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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

VOLUME 2 – MAIN EIAR

CHAPTER 12 – HYDROLOGY AND WATER QUALITY

Prepared for:

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12. HYDROLOGY AND WATER QUALITY

12.1 Introduction

This chapter examines the potential effects of the proposed Coumnagappul Wind Farm, associated grid connection and turbine delivery route on existing hydrological conditions, which may include changes to the surface water regime or water quality. Mitigation measures to reduce or eliminate effects on hydrology and water quality are prescribed as necessary. The assessment also considers the cumulative impacts associated with other nearby developments.

A full description of the Project assessed in this EIAR is provided in Chapter 2 Development Description and comprises the following elements:

- The wind farm site (referred to in this EIAR as the 'Site');
- The grid connection (referred to in this EIAR as the 'GCR');
- The turbine delivery route (referred to in this EIAR as the 'TDR').

The general layouts of the proposed wind farm site (Site), grid connection (GCR) and turbine delivery route (TDR) are presented in Figures 2.2 to 2.4 in Volume IV.

The plans and particulars submitted with this application for consent are precise and provide specific dimensions for the turbine structures. This EIAR assesses wind turbine specifications with a hub height of 104 m and a rotor diameter of 162 m with a tip height of 185 m.

Specifics of the Proposed Development which relate to hydrology are described in Section 12.7.

This Chapter is supported by Figures 12.1 – 12.5 provided in Volume IV, and should be read in conjunction with the following:

- Appendix 12.1, Volume III - Field Assessment Observations
- Appendix 2.1, Volume III - Construction Environmental Management Plan, Appendix D thereof – Surface Water Management Plan
- Drainage Planning Drawings (100 Series and 500 series) accompanying the planning application

12.2 Statement of Authority

Roberto Mione (MEng, BSc Civ. Eng) is a civil engineer specializing in windfarm drainage design, he possess the expertise and experience necessary to develop effective and efficient drainage systems for these complex projects. With a solid foundation in civil engineering principles, coupled with in-depth knowledge of windfarm infrastructure, Roberto is well-equipped to address the unique challenges posed by such installations. He has a comprehensive understanding of the industry's best practices, regulatory requirements, and environmental consideration, ensuring that designs optimize stormwater management, minimize erosion, and protect the overall integrity of the windfarm infrastructure.

Pablo Delgado, a Chartered Civil Engineer, has accumulated more than 8 years of professional experience in the hydraulic engineering domain. His specific area of expertise lies in the planning, design, and construction of hydraulic infrastructure projects, where he closely collaborates with Clients and Contractors. Pablo's primary focus centres around producing practical and efficient designs while proactively addressing any challenges that may arise throughout the project's execution. He possesses extensive knowledge in hydraulic design, enabling him to develop industry-leading guidelines and exhibit a high level of proficiency in drainage design, standards, and tools. Additionally, Pablo has a successful track record of delivering drainage designs within diverse project environments such as Design and Build (D&B) and Public-Private Partnership (PPP), including contributions to hydrologic and hydraulic chapters for Environmental Impact Assessments (EIA). His project portfolio encompasses engagements in the United Kingdom, Ireland, and Spain.

12.3 Study Area

The Study Area for hydrology and water quality comprises catchments, sub-catchments and sub-basins within which the Project is located, along with their associated waterbodies (refer to Figure 12.1, Volume IV). The delineation of the catchments and their waterbodies is defined by the latest "Cycle 3" Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) reporting and can be viewed via https://www.catchments.ie/ and https://gis.epa.ie/EPAMaps/Water. The characteristics and associated hydrological features of the catchments within which the Site, GCR and TRD are located are addressed within this Chapter and are listed in Table 12-1.

Table 12-1: WFD delineated waterbodies along the TDR, GCR and the Site

Catchment	Sub-catchment	Sub-Basin
Blackwater (Munster) Catchment (Hydrometric Area 18)	Finisk_SC_010	Finisk_020
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
		Colligan_020
		Colligan_030
		Colligan_040
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

Groundwater and hydrogeology is addressed in Chapter 11 - Land, Soils and Geology.

12.4 Consultation

This EIAR chapter has been compiled in light of the comments received from consultees throughout the EIA process, the relevant elements of which are summarised hereunder and presented in detail in Chapter 5 - EIA Scoping and Consultation.

12.4.1 Irish Water (IW)

IW advise that they do not have the capacity to advise on scoping of individual projects. However, they would like the following aspects of Water Services to be considered in the scope of an EIAR where relevant;

- If development impacts an IW Drinking Water Source the applicant provide details in ensuring no negative impact to IWs Drinking Water Source during construction and operational phases of the development
- A development discharging trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an IW collection network
- With management of surface water; the potential impact of surface water discharges to combined sewer networks & potential measures to minimise/stop surface waters from combined sewers
- Any impacts on the assimilative capacity of receiving waters in relation to IW discharge outfalls including changes in dispersion /circulation
- Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence/ present a risk to the quality of the water abstracted by IW for public supply
- Mitigation measures in relation to any of the above

12.4.2 National Parks and Wildlife Service (NPWS)

The following comments by NPWS were considered throughout this chapter:

- The proposed windfarm has the potential for significant changes in patterns of surface water flow and may desiccate the peat allowing pathways to open up resulting in subsurface water losses.
- A detailed site drainage map will be required and should show all existing watercourses, drainage ditches, flushes, lakes or ponds; new drainage ditches; all outfall points to watercourses or lakes; and all settlement ponds. The EIAR must demonstrate that the proposed wind farm development will not pose any threat to surface waters and associated species (e.g. Salmon). Any impact on water table levels or groundwater flows may impact on wetland sites some distance away. The EIAR should assess cumulative impacts with other plans or projects, if applicable. Where negative impacts are identified suitable mitigation measures should be detailed as appropriate.
- Construction work should not be allowed to impact on water quality and measures should be detailed in the EIAR to prevent sediment and/or fuel runoff from getting into watercourses which could adversely impact on aquatic species.

12.4.3 Waterford City & County Council

Waterford City & County Council highlighted the need for the EIAR to address the potential for direct and indirect impacts on water quality from excavation and soil stability as the upper reaches of the River Colligan are within a Blue Dot Catchment. The EIAR needs to demonstrate how the proposed development will impact on the objectives for protection of Blue Dot Catchments under the Water Framework Directive.

12.5 Methodology

12.5.1 Desk Study

The desk-based study assessed the surface water hydrology and water quality in the catchments relevant to the Project, including an assessment of the watercourses that will be crossed (through culvert or bridge) by the road infrastructure and those that will receive surface water runoff from the layout of the Site, GCR and TDR. The desk study involved an examination of the hydrological aspects and water quality aspects using the following sources of information (last accessed August 2023):

- Ordnance Survey Ireland mapping.
- Science and Stories about Integrated Catchment Management (https://www.catchments.ie/).
- OPW Indicative Flood Maps (https://www.floodinfo.ie/map/floodplans/).
- Geological Survey of Ireland (www.gsi.ie).
- History of flooding and status of drainage in the vicinity of the Proposed Development (available at http://www.floodinfo.ie/map/floodmaps/).
- Environmental Protection Agency river flow data (http://www.epa.ie/hydronet).
- Met Eireann Meteorological Database (available at https://www.met.ie).

12.5.2 Field Assessment

The field assessment of the existing hydrological environment within the Site, GCR and TDR, was undertaken to both verify desk-based assessment, record all significant hydrological features and assess the proposed crossing points along water features. Site walkover surveys were carried out by Roberto Mione on 05 October 2022 and 06 October 2022. Key tasks undertaken included;

- Identification of existing hydrological features and recording of locations for same;
- Measurements of on-site hydrological features, such as channel width, bank height and depth of water;
- Review of existing surface drainage network on and off site; and
- A photographic record of the hydrological features observed.

The site walkover involved a review of available information gathered in the desk study followed by a site visit. The key observations of surface water features are presented in Appendix 12.1, Volume III.

12.5.3 Relevant Legislation and Guidance

12.5.3.1 Relevant EU Directives and Legislation

The Water Framework Directive (2000/60/EC)[1]

[1] European Union, Water Framework Directive (2000/60/EC), 2000. Available online here:resource.html (europa.eu). Accessed August 2022.

Directive 2000/60/EC (WFD - Water Framework Directive) of the European Parliament and Council established a framework for community action in the field of water policy. The WFD requires EU member states to aim to reach good chemical and ecological status in inland and coastal waters. The WFD established a strategic framework for managing the water environment and requires a River Basin Management Plan (RBMP) to be developed every six years. River Basin Management Plan 2018-2021[2] has been prepared by Department of Housing, Planning and Local Government which sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in waterbodies (rivers, lakes, estuaries and coastal waters) by 2027.

The Third Cycle Draft River Basin Management Plan 2022-2027 has been published, has been subjected to public consultation and is expected to be published later this year (2023). The Draft Plan outlines the intended rollout of guidelines for planning authorities on the relationship between physical planning and river basin management planning.

The WFD has been transposed into Irish law following:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003).
- European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014).
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009).
- European Communities Environmental Objectives (Groundwater) Regulations, 2012 (S.I. No. 9 of 2012).
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2012 (S.I. No. 612 of 2012).
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011).
- The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations, 2009 (S.I. No. 296 of 2009).
- European Union (Drinking Water) Regulations, 2014 (S.I. No. 122 of 2014).

The Priority Substances Directive (2008/125/EC)

Directive 2008/125/EC of the European Parliament and Council of 16 December 2008 refers to the requirement to set environmental quality standards in the field of water policy, amended and subsequently repealed Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amended Directive 2000/60/EC of the European Parliament and Council. It is also known as the Priority Substances Directive (2008/125/EC) and was developed in response to the requirements of Article 16 of the WFD (2000/60/EC). The Priority Substances Directive requires the identification of priority substances to set Environmental Quality Standards (EQSs) for the concentrations of the priority substances in surface waterbodies and to review periodically the list of priority substances.

[2] Department of Housing, Local Government and Heritage, River Basin Management Plan for Ireland, 2017. Available online here: gov.ie - River Basin Management Plan 2018 - 2021 (www.gov.ie) Accessed March 2023.

The European Communities Environmental Objectives (Surface Water) Regulations 2009 as amended define the criteria and standards used for classifying surface waters in accordance with the WFD. There are five categories of surface water status: 'High', 'Good', 'Moderate', 'Poor' and 'Bad'. Additionally, the Regulations prescribe maximum allowable concentrations and annual average concentrations for priority substances used to define chemical status and required to support biological elements.

European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988)

The protected areas for Salmonid species are comprised of the 34 Salmonid rivers, tributaries and lakes listed in the Salmonid Regulations (S.I. 293 / 1988). These Regulations also prescribe quality standards for salmonid waters, the sampling programmes and the methods of analysis and inspection to be used by local authorities to determine compliance with the standards. The Salmonid Regulations designate the "waters capable of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*)" as protected.

The Colligan, Suir and Finisk rivers are not identified under the Salmonid Regulations.

12.5.3.2 Relevant Guidance

Regard was had to the following guidelines in the development of this chapter to identify relevant objectives relating to hydrology and surface water quality:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency (EPA), May 2022;
- The Planning System and Flood Risk Management - Guidelines for Planning Authorities - Department of Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW), November 2009
- Environmental good practice on site guide (fourth edition) (C741) - Construction Industry Research and Information Association (CIRIA), January 2015.
- Best Practice Guide BPGCS005 Oil Storage Guidelines (Enterprise Ireland)
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (National Roads Authority, 2005)
- Guidelines on Planning for Watercourses in the Urban Environment (Inland Fisheries Ireland, 2020)
- Guidelines on protection of fisheries during construction works in and adjacent to waters' to allow cable construction (Inland Fisheries Ireland, 2016)
- Good Practice During Wind Farm Construction (Scottish Natural Heritage 2019)
- The SuDS Manual (C753) - Construction Industry Research and Information Association (CIRIA), 2015
- Control of water pollution from linear construction projects (C648) – Construction Industry Research and Information Association (CIRIA), 2006;
- Control of water pollution from construction sites. Guidance for Consultants and Contractors (C532) - Construction Industry Research and Information Association (CIRIA), December 2001
- UK Guidance for Pollution Prevention (GPP):
    - GPP2: Above ground oil storage tanks (Natural Resources Wales (NRW), Northern Ireland Environment Agency (NIEA), the Scottish Environment Protection Agency (SEPA), Energy Institute, Oil Care Campaign, June 2021)
    - GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer (NRW, NIEA, SEPA, November 2017)

- GPP5: Works and maintenance in or near water (NRW, NIEA, SEPA, January 2017)
- GPP8: Safe storage and disposal of used oil (NRW, NIEA, SEPA, July 2017)
- GPP21: Pollution Incident Response Plans (NRW, NIEA, SEPA, July 2017)
- GPP22: Dealing with Spills (NRW, NIEA, SEPA, October 2018)
- GPP26: Safe storage of Drums and intermediate Bulk Containers (IBCs), (NRW, NIEA, SEPA, February 2019)

- GE-INT-01203- Introduction to the NRA Design Manual for Roads and Bridges (Transport Infrastructure Ireland, December 2013)
- Coillte (2013): Forest Operations & Water Protection Guidelines.

12.5.3.3 Objectives of the Waterford County Development Plan 2022-2028 for Surface Water and Flooding

The Waterford City and County Development 2022 - 2028 sets out the strategy for the proper planning and sustainable development of the City and County over the plan period from 2022 to 2028. The Plan also contains development management standards, policies and objectives and references statutory guidelines which will inform decision making over the period of the Plan. The approach is centred on the core principle of sustainability and compact growth with a focus on regeneration and economic development, supported by vibrant, liveable, climate resilient communities. This Chapter of the EIAR considers the objectives set out in the plan that relate to surface water and flooding. The key objectives are listed below:

- UTL 03- Water Supply & Drinking Water Regulations
- UTL 04: Drinking Water Report for Public Water Supplies
- UTL 08: Protection Water Resources
- UTL 09: Storm and Surface Water Management
- UTL 10: Flooding/SSFRA
- UTL 11: Flooding/SSFRA

The layout, design and construction methodology for the Proposed Development has taken account of these objectives, while ensuring compliance with the European Union Regulations and EPA policies and guidelines. Sustainable Drainage Systems measures have been incorporated into the design. Storm/ surface water management and run-off design has been carried out in accordance with Sustainable Urban Drainage Systems (SuDS) standards. Development in areas at risk of flooding will be avoided. Where possible, the causes of flooding to and from the Project will be reduced. Both ground and surface water resources will be protected.

