributaries.

Negative, indirect, imperceptible, short-term, unlikely effect on peat water hydrochemistry. There is no potential for significant effects in the absence of mitigation measures.

Proposed Mitigation Measures

- No batching of wet-cement products will occur on-site. Ready-mixed concrete will be delivered to site, and where possible, pre-cast elements will be used;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;

- Where concrete is delivered on-site, only the chute will be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be isolated in temporary lined wash-out pits located near proposed site compounds. These temporary lined wash-out pits will be removed from the site at the end of the construction phase;
- Any washing out of concrete pumping plant will also be into the temporary lined wash-out pits;
- The appointed contractor will ensure to use weather forecasting to plan dry days for pouring concrete; and,
- The appointed contractor will ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

No specific mitigation measures are required for potential groundwater impacts as the proposed mitigation measures will ensure minimal release of cement-based products to enter the ground and subsequently affect groundwater. Furthermore, the potential groundwater effects are imperceptible at the outset.

Proven and effective measures to mitigate the risk of releases cement-based products or cement truck wash water have been proposed above and will break the pathway between the potential source and each receptor.

Residual Effects

The residual effect is a negative, imperceptible, indirect, short-term, unlikely effect on groundwater quality and surface water quality in the receiving streams and down gradient rivers (Figile and Slate Rivers and their associated tributaries). Following the implementation of the proposed mitigation measures, the residual effect will remain as imperceptible.

Following the implementation of the proposed mitigation measures, the residual effect on the River Barrow and River Boyne will remain negative, imperceptible, indirect, and short-term.

Significance of Effects

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

9.5.2.6 Potential Effects from Wastewater Disposal

Pre-Mitigation Effect

Release of effluent from on-site temporary wastewater treatment systems has the potential to impact on groundwater and surface water quality if site conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

The potential for contamination resulting from wastewater disposal is a risk to surface and groundwater quality. This is a risk common to all construction sites containing staff welfare facilities.

Pathway: Groundwater flowpaths and site drainage network.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.
- The River Boyne downstream of the Proposed Wind Farm site.
- Underlying groundwater quality.

Description of Effects:

Negative, significant, indirect, temporary, unlikely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. There is the potential for significant effects on these watercourses in the absence of mitigation measures.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flowpath (approximately 20 to 33km) between the Proposed Wind Farm and the Proposed Grid Connection and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. However, the Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne due to the lack of any outfalls from the Proposed Wind Farm site within this catchment.

Negative, indirect, slight, temporary, unlikely effect on groundwater quality.

Proposed Mitigation Measures

- There are a total of 10 no. proposed construction compounds associated with the Proposed Project (the locations of the compounds are detailed in Table 4-2 of Chapter 4);
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at each of the site compounds, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to the Project Site and removed after use from the site to be discharged at a suitable off-site treatment location;
- No water or wastewater will be sourced on the Project Site, nor discharged to the Project Site.

Proven and effective measures to prevent the release of wastewater on-site have been proposed above and will break the potential pathway between source and receptor.

Residual Effect

The residual effect is a negative, imperceptible, indirect, short-term, unlikely effect on local groundwater quality, groundwater well supplies and receiving streams and down gradient rivers (Figile and Slate Rivers and their associated tributaries). Following the implementation of the proposed mitigation measures, the residual effect on the River Barrow will remain negative, imperceptible, indirect, temporary.

Significance of Effects

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

9.5.2.7 Potential Effects Associated with Piled Foundations

Pre-Mitigation Effect

Due to the depth of peat at the Proposed Turbines locations, piled foundations with a configuration of up to 20 no. 900 to 1200mm cylindrical bored piles are proposed. These piles could extend to a depth of between 5 to approximately 20metres below ground level.

The following potential scenarios arise in respect of proposed piling works:

- Creation of preferential pathways, through a low permeability subsurface layer (an aquitard such as lacustrine clay), to allow downward flow into the underlying aquifer;
- Creation of preferential pathways, through a low permeability subsurface layer (an aquitard such as lacustrine clay), to allow upward migration alkaline groundwater to the acidic bog surface, thus potentially altering local hydrochemistry and therefore vegetation at the bog surface; and,
- Creation of a blockage to regional groundwater flow within the underlying aquifer due to placement of pile clusters.

These pathways are analogous to pathways described for piling works associated with contaminated land sites, as detailed in Environment Agency (2001).

Pathway: Groundwater flowpaths (upward and/or downward pathways, and regional groundwater flows).

Receptors: Groundwater quality in the underlying GWBs (Cushina, Bagenalstown Upper, Trim and Kildare GWBs) and groundwater hydrochemistry within the peat bog.

Description of Effects: Negative, moderate, direct, short-term, likely effect on groundwater quality/hydrochemistry. There is no potential for significant effects in the absence of mitigation measures.

Proposed Mitigation Measures

The proposed mitigation measures designed for the protection of downstream surface water quality and groundwater quality within the Proposed Wind Farm will be implemented at all construction work areas.

- Mitigation measures for sediment control are detailed in Section 9.5.2.1 and 9.5.2.3.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.4.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.5.
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.6.

Proposed mitigation measures relative to piling works will comprise:

- Where driven piles are used, they will have a cross section without re-entrant angles;
- Strict QA/QC procedures for piling works will be followed;
- Piles will be kept vertical during piling works;

- Where required a bentonite seal will be used to prevent upward/downward movement of surface water/groundwater.

The ground conditions at the Proposed Wind Farm site can be typically categorised into the following deposits (based on data presented in Chapter 8):

- Peat – Typically described as light brown to dark brown amorphous to fibrous peat. Peat thicknesses ranged from 0.1 to 5.8 with an average peat depth of 1.6m. Approximately 90 percent of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths were 3.5 to 5.8m.
- Lacustrine Clay – Light grey to brown, soft to stiff slightly gravelly Silt/Clay with some cobbles and boulders. The thickness of the layer is variable across the Proposed Wind Farm site.
- Fluvioglacial Sand and Gravel – Typically described as grey silty sandy Gravel with fine to coarse Sand with cobbles and some boulders. The thickness of the layer is variable across the Proposed Wind Farm site.
- Limestone Bedrock – Strong massive dark blackish grey fine grained calp limestone. The upper 2m of the bedrock is described as weathered.
- Groundwater - Groundwater was recorded in 23 no. trial pits and varied between 0.6 and 4mbgl (metres below ground level).

Proposed piles will penetrate through peat deposits and lacustrine clay deposits where they occur, and then into underlying glacial tills. Where present the clay layer is likely to act as an aquitard/low permeability layer, through which only very small amounts of water can flow.

Peat water is perched above the regional groundwater table. Peat water occurs in the bog basin, while regional groundwater flow will occur in the underlying bedrock aquifer. Glacial tills that occur between the base of the peat/lacustrine clays may be permeable in local zones, but in general will have a moderate to low permeability. Therefore, the two main groundwater systems are the upper acidic peat water, and the lower regional bedrock groundwater. As the underlying bedrock is mainly limestone, the groundwater occurring within this aquifer will be alkaline.

For the driven piles the clay and also the glacial tills are likely to 'self-seal' around the piles, meaning that a long-term pathway between the upper peat/bog water and the lower bedrock aquifer will not be sustained.

Research indicates that provided the aquitard layer is of a reasonable thickness and the piles driven through have a cross section without re-entrant angles, the likelihood of creating preferential flow paths for downward migration of leachate (i.e. peat water) is very low. This hypothesis is consistent with the results obtained by Hayman et al (1993) and Boutwell et al (2000).

For bored piles, following the completion of boring, the steel reinforcement cage is lowered into the open bore and a tremie pipe is installed through the centre of the cage to the toe of the pile. A small amount of Vermiculite is used to create a plug between the concrete and the displaced water, therefore the concrete seals the entire pile column and pushes the vermiculite plug to the surface as concrete is added. The temporary steel casing is removed carefully as the concreting works are being completed. This concreting process is similar to that used when grouting a water supply production well (IGI (2007), and EPA (2013)). This means that a long-term pathway between the upper peat/bog water and the lower bedrock aquifer will not be sustained.

Scenario 1: Creating a Pathway for Downward Flow

To ensure downward flow of peat water and/or pollutants from the piling works does not occur, the mitigation measures outlined above will be implemented. The concrete added to the bored pile will seal the pile annulus. As a result, the potential for either piling work option to create pathways for

downward flow of peat water or pollutants that could affect groundwater quality in the underlying aquifer is imperceptible.

Scenario 2: Creating a Pathway for Upward Flow

No upwelling of groundwater to the peat surface water was recorded at any of the site investigation locations across the Proposed Wind Farm site.

Notwithstanding this, to ensure upward flow of underlying groundwater via potential pathways created by piling works does not occur, the mitigation measures outlined above will be implemented. The concrete added to the bored pile will seal the pile annulus. As a result, the potential for piling works to create pathways for upward flow of alkaline groundwater to the bog surface is imperceptible.

Scenario 3: Blocking Regional Groundwater Flow

The scale of the Proposed Wind Farm Site is important. The Proposed Project footprint (152ha) occurs over approximately 2.9% of the Proposed Wind Farm site (5,139ha).

If a piling array of 20 no. 900 to 1200mm cylindrical bored piles is applied at each turbine base (as piling Option 2a and 2b), this combined area of piling footprint amounts to:

Option a (900mm piles) – this combined area of piling footprint amounts to approximately 597m^2, or 12.72m^2 per turbine base. The turbine bases are also a significant distance apart. The area of the piles bored into the ground is distributed over a very large area, and that area only amounts to 0.01% of the Proposed Wind Farm site.

Option b (1,200mm piles) – this combined area of piling footprint amounts to approximately 1,063m^2, or 22.62m^2 per turbine base. The turbine bases are also a significant distance apart. The area of the piles bored into the ground is distributed over a very large area, and that area only amounts to 0.003% of the proposed site area.

The proposed piling options will not penetrate a significant distance into the underlying bedrock as there will be sufficient resistance, either in the over lying glacial tills/mineral subsoils or upon reaching the top of bedrock. At such wide separation distance, the ability of clusters of piles, with a plan area of between approximately 3.53m^2 per turbine to 32.17m^2 per turbine, to alter or affect regional groundwater flow is imperceptible. Groundwater will simply flow through and/or around these very localised insertions.

The proposed piling works potentially pose a threat to groundwater quality in the underlying regional groundwater system and also could potentially create a pathway for upward migration of alkaline groundwater to the peat surface. These potential effects will not arise at the Project Site due to a combination of the prevailing ground conditions, groundwater conditions, and proposed mitigation measures that will ensure the potential pathways for interaction of shallow (acidic peat water) and deeper (alkaline) groundwater are prevented from occurring. In addition, due to the small footprint of proposed pile clusters, and the significant spacing between turbine bases where pile clusters are proposed, the potential for such pile clusters to block regional groundwater flow is imperceptible at that scale. The proposed piled foundations therefore have no potential to change the WFD status or impact the WFD objectives of the underlying Cushina, Bagenalstown Upper, Trim and Kildare GWBs.

Residual Effects

The residual effect is a negative, imperceptible, indirect, short-term, unlikely effect on groundwater flow, and ground quality/peat water hydrochemistry.

Significance of Effects

For the reasons given above, no significant effects on regional groundwater and the Cushina, Bagenalstown Upper, Trim and Kildare GWBs will occur, and no significant effects on peat water hydrochemistry will occur from proposed piling works.

9.5.2.8 Potential Effects from Morphological Changes to Watercourses at the Proposed Wind Farm

Pre-Mitigation Effect

Within the Proposed Wind Farm, there are a total of 15 no. watercourse crossing locations over natural watercourses (EPA mapped rivers and streams) (refer to Figure 9-21). There are two proposed crossing locations over the Figile River, and both will be constructed as clear span crossings. Existing bridges are currently in place at these locations; these will be dismantled and replaced as part of the Proposed Wind Farm. All Proposed Wind Farm watercourse crossing details are presented in Section 4.4.1.11 and are summarised below:

- There are 3 no. crossings along the EPA mapped Clonbrown Stream which runs immediately to the east of the local road which separates Ballydermot North and Ballydermot South bogs in the west from Blackriver Bog in the east:
    - Proposed Wind Farm Crossing 1 - an existing crossing will be removed (existing piped drain) and a box culvert / bottomless culvert / pipe to be constructed approximately 270m to the east/southeast of T8 (X 665801.21, Y 723271.55);
    - Proposed Wind Farm Crossing 2 - A proposed new crossing via a box culvert / bottomless culvert / pipe approximately 300m to the east of T8 (X 665762.49, Y 723344.51); and,
    - Proposed Wind Farm Crossing 3 - an existing crossing approximately 630m to the southwest of T09 (X 665579.88, Y 723922.50). No works required to facilitate proposed amenity track.
- Proposed Wind Farm Crossing 4 - an existing crossing over the Figile River between Codd 1 and Codd 2 bogs (this will be replaced with a clear span bridge) (X 663544.30, Y 726783.07);
- 2 no. existing crossings close to Site Entrance 1A:
    - Proposed Wind Farm Crossing 5 - an existing crossing over the Ballykilleen Stream (X 661271.50, Y 727618.66). No works required to facilitate upgrade of access road; and,
    - Proposed Wind Farm Crossing 6 - an existing clear span bridge crossing over the Figile River (X 661437.80, Y 727522.47). No works required to facilitate upgrade of access road.
- Proposed Wind Farm Crossing 7 - an existing bridge over the Figile River between Glashabaun North and Glashabaun South bogs (this will be replaced with a clear span bridge) (X 666745.6, Y 727788.2);
- 3 no. crossings over the Lullymore East Stream;
    - Proposed Wind Farm Crossing 8 – an existing culvert crossing along amenity track (X 666820.63, Y 725833.35). No works are required at this location;
    - Proposed Wind Farm Crossing 9 – a new proposed crossing via clear span bridge / bottomless culvert between T39 and T40 (X 666785.58, Y 725833.35); and,
    - Proposed Wind Farm Crossing 10 – a new proposed crossing via clear span bridge / bottomless culvert to the south of T36 (X 667679.86, Y 725577.37).
- 5 no. crossings over the Lullybeg Stream;

- Proposed Wind Farm Crossing 11 – a new proposed crossing via clear span bridge / bottomless culvert to the east of T38 (X 667101.88, Y 725097.22);
- Proposed Wind Farm Crossing 12 – an existing culvert crossing to be upgraded to the south of T35 (X 667755.3, Y 724102.3);
- Proposed Wind Farm Crossing 13 – an existing culvert crossing to the upgraded to the north of T34 (X 668331.2, Y 724421.4);
- Proposed Wind Farm Crossing 14 – an existing culvert upgraded to a box culvert / bottomless culvert / pipe to the southeast of T10 (X 666088.41, Y 724944.52); and,
- Proposed Wind Farm Crossing 15 – a new proposed crossing via box culvert / bottomless culvert / pipe at X 666168.21, Y 724791.37 on the proposed road to T10 and T09.

Many of these watercourses are mapped by the EPA and have been integrated into the existing bog drainage network.

In addition to these EPA mapped natural watercourses, there are manmade peat drains within the Proposed Wind Farm site. However, these are not considered to be a significant constraint. Where these drains intersect the Proposed Wind Farm infrastructure, they will be integrated into the proposed drainage design or, where necessary, will be rerouted around the proposed infrastructure.

Pathway: Site drainage network.

Receptors: Surface waters (Figile River, Lullybeg Stream, Lullymore East Stream, Ballykilleen Stream and the Clonbrown Stream), associated water-dependant ecosystems downstream of the Proposed Wind Farm site.

Description of Effects: Negative, moderate, direct, long-term, likely effect on surface water flows, local stream morphology and surface water quality. In the absence of mitigation measures there is no potential for significant effects.

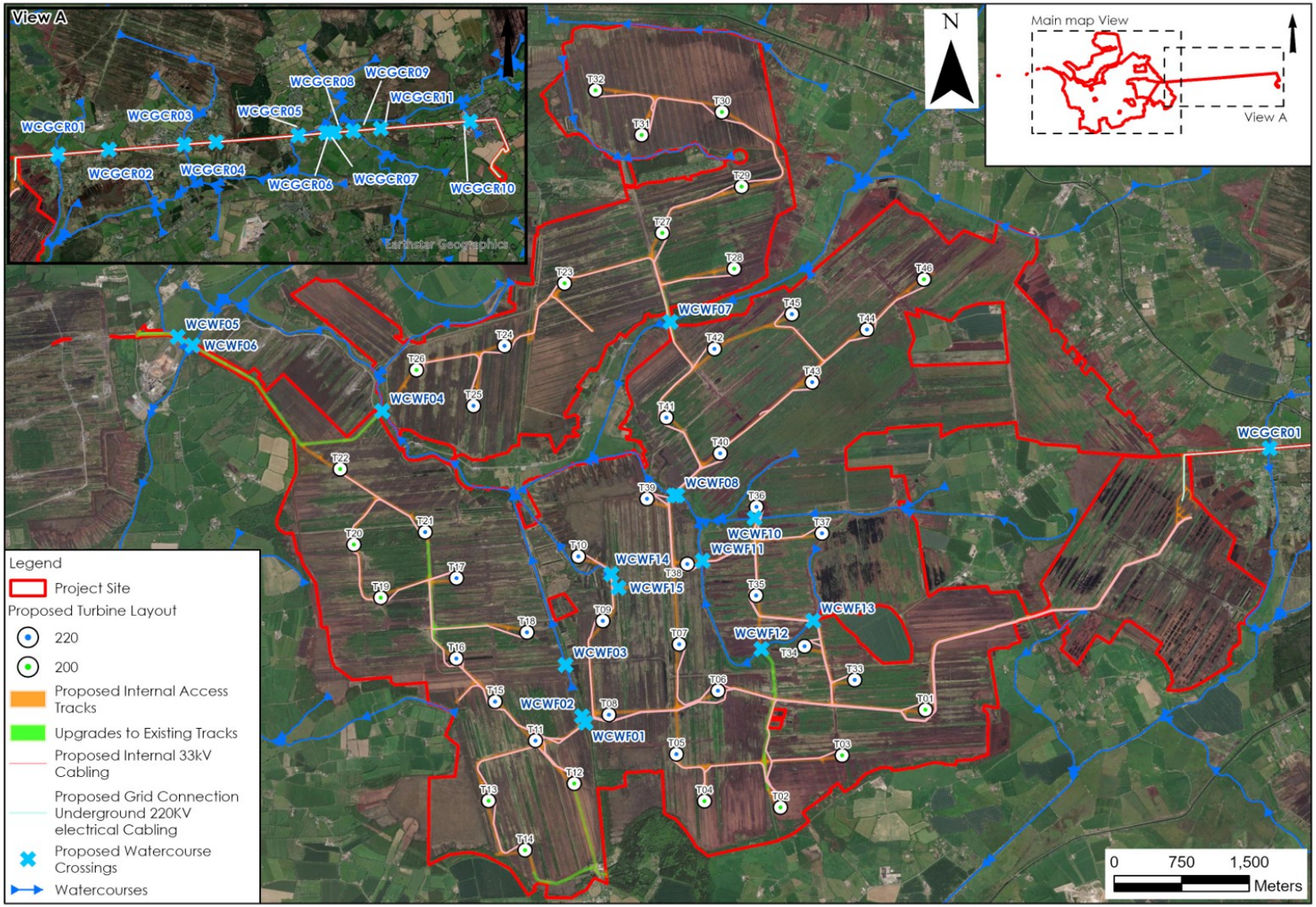


Figure 9-21: Map of Watercourse Crossings

Proposed Mitigation Measures

The Proposed Wind Farm design has been optimised to utilise the existing infrastructure and existing watercourse crossings where practicable. Of the 15 no. watercourse crossing locations, a number are existing crossings which reduces the nature of the works required. The crossings comprise of proposed new crossings, upgrade to existing crossing and the replacement of existing crossings. The proposed crossing types include clear-span bridges, bottomless culverts and appropriately sized culverts.

Mitigation measures for the watercourse crossings are detailed below:

- Clear-span bridge crossings will be designed to span the watercourse without disturbance to the watercourse bed and with abutments located outside the channel where practicable.
- Where bottomless culverts are proposed, the natural watercourse bed will be retained through the crossing where practicable. Construction will be undertaken from outside the watercourse channel and appropriate measures will be implemented to prevent the mobilisation of sediment into the watercourse;
- Where box culverts or pipes are proposed, the crossing will be suitably sized for the expected peak flows and designed to maintain hydraulic conveyance. Any works required within or immediately adjacent to the watercourse will be undertaken in accordance with the relevant OPW and IFI requirements and appropriate sediment and pollution control measures will be implemented;
- Existing crossings requiring upgrading or replacement will be constructed in a manner that minimises disturbance to the existing watercourse and its banks. Where existing structures are to be removed, works will be undertaken in accordance with the approved construction methodology and appropriate measures will be implemented to prevent sediment mobilisation;
- All proposed new and upgraded crossings will be designed to maintain existing watercourse flow conveyance and to avoid creating a restriction to flow or increasing flood risk upstream or downstream of the crossing;
- All guidance / mitigation measures required by the OPW and/or the Inland Fisheries Ireland (IFI)6 is incorporated into the design of the proposed crossings;
- All drainage measures will be installed in advance of the works;
- Plant and equipment will not be permitted to track across the watercourse. Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of a temporary pre-cast concrete or metal bridge;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by IFI for in-stream works according to the IFI (2016) guidance document “Guidelines on protection of fisheries during construction works in and adjacent to waters”, i.e., July to September inclusive. This time period coincides with the period of lowest expected 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 (any deviation from this will be done in discussion with the IFI);
- Where works are necessary inside the 50m buffer double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- All new river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent;
- Existing crossings requiring upgrading or replacement will be constructed in a manner that minimises disturbance to the existing watercourse and its banks. Where existing structures are to be removed, works will be undertaken in accordance with the approved

[6] *Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*

construction methodology and appropriate measures will be implemented to prevent sediment mobilisation; and,
- All proposed new and upgraded crossings will be designed to maintain existing watercourse flow conveyance and to avoid creating a restriction to flow or increasing flood risk upstream or downstream of the crossing.

The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines *'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945'*, and in consultation with IFI. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

Confirmatory inspections of the proposed new watercourse crossing location will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing.

All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Wind Farm will be suitably sized for the expected peak flows in the watercourse. All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

The proposed mitigation measures will minimise the potential for sediment mobilisation, changes to surface water flows and disturbance to watercourse morphology during the construction of the proposed crossings. The use of clear-span crossings, avoidance of instream works, appropriate drainage and sediment controls, and compliance with OPW and IFI requirements will minimise the potential for direct impacts on watercourses.

Residual Effects

The residual effect is a negative, imperceptible, direct, long-term, unlikely effect on downstream water quality and aquatic habitats in the Figile River, Lullybeg Stream, Lullymore East Stream, Ballykilleen Stream and the Clonbrown Stream.

Significance of Effects

For the reasons outlined above, no significant effects on stream morphology or stream water quality will occur at crossing locations.

9.5.2.9 Potential Effects from Morphological Changes to Watercourses along the Proposed Grid Connection

This assessment considers potential morphological effects associated with the crossing of mapped and non-mapped natural watercourses by the Proposed Grid Connection. Other underground cable trenching, including the section connecting the Proposed Onsite Substation at Lodge Bog to the public road, has been considered separately under the relevant assessments of excavation works, drainage and water quality in the preceding sections. There are no watercourse crossings within Lodge Bog.

Pre-Mitigation Effect

The Proposed Grid Connection underground electrical cabling route includes a total of 11 no. crossings over watercourses (7 no. crossings over EPA mapped watercourses, 1 no. crossing under the Grand Canal and an additional 3 no. crossings over non-EPA mapped watercourses). These crossings are detailed above in Section 9.3.3.2 and comprise of existing bridge/culvert crossings along the public road network with the exception of 1 no. new proposed crossing approximately 200m to the west of Shee Bridge under the Grand Canal (this will be completed by Horizontal Direction Drilling (HDD)). The

details of the proposed crossing methodologies to be used at each crossing location are detailed in Section 4.9.1.7 of Chapter 4. The crossing locations associated with the Proposed Grid Connection are included in Figure 9-21 above.

The potential proposed crossing methods are as follows:

- **Flatbed Formation Under** (Option C as per Section 4.9.1.7 of Chapter 4)
  - Where cable ducts are to be installed under an existing watercourse or service crossing where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench, the depth of which will be determined by the location of the top of the obstacle or the depth of excavatable material under it. The ducts will be laid in this trench in a flatbed formation under the existing watercourse/ service and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification.

- **Flatbed Formation Over** (Option C as per Section 4.9.1.7 of Chapter 4)
  - Where cable ducts are to be installed over a watercourse or service crossing where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the obstacle or the depth of excavatable material over it. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification.
  - Where a bridge/culvert or service has insufficient cover depth to fully accommodate the required trench, the ducts can be laid in a flatbed formation partially within the existing road surface. Where this option is to be employed, the ducts will also be encased in steel with a concrete surround as per ESB Networks specifications. In order to achieve cover over these ducts and restore the carriageway of the road, it may be necessary to raise the pavement level locally to fully cover the ducts. The increased road level will be achieved by overlaying the existing pavement with a new wearing course as required. Any addition of a new pavement will be tied back into the existing road pavement at grade. After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench.

- **Horizontal Directional Drilling** (Option D as per Section 4.9.1.7 of Chapter 4)
  - This is assessed separately in Section 9.5.2.10 below as HDD involves a distinct construction methodology, involving drilling beneath a waterbody and presents a different potential source-pathway-receptor interaction to the other crossing methods assessed here.

Pathways: Runoff and surface water flowpaths.

Receptors: All watercourses in the vicinity of the Proposed Grid Connection underground electrical cabling route including the Slate River and its tributaries (Killinagh Upper Stream, Upper Ballynakill Stream, Brockagh Stream and Temp Stream and other non EPA mapped watercourses) and associated water-dependent ecosystems.

Description of Effects: Negative, moderate, indirect, long-term, likely effect on downstream surface water flows and surface water quality. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures

Prior to the commencement of cable trenching or crossing works the following key temporary drainage measures will be installed:

- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside the watercourse 50m buffer zone;
- The following mitigation measures are proposed for the Proposed Grid Connection crossing works:
    - No stockpiling of construction materials will take place along the grid route;
    - No refuelling of machinery or overnight parking of machinery is permitted in this area;
    - No concrete truck chute cleaning is permitted in this area;
    - Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
    - Local road drainage, culverts and manholes will be temporarily blocked during the works;
    - Machinery deliveries will be arranged using existing structures along the public road;
    - All machinery operations will take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur;
    - Any excess construction material will be immediately removed from the area and sent to a licenced waste facility;
    - Spill kits will be available in each item of plant required to complete the works; and,
    - Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Mitigation measures for HDD are detailed in Section 9.5.2.10.

The proposed mitigation measures will minimise the potential for sediment mobilisation and changes to surface water flows during the proposed watercourse crossing works. The measures will also ensure that works are undertaken without direct disturbance to watercourse beds or banks. As no instream works or alterations to existing watercourse crossings are proposed, the potential for significant effects on surface water flows and surface water quality is considered to be low.

Residual Effect

The residual effect will be a negative, imperceptible, direct, long-term, likely effect on surface water flows and surface water quality.

Significance of Effects

For the reasons outlined above, no significant effects on surface water flows and surface water quality will occur.

9.5.2.10 Potential Effects from Horizontal Directional Drilling along the Proposed Grid Connection Underground Electrical Cabling Route

Pre-Mitigation Effect

Surface water quality effects on local watercourses may occur during drilling and groundworks associated with potential HDD at the proposed watercourse crossing under the Grand Canal approximately 210m to the west of Shee Bridge.

It is proposed that HDD will be undertaken at this location to prevent direct effects to the waterbody. However, there is a risk of indirect effects from sediment laden runoff during the launch pit and reception pit excavation works. There is also the unlikely risk of fracture blow out and contamination of the waterbody with drilling fluid.

Pathway: Surface water and groundwater flows.

Receptor: The Grand Canal and associated water-dependent ecosystems downstream of the Proposed Grid Connection underground electrical cabling route.

Description of Effects: Negative, moderate, indirect, temporary, likely effect on surface water quality. There is no potential for significant effects in the absence of mitigation measures.