12.6 Evaluation Criteria

The significance of likely effects has been assessed in accordance with the Environmental Protection Agency (2022) Guidelines through comparison of the character of the predicted effect to the sensitivity of the receiving environment, as per Image 12-1.

Categories for defining the sensitivity of the receiving environment are set out in Table 12-2.

The sensitivity of a hydrological receptor is based on its vulnerability to be impacted/altered by the development, i.e. the ability of the receptor to absorb development without perceptible change.

Table 12-2: Criteria for Determining Receptor Sensitivity

Sensitivity	Criteria	Typical Examples	
		Surface Water	Hydro-ecological receptors
High	Receptor has a high quality and rarity on a local scale and limited potential for substitution. Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly.	Surface water providing a regionally important drinking water resource. Surface water with high WFD status objective / Blue Dot catchments. Waterbodies identified as nutrient sensitive areas / waterbodies under WFD RBMP Cycle 2/3.	Protected under EU or Irish habitat legislation (e.g., Special Area of Conservation (SAC) or Natural Heritage Area (NHA)). Designated Salmonid / Cyprinid Waters. Nationally and internationally designated sites where hydrology/hydrogeology is a key factor in designation (e.g. SAC / NHA/ Special Protection Areas (SPA) sites)/ freshwater pearl mussel designated waterbodies and their associated catchments.
Medium	Receptor has a medium quality and rarity, local scale and limited potential for substitution/replacement or receptor with a low quality and rarity, regional or national scale and limited potential for substitution. Receptor is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high recoverability.	Watercourses with designate features such as Environmental or ecological significance, Cultural or historical value, recreational purposes and Water supply or drinking water sources. Large lakes with an extension of 50ha or more and non-potable reservoirs.	Statutory designated sites where hydrology/hydrogeology is a key factor in designation (e.g. National Nature Reserves (NNR), Local Nature Reserves (LNR)).
Low	Receptor with a low quality and rarity, local scale and limited potential for substitution. Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.	Watercourse with no designated features. Non-sensitive water resources (non WFD classified e.g. small lakes, ponds, land drain). Man-made feature not in hydraulic continuity (e.g. canal).	
Negligible	Attribute has a very low environmental importance and/or rarity on local scale.	Man-made feature with no ecological importance (e.g. farm land drainage ditches).	

Sensitivity	Criteria	Typical Examples	
		Surface Water	Hydro-ecological receptors
	Receptor is of negligible value, not vulnerable to impacts that may arise from the project and/or has high recoverability.		
Note	Professional judgement based on the baseline condition of the receptor should be used to determine a receptor's sensitivity.		

The surface hydrological environment of the Proposed Development and its downstream catchments are considered to be of **High sensitivity** given that both the Coligan and Nier catchments have a High WFD status Objective / are part of the Blue Dot Programme**.**

The scale of effect is determined in relation to the sensitivity of the receptor and the potential magnitude of change from baseline conditions, Image 12-1, presents how comparison of the magnitude of the predicted impact to the sensitivity of the receiving environment can determine the significance of the impact. Sensitivity of the receiving environment can be 'high', 'medium', 'low' or 'negligible'. Description of impact is defined by its character, magnitude, duration, probability and consequences (pre-mitigation). The magnitude of impact can be 'high', 'medium', 'low' or 'negligible'.

The conventional source-pathway-target model is applied to assess potential effects on environmental receptors resulting from the Proposed Development. The source being the activity that results in the potential effect or the potential source of pollution is described. The pathway being the route by which a potential source of effect can transfer or migrate. The receptor being a part of the natural environment that could potentially be affected, having regard to its sensitivity.

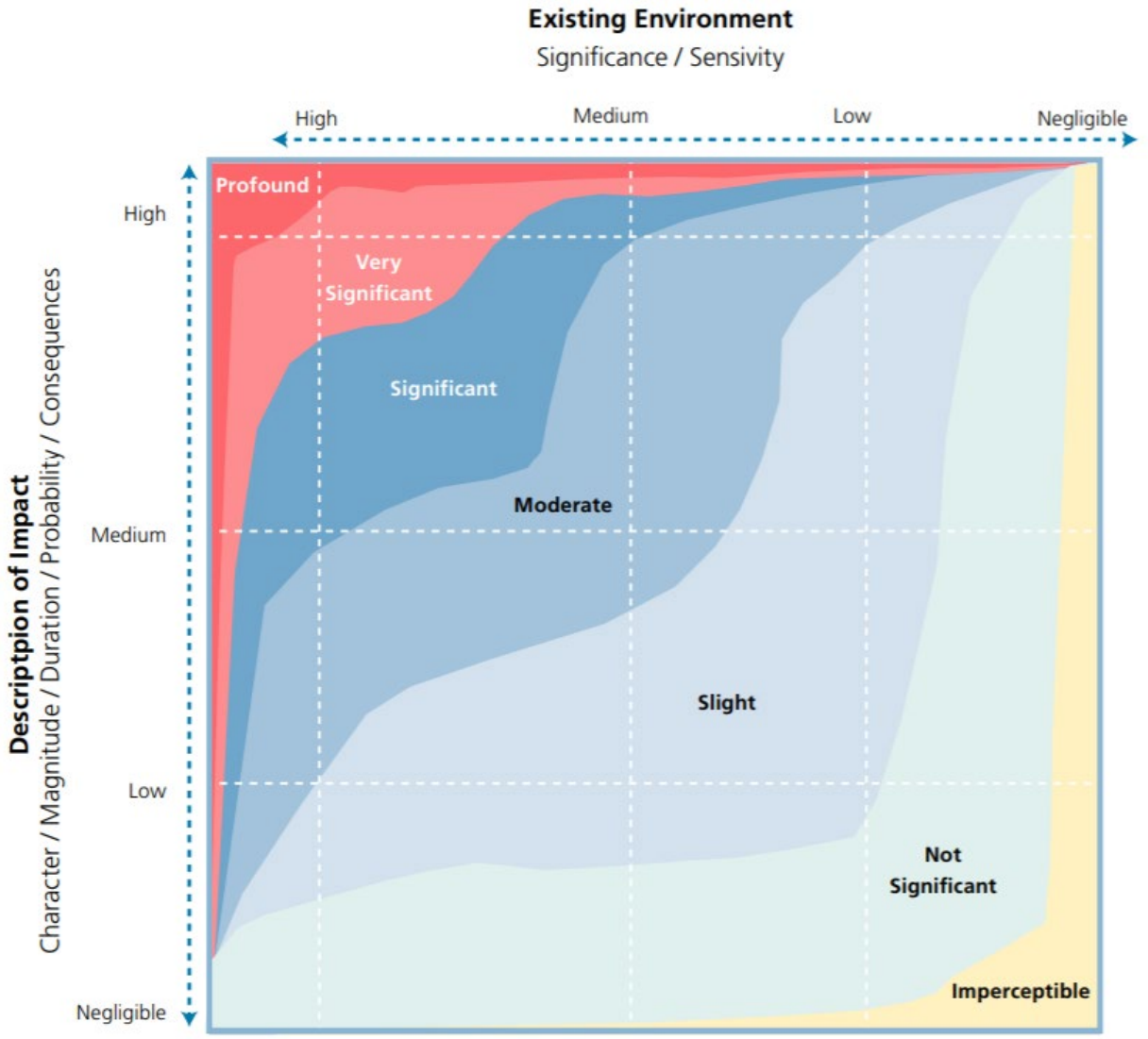

Image 12-1: Classifications of the Significance of Impacts

12.6.1.1 Assessment of Cumulative Impacts

The assessment of cumulative effects on the water environment considers the combined potential effects of other developments (existing, approved but not yet built or operational, or proposed), with the potential to affect the water environment, within the same catchment(s) as the Proposed Development, as discussed further in Section 12.10.5.

12.7 Project Description

12.7.1 Drainage Design

Surface water drainage features will be installed as part of the construction phase and retained where required such that they can be used during the decommissioning phase, ensuring that there would be no increase in the risk of surface water flooding to off-site areas during any phase of the Project. Further details of proposed site drainage is included in Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III of this EIAR and in Planning Drawings.

The drainage strategy within internal areas of the Site will incorporate three main components of Sustainable Drainage Systems (SuDS):

- Interceptor drains;
- Swales; and
- Settlement Ponds

A conceptual plan of the proposed drainage regime is included as Image 12-2 below.

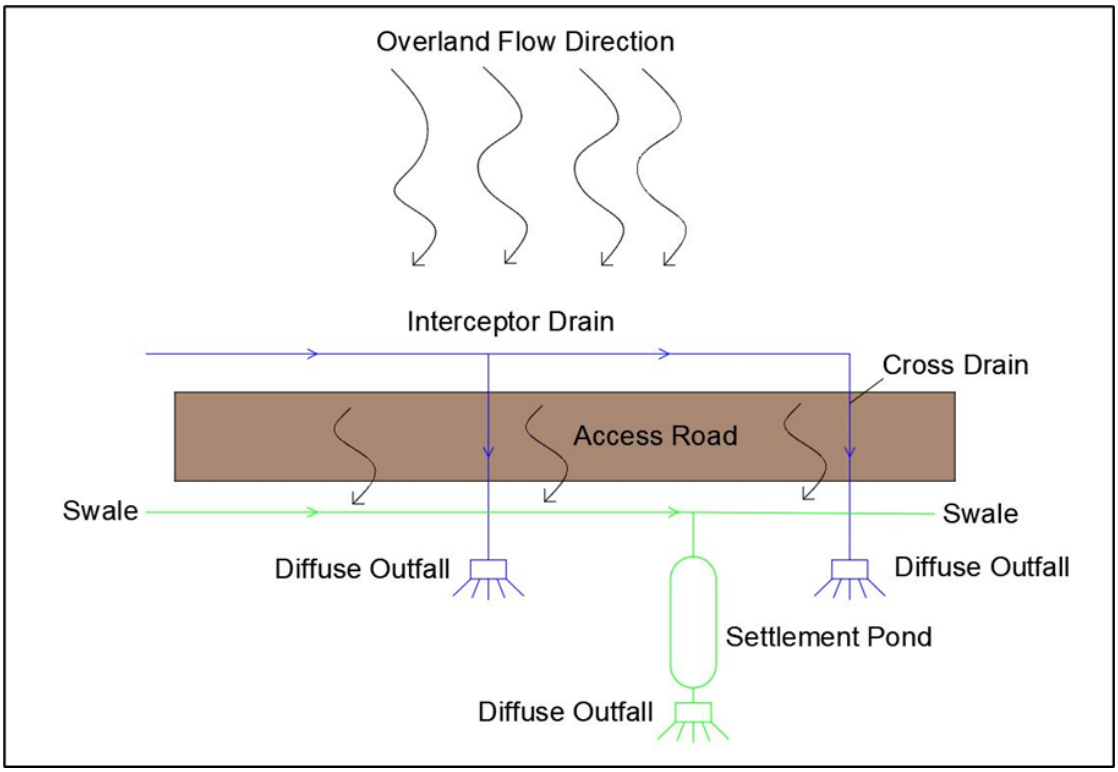

Image 12-2: Drainage Design Principles

Existing Undeveloped Areas

Interceptor drains will be constructed upslope of areas of hardstanding and new sections of access track. These will intercept overland flows from areas of undeveloped land, preventing mixing with runoff from access tracks and hard surfaces. These channels will direct flows around areas of hardstanding and across access tracks via cross drains at appropriate intervals. Flows will then be discharged diffusely across vegetated areas to minimise erosion and encourage evapotranspiration and infiltration to ground as per the existing drainage regime at the Site. Interceptor drains will be installed as part of the construction phase, in advance of earthworks, road and hardstand construction.

Where interceptor drains have a gradient of greater than 2%, crushed rock 'check dam' structures will be installed at appropriate intervals to reduce the velocity of the flows and prevent erosion.

Existing Tracks

Existing access tracks are generally drained by adjacent drainage ditches and swales. These drainage features will be retained and upgraded to the same standard as the proposed drainage design. Where existing tracks are widened, existing drainage will be realigned or replaced. The replacement sections of drain will have a similar gradient and width as existing channels to ensure the flow rate and capacity of the existing channel is retained and adequate for the contributing area.

All track widening will be undertaken using clean, uncrushable aggregate to allow for some dispersal of surface water runoff via infiltration and, therefore, reduce the rate of surface water runoff generated.

New Site Access Tracks and Hard Surfaces

The proposed internal access tracks will also be constructed using unbound aggregate materials which will allow a portion of surface water runoff to disperse via infiltration.

Vegetated swales will be installed adjacent to new access tracks and areas of hardstanding. These swales will be 0.5m in depth with 1 in 1 side slopes. Swales will be installed downslope of access tracks and hardstanding areas where coincident with the topography and will provide some attenuation for the surface water runoff during storm events.

Geotextile silt traps will be installed across the swales during the construction phase to prevent the ingress of silt and will remain in place until the vegetation has been established (refer to the Surface Water Management Plan for further details).

Where swales are constructed on slopes of greater than 2%, check dams will be installed at appropriate intervals to reduce flow velocities (refer to the Surface Water Management Plan for further details). By reducing flow rates, the check dams can also provide upstream storage within the swale allowing some dispersal via infiltration close to source rather than conveying all flows to a single larger downstream drainage feature, in accordance with the principles of SuDS.

Settlement ponds will be installed as construction progresses, and will be designed in accordance with the principles of CIRIA C648 (Control of water pollution from linear construction projects) and Stoke' law approach to ensure retention of the runoff and settlement of the particles to prevent sediment pollution to the receiving waterbodies. Ponds will be less than 1.5m deep with 1 in 3 side slopes. Runoff from access tracks and hardstands to the proposed swale networks will be discharged to these ponds and will be temporarily retained to allow for the settlement of sediment and suspended solids. During the construction phase, standing water from excavations will be pumped to settlement ponds and there will be no direct discharge to the existing drainage network prior to settlement.

Settlement ponds will not discharge directly to watercourses. Settled water will be discharged diffusely via an outfall to disperse via overland flow or into natural drainage features as per the existing regime. Discharge will be restricted to a rate at or below the existing greenfield runoff rate during storm events, and the ponds will be sized to accommodate flows for all storm events up to and including the 1 in 100 year event.

The settlement ponds will also contain surface water runoff in the event of a spill or leak, and the outflow can be closed off to retain any potential pollutants within the settlement ponds prior to any necessary treatment. Regular inspection and maintenance will be carried out to ensure the proper functioning of the settlement ponds and check dams (and timely identification of potential corrective maintenance needs). Ciria C753 SuDS manual will be adhered to, which provides guidance on the routine maintenance and inspections requirements for settlement ponds and check dams. Calculations on the sizing and location of the settling ponds are detailed in Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III of this EIAR and Planning Drawings.