Proposed Mitigation Measures

- Although no in-stream works are proposed, the drilling works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (dryer) ground conditions;
- The crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance;
- There will be no storage of material / equipment or overnight parking of machinery inside the hydrological buffer zone;
- Before any ground works are undertaken, double silt fencing will be placed upslope of the Grand Canal;
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the watercourse;
- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages and prevent the migration of drilling fluids from the works area;
- Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area;
- Spills of drilling fluid will be cleaned up immediately and contained in an adequately sized skip before being taken off-site;
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works);
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed settlement pond area at least 50m from the Grand Canal;

- The discharge of water onto vegetated ground will be via a silt bag which will filter any remaining sediment from the pumped water. The entire percolation area will be enclosed by a perimeter of double silt fencing;
- Any sediment laden water from the works area will not be discharged directly to the Grand Canal or drain;
- Works will not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted;
- Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the Grand Canal;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied;
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded at the soonest opportunity to prevent soil erosion;
- The silt fencing upslope of the Grand Canal will be left in place and maintained until the disturbed ground has re-vegetated;
- There will be no batching of cement along the Proposed Grid Connection underground electrical cabling route;
- There will be no refuelling allowed within 100m of the Grand Canal crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the canal crossing.

Fracture Blow-out (Frac-out) Prevention and Contingency Plan:

- The drilling fluid will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- One or more lines of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

Due to the avoidance of instream works, combined with the implementation of the prescribed mitigation measures, the potential for significant effects on surface water flows, watercourse morphology and surface water quality is low.

Residual Effect

The residual effect is negative, imperceptible, indirect, temporary, likely effect on surface water in the Grand Canal.

Significance of Effects

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

9.5.2.11 Potential Effects from Use of Siltbuster

Pre-Mitigation Effect

Siltbuster® systems are regularly used to remove suspended sediments on construction sites by means of chemical dosing and sedimentation (i.e. use of coagulants and flocculants to accelerate the settlement process). The benefits of using enhanced settlement systems on downstream surface water quality are widely known and provide a positive effect. However, potential overdosing with chemical agents means there is a perceived risk of chemical carryover in post treatment water which could result in negative effects on downstream water quality.

Wind farm construction water (i.e. surface water runoff or pumped groundwater) has sometimes very fine particles, particularly clays and peat, with slow settling velocities which do not settle out efficiently, even in a lamella clarifier at normal flow rates. In these cases, chemical dosing can be used to aggregate the particles (i.e. force them to combine and become heavier), increasing the particle settling rate and cleaning the water via gravity separation techniques. Agents commonly used include poly aluminium chloride (PAC), aluminium sulphate, ferric iron and ferrous iron. These agents are commonly used in drinking water treatment plants. So, their use is widespread, and there is significant scientific knowledge around their use and control.

The benefits of using a siltbuster system in emergency scenarios where all other water treatment systems have proven ineffective are considerable. An example of treatment capability of siltbuster systems from northwest Mayo is provided in Figure 9-22. This is a duration curve of downstream water quality data post siltbuster treatment. The system was set up so that any water not meeting discharge criteria was recycled back to the settlement ponds. The graph shows all data, and only 24 data points out of 1194 records were above 20 mg/L (i.e. recycling, and repeat treatment occurred at these times to ensure compliance at the discharge location).

The siltbuster system will not be used under normal conditions during the construction phase. The mitigation proposed to protect water quality is already outlined above in Section 9.5.2.1 to Section 9.5.2.10. The use of Siltbuster® is only proposed as an emergency backup in the event of failure of all other proposed water treatment mitigation measures, e.g. in the event of landslide failure. The Siltbuster system is a proven and effective method of water quality treatment during these events. Given the flat topography of the Proposed Wind Farm site, the risk of a landslide is considered to be low. The GPSR (FT, 2026a) attached as Appendix 8-1, concluded that the Proposed Wind Farm site has an acceptable margin of safety and is suitable for the Proposed Project. Therefore, it is extremely unlikely that the Siltbuster system will be utilised.

The Proposed Grid Connection underground electrical cabling route and the Proposed Offsite Substation have been scoped out of this assessment due to the minor nature of the works and the lack of peat in these areas.

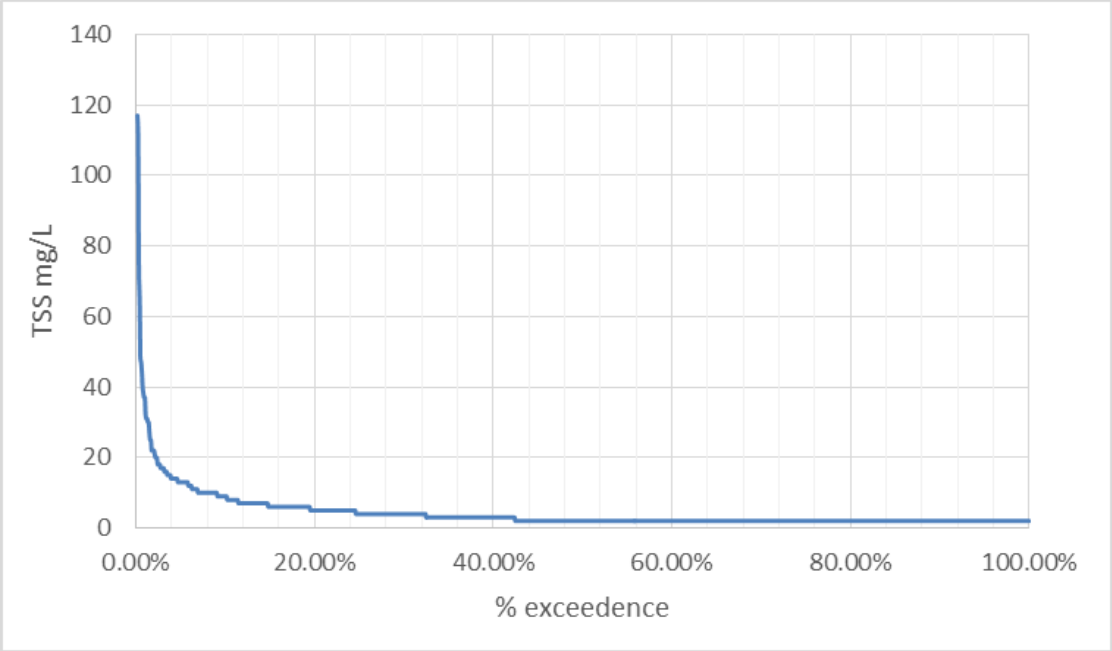


Figure 9-22: TSS treatment data using Siltbuster systems (with chemical dosing)

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters (Figile and Slate rivers and associated tributaries) and associated water-dependant ecosystems downstream of the Proposed Wind Farm site.

Description of Effects: Negative, slight, indirect, temporary, unlikely effect on downgradient water quality. There is no potential for significant effects.

Mitigation Measures

Measures employed to prevent overdosing and potential chemical carryover:

- The Siltbuster system comprises an electronic in-line dosing system which provides an accurate means of adding reagents, and this minimises the risk of overdosing;
- Continued monitoring and water analysis of pre and post treated water by means of an inhouse lab and dedicated, suitably qualified staff, means the correct amount of chemical is added by the dosing system;
- Dosing rates of chemical to initiate settlement is small, being in the order of 2-10 mg/L and the vast majority of the chemical is removed in the deposited sediment;
- Final effluent not meeting the discharge criteria will be recycled and retreated, which has a secondary positive effect of reducing carryover; and,
- The use of biodegradable chemical agents will be implemented at very sensitive sites (i.e. adjacent to SACs).

With the implementation of the dosing technology and the continual monitoring of pre and post treatment water, the appropriate volume of chemical agent can be added to ensure that chemical carryover concentrations are present only in tiny trace amounts which will not cause any effects to receiving waters or associated aquatic ecology.

Residual Effect

The residual effect is a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality.

Significance of Effects

For the reasons outlined above, no significant effects on the surface water quality will occur. In fact, it is considered that the use of Siltbuster systems has a significant positive effect in respect of protected surface water quality.

9.5.2.12 Potential Effects from Clear-Felled Forestry and Vegetation Removal

Pre-Mitigation Effect

Clear-felled tree felling will be required within and around the Proposed Project footprint to allow for the construction of the turbine bases, access roads, the Proposed Onsite Substation, underground cabling, and other ancillary infrastructure and for the Proposed Enhancement areas. A total of 60.7ha of forestry (comprising conifer plantation) will be permanently clear felled.

The felling activities required as part of the Proposed Project will be the subject of a Felling Licence application to the Forest Service, in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.

In addition, a total of 176ha of vegetation (bog woodland and scrub) will be removed as part of the Proposed Project. All vegetation removed will be replanted within the Project Site as part of the Proposed Enhancement Areas.

Potential effects on downstream surface watercourses during Clear-felled tree felling occurs mainly from:

- Exposure of soil and subsoils due to vehicle tracking, 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 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 could be significant if not mitigated.

Pathways: Drainage and surface water discharge routes.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm.
- The River Barrow downstream of the Figile and Slate rivers.
- The River Boyne downstream of the Proposed Wind Farm.

Description of Effects:

Negative, significant, indirect, temporary, likely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. There is the potential for significant effects on these watercourses in the absence of mitigation measures.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flowpath (approximately 20 – 33km) between the Project Site and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. However, the Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne as there are no surface water outfalls from the Proposed Wind Farm site to the River Boyne or its tributaries.

Proposed Mitigation Measures

Clear-felled tree felling 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 felling, planting and other forestry operations result in minimal potential negative effects to the receiving environment.

- Forestry Standards Manual (Forest Service, 2015)
- 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)
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018)
- Coillte Planting Guideline SOP
- 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 at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in Table 9-25.

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 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.

Table 9-25: Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

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

Mitigation by Design:

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

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- All machinery will be operated by suitably qualified personnel;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. 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 felling works;
- Machines will traverse the Project Site along specified off-road routes (referred to as racks);
- The location of racks will be chosen to avoid wet and potentially sensitive areas;
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing 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 mats become heavily used and worn. Provision will 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 felling areas. No direct discharge of such drains to watercourses will occur. Sediment traps and silt fences will be installed in advance of any felling 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 and spoil 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 construction;
- Double silt fencing will also be put down slope of felling areas which are located in close proximity to streams and/or relevant watercourses;
- Drains and silt traps will be maintained throughout all felling 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. Check dams and silt traps will 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 or maintenance of machinery will not occur within 50m of an aquatic zone or within 20m of any other hydrological feature. 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.

Silt Traps:

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time, and allow settling of silt in a controlled manner.

Timing of Proposed Project Felling Works:

Felling will only be carried out during periods of no or 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 will be carried out during pre-felling inspections and after:

- Communication with tree felling 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 pre-felling inspections the main drainage ditches will be identified. Ideally the pre-felling inspection will be carried out during rainfall;
- Following tree felling all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will 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, if impeded by silt or debris, 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:

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4 weeks of the felling activity commencing, 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 samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact 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 impact of land-uses other than forestry;
- Downstream locations will 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 impact 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 tree felling is proposed.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will be utilised at every works site near a watercourse (to be completed by the EnvCoW). These will be kept on site for record and inspection.

The proposed mitigation measures will minimise the potential for sediment mobilisation and nutrient release associated with tree felling and vegetation removal and prevent the transport of sediment-laden runoff to downstream watercourses. The use of buffer zones, appropriate felling practices, sediment controls, drainage management and surface water quality monitoring will further reduce the potential for effects on downstream water quality and aquatic habitats.

Residual Effect

The residual effect will be a negative, imperceptible, indirect, temporary, likely effect on downstream watercourses and associated water-dependent ecosystems.

Significance of Effects

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

9.5.2.13 Potential Effects on Surface Water Quality During Fluvial Flooding

Pre-Mitigation Effect

Some areas of the Proposed Wind Farm site, including approximately 3.29ha of Proposed Wind Farm infrastructure (T46 Hardstand, Turning Head and Access Road, T42 Hardstand and Access Road and T45 Hardstand, T38 Hardstand and Access Road, T10 Hardstand, Access Roads and Turning Head, T22 Hardstand, Upgrade of Existing Site Access Roads at Site Entrance 1A and several watercourse crossings) are mapped in NIFM fluvial flood zones. The footprint of the Proposed Wind Farm within the NIFM flood zones equates to ~0.06% of the Proposed Wind Farm site (5,139ha).

If a flood event coincide with the construction phase when excavations and earthworks are being undertaken within the floodplains, there is the potential for surface water quality effects.

However, during such a flood event, surface water quality in the general area would be significantly compromised due to natural river erosion due to the large flow volumes. During flooding, floodwaters are generally highly turbid with a large suspended solid concentration due to the sheer volume and flow of water.

The Proposed Onsite Substation and the Proposed Offsite Substation are mapped within Flood Zone C and are considered to be at low risk of flooding. Some fluvial flood zones are mapped along the Proposed Grid Connection underground electrical cabling route. However, these occur at existing watercourse crossings along the R403. The Proposed Grid Connection underground electrical cable route will have no effect on flooding or mapped flood zones as no instream works are proposed at the crossing locations.

Pathways: Drainage and surface water discharge routes.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The Slate River and its tributaries downstream of the Proposed Grid Connection underground electrical cabling route.
- The River Barrow downstream of the Figile and Slate rivers.
- The River Boyne downstream of the Proposed Wind Farm site.

Description of Effects:

Negative, significant, indirect, temporary, likely effect on the downstream surface water quality (Figile and Slate Rivers and their associated tributaries). In the absence of mitigation measures, there is the potential for significant effects.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow due to the length of the hydrological flowpath (approximately 20 – 33km) between the Proposed Wind Farm and Proposed Grid Connection and the River Barrow, and the large volumes of water within the River Barrow in comparison to surface water runoff volumes from the Project Site. The Proposed Project does not rely in any way on the dilution/assimilative capacity of any downstream watercourse.

Negative, imperceptible, indirect, temporary, unlikely effect on the River Boyne. There is no potential for significant effects on the River Boyne as there are no surface water outfalls from the Proposed Wind Farm site to the River Boyne or its tributaries.

Proposed Mitigation Measures

Despite the low likelihood of a fluvial flood event occurring during the construction of the Proposed Wind Farm, weather/rainfall events of those magnitudes likely to generate significant rainfall which would in turn cause fluvial flooding would be forecastable.

An emergency response system has been developed for the construction phase of the Proposed Project to respond to high rainfall events which may result in fluvial flooding.

A potential high intensity rainfall event would likely be identified 3-5 days in advance, with more accurate forecasts of severity within 24-48 hours of occurrence. Preparations for a flood event would begin from the initial indications that there may be a high rainfall event. This would allow time for the preparation and the implementation of additional emergency mitigation measures.

As above, the first point of mitigation is ongoing monitoring of weather forecasts and weather warning. The project Environmental Manager (EM) or the site Ecological Clerk of Works (ECoW) will be responsible for monitoring weather forecasts during the construction phase. There will be a 24-hour advance meteorological forecasting (Met Eireann download) linked to a trigger-response system. When a pre-determined rainfall trigger levels is exceeded (e.g., sustained rainfall (any foreseen rainfall event longer than 4 hour duration) and/or any yellow or greater rainfall warning (>25mm/hour) issued by Met Eireann), planned responses (detailed below) will be undertaken.

Cessation of all construction works until the storm event, including the storm runoff has passed. All construction works will cease during storm events such as yellow warning rainfall events. Following heavy rainfall events, and before construction works recommence, the Project Site will be inspected and corrective measures implemented to ensure safe working conditions e.g. dewatering of standing water in open excavations, etc.

Exposed soils/peat (exposed temporary stockpiles) will be covered with plastic sheeting during all relatively heavy rainfall events and during periods where works have temporarily ceased before completion at a particular area (e.g., overnight and weekends).

With regards to the fluvial flood zones at the Proposed Wind Farm site, a managed retreat from the fluvial flood zones will be implemented in the event of a high intensity rainfall event and/or weather warning related to rainfall. This will include the following:

- Any areas where soil/subsoil is exposed at the surface will be compacted firmly with a digger bucket of a suitably sized excavator.
- Open trenches will be backfilled and compacted.
- Existing sediment control measures will be removed, as these may be washed away and deposited elsewhere by the floodwaters.
- All plant, machinery and equipment will be removed from the flood zones.

With regards to the flood zones mapped along the Proposed Grid Connection underground electrical cabling route, works in the vicinity of these watercourse crossings will be postponed in the event of flood or high flows in the river.

The proposed mitigation measures will minimise the potential for construction activities and exposed soils to contribute to surface water quality impacts during fluvial flooding. The monitoring of weather forecasts, cessation of works during significant rainfall events, and a managed retreat from flood-prone areas will reduce the potential for sediment and other pollutants to be mobilised and transported to downstream watercourses.

Residual Effect

The likely residual effect is a negative, slight, direct, short-term, unlikely effect on downstream surface water quality in watercourses and associated water dependent ecosystems downstream of the Proposed Wind Farm site including the Slate and Figile rivers. Following the implementation of the proposed mitigation measures, the residual effect on the River Barrow will remain negative, imperceptible, indirect, temporary.

Significance of Effects

For the reasons outlined above and with the application of mitigation measures no significant effects on surface water quality due to fluvial flooding will occur.

9.5.2.14 Potential Effects on Karst

Pre-Mitigation Effect

There are no GSI mapped karst features in the area of the Proposed Wind Farm site or the Proposed Grid Connection. As stated in Section 9.3.11 the closest GSI mapped karst features are located approximately 2.3km to the west of the Proposed Wind Farm site. However, 28 no. Proposed Turbines and 2.27km of the Proposed Grid Connection underground electrical cabling route are mapped to be underlain by a Karst Aquifer (www.gsi.ie).

Any potential alteration in local groundwater quality or surface water quality has the potential to impact the Karst Bedrock Aquifer (assuming the underlying bedrock is karstified).

The potential for effects on the underling karst aquifer along the Proposed Wind Farm are limited for the following reasons:

- No evidence of karst features has been identified within the Proposed Wind Farm. This is supported by the extensive site investigation data collected for the Proposed Wind Farm and the surrounding area, including:
    - Extensive site walkover surveys and geological mapping;
    - Completion of 1,026 no. peat probes at the Proposed Wind Farm;
    - Excavation of 55 no. trial pits at the Proposed Wind Farm;
    - Completion of 6 no. rotary core boreholes at the Proposed Wind Farm; and,
    - Excavation of an additional 7 no. trial pits and 3 no. boreholes to the west of Codd 1 Bog.
- A review of available desk study information has not identified the presence of karst features at the Proposed Wind Farm:
    - The GSI Karst Features database (www.gsi.ie) does not record the presence of any karst features at the Proposed Wind Farm;
    - Historic 6" or 25" base mapping does not record any karst-related features at the Proposed Wind Farm;
    - Inspection of recent and historic aerial imagery has not identified any features indicative of karst development at the Proposed Wind Farm
- BnM's lidar data for the bogs associated with the Proposed Wind Farm and the Proposed Onsite Substation does not indicate the presence of depressions, sinkholes or other topographical anomalies that may be associated with karstification;
- Site investigations have demonstrated that the Proposed Wind Farm is overlain by low permeability peat and lacustrine clay. These soils/subsoils significantly restrict groundwater recharge and protect the underlying bedrock aquifers;
- A total of 3 no. rotary core boreholes have been drilled in areas mapped to be underlain by a Regionally Important Karst Aquifer at T07, T17 and T14. These rotary core boreholes encountered rock at depths of 10.4 to 15.8mbgl and the bedrock was described as strong to extremely strong, thinly bedded, slightly bioclastic fine to coarse grained limestone. There was no evidence of karstification or water bearing conduits during the drilling of these boreholes; and,
- The groundwater table in the peat is perched and isolated from the deeper regional groundwater system in the bedrock, limiting the potential for interaction.

The potential for effects on the underling karst aquifer along the Proposed Grid Connection underground electrical cabling route are limited for the following reasons:

- There are no mapped karst features in the immediate vicinity of the Proposed Grid Connection; and,
- The proposed works are minor and transient in nature.

The absence of identified karst features, the limited potential for groundwater recharge and interaction with the underlying aquifer, and the prescribed mitigation measures for the protection of groundwater quality will minimise the potential for effects on the karst aquifer and any associated karst features.

Pathway: Groundwater recharge and surface water drainage.

Receptor: Regionally Important Karst Aquifer.

Description of Effects:

Indirect, negative, slight, unlikely effect on karst features and karst aquifer. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures

Detailed, tried and tested, best practice mitigation measures have been prescribed in relation to the protection of surface water and groundwater quality, including with respect to the proposed use of piled foundations (Section 9.5.2.7). No additional mitigation measures are required.

Residual Effect

The residual effect is an indirect, negative, imperceptible, short-term, unlikely effect.

Significance of Effects

No significant effects on karst features will occur.

9.5.2.15 Potential Effects on Hydrologically/Hydrogeologically Connected Designated Sites

Pre-Mitigation Effect

The Proposed Wind Farm site is not located within any designated conservation site. However, as stated in Section 9.3.14 above, the Proposed Wind Farm site is hydrologically connected to the Long Derries, Edenderry SAC/pNHA via the existing surface water drainage network at Ticknevin Bog which outfalls to the Codd Stream that flows through the SAC/pNHA. The Proposed Wind Farm site is also hydrologically connected to the River Barrow and River Nore SAC via the existing bog drainage network and outfalls, which discharge to the Figile and Slate Rivers and ultimately the River Barrow. Any potential effect on these SACs would be indirect, as there is no discharge directly to these designated sites. The surface water connections from the Proposed Wind Farm site could transfer poor quality surface water that may affect the conservation objectives of the designated sites.

The Proposed Grid Connection underground electrical cabling route crosses the Grand Canal pNHA and the Ballynafagh Lake SAC. The Proposed Grid Connection is also hydrologically connected to the River Barrow and River Nore SAC via the Slate River and its tributaries and Ballynafagh Bog SAC/pNHA via the Temp Stream and the Slate River.

The Project Site may also be hydrogeologically connected to designated sites where groundwater flowpaths provide a potential connection.

The potential effects of the Proposed Project on designated sites have also been assessed as part of a detailed WFD Compliance Assessment Report and is included in Appendix 9-4.

Pathway: Surface water flow paths and groundwater flow paths.

Receptor: Down-gradient water quality Long Derries, Edenderry SAC/pNHA, Grand Canal pNHA, River Barrow and River Nore SAC, Ballynafagh Lake SAC and Ballynafagh Bog SAC/pNHA.

Long Derries, Edenderry SAC/pNHA

There is no potential for significant effects on the Long Derries, Edenderry SAC/pNHA for the following reasons:

- The distance between the closest Proposed Turbine and the SAC/pNHA (>300m). A 200m buffer was applied to the SAC and no construction works will occur within this zone. The closest construction works are located ~260m from the boundary of the SAC/pNHA;

- The SAC is designated for orchid-rich dry calcareous grassland. This habitat occurs on glaciofluvial sands and gravels adjacent to the peatland, rather than on the peatland itself. The SAC site synopsis (NPWS, 00213) specifically refers to the presence of "*good quality dry, calcareous grassland*" and an "*interesting gravel pit flora*", indicating that the conservation interests of the SAC are associated with mineral substrates (i.e. sand and gravels) rather than peat;
- The orchid-rich calcareous grasslands are not a hydrologically sensitive habitat; and,
- The qualifying habitat occurs on elevated mineral soils, approximately 1–3 m above the adjacent bog surface, the footprint of the Proposed Wind Farm and also above the Codd Stream which outfalls from Ticknevin Bog. This restricts the potential for hydrogeological effects.

River Barrow and River Nore SAC

There is no potential for significant effects on the River Barrow and River Nore SAC for the following reasons:

- The distance between the Proposed Project and the SAC. The length of the hydrological flowpath is >19km; and,
- The large volume of water with the River Barrow. However, the Proposed Project does not rely in any way on the dilution or assimilative capacity of any downstream watercourses. The prescribed mitigation measures ensure the protection of all watercourses, including those in the immediate vicinity of the proposed works.

Grand Canal pNHA

There is no potential for significant effects on the Grand Canal pNHA for the following reasons:

- Mitigation measures are also prescribed in relation to the HDD proposed under the canal in Section 9.5.2.10; and,
- The temporary, minor and transient nature of the works proposed along the Proposed Grid Connection underground electrical cabling route.

Ballynafagh Lake SAC

There is no potential for significant effects on the Ballynafagh Lake SAC for the following reasons:

- The temporary, minor and transient nature of the works proposed along the Proposed Grid Connection underground electrical cabling route;
- The shallow nature of the trench excavations; and,
- No instream works are proposed on the feeder canal over which the Proposed Grid Connection underground electrical cable route crosses.

Ballynafagh Bog SAC/pNHA

There is no potential for significant effects on the Ballynafagh Bog SAC/pNHA for the following reasons:

- The separation distance between the Proposed Grid Connection underground electrical cabling route and the SAC/pNHA (approximately 146m);
- The temporary, shallow, minor and transient nature of the works proposed along the Proposed Grid Connection underground electrical cabling route;
- There is also a hydrological connection between the Proposed Grid Connection underground electrical cabling route and the SAC/pNHA via the Temp Stream and the Slate River;

- However, the potential for effects is limited due to the temporary, minor and transient nature of the works.

Description of Effects:

Negative, slight, indirect, short-term, likely effect on the Long Derries, Edenderry SAC/pNHA, Grand Canal pNHA, the Ballynafagh Lake SAC, and Ballynafagh Bog SAC/pNHA. Negative, imperceptible, indirect, short-term, unlikely effect on the River Barrow and River Nore SAC. In the absence of mitigation measures, there is no potential for significant effects.

Proposed Mitigation Measures

Mitigation measures relating to the protection of surface water drainage regimes and surface water quality within the Project Site have been detailed in Section 9.5.2.1 and 9.5.2.3 (suspended solids), Section 9.5.2.4 (hydrocarbons), Section 9.5.2.5 (cement-based products), Section 9.5.2.6 (wastewater) and Section 9.5.2.8 (morphological changes). Mitigation measures have also been proposed along the Proposed Grid Connection in Section 9.5.2.9 and 9.5.2.10.

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed in Section 9.5.2.2 (groundwater levels), Section 9.5.2.4 (hydrocarbons), Section 9.5.2.5 (cement-based products), Section 9.5.2.6 (wastewater).

There are no potential for significant effects on the Long Derries, Edenderry SAC/pNHA, Long Derries, Edenderry SAC/pNHA, Grand Canal pNHA, the Ballynafagh Lake SAC, and Ballynafagh Bog SAC for the following reasons:

- The implementation of the prescribed strict, tried and tested, best practice mitigation measures for the protection of the surface and groundwater environment during the construction of the Proposed Wind Farm and Proposed Grid Connection.

Residual Effect

The residual effect is a negative, imperceptible, indirect, short-term, unlikely effect on hydrologically connected designated sites (Long Derries, Edenderry SAC/pNHA, Grand Canal pNHA, Ballynafagh Lake SAC, Ballynafagh Bog SAC, and River Barrow and River Nore SAC).

Significance of Effects

For the reasons provided above, and with the implementation of the listed mitigation measures, no significant effects on downstream designated sites will occur.

9.5.2.16 Potential Effects on Groundwater Abstractions (Public and Private)

Pre-Mitigation Effect

As stated in Section 9.3.9 above, the groundwater flow at the Proposed Wind Farm site discharges into the local surface waterbody network, i.e. the existing bog drainage network which discharges to tributaries of the Figile and Slate rivers.

Using this conceptual model of groundwater flow an impact assessment for local wells is undertaken below. This assessment is completed in accordance with “Wind farms and groundwater impacts - A guide to EIA and Planning considerations” (DoE/NIEA, 2015).

Public Water Supplies

The GSI mapped Ballykilleen and Bracknagh GWSs and the Clonbullogue, Robertstown, Edenderry and Rathangan PWSs in the vicinity of the Project Site which can be assessed on the basis of impacts relating to groundwater quality and water quantity (the volume of water available). The GSI's delineated source protection areas associated with these GWSs and PWSs do not overlap with the Project Site. The distances between the Project Site and the mapped source protection areas are detailed in Section 9.3.15 above. The inclusion of all of the GWSs and PWSs in the impact assessment is considered to be very conservative given the nature of the hydrogeological regime at the Proposed Wind Farm site.