Drainage of Temporary Site Compounds

The proposed construction compounds will be drained in a similar manner as the access tracks and hardstands, with surface water runoff from undeveloped areas intercepted and dispersed naturally, and surface water runoff from areas of hardstanding intercepted by swales and conveyed to settlement ponds. Surface water runoff from the compound area will be directed through a Class 1 Full Retention Separator Oil Interceptor (sized relative to area served) before discharge to the surface water drainage network.

There will be no discharge of foul flows from welfare units, with water retained in holding tanks and removed from site by a contractor.

Drainage of Substation

The substation will be drained via an underground piped surface water drainage network. The network will also utilise linear drainage channels and filter drains.

The network will discharge overland via a Class 1 Full Retention Oil Separator at a restricted greenfield rate. Attenuation for flows exceeding this rate will be provided within an underground tank.

In accordance with SuDS best practice, a rainwater harvesting tank will beincluded. Rainwater will be filtered and stored within the underground tank for reuse.

There will also be no discharge of foul flows from welfare units within the substation, with water stored in tanks and removed from site by a contractor.

12.7.2 Watercourse Crossings

Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010 requires that: “No Person, including a body corporate, will construct any new bridge or alter, reconstruct, or restore any existing bridge over any watercourse without the Consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners.”

The word “bridge” as defined in said Regulations includes a culvert or other like structure. The word “watercourse” as defined in said Regulations includes rivers, streams, and other natural watercourses, and also canals, drains, and other artificial watercourses.

The OPW is responsible for the implementation of the regulations and consent to construct any bridge will be sought from the OPW via their application process. Details on the application process and guidance / requirements of the bridge design and considerations in terms of flow can be found in the OPW guide Construction, Replacement, or Alteration of Bridges and Culverts (A Guide to Applying for Consent under Regulation 50 of the EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010 and Section 50 of The Arterial Drainage Act, 1945).

All watercourse crossings required for the Project will be subject to the requirements of Regulation 50.

12.7.2.1 Watercourse Crossings - Site

Within the Site there are three watercourses (mapped as Rivers by the EPA as part of the Water Framework Directive Reporting), as set out in Table 12-3 below, which will be required to be crossed by the turbine access roads within the Site.

River crossings will be designed in accordance with National Roads Authority guidance 'Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes', with clear span bridge being the preferable type of water crossing, with culverts used where a bridge would not be feasible. One single-span bridge and one open bottomed box culvert crossing and one piped culvert will be installed on these watercourses (see Table 12-3 for further details). The locations of watercourse crossings are shown on the 100 series Planning Drawings submitted as part of the planning application.

All other minor streams or drains within the Site (which are not identified as Rivers by the EPA in their reporting under the Water Framework Directive) which are crossed by the access roads will be collected by interceptor drains and carried under the road by cross drains. Further details on the locations of such cross drains are provided in the Surface water Management Plan in Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III of this EIAR and in the Drainage Drawings (100 series and 500 series Planning drawings).

Table 12-3: River Crossings within the Wind Farm Site

Watercourse Name	Coordinates: ITM	Width at Base	Width at top of bank	Bank Height	Depth of Water	Type of Crossing
Watercourse Crossing 4 - Skeheens Stream (COLLIGAN_010)	622466.431, 609322.014	2500mm	4000mm	600mm	c. 100mm	Open-bottomed box Culvert to replace existing river ford on forest access track. River comprises a cobble, gravel, silt and boulder substrate upstream and downstream of the ford. Flows are characterised by riffles and glides.

Watercourse Name	Coordinates: ITM	Width at Base	Width at top of bank	Bank Height	Depth of Water	Type of Crossing
Watercourse Crossing 5 - Knockavanniamountain Stream tributary of the Colligan River (COLLIGAN_010)	624882.65, 609163.46	1200mm	1800mm	450mm	Ponding Water	Piped Culvert Small stream comprising boulder cobble and gravel.
Watercourse Crossing 6 - Colligan River (COLLIGAN_010)	624241.28, 608601.32	2600mm - 3000mm	3300mm - 3500mm	450mm - 600mm	c. 100mm	Clear Span Bridge c. 15m in length High energy watercourse with bed substrate comprising boulder cobble and gravel.

A cross section of the single-span bridge is shown in Planning Drawing P2360-0300-0018. The soffit level of the bridge will provide a minimum freeboard of 300mm to allow a fluvial flood level of 1 in 100 years (+20%). The crossing will also be sized to convey the flow from 1 in 100 year (+20%) flood event unobstructed.

Culverts will be used at the remaining two river crossings (one open-bottomed box culvert and one piped culvert). These will also be sized to accommodate the 1 in 100 year (+20%) flood flow. Cross sections of an open-bottomed culvert and a piped culvert are shown in P2360-0300-0019 and P2360-0501-0002 respectively.

Construction methodologies are provided in Chapter 2 - Development Description.

With suitably sized culvert crossings, and a suitably-designed bridge, there will be no impact on flows within watercourses and the risk of flooding will not be increased as a result of the Proposed Development.

12.7.2.2 River Crossings - CGR

It is proposed to connect the development via underground cable to the existing Dungarvan 110kV substation. The proposed grid connection for the Coumnagappul Wind Farm is 22.47km in length and runs in a northerly direction from the existing Dungarvan 110kV Substation.

The GCR will consist of 3 No. 125mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications ducts and 1 No. earth continuity conductor duct to be installed in an excavated trench. The trench will be 825mm wide by 1,315mm deep with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings.

The river crossings associated with the cable route are presented in Table 12-2. Construction methodologies are provided in Chapter 2 - Development Description and Appendix 2.1 – CEMP (Appendix B thereof – Grid Connection Construction Methodology), in Volume III of this EIAR. Where required, all other minor stream or land drain crossings will be removed and reinstated in accordance with Inland Fisheries Ireland (2016) *'Guidelines on protection of fisheries during construction works in and adjacent to waters'* to allow cable construction.

Table 12-4: River Crossings on the GCR

Watercourse Name	Coordinates: ITM	Road Name	Crossing Type
Watercourse 1 - Coligan River (COLLIGAN_040)	623170.967, 595184.165 [Cable route Chainage 550m]	N72 - Bridge Crossing (TII bridge: WD-N72-007.00)	There is insufficient cover available to allow the ducts to be installed in the bridge deck. Therefore the watercourse will be crossed by Horizontal Directional Drilling (HDD) to pass under the bridge and riverbed. Entry and exit pits will be within the N72 road corridor.
Watercourse 2 - Ballynaguilkee Lower stream (FINISK_020)	620455.928, 603348.975 [Chainage 10,550m].	L1041	Existing culverted stream. The crossing method will use a culvert undercrossing or overcrossing method which will be selected based on the cover available above the culvert. Culvert crossings have been designed in line with ESB specifications. Where it is not possible to cross under an existing culvert while maintaining the culvert in place, the culvert may be replaced. All reinstatement works will be carried out to the required Waterford City & County Councils specification and in line with the 'Guidelines for Managing Openings in Public Roads – 2017'.
Watercourse 3 - Unnamed tributary of the Skeheens Stream (COLLIGAN_010)	621231.261, 608261.270 [Cable route Chainage 15,500m]	Unnamed road at a staggered crossroads (Bryan's Crossroads)	The cable will exit the public road and enter privately owned lands which are in agricultural use. Here the cable will cross the stream utilising an Horizontal Directional Drilling (HDD stream undercrossing). Entry and exit pits will be within the adjacent agricultural lands.
Watercourse 4 - Skeheens Stream (COLLIGAN_010))	622466.431, 609322.014 [Cable route Chainage 17,950m]	On the access road within the Wind Farm Site.	The crossing is an existing river ford (shallow point where a river or stream may be crossed by wading, or inside a vehicle getting its wheels wet) on the existing forestry track. The river bed has been modified and raised to allow this crossing. This crossing will be upgraded as part of the Project by replacement with an open-bottomed culvert. The cable ducting will be installed above the culvert.

12.7.2.3 River Crossing - TDR

The TDR crosses the Colligan River (COLLIGAN_040) on the N72 Bridge Crossing (TII bridge: WD-N72-007.00), however, no accommodation works are proposed at this location.

Works to accommodate turbine delivery are proposed at one watercourse only: the unnamed tributary of the Skeheens Stream (COLLIGAN_010) at Bryan's Crossroads (621231.261, 608261.270). These works will require that the delivery route enters private lands to the south of the crossroads (see extract from Abnormal Indivisible Load Route Survey in Image 12-3 hereunder, the full report is available in Appendix 2.2, Volume III). A temporary piped culvert crossing will be constructed, which will be a sized to accommodate the 1 in 100 year flood flow.

Construction methodologies are provided in Chapter 2 - Development Description.

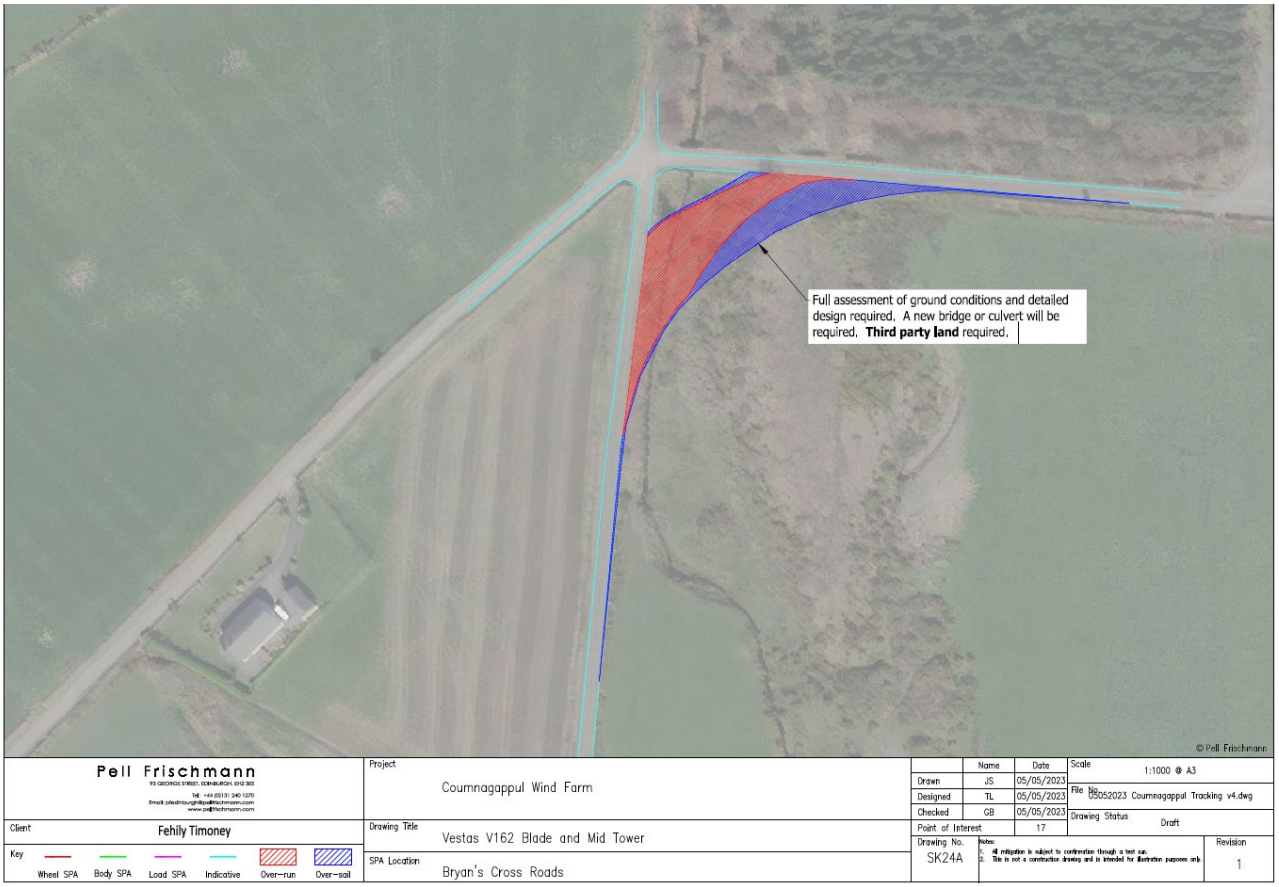

Image 12-3: Extract from Abnormal Indivisible Load Route Survey (Pell Frischmann, June 2023)

12.8 Existing Environment

12.8.1 General Description of the Catchments

This section describes catchment characteristics of the Site and the GC and the TDR.

Within the region, the surface water drainage and hydrology are delineated into three levels of hierarchy under the WFD: catchment, sub-catchment and sub-basin. Table 12-5 summarises the hydrology within the Site.

The Site is located within two waterbody catchments: these are the Colligan-Mahon catchment (Hydrometric Area 17) and the Suir catchment (Hydrometric Area 16). The Site is characterised by an extensive network of field drains, ditches and first-order streams which have been straightened and deepened in places through land management practices. Site topography is steep resulting in clusters of small runnels which join to form ditches, which, for the majority of the Site, drain to the Colligan River. There are no naturally occurring lakes or reservoirs within the Site. There are heavily modified surface waterbodies within the Site.

Within the Nier_020 sub-basin, the Shanballyanne stream drains away from the Site to the north. This drains into the Nier river, this in turn drains into the Suir river (sub-catchment Suir_SC_120).

Within the Colligan_010 sub-basin, the Skeheens Stream flows in a southerly direction along the western boundary of the Site and meets the Colligan river downstream. The Knockavanniamountain stream drains in a south-west direction near the centre of the Site, flowing into the Colligan river. The Glennaneanemountain stream and Carrigbrack stream flows in a south-west direction into the Colligan river near the southern boundary of the Site (outside of the Site). **See Figure 12.2, Volume IV** for map of hydrological features.

All of the wind turbines (turbine foundation and hardstanding) are located a minimum of 100m away from any mapped WFD surface water. There are two construction compounds proposed for the Project. The first is to be located at the access to the Site and will be located 20m west of the Skeheens Stream. The second is to be located to the north of the on-site substation, located 145m west of the Knockavanniamountain stream.

The GCR crosses Skeheens Stream which is within the Colligan_010 sub-catchment, and the Colligan River which is within the Colligan_010 sub-catchment. The GCR and TDR crosses the Ballynaguilkee Lower stream, which is tributary of the Blackwater River. The Blackwater River is a Special Area of Conservation (SAC). The Ballynaguilkee Lower stream is within the Finisk_SC_010 sub-catchment.