Groundwater flowpaths are likely to be short and will discharge into the local surface water features. Furthermore, given the low permeability of the peat, soils and subsoils at the Proposed Wind Farm site, groundwater recharge will be significantly restricted. According to GSI and EPA mapping, there are several watercourses mapped between the Proposed Wind Farm site and these GWSs and PWSs. These streams act as hydrological barriers. There are also deep boundary bog drains which run along the perimeter of the bog which act as hydrological barriers.

Private Water Supplies

The GSI also map additional private boreholes and wells in the vicinity of the Proposed Wind Farm site. Other wells may also exist at local dwellings in the lands surrounding the Proposed Wind Farm site and are not mapped by the GSI. There are 33 no. inhabitable dwellings located within 1km of the Proposed Turbine locations. The Proposed Turbines are located a significant distance (>700m) from dwellings. An assessment of private wells in the lands surrounding the Proposed Wind Farm Site has been completed. In order to be conservative and following a precautionary approach, we have assumed that all dwellings in the surrounding lands have a private groundwater well. These private water supplies are reliant on groundwater flows in the deeper bedrock aquifer underlying the glacial deposits.

The biggest risk to groundwater wells will be from where deeper excavations are required such as the turbine bases. Construction of internal roads, substation compounds, access roads, met masts, relay mast, amenity track, underground cable route trench between the Proposed Turbines and the Proposed Onsite Substation, and the construction of the Proposed Grid Connection and all associated infrastructure will not have the potential to affect local wells due to the shallow nature of the works.

Due to the high drainage density of the peat bog and the surrounding lands, it is expected that the majority of groundwater flow will discharge to proposed construction phase drainage network and the existing bog drainage network, as well as to the larger drainage ditches around the perimeter of bogs. The water will then be directed to the IPC licenced settlement ponds prior to discharge to local watercourses. These drainage systems will act as hydraulic barriers between the Proposed Wind Farm infrastructure locations and the location of potential groundwater wells.

Deep groundwater recharge from the bogs associated with the Proposed Wind Farm and the Proposed Onsite Substation to the underlying bedrock aquifers is minimal. The restriction of recharge relates to the generally impermeable layers which underlie much of Ireland's bogs leading to a 4% recharge coefficient for the Proposed Wind Farm site. Therefore, the majority of the groundwater drainage and seepage in the bog is via lateral flow, discharging into the perimeter drains and entering the surface water drainage network in the lands surrounding the site.

The closest dwelling to the Proposed Offsite Substation is approximately 220m to the east. This is upgradient of the Proposed Offsite Substation with land sloping to the west towards the small hydrological feature recorded to the west of the substation.

Pathway: Groundwater flowpaths.

Receptor: Groundwater well supplies.

Description of Effects: Negative, imperceptible, indirect, long-term, unlikely effect. There is no potential for significant effects.

Proposed Mitigation Measures

No significant effects on local groundwater well supplies, public or private, will occur due to the separation distance between the Proposed Wind Farm infrastructure and potential groundwater well supplies.

Nevertheless, detailed, tried and tested best practice mitigation measures have been prescribed in the preceding section for the protection of groundwater quality as follows:

- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.4.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.5.
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.6.
- Mitigation measures in relation to piling works are detailed in Section 9.5.2.7.

The implementation of these mitigation measures will ensure the protection of local groundwater quality.

For the reasons outlined above (separation distances, and prevailing geology, topography and groundwater flow directions) combined with the prescribed mitigation measures, there is no potential for significant effects.

Residual Effect

The residual effect will be a negative, imperceptible, indirect, long-term, unlikely effect in terms of quality or quantity on local groundwater well supplies (PWSs, GWSs and private well supplies).

Significance of Effects

For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on groundwater abstractions will occur.

9.5.2.17 Potential Effects on Downstream Surface Water Drinking Supplies

Pre-Mitigation Effect

The closest abstraction for drinking water downstream of the Proposed Wind Farm is associated with the Barrow PWS and the Barrow_130 DWPA. The shortest hydrological flowpath between the Project Site and this DWPA is approximately 35km in length.

The Liffey_150 DWPA is also located downstream of the Proposed Grid Connection in the Liffey and Dublin Bay Catchment. This DWPA is located near Celbridge and is approximately 15km to the northeast of the Proposed Offsite Substation.

Any potential effects on these downstream DWPAs are limited given their distance from the Project Site.

Construction activities pose a threat to surface water DWPA linked with the Proposed Project.

Pathways: Surface water flowpaths, and groundwater levels.

Receptors: Down-gradient water quality in the Barrow_130 DWPA and the Liffey_150 DWPA.

Description of Effects: Negative, imperceptible, indirect, short-term, likely effect on the Barrow_130 DWPA. There is no potential for significant effects in the absence of mitigation measures.

Proposed Mitigation Measures

- Mitigation measures for sediment control are detailed in Section 9.5.2.1.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.4.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.5.

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters.

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 Project Site will be equivalent to baseline conditions and will therefore have no effect on downstream water quality.

Residual Effect

Following the implementation of the proposed mitigation measures, the residual effect on the Barrow_130 DWPA and the Liffey_150DWPA will remain as imperceptible.

Significance of Effects

For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on downstream surface water abstractions will occur.

9.5.2.18 Potential Effects on WFD Status and Objectives

Pre-Mitigation Effect

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 Project are defined in Section 9.3.15.1 and Section 9.3.15.2 respectively.

A detailed WFD Compliance Assessment Report has been completed in combination with this EIAR Chapter and is included in Appendix 9-4.

Pathways: Surface water flowpaths and groundwater flowpaths.

Receptors: WFD status of underlying GWBs and downstream SWBs.

Description of Effects: Indirect, negative, significant, temporary, unlikely effect on downstream SWBs. In the absence of mitigation measures there is the potential for significant effects on downstream SWBs.

Indirect, negative, slight, temporary, unlikely effect on the underlying GWBs. In the absence of mitigation measures there is no potential for significant effects on underlying GWBs.

Proposed Mitigation Measures

- Mitigation measures for sediment control are detailed in Section 9.5.2.1.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.4.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.5.

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters.

Furthermore, the mitigation measures previously outlined for the protection of groundwater quality and groundwater quantity are detailed above:

- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.4.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.5.
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.6.
- Mitigation measures in relation to piling works are detailed in Section 9.5.2.7.

We summarise that there will be no significant effects on GWB or SWB WFD status for the following reasons:

- The small footprint (152ha) of the Proposed Project in relation to the scale of the underlying GWBs;
- The Proposed Project does not involve any significant alteration of drainage patterns, therefore, the quantitative status of the receiving surface and groundwaters will remain unaltered;
- There will be no direct discharge from the Proposed Project to receiving waters; and,
- Mitigation measures for the protection of surface and groundwater water quality will be implemented during the construction phase of the Proposed Project to ensure that there is no deterioration in local or downstream water quality. These mitigation measures will ensure the qualitative status the receiving waterbodies remains unaltered by the Proposed Project.

Mitigation for the protection of surface and groundwater during the construction phase of the Proposed Project will ensure the qualitative and quantitative status of the receiving waters will not be altered by the Proposed Project.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Project. 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.

Residual Effects

The residual effect on GWBs is negative, imperceptible, indirect, temporary and unlikely.

The residual effect on SWBs is negative, imperceptible, indirect, temporary and unlikely.

Significance of Effects

For the reasons outlined above, no significant effects on WFD GWBs and SWBs status, risk or future objectives will occur as a result of the Proposed Project.

9.5.2.19 Potential Effects from Biodiversity Enhancement

Pre-Mitigation Effect

A Biodiversity Management Plan (BMP) has been prepared for the Proposed Project and is included as Appendix 6-5 of this EIAR. This BMP has been developed to offset the loss of habitats identified within the Project Site and further to enhance the biodiversity (flora and fauna, including birds) of the Project Site and its environs.

The proposed biodiversity enhancement includes the following ornithological mitigation and enhancement measures:

- The creation of a 246.27ha scrub mosaic habitat within 250m of the Proposed Turbines including the application of agricultural lime (calcium carbonate) and slow release fertiliser to accelerate the growth of scrub species and drain blocking where dry cutover peat exists and conditions are not optimal for germination;
- The enhancement of Lodge Bog will be achieved through:
    - Scrub removal and management and drain blocking;
    - The creation of 2 no. permanent waterbodies for Whooper Swan (7.8ha and 5.6ha). These areas coincide with wetland areas which have already undergone drain blocking and water pumping has ceased. The proposed measures include the controlled flooding of these areas to a depth of 1.5m.
    - The creation of 3 no. breeding wader areas (12ha, 7ha and 6ha). Drains in these areas have already been blocked under PCAS or the IPC licence rehabilitation works. There may be some requirement for areas to be reprofiled and slow release fertiliser will be applied.
- Approximately 60.7ha of forestry and woodland within Killina Bog will be felled and managed as open peatland. The process will be aided by drain blocking to create suitable habitat for golden plover.

The Proposed Enhancement Areas includes the following ecological offsetting and enhancement measures:

- Mitigation and enhancement for Marsh Fritillary;
- Peatland Enhancement across 4 no. blocks totalling an area of 263.79ha. The proposed works include drain blocking and rewetting to re-establish water levels at the bog levels at the bog surface, where possible, and to increase the extent of favourable conditions for the establishment of raised bog vegetation;
- Management of Peatland Adjacent to Proposed Project infrastructure;
- Pollinator connectivity; and,
- Woodland Enhancement.

The elements of the biodiversity enhancement which have the potential to impact on the water environment include the clear-felling of forestry and removal of vegetation, and the blocking of drains associated with both the peatland restoration and the creation of the waterbodies for Whooper Swan within Lodge Bog. The application of fertiliser also has the potential to result in effects on surface water quality. These drain blocking and creation of waterbodies will have a positive effect on the local hydrological regime, providing water attenuation and slowing the release of water from the Proposed Wind Farm site.

Pathway: Water volume and peat water level rise.

Receptor: Local peat bog hydrology/hydrogeology.

Description of Effects:

Positive, direct, moderate, permanent, likely effect on the local peat bog hydrology/hydrogeology.

Negative, indirect, slight, short-term, likely effect on downstream surface water quality.

Proposed Mitigation Measures

No specific mitigation measures are required in relation to the proposed peatland restoration or the controlled flooding of the whooper swan biodiversity enhancement areas. The proposed works will have a positive effect on bog hydrology/hydrogeology.

All felling and vegetation removal works undertaken in accordance with the mitigation measures prescribed in Section 9.5.2.12.

Slow release fertilisers will be used to reduce nutrient losses through leaching and surface runoff by releasing nutrients gradually in line with vegetation requirements. There will be no application of fertilizers within the hydrological buffer zones.

Impact Assessment: Following the implementation of the proposed biodiversity enhancement works, particularly the proposed Whooper Swan enhancement areas and the peatland restoration will have a positive effect on the bog hydrogeology. These areas of the Proposed Wind Farm site will likely be wetter, will retain more water and will recolonise with vegetation slowly. Furthermore, the mitigation measures detailed in the preceding sections for the protection of water quality will ensure that the biodiversity enhancement measures will not result in a significant effect on downstream water quality.

Residual Effect

The residual effects will be a moderate, positive, direct, permanent effect on local peat bog hydrology/hydrogeology and an imperceptible, negative, indirect, short-term, effect on downstream surface water quality.

Significance of Effects

For the reasons provided above, and with the implementation of the listed mitigation measures, no significant effects will occur.

9.5.2.20 Potential Effects Associated with Amenity Proposals

Pre-Mitigation Effect

The Proposed Project includes a total of 4 no. amenity car parks and approximately 55.2km of amenity track as detailed in Section 4.4.1.9 of Chapter 4. Construction of these features have the potential to affect downgradient surface water quality.

Pathway: Extraction/excavation of soil/subsoil.

Receptor: Surface water quality in downstream rivers and groundwater quality in the peat bog.

Description of Effects:

Negative, slight, indirect, unlikely, short-term effect on surface water quality. There is no potential for significant effects.

Negative, imperceptible, indirect, unlikely, long-term effect on groundwater quality. There is no potential for significant effects.

Proposed Mitigation Measures

Detailed mitigation measures for sediment control are outlined in Section 9.5.2.1. and detailed mitigation measures for control of hydrocarbons during construction works are outlined in Section 9.5.2.4.

No additional mitigation measures are required due to the small scale nature of the proposed works.

The proposed amenity works are limited in scale and will be subject to the sediment and hydrocarbon control measures. These measures will minimise the potential for effects on downstream surface water and groundwater quality. Significant effects are therefore considered unlikely.

Residual Effect

The residual effects are – negative, imperceptible, indirect, unlikely, short-term effects on surface water quality in downstream rivers and groundwater quality in the peat bog.

Significance of Effects

For the reasons given above, no significant effects on surface water and groundwater quality will occur.

9.5.2.21 Potential Effects Due to Turbine Delivery Route Works

Pre-Mitigation Effect

Minor temporary haul route works are required at several locations listed in Section 4.5.2.3 of Chapter 4, however all proposed road works are small-scale and localised, and no significant water quality effects are anticipated.

Due to the shallow nature of the temporary and permanent works effects on groundwater flows and levels are not anticipated. However, there is a potential for effects on groundwater and surface water quality from fuels and other chemicals during the construction phase.

Pathway: Surface water and groundwater flow paths.

Receptor: Down-gradient water quality.

Description of Effects:

Indirect, negative, slight, temporary, unlikely effect on surface water quality. There is no potential for significant effects.

Indirect, negative, slight, temporary, unlikely effect on groundwater quality. There is no potential for significant effects.

Proposed Mitigation Measures

The following mitigation measures are proposed:

Mitigation by Avoidance:

A constraint/buffer zone will be maintained for all upgrade works locations where possible. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The purpose of the constraint zone is to:

- Avoid physical damage to surface water channels;
- Provide a buffer against hydraulic loading by additional surface water run-off;
- Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;
- Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and,
- Provide a buffer against construction plant and materials entering any watercourse.

General Best Practice Pollution Prevention Measures will also include:

- No stock-piling of construction materials will take place within the constraints zone. No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
- Plant will travel slowly across bare ground at a maximum of 5km/hr.
- Machinery deliveries will be arranged using existing structures along the public road;
- All machinery operations will take place away from the stream and ditch banks, although no instream works are proposed or will occur;
- Any excess construction material will be immediately removed from the area and taken to a licensed waste facility or the on-site spoil management areas;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits will be available in each item of plant required; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Mitigation Measures relating to the use and storage of fuels and chemicals in terms of groundwater protection:

- No maintenance of construction vehicles or plant will take place along the temporary junction works areas;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- Spill kits will be available to deal with accidental spillage.

The temporary road improvement works have the potential to negatively impact the local surface water and groundwater quality, through increased sediment supply to the river channel, and the potential for fuel/oil spills which could impact surface water and groundwater. Proven and effective measures to mitigate the risk of excess runoff and fuel/oil spills have been proposed above and will break the pathway between the potential source and each receptor.

Residual Effect

The residual effect is an indirect, negative, imperceptible, temporary, unlikely effect on surface water quality.

Significance of Effects

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

9.5.2.22 Potential Effects on Mapped Wetlands

Pre-Mitigation Effect

This section addresses the potential effects of the Proposed Project on mapped wetland areas in response to the consultation received from IPCC and the pre-planning meetings with KCC.

The Irish Wetlands Map identifies the Proposed Wind Farm site as a wetland. This reflects the extensive areas of cutover bog and associated wetland habitats present across the Proposed Wind Farm site. The Irish Wetlands Map also identifies a number of specific locations within the Proposed Wind Farm site, including areas described as cutover bog, regenerating cutover bog and birch woodland.

The potential for the Proposed Project to result in a significant alteration of the hydrological conditions supporting wetland habitats is limited by the existing modified hydrological regime, the proposed layout and avoidance measures, the predominantly shallow and temporary nature of construction works, and the implementation of the proposed mitigation measures.

Therefore, the Proposed Project is not expected to result in a significant alteration of the hydrological conditions supporting wetland habitats within the Proposed Wind Farm site.

These mapped wetland areas have been considered in this impact assessment. A separate impact assessment is presented below which assess those ecologically sensitive areas identified by the ecology project team (Section 9.5.2.23).

The principal potential effects on wetlands are associated with temporary alteration of shallow groundwater flowpaths and peat water levels during construction, together with potential changes to surface water runoff, drainage patterns and surface water quality. The potential for effects is considered in the context of the substantially modified hydrological regime across the Proposed Wind Farm site resulting from historic peat extraction and associated drainage.

Pathway: Shallow groundwater flowpaths, surface water drainage and surface water discharge routes.

Receptors: Wetland habitats and associated wetland hydrological conditions within the Proposed Wind Farm, including cutover bog, regenerating cutover bog and associated wetland habitats.

Description of Effects: Negative, slight, indirect, short-term, unlikely effect on wetland habitats and associated wetland hydrological conditions. In the absence of mitigation measures, there is no potential for significant effects.

Proposed Mitigation Measures

The mitigation measures proposed to protect surface water and groundwater during construction are detailed in Sections 9.5.2.1 and 9.5.2.4 and include measures for sediment control, and the prevention of hydrocarbon releases.

In addition, the Proposed Project layout has, where practicable, avoided the most sensitive ecological areas.

Residual Effect

The residual effect is a negative, imperceptible, indirect, short-term, unlikely effect on wetland habitats and associated wetland hydrological conditions.

Significance of Effects

For the reasons outlined above, and with the implementation of the proposed mitigation measures, no significant effects on wetlands will occur.

9.5.2.23 Potential Effects on Raised Bog

Pre-Mitigation Effect

Construction phase activities at the Proposed Wind Farm site have the potential to impact peatland habitats through the alteration of the local hydrogeological regime. Excavations can require temporary dewatering which would impact on water levels in the surrounding lands. The Proposed Wind Farm infrastructure is proposed across a larger area of cutover raised bog whose hydrogeological regime has been significantly altered from its original condition due to the previous peat extraction and ancillary activities. The drainage modifications across the bogs all pre-date 1988.

The impact assessment presented herein has been informed by consultation between the hydrological and ecological project teams. This assessment addresses the potential effects on the areas of raised bog habitats identified by the project ecologists.

Pathway: Shallow ground water flowpaths.

Receptor: Peat water table in the remnant high bog and regenerating cutover bog.

No significant effects on the raised bog habitats will occur due to the following:

- The Proposed Wind Farm layout has largely avoided ecologically sensitive areas.
- The potential for effects is limited given the separation distance between the Proposed Turbines and the areas of raised bog (all Proposed Turbines are in excess of 100m from these areas including T13 and T14 which exist to the east of a large area of raised bog).
- The only infrastructure proposed within the 100m buffer zone comprises of underground cabling and access tracks. These works will not have the potential to significantly alter the local peat water table as the works are transient, shallow and minor in nature. The excavation of a shallow trench which will remain open for a very short-time period before it is reinstated and has very limited potential to result in any significant effects on the peat water table.
- The drainage in the cutover bog, surrounding the raised bog habitats, is already heavily modified.
- Large drains and face banks exist at the boundaries of the raised bog areas and water levels at the margins of the raised bog have already experienced drawdown.
- These drains also act as hydraulic barriers between the works area and the raised bog areas and are the primary control on water levels within the high bog.
- The presence of low permeability subsoils underlying the peat acts as a hydrogeological barrier, preventing groundwater recharge, essentially isolating the peat water table from the underlying regional groundwater system.
- Mitigation is provided in the EIAR to deal with typical construction phase groundwater quality hazards such as oils and fuels (refer to Section 9.5.2.4).

- No significant groundwater dewatering will be required for the Proposed Wind Farm and strict mitigation measures will be implemented with respect to the proposed piled foundations (Section 9.5.2.7).

Description of Effects: Indirect, negative, imperceptible, short-term, unlikely effect on peat water levels in the remnant areas of raised bog. With the absence of mitigation measures there would be no significant effect on peat water levels in the remnant high bog or regenerating cutover bog as the hydrological regime is already highly modified at the Proposed Wind Farm site. The Proposed Wind Farm drainage infrastructure is consistent with the baseline environment having significantly modified drainage from its natural state.

Proposed Mitigation Measures

The Proposed Wind Farm layout has largely avoided ecologically sensitive areas and the majority of works are located a significant distance from the areas of remnant raised bog.

Mitigation is provided in the EIAR to deal with typical construction phase groundwater quality hazards such as oils and fuels (refer to Section 9.5.2.4).

Residual Effect

The residual effect is a negative, imperceptible, indirect, short-term, unlikely effect on the areas of remnant raised bog.

Significance of Effects

For the reasons outlined above, and with the implementation of the above-listed mitigation measures, no significant effects on the areas of remnant raised bog will occur.

9.5.3 Operational Phase - Likely Significant Effects and Mitigation Measures

9.5.3.1 Potential Effects from the Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Pre-Mitigation Effect

Progressive replacement of the peat or vegetated surface with lower permeability surfaces will likely result in an increase in surface water runoff rates in the surface water drainage network. This could potentially increase discharge rates from the Project Site and increase flood risk downstream of the Proposed Project. In reality, the proposed internal access roads for the Proposed Wind Farm and the Proposed Onsite Substation will have a higher permeability than the existing peat. However, in the baseline scenario runoff rates are high as a result of the prevailing peat soils (96% runoff). In order to assess the potential change as a result of proposed internal access road and hardstand footprints we have increased the runoff rate to the maximum, i.e., 100% (4% higher than normal). The assessed footprint comprises Proposed Turbine foundations and hardstandings, internal roads, amenity tracks and carparks, site entrances, Proposed Onsite Substation, 2 no. met mast footprint and the relay mast footprint. During storm rainfall events, additional runoff coupled with the increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on water quality.

The assessment presented herein relates to the Proposed Wind Farm footprint and the Proposed Onsite Substation (25,615m^2) located within the Proposed Wind Farm site. The Proposed Offsite Substation and Proposed Grid Connection underground electrical cabling route are not considered further in this

assessment. The Proposed Offsite Substation is located within agricultural land and has a small footprint (9,307m^2) in comparison to the wider agricultural area within which it is located, while the Proposed Grid Connection underground electrical cabling route is located predominantly within the footprint of existing roads. Consequently, these elements of the Proposed Project will not result in a significant increase in impermeable or lower permeability surface area or a significant change in existing surface water runoff rates.

The emplacement of the proposed permanent Proposed Project footprint, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials under a precautionary scenario) could result in an average total site increase in surface water runoff of approximately 5,192m^3/month (Table 9-26). This represents a potential increase of approximately 0.12% in the average daily/monthly volume of runoff from the bogs associated with the Proposed Wind Farm and the Proposed Onsite Substation in comparison to the baseline pre-development site runoff conditions. This is a very small increase in average runoff and results from the naturally high surface water runoff rates and the relatively small area being developed, the proposed total permanent footprint being approximately 152ha, representing approximately 2.9% of the Proposed Wind Farm site (5,139ha).

Table 9-26: Baseline Site Runoff Vs Proposed Project Runoff

Development Type	Site Baseline Runoff/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)
Wind Farm	4,213,517	135,908	1,520,000	129808	124,615	5,192	167	0.12%

The additional volume is low due to the fact that the runoff potential from the Proposed Wind Farm site is naturally high (96%). Also, the calculation assumes that all hardstanding areas will be impermeable which will not be the case as internal roads and amenity tracks will be constructed of permeable stone aggregate. The increase in runoff from the bogs will, therefore, be negligible. This is even before mitigation measures will be put in place. Therefore, there will be no risk of exacerbated flooding downstream of the Proposed Wind Farm or the Proposed Onsite Substation.

Similarly, there will be no significant increase in runoff from the Proposed Offsite Substation due to its small footprint and the local hydrogeological regime which is characterized by high rates of surface water runoff and low rates of groundwater recharge.

Pathway: Existing drainage network.

Receptor: Surface waters and dependent ecosystems.

As stated in Section 9.3.5 above there are existing surface water control measures at the Proposed Wind Farm site as per the IPC licence which comprise high level bog surface drains, low level main drains and settlement ponds. All these existing drainage measures offer some surface water attenuation during rainfall events. However, as the part of the Proposed Wind Farm drainage and Proposed Onsite Substation drainage (which is outlined further in Section 9.4.1 and Section 9.4.2 above), it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed silt traps, settlement ponds and vegetated buffer areas prior to release into the existing drainage network. The new proposed drainage measures will then in effect create significant additional attenuation to what is already present at the proposed Wind Farm. The net effect of this will be a reduction in the overall runoff coefficient as demonstrated by the use of the Rational Method in Table 9-27 below. Based on a

conservative reduction in the runoff coefficient from 0.96 to 0.85 for the Proposed Wind Farm site, there would be a potential 13.25% reduction in runoff volumes. This assessment demonstrates that there will be no risk of exacerbated flooding down-gradient of the Proposed Wind Farm or the Proposed Onsite Substation as a result of the Proposed Project. The Proposed Project will, in effect, retain water for longer periods.

Table 9-27: Surface Water Runoff Assessment for Proposed Wind Farm and Proposed Onsite Substation Drainage

Proposed Wind Farm and Proposed Onsite Substation	C (1)	Area (m^2)	Rc (2)	100-Year 6hr Rainfall Depth (m)	Runoff Volume (m^3)	Total Site Runoff Volume (m^3)
Without Proposed Project Drainage Control						
Undeveloped Area	2.78	50,160,000	0.96	0.0528	7,027,313	7,250,425
Proposed Wind Farm and Proposed Onsite Substation Footprint	2.78	1,520,000	1.00	0.0528	223,111	
With Proposed Project Drainage Control						
Undeveloped Area	2.78	23,258,000	0.85	0.0528	6,222,100	6,288,615
Proposed Wind Farm and Proposed Onsite Substation Footprint	2.78	342,000	0.95	0.0528	66,515	
Estimated Potential Reduction in Site Runoff Volumes (%)						13.25%

Notes: 1 – Constant, 2- Runoff Coefficient

Description of Effects: Negative, slight, direct, permanent, unlikely effect on all downstream surface water bodies. There is no potential for significant effects.

Proposed Mitigation Measures

As the part of the Proposed Project drainage design, it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed silt traps, settlement ponds and vegetated buffer areas prior to release into the existing drainage network. The proposed operational phase drainage system is detailed in Section 9.4.3 above.

Residual Effect

With the implementation of the Proposed Project drainage measures as outlined above, and based on the post-mitigation assessment of runoff, the residual effect is a negative, imperceptible, indirect, long-term, likely effect on all downstream surface water bodies.

Significance of Effects

For the reasons outlined above, and with the implementation of the proposed drainage system, no significant effects on downstream flood risk will occur.

9.5.3.2 Potential Effects from Suspended Solids Entrainment in Surface Waters

Pre-Mitigation Effect

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads, hardstand areas and amenity tracks. 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.

The potential for sediment mobilisation during the operational phase is limited to minor and infrequent maintenance works. The permanent drainage measures, together with the proposed sediment and hydrocarbon control measures, will minimise the potential for suspended solids or pollutants to reach downstream watercourses. Significant effects on surface water quality are unlikely.

During maintenance works there is a small risk associated with release of hydrocarbons from site vehicles, although it is not envisaged that any significant refuelling works will be undertaken on-site during the operational phase.

Pathways: Drainage and surface water discharge routes.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.
- The River Boyne downstream of the Proposed Wind Farm site.

Description of Effects: Negative, slight, indirect, temporary, likely effect on downstream watercourses (Figile and Slate Rivers and their associated tributaries) and water-dependent ecosystems. No potential for effects on the River Boyne or the River Barrow. There is no potential for significant effects on surface water quality in the absence of mitigation measures.

Proposed Mitigation Measures

Mitigation measures for sediment control are the same as those outlined in Section 9.5.2.1.

Mitigation measures for control of hydrocarbons during maintenance works are similar to those outlined in Section 9.5.2.4.

Residual Effects

The residual effect is a negative, imperceptible, indirect, temporary, unlikely effect on surface water quality in the receiving and down gradient rivers.

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 Cement-Based Products

Pre-Mitigation Effect

During the operational phase, the placed concrete in turbine bases and foundations will remain in contact with the surrounding ground and groundwater and therefore have the potential to cause minor localised effects on groundwater quality through the release of cement-based products over time. However, due to the limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts considered to be imperceptible.