Table 12-5: WFD delineated waterbodies - Site

Catchment	Sub-catchment	Sub-Basin
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

Table 12-6: WFD Waterbodies - GCR

Catchment	Sub-catchment	Sub-Basin
Blackwater (Munster) Catchment (Hydrometric Area 18)	Finisk_SC_010	Finisk_020
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
		Colligan_020
		Colligan_030
		Colligan_040
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

Table 12-7: WFD delineated waterbodies - TDR

Catchment	Sub-catchment	Sub-Basin
Blackwater (Munster) Catchment (Hydrometric Area 18)	Finisk_SC_010	Finisk_020
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
		Colligan_020
		Colligan_030
		Colligan_040
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

There are several structures within the Colligan and Nier sub-catchments that have been identified by Inland Fisheries Ireland (IFI) in their National Barrier Programme[3] as potential barriers to fish passage. None of these potential barriers occur within the Site. There is one identified potential fish passage barrier along the GCR which is a culverted bridge crossing at Bryan's Crossroads (621201.08, 608421.30). However, at this location the grid route diverts off of the road and crosses the stream by HDD. The turbine delivery route will pass through Bryan's Crossroads and will require some accommodation works at this location. However, these works will not require any direct interaction with the bridge the route will divert off road at this location. As such, there will be no interaction with the structure at Bryan's Crossroads as part of the Project.

12.8.2 Rainfall

Rainfall data from Met Éireann was analysed which was recorded at Ballinamult (Doon) which is c.8 km south-west of the Site and associated infrastructure, Clonmel (Redmondstown) weather stations which is c.15 km north of the Site and associated infrastructure and Dungarvan (Carriglea) which is c.17 km south-west of the Site and associated infrastructure.

The rainfall data is presented in Table 12-9 Table 12-9 (source https://www.met.ie/climate/available-data/monthly-data).

The 30-year annual average rainfall at this location from 1992-2022 was calculated to be 1239.7mm at Ballinamult (Doon) weather station. The average rainfall at the wind farm Site may be higher than this due to relief rainfall as it is located at a higher elevation than the location of the station.

The M5-60 predicted rainfall value (a sixty minute storm that will occur with a frequency of once every five years) at the development location is 18.4 mm according to the Met Éireann rainfall data, as shown in Table 12-8.

[3]https://opendata-ifigis.hub.arcgis.com/datasets/national-barriers-programme-dataset/explore?location=53.323115%2C-8.002350%2C8.53

Table 12-8: Met Eireann Return Period Rainfall Depths (mm)

	Years		
Duration	**1**	**5**	**100**
1 hours	13.2	18.4	31.9
25 days	257.8	316.3	444.4

Table 12-9: Met Eireann Rainfall data

Total rainfall in millimetres for Ballinamult (Doon) weather station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	137.3												
2022	47.4	114.2	89.9	83.1	32.4	100.6	37	22.1	218.5	327.4	226	106.1	1404.7
2021	134.6	195.3	63	24.9	207	27.8	113.7	106.6	60.5	226.9	46.1	164.6	1371
2020	92.7	212.5	65.8	54.6	34.8	78.7	94.1	217.6	45.1	137.4	135.4	204.3	1373
2019	75.5	82	150.2	154.9	43.8	69.8	-	-	-	-	201	139.7	916.9
2018	166.4	53.9	129.7	150.1	45	23.4	47.7	46.4	91.5	66.8	210.7	228.1	1259.7

Total rainfall in millimetres for Clonmel (Redmondstown) weather station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2021	99.1	180.7											
2020	78	142.7	42.7	65	24.2	57.4	54	166.4	23.9	123.3	114	156.9	1048.5
2019	61.7	51.7	108.6	93.2	33.2	86.9	28	93.5	69	116.9	193.3	104.4	1040.4
2018	141.5	48.3	159.1	151.8	36.1	6.5	48.9	41.9	65.4	57.6	179.4	138	1074.5

Total rainfall in millimetres for Dungarvan (Carriglea) weather station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	120.5												
2022	43.5	102.9	108.1	51.4	36.8	86.2	23.8	32.2	175.7	264.9	192.1	125.5	1243.1
2021	128.4	186	43.4	19.9	172.3	22.5	82.4	112.4	56.1	211.6	32.1	148.2	1215.3
2020	86	165.9	51.9	60.4	41.6	66.8	79	180.3	38.5	109.9	156	175.6	1211.9
2019	66.6	-	116	-	-	-	26.8	104.7	100.2	191.8	177.6	122.8	906.5
2018	134.9	56.6	131.3	165.6	61.1	13.8	50.2	53.8	93	70.5	277.4	234.7	1342.9

12.8.3 Historical Flooding

Online OPW mapping does not show any recorded historical flooding events within the Site.

There was a recurring flooding noted at the final section of the GCR along the N72 approximately 300m before Dungarvan substation at the Colligan River at Kildangan Bridge (Flood ID 3812). A combination of heavy rain and high tides causes overbank flow from the Colligan on a recurring basis. A factory and the N72 road flooded periodically. The TDR also passes through this area. There were additional recurring flooding events noted along the TDR at Carroll's Cross N25 (Flood ID 3953), following heavy rainfall, the N25 National Primary Road is regularly flooded and at Kildermod (Flood ID-3958) where the N25 National Primary Road has flooded regularly due to rainfall runoff from adjacent high ground. This may cause disruption when turbines are being delivered during the construction phase and this will be managed accordingly.

'Benefiting lands' are defined as a dataset prepared by the Office for Public Works (OPW) identifying land that might benefit from the implementation of Arterial Drainage Schemes (under the Arterial Drainage act 1945) and areas of land subject to flooding or poor drainage. There are no areas defined as 'benefiting lands' within the Site, GCR or TDR.

12.8.4 Surface Water Quality

WFD water quality status (2016-2021) and river waterbody risk for the Colligan, Finisk and Nier Rivers are provided in Table 12-10.

Within the Colligan_010 sub-catchment, the WFD ecological status is assigned as 'Good' for all the streams identified in Table 12-10. The Colligan River has a High Status WFD objective. The streams within the sub-catchment are reported to be 'Not at Risk'[4]. The assigned status is based upon assessment of biological (macroinvertebrate indicative of High Status) and hydromorphological conditions (indicative of Good Status). No physiochemical monitoring is carried out within this sub-catchment.

Further down the catchment (sub-catchment Colligan_020) the river degrades to Moderate Status. This Moderate Status is driven by a Moderate Fish Status (as per IFI 2017 monitoring) as per the one-out-all-out rule. All other monitored conditions (hydromorphological, invertebrate and supporting chemical conditions) are identified as representing High or Good Status. Notwithstanding this, the sub-catchment is identified as being 'At Risk' from Anthropogenic Pressures (which include nutrient, organic and sediment pollution). There are no works associated with the Project within this sub-catchment.

Within the Nier River sub-catchment the Shanballyanne stream is reported to have a 'Moderate' ecological status (which has been driven by the biological status, with the supporting chemistry conditions indicating Good to High conditions). The WFD objective for this waterbody is to achieve High Status. It was also reported that the waterbody it is 'At Risk' in the WFD Cycle-2 programme with 'Forestry pressure' (forestry, drainage, clear felling, planting and establishment stage) identified for the catchment . The Project will not require any clearance of forestry within the Nier River sub-catchment.

[4] Environment Protection Agency, 2021. 3rd Cycle Draft Colligan-Mahon Catchment Report (HA 17). Available online here: Data - Catchments.ie - Catchments.ie

Within the Finisk-020 sub-catchment, the WFD ecological status is 'Moderate' and includes the Ballynaguilkee Lower stream identified in Table 12-10. This Moderate Status is driven by nitrogen conditions in the waterbody and by fish status. The objective for this waterbody is to achieve Good Status. The WFD risk is 'Under Review'[5]. The works associated with the Project within this sub-catchment relate to the grid connection and are confined to the road and will require a crossing of a culverted section of the Ballynaguilkee Lower stream, near its headwater(which has a sluggish flow seeping through wet grassland), noting that this existing structure is not identified on IFI's National Barrier Programme.

Table 12-10: WFD River Status and River Waterbody Risk

Watercourses (as shown on Figure 12-2)	Waterbody	River Status	Waterbody Risk
Wind Farm			
Shanballyanne stream	Nier_020	Moderate	At Risk
Knockavanniamountain stream	Colligan_010	Good	Not at Risk
Glennaneanemountain stream	Colligan_010	Good	Not at Risk
Carrigbrack stream	Colligan_010	Good	Not at Risk
Grid Connection Route (GCR)			
Skeheens Stream	Colligan_010	Good	Not at Risk
Ballynaguilkee Lower	Finisk_020	Moderate	Under Review
Colligan River	Colligan_040	Good	Not at Risk

Regarding surface water features local to the Site, the Knockavanniamountain stream , Glennaneanemountain stream, Carrigbrack stream all drain from the Site into the Colligan river. The Colligan river, draining southwards from the Site, was given a Biological Quality Rating of Q4-5 in 2022 as shown in Table 12-11.

The Shanballyanne stream drains in a northern direction from the Site into the Nier river. The Nier river, draining in a western direction, was given a Biological Quality Rating of Q4 in 2022 as shown in Table 12-11.

The EPA has identified the Lower River Suir Catchment (which includes the Nier sub-catchment) and the Blackwater Estuary Lower Catchment (which includes the Finisk sub-catchment) as catchments of interest in relation to sensitivity to nutrient loading.

[5] Environment Protection Agency, 2022. WFD Cycle 2, Catchment Blackwater (Munster), Subcatchment Finisk_SC_010. Available online here: Subcatchment Assessment (catchments.ie)

Table 12-11: EPA Biological Water Quality Rating

Sub-Basin	Station ID	Station Location	1981	1984	1987	1991	1996	1998	2001	2004	2007	2010	2013	2016	2019	2022
Colligan_010	RS17C010090	Scart Br (West)			4-5	4	4-5	4-5	4	4-5	4-5	4-5	4	4-5	4-5	4-5
Colligan_010	RS17C010100	Scart Br (East)	5	4	4-5	4	4-5	4-5	4	4-5	4	4-5	4	4-5	4-5	4-5
Colligan_010	RS17C010150	Br ESE of Lackandarra					4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5
Colligan_010	RS17C010180	Colligan Br			4	4	4-5	4-5	4-5	4-5						
Colligan_010	RS17C010250	Br nr Killadangan				4	4	4	4	4	4	4	3-4	4	4	4

Sub-Basin	Station ID	Station Location	1976	1983	1988	1992	1996	1999	2002	2006	2008	2011	2014	2017	2018	2019	2020
Nier_020	RS16N010010	Br SW of Glennanore					4-5	4	4-5	4-5	4-5	4-5	4-5	3-4		4	4
Nier_020	RS16N010030	Birchell's Br			4	4-5											
Nier_020	RS16N010070	Br SW of Knockalisheen			5	5	4	4	4-5								
Nier_020	RS16N010100	Br.ENE of Ballymacarby		4-5	4-5	4-5					4-5	4-5	4	3-4	3-4	4	4
Nier_020	RS16N010200	Deerpark Bridge			4-5	4-5	4	4	4	4							
Nier_020	RS16N010300	Four Mile Water Br		4-5	4-5	5											
Nier_020	RS16N010400	Ballymakee Br	5	5	4-5	4-5	4-5	4	4	4	4	4	4	4			4

12.8.5 Water Dependent Protected Areas

The EPA in 2018, to inform the WFD River Basin Management Plan Cycle-3, identified Special Areas of Conservation and Special Protection Areas that have protected water dependent habitats or species. While the Project is not located within any of these protected areas, the waterbody catchment in which the Project is located overlap with such protected areas as follows:

- An area of the Site is located within the Nier_020 sub-catchment which drains to the River Suir, which is designated as part of the Lower River Suir SAC (site code 002137). The SAC is selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive, almost all of which are water dependent habitats or species: Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330], Mediterranean salt meadows (Juncetalia maritimi) [1410], Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260], Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430], Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0], Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0], Taxus baccata woods of the British Isles [91J0], Margaritifera margaritifera (Freshwater Pearl Mussel) [1029], Austropotamobius pallipes (White-clawed Crayfish) [1092], Petromyzon marinus (Sea Lamprey) [1095], Lampetra planeri (Brook Lamprey) [1096], Lampetra fluviatilis (River Lamprey) [1099], Alosa fallax fallax (Twaite Shad) [1103], Salmo salar (Salmon) [1106], Lutra lutra (Otter) [1355][6].
- The Blackwater River (Cork/Waterford) SAC (site code 002170) is partially located within the Finisk_SC_010 cub-catchment. The GCR and TDR accommodation works crosses the Ballynaguilkee Lower stream (which is not part of the SAC) which flows into the River Finisk ca. 2.2km downstream, at which point the Finisk is part of the Blackwater River (Cork/Waterford) SAC. The SAC is selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes), almost all of which are water dependent: [1130] Estuaries [1140] Tidal Mudflats and Sandflats [1220] Perennial Vegetation of Stony Banks [1310] Salicornia Mud [1330] Atlantic Salt Meadows [1410] Mediterranean Salt Meadows [3260] Floating River Vegetation [91A0] Old Oak Woodlands [91E0] Alluvial Forests* [1029] Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1092] White-clawed Crayfish (*Austropotamobius pallipes*) [1095] Sea Lamprey (*Petromyzon marinus*) [1096] Brook Lamprey (*Lampetra planeri*) [1099] River Lamprey (*Lampetra fluviatilis*) [1103] Twaite Shad (*Alosa fallax*) [1106] Atlantic Salmon (*Salmo salar*) [1355] Otter (*Lutra lutra*) [1421] Killarney Fern (*Trichomanes speciosum*)[7]

[6] NPWS (2017) Conservation Objectives: Lower River Suir SAC 002137. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
NPWS (2012) Conservation Objectives: Blackwater River (Cork/Waterford) SAC 002170. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

- The Wind Farm Site is located within the Colligan_010 sub-catchment, which drains the foothills of the Comeragh Mountains, which are designated as part of the Comeragh Mountains SAC (site code 00195) (also a pNHA). The Comeragh Mountains consist of a plateau of Old Red Sandstone with its edges deeply scarred by recent glaciation. The SAC is selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes): [3110] Oligotrophic Waters containing very few minerals [3260] Floating River Vegetation [4010] Wet Heath [4030] Dry Heath [4060] Alpine and Subalpine Heaths [7130] Blanket Bogs (Active)* [8110] Siliceous Scree [8210] Calcareous Rocky Slopes [8220] Siliceous Rocky Slopes [1393] Slender Green Feather-moss (*Drepanocladus vernicosus*)[8].