The concrete in turbine bases sets within 3 days of concrete pour. Therefore, the concrete foundations will be fully cured prior to commencement of the operational phase. The limited potential for interaction between the cured concrete and groundwater, together with the prevailing groundwater conditions and dilution within the wider groundwater system, means that any potential effects on groundwater quality are considered imperceptible.

Pathways: Site drainage network and groundwater flows.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm site.
- The River Barrow downstream of the Figile and Slate rivers.
- The River Boyne downstream of the Proposed Wind Farm site.
- Peat water hydrochemistry.

Description of Effects: Negative, imperceptible, indirect, short-term, likely effect to surface water quality in the Figile and Slate river and their associated tributaries. No potential for effects on the River Boyne or the River Barrow. There is no potential for significant effects on surface water quality in the absence of mitigation measures.

Negative, imperceptible, indirect, short-term, unlikely effect on peat water hydrochemistry. There is no potential for significant effects on groundwater quality in the absence of mitigation measures.

Proposed Mitigation Measures

None required.

Residual Effect

Negative, imperceptible, indirect, short-term, unlikely effect to surface water quality. Negative, imperceptible, indirect, short-term, likely effect on peat water hydrochemistry.

Significance of Effects

For the reasons given above, no significant effects on the surface water or groundwater quality will occur.

9.5.3.4 Potential Effects from the Release of Wastewater

Pre-Mitigation Effect

During the operational phase the wind farm control buildings and the Proposed Onsite Substation and the Proposed Offsite Substation compounds will include staff welfare facilities. The release of untreated wastewater can have a negative effect on water quality in the receiving watercourses and can also negatively affect groundwater quality.

The potential for contamination resulting from wastewater disposal is a risk to surface and groundwater quality. This is a risk common to all wind farm sites containing staff welfare facilities. Proven and effective measures to prevent the release of wastewater on-site have been proposed in the mitigation measures section and will the potential source and each receptor. The potential for effects is unlikely.

Pathways: Groundwater flowpaths and site drainage network.

Receptors:

- Surface water quality in the Figile River and its tributaries (Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbullogue and Ballygarrett streams) which receive discharge from the Proposed Wind Farm site and the Proposed Onsite Substation.
- Surface water quality in the Slate River and its tributaries (Killinagh Upper and Drumsru streams) which receive discharge from the Proposed Wind Farm.
- The River Barrow downstream of the Figile and Slate rivers.
- The tributaries of the River Liffey in the vicinity of the Proposed Offsite Substation.

Description of Effects: Negative, significant, indirect, temporary, unlikely effect on surface water quality in the Slate, Figile and Liffey rivers and their associated tributaries. Negative, imperceptible, indirect, temporary, unlikely effect on the River Barrow. There is no potential for significant effects on the River Barrow.

Negative, slight, indirect, temporary, unlikely effect on local groundwater. There is no potential for significant effects.

Proposed Mitigation Measures

It is proposed to install sealed underground holding tanks for effluent (wastewater) at the control buildings. The tanks will be routinely emptied by a licensed contractor. A level sensor will be installed in the tanks which will be linked to the on-site SCADA system. If the level of the tank contents rise to a predetermined ‘high‘ level a warning will appear on the overall SCADA system for the site and automatic notification will be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on-site. There will be no discharge of wastewater to ground at the Project Site, and therefore there is no potential to impact groundwater or surface water quality.

Residual Effect

The residual effect is a negative, imperceptible, indirect, temporary, unlikely effect on surface water or groundwater quality.

Significance of Effects

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

9.5.3.5 Potential Effects on Groundwater Levels from the Proposed Water Supplies at Substations

Pre-Mitigation Effect

It is proposed to install groundwater wells adjacent to both the Proposed Onsite Substation and the Proposed Offsite Substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The wells will be flush to the ground and covered with a standard manhole. An in-well pump will direct water to a water tank within the roof space of the control buildings.

The proposed groundwater wells and associated groundwater abstractions have the potential to affect local groundwater levels in the surrounding lands.

The abstraction rate for the proposed groundwater wells at the Proposed Onsite Substation and the Proposed Offsite Substation will be comparable to a domestic well, with a well supplying a single household typically abstracting less than $1m^3$/day. The wells are proposed in locally important aquifers which are moderately productive only in local zones. The aquifer at the Proposed Offsite Substation forms part of the Dublin GWB which is comprises poorly productive bedrock and groundwater flow will be concentrated in the upper weathered zone of the aquifer. The aquifer at the Proposed Onsite Substation forms part of the Kildare GWB which is also characterised by poorly productive bedrock. Therefore due to the nature of the underlying bedrock aquifers and the proposed abstraction rates, no effects on local groundwater levels will occur. There are no groundwater receptors or groundwater well supplies in the vicinity of the Proposed Onsite Substation or the Proposed Offsite Substation.

Pathway: Groundwater flow paths

Receptor: Groundwater levels

Description of Effects: Direct, negative, imperceptible, permanent, likely effect on local groundwater levels.

Proposed Mitigation Measures

No mitigation measures are required.

Residual Effects

Due to the scale of the proposed abstractions and the nature of the bedrock aquifers, the residual effect is a direct, negative, imperceptible, permanent, likely effect on local groundwater levels.

Significance of Effects

For the reasons given above, no significant effects on groundwater quantity will occur.

9.5.3.6 Potential Effects on Downstream Flood Risk

Pre-Mitigation Effect

Proposed Wind Farm

An SSFRA (Appendix 9-1) has been completed for the Proposed Wind Farm and the Proposed Onsite Substation. The SSFRA reveals that several flood zones are mapped within the Proposed Wind Farm site. The GSI Historical 2015/2016 flood map records historic surface water flood zones in several areas (refer to Section 0 above). In terms of Proposed Wind Farm infrastructure, the hardstand associated with T23 and sections of access road are mapped in this historical flood zone. No GSI 2015/2016 surface water flood zones are mapped at the Proposed Onsite Substation.

In addition to the GSI Historic Surface Water Flood zones, NIFM fluvial flood zones encroach upon the Proposed Wind Farm site. Some elements of the Proposed Wind Farm infrastructure are mapped within these flood zones. The flooding is likely to be a combination of fluvial and pluvial flooding due to the flat low-lying nature of the Proposed Wind Farm site and the low permeability of the soils and subsoils. The total footprint of the Proposed Wind Farm infrastructure mapped within the flood zones is (3.29ha) and includes the following areas: T46 Hardstand, Turning Head and Access Road, T42 Hardstand and Access Road and T45 Hardstand, T38 Hardstand and Access Road, T10 Hardstand, Access Roads and Turning Head, T22 Hardstand, Upgrade of Existing Site Access Roads at Site Entrance 1A and several watercourse crossings. Volumetric analysis has shown that the emplacement of the proposed infrastructure within the flood zones has no potential for significant effects and will only result in minor increase in flood water levels within the site. The cutover bogs comprising the Proposed Wind Farm site are flat and extensive and have sufficient capacity to buffer the effect of any displaced floodwater.

The Proposed Onsite Substation is mapped in Flood Zone C and is considered to be a low risk of flooding. The SSFRA includes volumetric analysis and recommends a 1m freeboard above the 1,000-year flood level. At this elevation the risk of flooding at the Proposed Onsite Substation is negligible.

Proposed Grid Connection

A SSFRA (Appendix 9-2) has also been prepared for the Proposed Grid Connection underground electrical cabling route and the Proposed Offsite Substation. This SSFRA demonstrates that the Proposed Offsite Substation is located in Flood Zone C and is at low risk of flooding. Some fluvial flood zones are mapped along the Proposed Grid Connection underground electrical cabling route. However, these occur at existing watercourse crossings along the R403. The Proposed Grid Connection underground electrical cable route will have no effect on flooding or mapped flood zones as no instream works are proposed at these locations.

Pathways: Drainage and surface water discharge routes.

Receptors: Proposed Wind Farm infrastructure as well as upstream and downstream receptors (i.e. property and people).

Volumetric analysis has shown that the emplacement of the proposed infrastructure within the flood zones has no potential for significant effects and will only result in minor increase in flood water levels within the site. The cutover bogs comprising the Proposed Wind Farm are flat and extensive and have sufficient capacity to buffer the effect of any displaced floodwater.

The Proposed Wind Farm site comprises of a large cutover bog which is characterised by shallow topographic gradients, artificial drainage networks and modified hydrology. Cutover bogs are extensive low-lying areas whose surface topography has been lowered by previous peat extraction activities. These settings are therefore often susceptible to flooding, either fluvial flooding from local watercourses

or pluvial flooding following intense or prolonged rainfall events. However, given the relatively flat topography and the extensive areas of cutover bog, flooding tends to be shallow and the existing drainage networks within the bogs reduce the flood sensitivity of the Proposed Wind Farm site. Any flooding at the Proposed Wind Farm site will comprise of slow moving and shallow waters which will spread out over a significant area, typically within lower peat fields. Any displacement of floodwaters, and associated increase in flood levels, by the Proposed Wind farm will be small and retained within the Site (as demonstrated below).

Description of Effects: Negative, moderate, direct, long-term, likely effect on proposed wind farm infrastructure. Negative, imperceptible, indirect, long-term, likely effect on downstream receptors (i.e. property and people). There is no potential for significant effects.

Proposed Mitigation Measures

The layout of the Proposed Wind Farm has been developed through a comprehensive and detailed design process, the design team was cognisant of the flooding constraints and the avoidance of these flood zones was prioritised wherever possible. However, the footprint of the Proposed Wind Farm infrastructure is not solely constrained by flooding but must consider a wide-range of constraints including ecological, hydrological and geotechnical constraints as well as turbine spacing and planning constraints. The final Proposed Wind Farm design was chosen to limit all potential environmental effects that the construction and operation of the Proposed Wind Farm may have.

The avoidance of fluvial flood zones was prioritised during the layout design but in some locations, infrastructure encroaches upon the modelled flood zones. The total footprint of the Proposed Wind Farm infrastructure mapped within the flood zones (3.29ha) represents only a very small percentage of the total footprint of the Proposed Wind Farm infrastructure (152ha). The total footprint of the Proposed Wind Farm infrastructure mapped within the flood zones (3.29ha) is negligible in comparison to the total area of the Proposed Wind Farm site (5,139ha) and represents 0.06% of the total Project Site area (5,157ha).

All proposed infrastructure will be constructed above known flood levels, and there will be no potential impediment for access of Emergency Service vehicles.

The Proposed Onsite Substation is mapped in Flood Zone C and is considered to be at low risk of flooding. The SSFRA includes volumetric analysis and recommends a 1m freeboard above the 1,000-year flood level. At this elevation the risk of flooding at the Proposed Onsite Substation is negligible.

The Proposed Offsite Substation is mapped in Flood Zone C and is considered to be at low risk of flooding. It will be constructed a minimum of 1,000mm above existing ground levels. At this elevation the risk of flooding at the Proposed Offsite Substation is negligible.

Residual Effects

With the implementation of the proposed wind farm drainage system and the small footprint of the infrastructure proposed within the flood zones, the residual effect is a negative, imperceptible, indirect, brief, unlikely effect on flood risk and downstream receptors (i.e. property and people).

Significance of Effects

For the reasons outlined above, there are no significant effects with regard to flood risk.

9.5.3.7 Potential Effects on WFD Status and Objectives

Pre-Mitigation Effect

A full assessment of the potential effects of the operational phase of the Proposed Project on the status of the receiving waterbodies is included in WFD Compliance Assessment Report attached as Appendix 9-4.

Pathways: Surface water flowpaths and groundwater flowpaths.

Receptors: WFD status of underlying GWBs and downstream SWBs.

Description of Effects: Indirect, negative, imperceptible, temporary, unlikely effect on downstream SWBs. In the absence of mitigation measures there is the potential for significant effects on downstream SWBs.

Indirect, negative, imperceptible, temporary, unlikely effect on the underlying GWBs. In the absence of mitigation measures there is no potential for significant effects on underlying GWBs.

Proposed Mitigation Measures

- Mitigation measures for sediment control are detailed in Section 9.5.3.2.
- Mitigation measures for the control of cement-based products are detailed in Section 9.5.3.3.
- Mitigation measures for wastewater are detailed in Section 9.5.3.4.

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters. Furthermore, the mitigation measures will also ensure the protection of groundwater quality and groundwater quantity.

We summarise that there will be no significant effects on GWB or SWB WFD status for the following reasons:

- The small footprint (152ha) of the Proposed Project in relation to the scale of the underlying GWBs;
- The nature of the operational phase and reduced works/disturbance;
- There will be no direct discharge from the Proposed Project to receiving waters; and,
- Mitigation measures for the protection of surface and groundwater water quality will be implemented during the operational phase of the Proposed Project to ensure that there is no deterioration in local or downstream water quality. These mitigation measures will ensure the qualitative status the receiving waterbodies remains unaltered by the Proposed Project.

Mitigation for the protection of surface and groundwater will ensure the qualitative and quantitative status of the receiving waters will not be altered by the Proposed Project.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Project. 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.

Residual Effects

The residual effect on GWBs is negative, imperceptible, indirect, temporary and unlikely.

The residual effect on SWBs is negative, imperceptible, indirect, temporary and unlikely.

Significance of Effects

For the reasons outlined above, no significant effects on WFD GWBs and SWBs status, risk or future objectives will occur as a result of the Proposed Project.

9.5.3.8 Potential Effects from Turbine Blade Erosion/Leaching

Pre-Mitigation Effect

Chemicals and materials associated with turbine blade coatings including forever chemicals (PFAS - polyfluoroalkyl substances) and microplastics are persistent in the environment and pose a risk to the water environment.

However, to date, there has been no published or peer-reviewed evidence which demonstrates that the normal operation of a commercial wind farm, or weathering of commercial wind turbine coatings, results in measurable concentrations of these substances entering the water environment. Furthermore, any rainfall contacting the Proposed Turbines will be dispersed over a wide area (i.e. the large geographic spread of the turbines). Any substances leached from the blade coatings would be subject to dilution, dispersion and natural attenuation across the bogs. While turbine blade coatings may contain harmful chemicals, there is currently no published evidence demonstrating that normal operation and weathering of commercial wind turbine coatings results in measurable concentrations entering the water environment. Any material released from the blades would be dispersed over a large area and subject to dilution, dispersion and natural attenuation before reaching surface water receptors. The potential for significant effects is unlikely.