Further information is provided on protected sites in the Biodiversity Chapter 9.

12.8.6 Internal Main Wind Farm Site Drainage

As stated in Chapter 2 - Development Description, the proposed wind farm Site supports a small area of commercial conifer forestry, expansive areas of heathland, areas of exposed rock and small parcels of improved agricultural grassland. The lands are used for cattle and sheep grazing.

The Site has significant manmade drains throughout with runoff dispersing via a combination of infiltration, evapotranspiration and overland flow. All the watercourses within the Site are unmodified, however there are several extensive deeply cut land drains.

12.8.7 Drain Crossing Infrastructure

There are 2 existing tracks that will be upgraded as part of the Proposed Development. One is a forestry track and one is an agricultural track. The agricultural track does not cross any existing drains/streams. The forest track crosses the Colligan River (Skeheens Stream) by a forded crossing, which will be upgraded to an open-bottomed box culvert crossing, and the existing concrete slab which is in place for fording the river will be removed.

Surface water runoff from the existing access tracks within the Site generally discharge to adjacent drainage channels. Flows then disperse naturally by infiltration and evapotranspiration within the channel, with excess flows directed to areas of open ground.

[8] NPWS (2021) Conservation Objectives: Comeragh Mountains SAC 001952. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage

12.9 Flood Risk Identification and Assessment

12.9.1 Methodology

National Planning Policy

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) was published in 2009 by the Office for Public Works (OPW). These outline the core objectives for the management of flood risk, including those for new planning applications. Flood risk is defined as a combination of two components:

- The likelihood/probability of flooding; and
- The consequences of flooding.

The PSFRM Guidelines divide geographical areas into three flood zones based on the probability of flooding:

- Zone A (High Risk): a probability of greater than 1 in 100 (1% Annual Exceedance Probability) for river flooding or 1 in 200 (0.5% AEP) for coastal flooding;
- Zone B (Moderate Risk): a probability of between 1 in 1000 and 1 in 120 (0.1% - 1.0% AEP) for river flooding and 1 in 1200 and 1 in 200 (0.1% - 0.5% AEP) for coastal flooding; and
- Zone C (Low Risk): a probability of less than 1 in 1000 (0.1% AEP) for both river and coastal flooding.

The PSFRM Guidelines are based on a 'sequential' approach to ensure that new development is directed towards land at a low risk of flooding. If a Proposed Development lies within a higher risk area, appropriate justification is required and measures for mitigating the flood risk are to be identified via the Justification Test.

The consequences of flooding depend on the hazards caused by flooding (e.g. depth of water, speed of flow, rate of onset and water quality) and the vulnerability of the receptor. Table 3.1 of the Guidelines, reproduced as Table 12-12 below, outlines the three vulnerability classifications and examples of the types of development included.

Table 12-12: Vulnerability Class and Development Types

Vulnerability Class	Example Land Use and Types of Development
Highly Vulnerable Development (including Essential Infrastructure)	• Garda, ambulance and fire stations and command centres required to be operational during flooding; • Hospitals; • Dwellings, student halls of residence, hostels, residential institutions (care homes, children's homes and social services homes), dwellings designed/constructed/adapted for the elderly or people with impaired mobility; • Caravans and mobile home parks; • Essential infrastructure including primary transport and utilities distribution, electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution in the event of flooding.
Less Vulnerable Development	• Buildings used for retail, leisure, warehousing, commercial, industrial and non-residential institutions • Land and buildings used for holiday or short-let caravans and camping (subject to specific warning and evacuation plans) • Land and buildings used for agriculture and forestry • Waste treatment (except landfill and hazardous waste) • Mineral working and processing • Local transport infrastructure
Water-Compatible Development	• Flood control infrastructure • Docks, marinas and wharves • Water-based recreation and tourism • Amenity open space, outdoor sports and recreation and essential facilities

Table 3.2 of the Guidelines, reproduced in Table 12-13 below, states what types of development would be appropriate within each Flood Zone and those that would be required to meet the criteria of the Justification Test.

Table 12-13: Appropriate Development within Flood Zones

Vulnerability	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable development (Including Essential Infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-Compatible Development	Appropriate	Appropriate	Appropriate

The OPW published the Flood Risk Management Climate Change Sectoral Adoption Plan for Flood Risk Management in 2015 (updated in 2022) and provides information on the potential changes in flood hazard as a result of climate change. The Plan outlines two potential future scenarios:

- Mid-Range Future Scenario (MRFS) -typical or near to the general average of future climate projections; and
- High-End Future Scenario (HEFS) - a more extreme future based on the upper end of the range of projections of future climatic conditions.

Table 5-1 of the Plan (reproduced as Table 12-14 below) shows the changes to flood-related parameters under both scenarios.

Table 12-14: Allowances Flood Parameters for Mid-Range and High-End Future Scenarios

Vulnerability	Mid-Range Future Scenario	High-End Future Scenario
Extreme Rainfall Depths	+20%	+30%
Peak Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1200

A series of flood maps were produced in 2015 as part of the National Catchment based Flood Risk Assessment and Management (CFRAM) program. The mapping shows the extent of fluvial and coastal flooding in the present-day scenario, and the Mid-Range and High-End future scenarios.

A further series of flood maps were produced in 2019 as part of the National Indicative Fluvial Mapping (NIFM) project. The mapping extends to areas not covered by the 2015 CFRAM program and includes the present-day scenario, and the Mid-Range and High-End future scenarios.

Local Planning Policy

The Strategic Flood Risk Assessment for Waterford City and County Development Plan 2022-2028 (SFRA) (JBA Consulting Engineers and Scientists, 2022) provides a broad assessment of all types of flood risk to inform strategic land-use planning decisions within County Waterford. The SFRA contains flood mapping, a Flood Risk Management Plan, and advice on zoning and land use proposals within settlements.

12.9.2 Flood Risk Identification – Risk to the Development

12.9.2.1 Wind Farm Site

Online Catchment Flood Risk Assessment and Management (CFRAM) fluvial flood mapping shows that the Site is not located in an area with a High, Medium or Low probability of fluvial flooding in the present day scenario (see Figure 12.4, Volume IV). The extent of the fluvial flood risk in the Mid-Range and High-End future scenarios generally follows the present-day flood extents, and the site is not affected.[9]

[9] Source: Catchment Flood Risk Assessment and Management (CFRAM) fluvial flood mapping. Available online here: Flood Maps - Floodinfo.ie . Accessed September 2022.

The NIFM fluvial mapping also shows that the site is not at risk of fluvial flooding in the present day scenario (see Figure 12.5, Volume IV). The closest area of Low risk (i.e. Zone C) is located outside the redline boundary in southern direction and has an approximate distance of 950 from the closest proposed turbine T10.[10]

Whilst the NIFM project modelled smaller watercourses, which were not modelled as part of the CFRAM project, it is considered unlikely that the watercourses within the Site were assessed. Due to the steep topography of the Site, however, it is considered unlikely that there would be large areas of low-lying open ground where fluvial flooding could accumulate.

The Geological Survey Ireland (GSI) Groundwater Flooding Probability Maps show that the Site is not located in an area with an increased level of groundwater flooding.

12.9.2.2 GCR & TDR

The proposed GCR and TDR generally crosses land with no elevated risk of fluvial flooding. The cable route, however, extends through low-lying ground at the Skeheens Stream crossing (Watercourse 4 on the GCR). NIFM mapping shows that this area has a Medium probability of flooding (i.e. 1 in 1000 to 1 in 100 probability) which would be classified as Zone B. The cable will cross the river via the proposed new open-bottomed box culvert at this location.

The cable will cross the Ballynaguilkee Lower stream using horizontal directional drilling (HDD) to extend the cable beneath the channel. There will, therefore, be no large open sections of trench during the construction phase which could be inundated during a fluvial flooding event. This risk will be further mitigated by only undertaking HDD during dry periods.

Where the cable route crosses smaller watercourses the cable will be installed within an excavated trench. This will be done during periods of dry weather with the watercourse dammed and water diverted over or around the works by overpumping.

The Geological Survey Ireland (GSI) Groundwater Flooding Probability Maps show that the GCR is not located in an area with an increased level of groundwater flooding.

With the full implementation of the control measures set out in this section, the risk of flooding will be minimal.

12.9.3 Flood Risk Identification – Risk from the Development

12.9.3.1 Wind Farm Site

The Site is not located within areas of Flood Zone A, B or C and it is considered that there will be no impact on floodplain storage or fluvial flood flow routes as a result of the Proposed Development.

[10] Source: National Indicative Fluvial Mapping (NIFM) Flood River Extent mapping. Available online here: Flood Maps - Floodinfo.ie. Accessed September 2022.

The majority of the Site consists of agricultural land and mountain land, with the only development being the series of access tracks extending through the Site. Approximately 11.3km of new internal tracks, approximately 5m wide and be constructed from aggregate, will be constructed to provide access to the wind turbines. There will, therefore, be an increase in impermeable area as a result of the Proposed Development. The rate and volume of surface water runoff could, therefore, increase during storm events. However, when compared to the total area of the overlapping waterbody catchments it is considered that the increase in impermeable area and subsequent impact on surface water runoff will be minimal.

Climate change could also exacerbate the risk of flooding associated with the Proposed Development. Increases in rainfall intensity could increase the rate and volume of surface water runoff and flows within watercourses. As shown in Table 12-9, rainfall intensity could increase by between 20% and 30% in the mid-range and high-end future scenarios respectively.

Best practice measures as part of design and construction (e.g. implementation of SuDS) ensures that the risk of fluvial flooding and surface water flooding to downstream areas is not increased as a result of the Proposed Development.

12.9.3.2 GCR and TDR

The majority of the cable route and TDR will be located within the road corridor away from areas of Flood Zone A, B and C and it is considered that there would be no impact on fluvial flooding in these locations as a result of the Proposed Development. Where the cable route crosses areas of Flood Zone B, it will be installed below ground level.

Where the cable route crosses smaller watercourses, this will generally be done within an excavated trench. For larger watercourses, horizontal directional drilling (HDD) will be used to pass the cable beneath the channel.

With appropriate control measures in place during construction there will, therefore, be no impact on floodplain storage or fluvial flood flow routes as a result of the proposed GCR of TDR accommodation works.

Where the cable route crosses agricultural land the trench will be infilled and reinstated as per the existing condition. Similarly, the temporary accommodation works along the TDR will be removed and lands reinstated following turbine delivery. There will be no increase in impermeable area or changes in topography and it is considered that there will be no impact on surface water flooding as a result of the proposed GCR and TDR accommodation works.

12.9.4 Summary of Flood Risk Identification and Assessment

It is considered that the Site is at a very low risk of flooding from fluvial sources, surface water runoff or groundwater. Mitigation will be required to ensure that the Proposed Development does not increase the risk of flooding as a result of increased impermeable area, or impact on existing watercourses and overland flow routes resulting from the construction of access tracks.

The risk of surface water and groundwater flooding is considered to be low during the installation of the underground GCR cable and TDR accommodation works. Installation methods during the construction phase, utilising HDD or the damming and temporary diversion of watercourses, will mean that the underground cable route will also be at a very low risk of fluvial flooding during the construction phase. Trenches will be back-filled and restored to their existing pre-construction surface condition and ground level, meaning that there will be no impact on the rate of surface water runoff, flood plain storage or flood flow routes.

The risk of flooding from all sources is also considered to be very low along the turbine delivery route.

12.10 Likely Significant Effects

12.10.1 Do-Nothing Scenario

If the Proposed Development does not proceed, the land use within the Site will likely remain as per the current scenario for the foreseeable future, i.e. open heathland in use for sheep grazing with smaller pockets of conifer plantation and improved agricultural grassland. As such, surface water drainage will continue as it is occurring currently.

It is likely that the Colligan_010 will remain at Good WFD Status in the absence of any targeted WFD programme of measures / identification as Areas for Action (noting that the objective of this waterbody is to achieve High Status). The Nier_020 is assigned a Moderate WFD Status and is identified as being 'At Risk' due to forestry pressures. Programmes of Measures implemented under the River Basin Management Plan will aim to improve the quality of this waterbody by addressing forestry pressures in the catchment which will likely include measures identified in the EPA HYDROFOR[11] and DAFM's Environmental Requirements for Afforestation. Note there are no existing forestry activities within the area of the Nier sub-catchment which lies within the Wind Farm Site. There are small areas of forestry within the Colligan catchment within or immediately adjacent to the Site which were planted approximately 25 years ago and would likely be subjected to felling and reforestation in the short to medium term. Such activities will be required to be subjected to Felling Licence and any associated environmental protection measures.

The existing agricultural and forestry operations can and will continue in conjunction with the operation of the Proposed Development.

12.10.2 Potential Effects During Construction

Potential construction phase effects, in the absence of mitigation, of the Project on Hydrology and Water Quality are set out hereunder.

12.10.2.1 Potential Effects on Surface Water WFD Status

WFD Ecological Status for inland surface waterbodies is determined based on biological quality elements and supporting physico-chemical and hydromorphological quality elements.

Effects on WFD biological quality elements are addressed in Chapter 9 - Biodiversity. The potential for significant effects on hydromorphology and physico-chemical conditions is discussed hereunder.

12.10.2.1.1 Potential for Effects on Hydrology / Hydromorphology (Including Flood Risk)

Hydromorphology is the physical and hydrological condition of surface water bodies which comprises the habitats and natural processes that support and maintain healthy aquatic ecosystems. Potential significant effects to hydromorphology can be caused by changes in the physical habitat or flow conditions of a waterbody.

[11] https://www.epa.ie/publications/research/water/EPA-RR-169-Essentra-final-web.pdf

The Project will require the excavation and removal of vegetation cover and soil, and replacement with less permeable surfaces with a resulting potential to contribute to the increase in runoff or a change in the hydrological response of the Site to rainfall. Any alteration in the existing drainage regime / hydrology of the Site can impact on the volume of surface water which drains to the local streams and watercourses or to the rate at which such drainage occurs. This in turn can have an effect on hydromorphology through, for example, an increase in erosion and sediment transport, increase flow velocity, alteration of flood regime The proposed windfarm is located withing 3 sub-basin, the Colligan_010, the Nier_010 and the Nier_020. The increase in impermeable area caused by wind farm footprint directly influences the volume and velocity of runoff. As the footprint expands, there is a larger proportion of impermeable surfaces compared to natural or vegetated areas. This alteration disrupts the natural hydrological cycle, reducing the amount of water that can be absorbed by the soil and increasing the amount of runoff generated.

As shown in Table 12-15 the increase of the impermeable area due to the Proposed Development it is minimal in comparison of the overall catchment of each sub-basin where it is located. However, when considering the most extended developed side of the windfarm, the entire area of the Colligan_010 sub-basin this increase is only by 0.303%.

Table 12-15: Impermeable footprint increase ratio

Increase of impermeable area to Colligan_010	Existing	Post Development
Sub-Basin Overall Catchment Area (ha)	2789	2789
New Hardstanding, Earthworks, Compound and Substation Area (ha)	0	16.90
Run-off Coefficent of the New Hardstanding - Type 1 Granular Material	0.5	0.50
Increase of net impermeable Area (ha)	0	8.450
Increase in run-off to Nier_10	**Exisiting**	**Post Development**
Sub-Basin Overall Catchment Area (ha)	2913	2913
New Hardstanding, Earthworks, Compound and Substation Area (ha)	0	0.53
Run-off Coefficent of the New Hardstanding - Type 1 Granular Material	0.50	0.5
Increase of net impermeable Area (ha)	0	0.27
Increase in run-off to Nier_20	**Exisiting**	**Post Development**
Sub-Basin Overall Catchment Area (ha)	3994	3994
New Hardstanding, Earthworks, Compound and Substation Area (ha)	0	1.46
Run-off Coefficent of the New Hardstanding - Type 1 Granular Material	0.50	0.5
Increase of net impermeable Area (ha)	0	0.73

Total Increase of impermeable Area within the Catchment in percentage		
		%
On Colligan_010		**0.303%**
On Nier_10		**0.009%**
OnNier_20		**0.018%**

Several drain and watercourse crossings (refer to Section 12.7.2) will be constructed as part of the Project which if misplaced or inappropriately sized can cause alteration of drainage patterns and changes in hydromorphology through change in flow velocity, scour and alteration of sediment transport.

Minimal land take is required for the both the Turbine Delivery Route and Grid Connect Route, considering that the majority of the routes will traverse already existing roadways. The TDR will not require any works to existing water crossings (with the exception of some minor vegetation trimming). Where the cable route intersects with culverts, the culvert will remain in place where possible and the ducting will be installed either above or below the culvert. However, if it is necessary to remove the culvert, it will be replaced with a suitable structure from a hydromorphological perspective.

Pathway / Mechanism:

- Site drainage network, tributaries on Site, access tracks.

Receptor:

- Waterbodies within and down gradient from the Site: Colligan River and Nier River. All the relevant waterbodies are named in Section 12.7.1.

Potential Effects:

- Direct, negative moderate to significant long-term effects.

Due to the relatively small infrastructure footprint compared with the extension of the sub-basins. This is without taking account of mitigation measures that will be put in place to slow runoff down to mimic pre-development conditions within the proposed wind farm drainage system.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Low' in nature. The importance is considered to be 'High'. The rating of these potential impacts, prior to mitigation, is considered to be of **Medium significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

The increase in runoff due to GCR is not anticipated because the finished surfaces are not changed. The impact of the TDR is anticipated to be Not Significant to the hydrological environment as existing roads will be used and only temporary, minor vegetation trimming is anticipated to be required.

Potential Effect on Flood Risk

Infrastructure development can increase the risk of flooding. Construction activities can alter the natural drainage patterns and increase the amount of impervious surfaces, which can lead to increased surface runoff during rainfall events. The alteration of natural flow paths, coupled with the potential for inadequate stormwater management, can also contribute to increased flood risk downstream. The changes in hydrology caused by development may result in a greater volume and velocity of water being discharged into downstream areas during heavy rainfall or flood events. This increased water flow can overwhelm existing drainage systems and potentially lead to flooding in downstream communities or areas adjacent to the development. It is crucial to implement effective stormwater management measures, including proper drainage design, retention ponds, and flood control structures, to mitigate the potential flood risks associated with infrastructure development.

The Drainage Design for the Proposed Development (as set out in Section 12.7 and in Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III incorporates SuDS. As such there will be no change in hydrology of the affected catchments.

The Proposed Development is not located in any Flood Zone, there's no potential risk from Flooding for all the infrastructures provided.

12.10.2.1.2 Potential for Effects on Water Quality / Physico-chemical Conditions

The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended) prescribe physico-chemical conditions for surface waters which are necessary to maintain / achieve Good or High Biological Status. These relate to water temperature, oxygen conditions, pH, and nutrient conditions. Notably the Regulations are mute on the sedimentation conditions required to support biology. As such, reference is made to the European Communities (Quality of Salmonid Waters) Regulations, 1988 which require an average concentration of <25mg/l of suspended solids (measured monthly over a period of 12 months) in order to support salmonid fish species. The Surface Water Regulations also prescribe environmental quality standards for priority substances and priority hazardous substances and requires the progressive reduction / phasing out these substances in waterbody catchments.

Construction phase activities will require earthworks and use of materials that have potential to negatively impact the physico-chemical conditions for surface waters. It is noted that for tree felling that will be carried out under licence under the Forestry Act 2014, a WFD specific assessment will be carried out as required by the Department of Agriculture, Food & the Marine.

Release of Construction or Cementitious Materials

To facilitate the Proposed Development, the incorporation of concrete structures, including those in close proximity to receptors like surface water crossings, is necessary. The choice of materials can have implications for hydrochemistry and potentially affect sensitive aspects such as ecology, depending on their composition. For instance, the use of cementitious materials like concrete, cement, or lean mix can lead to changes in soil and water pH, as well as increased concentrations of sulphates and other constituents found in concrete, which can further impact water quality. While surface water runoff and groundwater that come into contact with concrete will be influenced to some extent, water percolating through lean mix concrete will be significantly affected. The production/acquisition, transportation of materials, and management of plant machinery must also be taken into account. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They can generate very fine, highly alkaline silt (pH 11.5) that can alter water chemistry. A pH range of between 6-9 is set in the Surface Waters Regulations (for hard water) as the standard required to support Good / High WFD Status. Inland Fisheries Ireland (2016) 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' prescribe that artificial variations in waters must not be in excess of ±0.5 of a pH units.

Pathway / Mechanism:

- Accidental spillage or unmanaged deposition of construction materials such as wet concrete which is intercepted by drainage or surface water networks associated with the Proposed Development.
- Dust generation in relation to the production of concrete and management of raw materials. Reinstatement activities; similar to construction.
- Pouring, forming, deposition of concrete during construction.
- Transport of material on Site and washout of plant machinery.

Impact:

- Release of cementitious material in runoff, intercepted by surface water network.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Surface Water - Negative, direct, profound, likely, long-term to permanent.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Medium' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Moderate**. The Impact Classification is negative, permanent, direct and will have likely effects.

Release of Suspended Solids

The construction phase of the Proposed Development will invariably involve earthworks including; removal of vegetation cover, roads, etc. to facilitate the installation of turbine foundations, roads and hardstands, and temporary stockpiling of subsoils and bedrock.

Throughout the excavation, storage, and reuse of materials in the Proposed Development, it is expected that a significant amount of suspended solids will be carried by surface water runoff and intercepted by surface water networks. This likelihood is particularly high during sustained rainfall events. The elements most vulnerable to the deterioration of surface water quality include:

- Exposed soils / peat generally, including new drainage channels, temporary stockpiles.
- The development of turbine hardstands and infrastructure, particularly in areas characterized by extensive existing drainage networks that provide a direct connection to mapped surface water features.
- Infrastructure construction near surface waters and in-stream works associated with planned watercourse crossing locations are at risk.

The construction phase, involving vehicular movements and excavation works (earthworks), has the potential to impact soil stability, especially at a local scale. The degree of risk varies depending on factors like the depth of peat at specific locations (peat stability risk at the Site is described in Chapter 11 - Soils, Geology and Hydrogeology and determined that peat depths were generally very thin and characteristic of a highly organic Topsoil with a Peaty appearance). It is crucial to consider the earthworks associated with reinstatement as well. Localized stability issues, erosion, or degradation of soil caused by vehicular movements can heighten the likelihood of suspended solids being carried by surface water runoff, disrupt established drainage networks, and necessitate additional excavation works. Consequently, these factors increase the potential for adverse effects typically associated with earthworks.

The development will inevitably bring about alterations in the drainage patterns at the site. If not effectively managed, these alterations have the potential to create new pathways for runoff, potentially causing erosion of soils and construction materials, as well as the entrainment of solids in the runoff process.

Pathway / Mechanism:

- Construction activities; excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking. Chemical leak - minor in scale
- Erosion in areas with newly formed preferential pathways for water runoff.
- Reinstatement activities; similar to construction.
- Erosion in areas impacted by construction activities.

Impact:

- Release of suspended solids entrained in runoff, intercepted by surface water network.

Receptor:

- Surface Water, Surface water quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River and Nier River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Negative, direct, moderate, likely, long-term to permanent.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be ‘Medium’ in nature. The importance is considered to be ‘Medium’. The rating of these potential impacts, prior to mitigation, is considered to be of **Moderate significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

Release of Waste Water Sanitation Contaminants

During the Construction phase at the site, it will be necessary to provide welfare facilities. The degree of risk associated with these facilities depends on their condition, maintenance, and the use of any chemical agents, if applicable. Consequently, the impact can range from potentially significant to insignificant, directly correlated with the type of sanitation employed. For this development, it is proposed to utilize porta-loos.

Pathway / Mechanism:

- Waste water leak
- Chemical leak

Impact:

- Release of waste water/ chemicals in runoff, intercepted by surface water network
- Release of hydrocarbons to ground, intercepted by groundwater.

Receptor:

- Surface Water, Surface water quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River and Nier River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Direct, negative, slight, likely, long-term to permanent effects.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Low' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Slight significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

Excavation Dewatering & Construction Water

Throughout the construction phase of the Development, the activities involved in dewatering excavated areas are expected to have notable adverse consequences for the surface runoff water quality. In the event of dewatering being necessary for an open excavation, the drainage and attenuation features designed to handle the water will likely become overwhelmed by a sudden influx of water containing high concentrations of suspended solids. If left unaddressed, this overflow of water into the surface water systems will result in a temporary but significant deterioration in the quality of the receiving surface water. It is important to bear in mind that obtaining an EPA license is mandatory for discharging this water directly into the surface water network.

Moreover, the dewatering methods employed, such as concurrent drainage during excavation or pumping, will also have a temporary impact on the local groundwater and the hydrogeological flow patterns. However, based on the information provided in previous sections, the expected impact on peat areas is projected to be negligible.

Pathway / Mechanism:

- Dewatering of open excavations.

Impact:

- Release of suspended solids, intercepted by surface water network
- Significant surge release of suspended solids, intercepted by surface water network.

Receptor:

- Surface Water, Surface water quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River and Nier River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Direct, negative, moderate, likely, long-term to permanent effects.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Medium' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Moderate**. The Impact Classification is negative, permanent, direct and will have likely effects.

Watercourse Crossings and Cross Drains (including interceptor and collector drains)

The Site where the development is taking place has no existing bridges that are located within the mapped streams and rivers. The Proposed Development will require the construction of a new bridge and several amount of cross drains as shown in Section 12.7 and in Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III.

Pathway / Mechanism:

- Construction activities (Earthworks, addressed under Release of Suspended Solids)
- Poor design and/or installation of watercourse crossings and drainage.
- Significant changes to the hydrological regime at the Site.
- Connecting new and existing drainage channels

Impact:

- Release of suspended solids, intercepted by surface water network
- Significant surge release of suspended solids, intercepted by surface water network.
- Restricting water flow.
- Altering hydrological regime at a particular location. Potentially leading to erosion / deposition not in line with baseline conditions.

Receptor:

- Surface Water, Surface water quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River and Nier River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Direct, negative, moderate, likely, long-term to permanent effects.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Medium' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Moderate significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

Release of Hydrocarbons and Storage

During the construction phase of the Development, the utilization of plant equipment and vehicles for excavation, material transport, and construction activities introduces the potential for hydrocarbon spillages and leaks, especially during regular refuelling procedures. This implies the need for either an on-site fuelling station that incorporates fuel storage facilities or a fuel tanker arrangement to directly refuel the plant machinery.

If hydrocarbons are accidentally introduced into the environment, they are expected to be intercepted by the drainage and surface water networks connected to the Proposed Development.

Pathway / Mechanism:

- Lubricants and other construction consumables.
- Fuel leak from personnel vehicle.
- Fuel spill during refuelling.
- Fuel leak from storage.

Impact:

- Release of hydrocarbons in runoff, intercepted by surface water network.
- Release of hydrocarbons to ground, intercepted by groundwater.

Receptor:

- Surface Water, Surface water quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River and Nier River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Direct, negative, moderate, likely, long-term to permanent effects

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Medium' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Moderate significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

Cabling and Grid Connection Route (CGR)

In Chapter 2 of the Environmental Impact Assessment Report (EIAR), it is outlined that the electricity generated from wind turbines will be collected at medium voltage through an internal circuit of buried cables. These cables will follow the on-site access tracks and be terminated at a proposed on-site substation. Subsequently, the electricity will be exported to the grid via a high voltage (110kV) buried cable to the existing Dungarvan substation.

To facilitate this connection, various works will be undertaken, including the installation of ducting, joint bays, drainage systems, and other necessary infrastructure. The cables will be routed along the existing road network and new internal wind farm tracks. For cable trenches located in public roads, the contractor will excavate the trenches and lay high-density polyethylene (HDPE) ducting, which will be surrounded by cement bound material (CBM). The back-filling and reinstatement in public roads will adhere to a specification agreed upon with the road authority.

A similar construction approach will be followed for cable trenches within the Site's access tracks. In this case, the cable-ducts will generally be laid during the construction of the tracks, following the track's edge. The trenches within these areas will be backfilled using the excavated material.

Direct impacts to the existing environment associated with the proposed internal cabling and grid connection works include:

- Runoff and Contaminant Transport: Stormwater runoff from construction sites can carry pollutants, including sediment, chemicals, and construction materials, into nearby surface water. These contaminants can degrade water quality and harm aquatic ecosystems.
- Water Quality Impacts from Chemicals: Construction activities may involve the use of chemicals such as concrete additives, lubricants, or fuel for machinery. Improper handling, storage, or accidental spills of these chemicals can result in water contamination if they enter surface water bodies.
- Where the material excavated from the proposed grid connection excavations are not suitable for reuse as backfill or deposition on Site, this material will be disposed of at a facility licenced (subject to environmental testing and classification) to accept this waste type.