Pathway: Surface water runoff, drainage and groundwater flowpaths.

Receptors: Surface water quality in the receiving watercourses and downstream rivers, and groundwater quality within the underlying aquifers.

Description of Effects: Negative, imperceptible, indirect, long-term, unlikely effect on surface water and groundwater quality. In the absence of mitigation measures, there is no potential for significant effects.

Proposed Mitigation Measures

The Proposed Turbine blades will be subject to routine inspection and maintenance in accordance with the turbine manufacturer's requirements. Where blade repairs or coating maintenance are required, appropriate procedures will be implemented to prevent uncontrolled release of coating materials to the environment.

No other specific mitigation measures are required.

Residual Effect

The residual effect is negative, imperceptible, indirect, long-term and unlikely on surface water and groundwater quality.

Significance of Effects

For the reasons outlined above, no significant effects on surface water or groundwater quality due to turbine blade erosion or leaching.

9.5.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the Proposed Project will be similar to those associated with the construction phase but of a reduced magnitude due to the smaller scale of the proposed decommissioning works.

A decommissioning plan will be agreed with both Offaly County Council and Kildare County Council prior to decommissioning of the Proposed Project. A decommissioning plan is included as Appendix 4-7.

During decommissioning, it may 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 and peat and spoil areas. This will be done by covering with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation. Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude. However, 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".*

Some of the effects will be avoided by leaving elements of the Proposed Project in place where appropriate. The Proposed Grid Connection, Proposed Onsite substation and Proposed Offsite substation will be retained by EirGrid. The turbine bases will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects, subject to the detailed decommissioning arrangement in place at that time.

The Project Site internal access roads could be in use for purposes other than the operation of the Proposed Project by the time the decommissioning of the Proposed Wind Farm is to be considered, and therefore it may be more appropriate to leave the Project Site internal access roads in situ for future use. It is envisaged that the roads will be widely utilised for amenity purposes by the local community.

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

No significant effects on the hydrological and hydrogeological environment are envisaged during the decommissioning stage of the proposed development.

9.5.5 Risk of Major Accidents and Disasters

The main risk of major accidents and disasters (MADs) at peatland sites is related to peat stability. However, there is no record of peat instability or historic peat slides at the Project Site. A peat stability risk assessment (Appendix 8-1) has been completed for the Project Site, and it concludes that with the implementation of the proposed mitigation measures that the risk of a peat failure at the site is negligible/none.

Flooding can also result in downstream MADs. Volumetric analysis has shown that the emplacement of the proposed infrastructure within the flood zones has no potential for significant effects and will only result in minor increase in flood water levels. The cutover bogs comprising the Proposed Wind Farm are flat and extensive and have sufficient capacity to buffer the effect of any displaced floodwater.

Furthermore, mitigation measures have been prescribed in Section 9.5.2.13 in relation to surface water flooding during the construction phase. The SSFRAs (Appendix 9-1 and 9-2) concludes that the Proposed Project will not result in any significant effects on the upstream or downstream flood risk during any phase of the Proposed Project.

A full assessment of MADs is provided in Chapter 17.

9.5.6 Assessment of Potential Health Effects

Potential health effects are associated with negative impacts (i.e. contamination) on public and private water supplies and potential flooding. There are no mapped PWS or GWS within the Project Site. The Ballykilleen and Bracknagh GWSs and the Clonbullogue, Robertstown, Edenderry and Rathangan PWSs are mapped in the vicinity of the Project Site, however the mapped source protection zone for this GWS does not fall within the Project Site. The local streams and rivers also acts as a hydrological barrier between the Project Site and these water supply schemes. Notwithstanding this, the Proposed Project design and mitigation measures ensures that the potential for impacts on the groundwater environment are not 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. SSFRAs (Appendix 9-1 and 9-2) have shown that the risk of the Proposed Project contributing to downstream flooding is also very low, as the long-term plan for the Proposed Wind Farm site is to retain and slow down drainage water within the existing site. On-site drainage control measures will ensure no downstream increase in flood risk.

9.5.7 Assessment of Potential Cumulative Effects

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

All of the developments, plans and projects listed in Section 2.10 of Chapter 2 were reviewed in terms of the potential for cumulative effects with the Proposed Project. 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 Proposed Wind Farm site (i.e. low permeability peat, silts and clays overlying predominantly poor bedrock aquifers) and the near surface nature of construction activities, cumulative impacts with regard groundwater quality or quantity arising from the Proposed Project are assessed as unlikely.

The cumulative study area for this assessment is the same as the Water Study Area shown in Figure 9-1.

9.5.7.1 Cumulative Effects with Turbary Peat Cutting

Private peat cutting on turbary plots at the periphery of the Proposed Wind Farm site will likely continue. The construction phase of the Proposed Project may interact with these turbary activities and result in a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However, private peat cutting is expected to be limited in extent and volume, which limits the potential for cumulative effects to arise in combination with the Proposed Project. Nevertheless, the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Project will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with turbary activities.

9.5.7.2 Cumulative Effects with Agriculture

The Project Site is situated within an agricultural setting, with elements of the Proposed Grid Connection being located on agricultural lands. Corine land cover maps (1990 – 2018) show that the majority of the surrounding lands are being used for agricultural purposes.

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 impact on local and downstream surface water quality.

The construction phase of the Proposed Project would have the potential to interact with these agricultural activities and contribute to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Project will ensure the protection of downstream surface water quality.

For these reasons outlined above, there will not be a significant cumulative effect associated with agriculture.

9.5.7.3 Cumulative Effects with Forestry

The Project Site and the wider hydrological cumulative study area includes some 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 felling may also give rise to modified stream flow regimes caused by associated land drainage.

Given the occurrence of several forestry blocks within the cumulative study area and given that they drain to the Figile and Slate rivers, the potential cumulative effects on downstream water quality and quantity has been assessed.

Replacement afforestation associated with the Proposed Project has also been considered as part of the cumulative assessment. From a water environment perspective, the principal potential cumulative pathways associated with afforestation establishment relate to sediment and nutrient mobilisation associated with ground preparation and drainage works. The potential for cumulative effects is therefore dependent primarily on hydrological connectivity to a common downstream receptor and temporal overlap with construction activities associated with the Proposed Project, rather than spatial proximity alone. Where replacement afforestation is not hydrologically connected to the same downstream receptors, no cumulative hydrological pathway would exist. Where lands are hydrologically connected, appropriate sequencing of BnM-controlled afforestation establishment relative to the principal earthworks and drainage works associated with the Proposed Project would avoid meaningful temporal interaction.

However, the mitigation measures detailed above in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Project will ensure the protection of downstream surface water quality.

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

9.5.7.4 Cumulative Effects with One Off Housing Developments

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within a combined river sub-basin zone within the vicinity of the Project Site.

Planning applications have been consulted within the cumulative study area described above. These applications are for new dwellings or renovations of existing dwellings, as well as for the erection of farm buildings. Based on the scale of the works, their proximity to the Project Site and the temporal period of likely works, no cumulative effects will occur as a result of the Proposed Project (construction, operation and decommissioning phases).

9.5.7.5 Cumulative Effects with other Wind Farm Developments

All consented, proposed and operational wind farms within 25km of the Project Site are detailed in Section 2.10.2.2 of Chapter 2 of this EIAR. Several wind farms have been identified in the cumulative study area. These include the 3 no. operational wind farms (Cloncreen, Cushaling and Mountlucas WFs) and 2 no. wind farms which has been granted planning permission (Cloncarrow WF and Ballinla WF). All other wind farm developments are located outside of the Water Study Area and have no potential to result in in-combination effects with the Proposed Project.

Table 9-28 below identifies operational, consented and proposed wind farms within the cumulative study area. Three of these wind farms (Cloncreen WF, Cushaling WF and Mountlucas WF) have already been constructed, significantly reducing the potential for cumulative effects with the Proposed Project. The EIARs for these wind farms detail mitigation measures for both the operation and decommissioning phases to ensure that there will be no significant effects on the water environment. Similarly, this chapter details strict, tried and tested, best practice mitigation measures for the protection of the water environment during the construction, operation and decommissioning phases. Therefore, there is no potential for significant cumulative effects with other wind farm developments.

Cloncarrow WF and Ballinla WF has been granted planning. The greatest potential for cumulative effects would occur if the construction phase of the Proposed Project was to overlap with the construction phase of either of these projects. However, Cloncarrow WF and Ballinla WF are accompanied by an EIAR which detailed mitigation measures for the protection of the water environment. Similarly, this chapter details strict, tried and tested, best practice mitigation measures for the protection of the water environment during the construction phase. Therefore, there is no potential for significant cumulative effects with these projects if the construction phases were to overlap.

Table 9-28: Wind Farm Developments within Water Study Area

Wind Farm Name	Status	Total No. Turbines	Sub-Catchment
Cloncarrow WF	Granted	4	Figile River
Cloncreen WF	Operational	21	Figile River
Cushaling WF	Operational	9	Figile River
Mountlucas WF	Operational	28	Figile River
Ballinla WF	Granted	7	Figile River

9.5.7.6 Cumulative Effects with Uisce Éireann Water Supply Project

Planning permission for the Eastern and Midlands Region Water Supply Project (WSP) has been submitted to ACP (Case no: 323980). The WSP includes an abstraction from Parteen Basin on the Lower River Shannon, and various elements of water supply infrastructure, which will extend from Parteen Basin, through the midlands, to Peamount in Co. Dublin. The Water Supply Project aim to increase water supply resilience in the East and Midlands region.

The pipeline associated with the UÉ Water Supply is proposed to pass through Codd 2, Glashabaun North, Glashabaun South and Derrybrennan bogs and will include a proposed abstraction from the Figile River (during the testing and commissioning phase). The planning application was submitted to ACP in December 2025 and the construction phase will commence in Q1 of 2028 and completes at Q4 of 2032, subject to planning approval. The WSP has been considered in the design of the Proposed Project and is considered in the cumulative impact assessments of this EIAR chapter. This approach has been adopted due to the potential for temporal overlap between the construction phases of the Proposed Project and the WSP, resulting in the possibility of concurrent construction activities within the Proposed Wind Farm site. Without appropriate management, concurrent construction works could result in cumulative pressures on the local water environment, including increased sediment generation and disturbance.

To minimise the potential for cumulative effects, the respective project teams will maintain ongoing liaison during the construction phases, as required. This will facilitate the exchange of programme information and coordination of construction activities where appropriate.

Furthermore, the EIAR submitted for the WSP concludes that following the implementation of the mitigation and control measures, there would be no significant effect and that the project would not compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater WFD designated water body and/or jeopardise the attainment of good surface water (or good ecological potential) or groundwater status. The EIAR includes detailed restrictions on abstraction rates from the Figile River (during the testing and commissioning phase) for a range of flow volumes to ensure that there are no significant negative effects.

Similarly, the mitigation measures prescribed in this EIAR for the Proposed Project, will ensure that there are no significant effects on the water environment and the WFD Compliance Assessment Report (Appendix 9-4) demonstrates compliance with WFD.

Considering the mitigation measures prescribed for both projects, and the coordination between construction teams, significant cumulative effects will not occur.

9.5.7.7 Cumulative Effects with Cutaway Bog Decommissioning and Rehabilitation Plans for the Allen Bog Group

The Applicant intends to utilise the Proposed Wind Farm site for both peatland rehabilitation and wind energy infrastructure in order to facilitate environmental stabilisation of the bog group.

The Draft Rehabilitation Plans for the 14 no. bogs of the Allen Bog group which form the Proposed Wind Farm site will be implemented in order to meet the requirements of the IPC licence. The Draft Rehabilitation Plans, provided as Appendix 2-4, detail the proposed restoration and rehabilitation measures to be implemented, and will be subject to consultation as well as input from the EPA prior to their implementation.

The overall footprint of the Proposed Project is approximately 2.9% of the total area of the Proposed Wind Farm site. The objective of the Draft Rehabilitation Plan is environmental stabilisation. The main risk to downstream surface water quality and the underlying groundwater quality associated with the Draft Rehabilitation Plans will occur whilst the restoration measures are being implemented. Cumulative effects could potentially occur if the restoration works and the construction phase of the Proposed Project were to overlap. However, the actions associated with the rehabilitation will be implemented once the Proposed Project has been constructed. This reduces the potential for cumulative effects. Furthermore, all works completed as part of the Draft Rehabilitation Plans, will be completed in accordance with IPC licence requirements and using standard best practice measures. This will ensure that there will be no negative effect on downstream surface water quality or quantity or underlying groundwater quality.

During the operational phase, the targeted rehabilitation within the Draft Rehabilitation Plans , such as drain blocking, will be implemented. The additional volumes of surface water runoff created by the construction of the Proposed Project infrastructure will be further attenuated within the bogs following the implementation of the rehabilitation measures. The Draft Rehabilitation Plans will improve both surface water quality and attenuation within the wider bog area, by slowing the movement of water and the stabilisation of substrates.

The interaction of the Proposed Project drainage infrastructure with the Draft Rehabilitation Plans is discussed in Section 9.4.3.1.1.

There will be no cumulative effects associated with the construction, operational or decommissioning phases of the Proposed Project and the Draft Rehabilitation Plans.

9.5.7.8 Cumulative Effects with Other Developments

All of the developments, plans and projects listed in Section 2.10 of Chapter 2 were reviewed in terms of the potential for cumulative effects with the Proposed Project.

The Edenderry Gas Pipeline (ACP Case No: 324280) overlaps with a small area of the Proposed Wind Farm in the vicinity of Edenderry Power Station and includes 2 crossings over the Ballykilleen Stream. An EIAR and WFD Compliance Assessment has been prepared for the Edenderry Gas Pipeline. These documents prescribe mitigation measures for the protection of the water environment and conclude that there is no potential for significant effects.

The mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Project will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with other large scale developments in the cumulative study area.

9.5.8 Post Construction Monitoring

The SWMP included as Appendix 4-6 details the post consent monitoring which includes monthly sampling for laboratory analysis during the first 6 months following construction. This will continue to be undertaken quarterly after construction is complete.

Monitoring will also continue in accordance with IPC Licence requirements.