Pathway / Mechanism:

- Accidental spillage or unmanaged deposition of construction materials such as wet concrete which is intercepted by drainage or surface water networks associated with the Development.

Impact:

- Release of suspended solids into surface waterbodies via runoff.
- Release of hydrocarbons, such as fuel into surface waterbodies via runoff.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Surface Water - Negative, direct, slight, likely, long-term to permanent.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Low' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Slight significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

Horizontal Directional Drilling (HDD)

HDD will be employed at one location (ITM coordinate 621231.32, 608263.86) to cross a waterbody as described in Chapter 2 of the EIAR. This HDD crossing will be entirely within private lands which comprise agricultural grasslands and will be under an unnamed tributary of the Skeheens Stream.

The operation will be carried out by an experienced HDD specialist and is expected to take place in a single day.

The process will involve setting up a small, tracked drilling rig on one side of the surface water feature. A shallow starter pit will be excavated at the point of entry and will be located at a sufficient distance from the stream to achieve a depth of at least 2m below the level of the watercourse.

A pilot hole will be bored as per the agreed alignment and will be tracked and controlled using a transmitter in the drill head. By tracking the depth, position and pitch of the drill head the operator can accurately steer the line of the drilling operation. The drilling operation will be lubricated using a fluid. When the pilot hole has been drilled to the correct profile, its diameter is increased, if necessary, to match the external diameter if the cable duct. The flexible plastic ducting is then pulled through the pre-drilled hole and sealed at each end until required for cable installation.

Pathway / Mechanism:

- Accidental spillage or unmanaged deposition of construction materials and release of lubricated fluids to the drainage or surface water networks associated with the Development.

Impact:

- Release of pollutants, including sediment, chemicals, and construction materials, into nearby surface water. These contaminants can degrade water quality and harm aquatic ecosystems.
- Release of suspended solids into surface waterbodies via runoff.
- Release of hydrocarbons, such as fuel into surface waterbodies via runoff.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from unnamed tributary of the Skeheens Stream: Colligan River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Surface Water - Negative, direct, slight, likely, long-term to permanent.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Low' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Slight significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

Turbine Delivery (TDR)

The proposed turbine delivery route (TDR) will be from Port of Waterford as described in more detail in Chapter 14 (Traffic and Transportation) of this EIAR. Accommodation works are required only at one location which will interact with a watercourse, which is at the same location as the proposed HDD crossing of the unnamed tributary of the Skeheens Stream. The accommodation works will require that the stream is temporarily culverted. The culvert will be sized such that it does not impede flood flows. The accommodation works will temporarily fill in an area of wet grassland surrounding the stream.

Pathway / Mechanism:

- Accidental spillage or unmanaged deposition of construction materials and release of lubricated fluids to the drainage or surface water networks associated with the Development.

Impact:

- Release of suspended solids into surface waterbodies via runoff.
- Release of hydrocarbons, such as fuel into surface waterbodies via runoff.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River. All the relevant waterbodies are named in Section 12.7.

Potential Effects:

- Surface Water - Negative, direct, slight, likely, long-term to permanent.

The Magnitude of the impact from these works on Surface Water related with Hydrology and Water Quality is considered to be 'Low' in nature. The importance is considered to be 'Medium'. The rating of these potential impacts, prior to mitigation, is considered to be of **Slight significance**. The Impact Classification is negative, permanent, direct and will have likely effects.

12.10.2.2 Potential Effects on Surface Water Dependent Designated Sites

Potential for hydrological connectivity between the Project and surface water dependent designated sites is set out in Section 12.8.5. Any potential negative change to the existing WFD status of the waterbodies supporting these sites or any activity that might impede the achievement of the objective WFD status for such waterbodies could have an effect on the attributes (structure and function) required to support the water dependent habitats and species of the designated sites.

Pathway / Mechanism:

- Sediment-laden runoff, accidental release of contaminants such as cement-based material, hydrocarbons and domestic wastewater.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River. All the relevant waterbodies are named in Section 12.3.

Potential Effects:

- Surface Water - Negative, direct, significanct, likely, long-term to permanent.

As presented in Section 12.10.2.1 accidental pollution of surface waters, particularly by sediment runoff and cement-based products is deemed to have a lasting effect and would be **Significant** in terms of the potential to alter the character of the aquatic environment which is required to support the conservation interests of surface water dependent designated sites.

12.10.3 Potential Effects During Operation and Maintenance

During the operational phase, accidental pollution from spills and leaks of fuel, oil and chemicals from vehicles and maintenance works may occur. Additionally, transformer oil will be used in cooling the transformers associated with the sub-station which creates potential for oil spills during any oil replacement activity or leaks during the operational phase, although the likelihood of this is low. There is no significant risk of sediment release to cause increase suspended solids in surface waters during the operational phase as vegetation will not be disturbed during this phase.

Pathway / Mechanism:

- Site drainage network and surface waterbodies.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River. All the relevant waterbodies are named in Section 12.3.

Potential Effects:

- Surface Water - Negative, direct, not likely, not significant.

The significance of the effect of the release of the hydrocarbons into the receiving waters is **Not Significant** due to the low likelihood and low quantities involved.

12.10.4 Potential Effects During Decommissioning

As described in Chapter 2, wind turbines will be deconstructed by unbolting the components by accessing using cranes. The hardstanding and foundation pedestals of the turbines will be covered over (with soil that was stripped during construction) and allowed to re-vegetate. This is less disruptive to the environment than removing the hardstanding and foundations.

Infrastructure that will be left in-situ following decommissioning includes; internal site access tracks, GCR infrastructure, including the on-site substation and ancillary electrical equipment.

Potential hydrocarbon and sediment release.

Pathway / Mechanism:

- Site drainage network and surface waterbodies.

Receptor:

- Surface Water, quality and ecological sensitivities on Waterbodies within and down gradient from the Site: Colligan River. All the relevant waterbodies are named in Section 12.3.

Potential Effects:

- Surface Water - Negative, direct, slight, likely, long-term to permanent.

As the hard standing infrastructure will remain in place the sediment disturbance is not significant during the disassembly. Potential impacts are similar to the construction phase but less significant as there is no invasive works breaking ground and it is mainly associated with the dis-assembly of the above ground components of the turbines. The potential receptors are the same as the construction phase. The significance of the effect of the release of the hydrocarbons into the receiving waters is **Slight** due to the low likelihood and low quantities involved.

12.10.5 Potential Cumulative Effects

It is generally understood and accepted that developments within the same catchment and at the construction stage need to be taken into consideration when assessing the potential for cumulative effects.

According to Entec's 2008 report "it is conceivable that two or more wind farms (or indeed other developments) in the catchment of a water receptor could result in combined runoff impacts to water quality, which then exceed Environmental Quality Standard thresholds. It is generally the case that in such circumstances any such effect is only likely to have the potential to be significant during the construction period. Once operational, any effects are likely to be restricted to high rainfall events when the level of dilution of impact is proportionately increased by higher flow levels that can be anticipated under these circumstances. Despite this theoretical potential impact, it is possible to control construction effects by good management techniques and therefore in practice significant effects, either individually or cumulatively, will rarely occur. Where such impacts occur other regulation provides additional controls. Due to the existing regulation over water environment there are absolute controls on the manner in which developments are constructed and operated in respect of the water environment which result in any potential effect being designed out. In this way it is unlikely that any cumulative effect would be significant."[12]

Therefore, only other developments that lie in the same catchment(s) as the Proposed Development that have the potential to have their construction stage overlap with the Proposed Development's construction stage are considered.

There are no proposed or consented developments that share a waterbody catchment with the Site (as per Waterford City and County Council and An Bord Pleanála planning data, accessed August 2023).

The GCR passes through the Finisk_020 sub-catchment. There is one proposed development (Dyrick Hill Wind Farm) within the Finisk_020 sub-catchment. There is potential for cumulative effects. However, the proposed works associated with the cable crossing for the proposed Coumnagappul Wind Farm within the Finisk_020 sub-catchment are minor in nature. As such, the magnitude of the impact from these works on the hydrology in terms of runoff is considered to be 'Small Adverse' in nature. The importance is considered to be 'Medium'. The rating of this potential cumulative impact is considered to be of ***Slight significance***. The Impact Classification is negative, short-term, indirect and has unlikely effects.

12.11 Risk of Major Accidents and Disasters

Wind farms are not generally associated with major risks regarding the water environment. The potential for landslide at the Site is determined to be low. Further details are provided in Chapter 11 - Soils, Geology and Hydrogeology.

[12] Entec UK Limited (2008) Review of Guidance on the Assessment of Cumulative Impacts of Onshore Windfarms: Phase 1 Report

12.12 Mitigation Measures

12.12.1 Mitigation By Avoidance

A process of 'mitigation by avoidance', as informed by constraints assessment and consultation, was undertaken by the EIA team during the design of the wind farm layout and selection of grid connection route (refer to Chapter 3 - Site Selection and Alternatives for further detail) with the objective of avoiding / minimising the potential for significant effects on water quality and hydrology. The Site layout and drainage infrastructure has been designed such that it is sympathetic to the existing topography and aims to maintain the existing hydrological regime of the Site such that it does not create a changed hydrological response to precipitation.

The infrastructure has been located such that it is set back as far as reasonably practicable from hydrological features, with an ethos of achieving a minimum setback of 75m between mapped surface waters and wind farm infrastructure, and a minimum setback of 15m from non-mapped streams and drainage features with the exception of HDD locations and watercourse crossings. Objective BD17 of the Waterford City and County Development Plan 2022-2028 requires that a buffer zone of at least 15m is maintained between the development works and the top of the riverbank. The Design of the Proposed Development meets the objective of the Development Plan, noting that there are a number of watercourse crossings included in the Proposed Development.

The GCR that was selected aims to limit the number of watercourse crossings and to cross by HDD where feasible in order to limit interaction with the watercourse and to protect riparian habitat.

A Surface Water Management Plan for the construction, operation and decommissioning stages of the Proposed Development is contained Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III. The proposed drainage design will:

- Collect surface water runoff upgradient of the Proposed Development via interceptor drains and will redistribute this 'clean' collected runoff downgradient of the Proposed Development by means of cross drains which will release via diffuse outfalls to vegetated areas (within the same catchment) or will divert the runoff back into the existing network serving the catchment. This drainage design aims to maintain the hydrological regime at the Site.
- Collect surface water runoff from the footprint of the Proposed Development (during construction, operation and decommissioning) and discharge diffusely to adjacent vegetated areas via settlement ponds, such that a deterioration in water quality does not occur.

Attenuation and Flood Risk

The Proposed Development will increase the impermeable area within the Site and as such can potentially increase the rate and volume of surface water runoff in response to precipitation events. Mitigation measures to address surface water runoff and drainage include in line attenuation features including check dams and stilling ponds and diffuse outfalls with a view to maintaining the baseline hydrological regime and to provide attenuation at greenfield run-off rates.

All access tracks will be constructed from aggregate which will allow a portion of rainfall to infiltrate and, therefore, reduce surface water runoff. Adjacent swales will also intercept and retain surface water runoff allowing this to disperse naturally via infiltration and evapotranspiration. Where swales are installed on sloped ground, check dam structures will be used within the channels to provide attenuation, allowing a portion of the flows to disperse naturally.

Swales and drainage channels will discharge runoff from access roads and areas of hardstanding to settlement ponds. These will be suitably sized to accommodate flows from storm events up to and including the 1 in 100-year storm event.

Settlement ponds will not discharge directly to any drain or watercourse. Rather, flows from the ponds will be dispersed diffusely over land to allow natural overland flow and percolation within the catchment.

Watercourse crossings will be designed and suitably sized to accommodate peak, or storm discharge rates so as not to cause risk of impeding flows during extreme storm events and causing flooding upstream of the crossing. All drain and watercourse crossings will be designed in accordance with the requirements of Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010. The channel width will be maintained and the crossings will be designed so as not to cause an impediment to the passage of woody debris or sediment transport. Appropriate freeboard will be provided to OPW requirements.

The cable trenches will be excavated in dry weather where possible and infilled and revegetated if required to prevent soil erosion or generation of silt pollution of nearby surface water. There will, therefore, be no increase in the risk of flooding.

The surface water management system at the Site will ensure that there will be no increase in the risk of fluvial or surface water flooding downstream as a result of the windfarm development.

12.12.2 Monitoring

An Environmental / Ecological Clerk of Works (EnCoW / ECoW) will be appointed by the Developer with responsibility for monitoring at the Site during the construction phase of the Development. The Clerk of Works will have the authority to temporarily stop works to prevent negative effects on hydrology or to ensure corrective action is taken to mitigate adverse effects.

A Surface Water Quality Monitoring Programme will be established which will commence 12 months prior to construction in order to establish baseline physio-chemical conditions and hydromorphological conditions of the watercourses within the Site and will continue throughout construction and for three months post-commissioning phase of the Proposed Development.

Monthly water quality grab samples will be taken from the Skeheens Stream (COLLIGAN_010), Knockavanniamountain Stream (COLLIGAN_010) and Colligan River (COLLIGAN_010) at locations approximately 10m downstream of the proposed watercourse crossings. Water quality sampling will be undertaken in accordance with *BS EN ISO 5667 - Water Quality Sampling*. The samples will be checked in situ for:

I. pH;
II. Temperature;
III. Turbidity;
IV. Conductivity; and
V. Dissolved Oxygen.

using a fully calibrated portable pH/temperature/conductivity meter (with pH resolution of 0.01 pH), turbidity probe and a flow impellor.

The samples will then be submitted to an appropriately certified laboratory (ILAB or similar) in accordance with the laboratory custody protocol for assessment of the following parameters:

i. Biological Oxygen Demand;
ii. Chemical Oxygen Demand;
iii. Total Hardness;
iv. Total Suspended Solids;
v. Total Dissolved Solids;
vi. Nitrate;
vii. Nitrite;
viii. Ammoniacal Nitrogen;
ix. Molybdate Reactive Phosphorus;
x. Total Coliforms; and
xi. Faecal Coliforms (E.coli).

A record of monthly meteorological conditions (as a minimum precipitation and temperature) will be maintained.

Biological water quality assessment using the EPA Q-value methodology will be carried out once prior to the commencement of construction and on a six month basis during the monitoring period.

The hydromorphological baseline at the proposed watercourse crossings within the Site will be established using the River Hydromorphology Assessment Technique (RHAT)[13]. Annual RHAT assessments will be carried out which will be compares against the baseline. The Design and Construction of the bridge crossing and culverts will minimise upstream afflux, avoid turbulence and minimise loss of the natural channel bed due to the culvert or structure in order to ensure that hydromorphology is not affected. The Design will ensure that the baseline river Hydromorphological Condition Score derived from the initial RHAT assessment is not altered such that it would impact the derived WFD hydromorphology classification.

The Contractor will ensure that the daily visual monitoring of the surface water network for visible signs of construction impact is carried out on a daily basis for example, riparian vegetation loss, evidence of oil/fuel slick, sediment plumes, fish kill.

During the construction and commissioning phase, water quality monitoring results will be recorded and compared against baseline data and where there is a deviation beyond the 95%ile, the Contractor will investigate and as necessary sample further upstream and determine if elevated concentrations are coming from the Site, in which case the Contractor will ensure that emergency control measures are put in place to return the levels to the baseline. Similarly, the Contractor will compare results of water quality monitoring with the 95%ile High Status Environmental Quality Standards arising from the European Union Environmental Objectives (Surface Waters) Regulations 2009 as amended. Any deviation beyond these standards will be investigated and the findings will be report to the Community Water Officer, South East Region.

During the construction and commissioning phase, daily inspection of environmental protection measures e.g. silt traps, check dams, ponds and outfalls and drainage channels will be carried out and any improvement works carried out within a timely manner.

[13] https://www.riverhabitatsurvey.org/RHSfiles/RHSToolboxHelp/RiverHabitatSurveyToolbox.html?RHAT.html

12.12.3 Mitigation Measures for the Construction Stage

The mitigation measures prescribed are aimed at ensuring no deterioration in WFD status waterbodies within the catchments of the Project, noting that the rivers have High Status objectives and are included in the Blue Dot Programme. Strict mitigation measures in relation to maintaining a high quality of surface water runoff from the Proposed Development will ensure that the status of surface waterbodies are not affected.

Best practice construction methods will be used to avoid potential for effects on water quality and hydrology following the documents and guidelines listed below:

- Water Run-Off from Construction Sites - SEPA - (WAT-SG-75)
- The SUDS Manual - CIRIA C697. ISBN 0 86017 697 5
- Site Handbook for the Construction of SUDS - CIRIA C698 ISBN 0 86017 698 3.
- Works and maintenance in or near water - PPG5 - (October 2007)
- Environmental good practice on site guide (fourth edition) (C741)
- Guidance for Pollution Prevention, dealing with spills: GPP 22-(October 2018)
- Temporary Construction Methods - SEPA -(WAT-SG-29)
- Guidelines on protection of Fisheries During Construction Works in and Adjacent to Waters - Inland Fisheries Ireland - (IFI 2016)
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes - TII Publications (2008)

Further environmental best practice measure for key parts of the construction phase are outlined in more detail in the Construction Environmental Management Plan CEMP (Appendix 2.1, Volume III).

Control of Accidental Spills and Leaks

Regarding good practice associated with mitigating the risk of hydrocarbon release during construction, as stated in the SWMP, construction vehicles will be refuelled off-site, wherever possible. This will primarily be the case for road vehicles such as vans and trucks. Refuelling of mobile plant during construction will be carried out by mobile fuel tanks equipped with pressure relief valves, built-in vents, handles for easy transportation, pumps, hoses and meters to facilitate fuel transfer operations. Any additional fuel containers and for smaller equipment (such as generators, lights etc.) use don site will be positioned on appropriately sized plant nappy/bund and stored within additional secondary containment e.g. bund for static tanks or drip trays for smaller mobile containers. Taps/nozzles for fuels and storage containers for oils will be fitted with locks to ensure their use is controlled. Only designated trained and competent operatives will be authorised to refuel plant on site.

All tank and drum storage areas will, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

- 110% of the capacity of the largest tank or drum within the bunded area; or
- 25% of the aggregate volume of all other substance which could be stored within the bunded area.

The purpose of this requirement is to ensure that any potential leaks, spills, or other releases from tanks or drums are effectively contained within the bunded area, preventing any environmental contamination or harm. The bunded area acts as a secondary containment system, providing an additional layer of protection against accidental releases and facilitating proper clean-up and mitigation measures.

All plant and equipment will be in good working order, checked regularly and maintained when necessary and a maintenance log maintained.

Fuels, lubricants and hydraulic fluids will be carefully handled to avoid spillage, properly secured and provided with appropriate type of spill containment kits in case of incident.

All spill-kits will be inspected on a weekly basis by the EnCoW to ensure they are maintained as fit for purpose

Welfare / hygiene facilities will be located within the construction compounds only.

All water from vehicle wheel washes will be removed from site and disposed of in line with Waste Legislation.

Control of Concrete Runoff

Precast concrete will be used wherever possible e.g. for the structural elements of watercourse crossings (single span / piped crossings) as well as cable joint bays. However, ready mix and lean mix concrete will be required during the construction phase e.g. for turbine foundations, as blinding works for joint bay pits, culverts and cross drains, for concrete pads for bottomless culvert and clear span bridge foundations. On-site batching will not be permitted. Concrete will instead be transported to the Site by concrete truck. Quick setting concrete mixes will be used as feasible to reduce the risk of contaminated run-off to drains and watercourses.

The risk of concrete runoff from turbine foundation works areas will be minimal given that all turbine foundations are located a minimum of 75m from any watercourse and 15m from any drain. Additionally, the formwork and site preparation works will contain the concrete in an enclosed, excavated area. For watercourse crossings requiring concrete works, these works will be carried out under dry works conditions, as discussed further below in relation to 'Works in or Adjacent to Waters'.

The acquisition, transport and use of concrete will be planned fully in advance of commencing works such that volumes are minimised, the route to and through the Site is predetermined so as to aim to avoid drains and watercourses, and wash down areas are appropriately located. Additionally, all concrete works will be supervised at all times by the Developer's appointed Environmental / Ecological Clerk of Works.

No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately.

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50m. This requirement will be communicated to all on-site personnel and to each concrete truck driver prior to entering into the works area. Washout areas / mortar bins will be sized such that they are capable of withstanding an unexpected heavy rainfall event without overtopping and they will be covered when not in use.

Concrete washing will be contained and managed. Waste concrete slurry, washings and supernatant will be allowed to settle/dry and will be taken to a licensed waste facility for disposal.

Any shuttering / formwork installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting, foams or other sealing products at joints.

Pouring of concrete into standing water within excavations will not be undertaken. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the treatment train and buffered surface water discharge systems in place. Where the isolated working area requires constant dewatering to maintain a dry works area, pumps will be turned off during the concrete pour, and remain off until it can be ensured that the discharge will not result in a change in pH of +/-0.5 units for any nearby watercourse or drain. Alternatively, any dewatering from these areas during the concrete pour will be taken off site for disposal at a licensed waste facility for disposal. Once concrete has cured the pH of any water required to be dewatered should be checked and none of that water allowed to enter the environment unless it is back to within the normal baseline range of the local network.

Concrete works will be scheduled during dry weather conditions to reduce the elevated risk of runoff and will avoid foreseen sustained rainfall (any event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3mm/hour), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann.

It will be ensured that suitably sized covers are available for freshly poured concrete to avoid wash off in the event of rain.

The EnCoW / ECoW will continually monitor the pH of any watercourse during concrete works in or adjacent to a watercourse or drain. Should any change in pH +/-0.5 be detected, concrete works will immediately be ceased. Steps will then be taken to identify the entry point to the drain or watercourse and appropriate measures will be implemented to prevent further escape to the environment.

Spill kits will be readily available at the location of concrete works and will be appropriate for the containment and control of concrete spills and/or runoff.

The Community Water Officer for the South East Region, National Parks and Wildlife Services and Inland Fisheries Ireland will be notified immediately of any concrete spills / runoff into a watercourse.

Control of Sediment Runoff

The drainage, attenuation and surface water management systems proposed for the Site as set out in the SWMP and 0500-Series planning application drawings will be installed concurrent with the main construction activities in order to control increased runoff and associated suspended solids loads.

Waters arising from dewatering during excavation works will be diverted into the surface water management system such that it is captured in settlement ponds and discharged diffusely over land. Where sediment loading from dewatering works is high, it may be necessary to first pass the flow through settlement tank(s) e.g. Silt Buster or similar. For smaller areas of dewatering it may be sufficient to dewater onto adjacent lands within the Planning Boundary via filter bags, filter mats or natural vegetation. This will be determined by the EnCoW / ECoW. Water quality in the nearby downstream drains and watercourses will be monitored in real time for turbidity. Where turbidity equals or exceeds 28 Nephelometric Turbidity Units (NTU) the works will be stopped and an investigation into cause carried out and measures taken as appropriate.

A Peat and Spoil Management Plan has been prepared for the Proposed Development and is included in Appendix 2.1 – CEMP (Appendix C thereof), in Volume III.

No permanent stockpile will remain on the site during the construction or operational phase of the Proposed Development. Excavated material will be either reused as fill / landscaping material within the Site or will be stored temporarily as stockpiles (in accordance with waste legislation) adjacent to the area of excavation and subsequently removed from the site in accordance with waste legislation. Stockpiles will be covered with plastic sheeting.

The Grid Connection Route will require excavation of cable trenches in existing roadways as well as within a small area of private lands where HDD works will be carried out. All spoil from trenches in public roadways will be removed form Site as it is excavated and transported to a licenced waste facility. Spoil from HDD entry and exit pits will be treated as above. Road surfacing materials will be stored in a skip for recycling.

Earthworks will be scheduled during dry weather conditions where feasible to reduce the elevated risk of runoff and will avoid any foreseen intense rainfall event (>3mm/hour), and will not proceed during any yellow (or worse) rainfall warning issued by Met Éireann.

Silt fences will be established downslope along the perimeter of source areas of contaminated runoff. Silt fences will be installed close to source (as opposed to close to receptor). Silt fences will be constructed using a permeable filter fabric (e.g. Hy Tex Terrastop Premium silt fence or similar) and not a mesh or terram. The base of the silt fence will be bedded at least 15- 30 cm into the ground. Once installed the silt fence will be inspected regularly, daily during the proposed works, weekly on completion of the works for at least one month, but particularly after heavy rains and periodically thereafter. The integrity of the silt fencing will be checked daily by the EnCoW and after poor weather conditions (rain or wind) and any failures rectified immediately. Any build-up of sediment along the fence will be removed as deemed necessary by the EnCoW and in accordance with manufacturers requirements. The silt fencing will be left in place until the works are completed (which includes removal of any temporary ground treatment). Silt fences will not be removed during heavy rainfall. The silt fence will not be pulled from the ground but cutaway at ground level and posts removed. A record of when it was installed, inspected and removed will be maintained by the EnCoW.

Works in or Adjacent to Waters

In-stream works will be required where existing culverts are to be replaced along the GCR, new culverts and cross drains are required within the Site, for the new bridge crossing, and for the temporary watercourse crossing for the TDR.

All works within and adjacent to watercourses will be carried out in accordance with Inland Fisheries Ireland Biosecurity Protocols: https://www.fisheriesireland.ie/Biosecurity/biosecurity.html. Appropriate facilities and measures will be put in place to ensure that aquatic pathogens and invasive species are not spread between watercourses.

All in-stream works will be carried out under dry works conditions i.e. the works area will be isolated from the river/stream/drain flow by means of temporarily overpumping or fluming the flow. The diversion of flow by overpumping / fluming will be into the same waterbody i.e. flows will not be diverted from one watercourse to another. The flume pipe and / or the pumps will be sized appropriate to watercourse flow and will have capacity to accommodate storm flows. Fluming is the preferred option for fishery watercourses and must be such that fish passage is maintained. Where overpumping is proposed, measures (such as screening) will be taken to ensure that fish do not become entrained in the pump. Additionally, measures will be taken to reduce sedimentation caused by pumping e.g. creating of a gravel-lined sump.

In order to create a dry works area, an upstream barrier will be installed using aquadam or sandbags (which will be double bagged and tied). Straw bales will not be permitted. Flows will either be overpumped or flumed downstream of the works area. A downstream barrier will then be installed and the works area dewatered. Direct dewatering into the watercourse will not be permitted as it will increase the risk of sedimentation. Instead dewatering will be via filter bag, sediment tank, filter mats or natural vegetation adjacent to the watercourse. Discharging of construction water (trade effluent) directly to surface waters is a licenced activity. No extracted or pumped or treated construction water from the isolated construction area will be discharged directly to a drain or watercourse (This is in accordance with Local Government (Water Pollution) Act, 1977 as amended).

Any watercourses requiring a dry works area will require a fish salvage exercise which must firstly be Authorised under Section 14 of the Fisheries (Consolidation) Act 1959. Fish salvage by electrofishing will not be carried out where water temperature exceeds 20ºC. Fish salvage operations can only be conducted by qualified ecologists under said licence. A detailed method statement will be required as part of the licence application. The work will have regard to the following general guidelines for electrical fishing include Beaumount et al., (2002) "Guidelines for Electric Fishing Best Practice" and Scottish Fisheries Coordination Centre (2007) "Electrofishing team leader training manual" and Central Fisheries Board (2008) Methods for the Water Framework Directive Electric Fishing in wadable reaches".

No in-stream works will be carried out in any WFD mapped watercourse or associated riparian area during the salmonid spawning season (which is October to May inclusive).

If it is necessary to sling concrete in a skip/hopper for the works or to pump concrete into the works area, the pump and/or hopper/skip will be moved only within or above the isolated works area and will not be allowed to operate above the watercourse.

Provided the construction water within the isolation area is managed effectively, overpumping / fluming of the surface water features does not pose a significant risk to surface water quality downstream of the watercourse crossings.

The EnCoW / ECoW will monitor the pH, temperature, DO, turbidity and conductivity of the watercourse upstream and downstream of the isolated works area. The works will be immediately stopped and an investigation of cause carried out and mitigated in the event of the following:

- any change in pH +/-0.5 detected between upstream and downstream monitoring locations;
- downstream turbidity exceed 28 NTU
- DO drops below 80% saturation

Horizontal Directional Drilling

HDD will be employed along the GCR in accordance with the following methodology:

- A specialist contractor will be appointed to prepare Method Statements of works.
- Fuels, lubricants and hydraulic fluids for equipment use on Site will be carefully handled to avoid spillage, properly secured and provided with spill containment kits in case of incident.
- The depth of the bore should be at least 3m below the level of the public road and stream bed so as not to conflict with the road drainage and watercourse;
- Fluid return lines used in HDD process will be tested for leaks prior to use to check their reliability;
- Inert, biodegradable drilling fluid will be used;

- All practices involving bentonite will be monitored closely, that is: pumping pressure,
- drilling mud formulation i.e., drilling fluid volume and the volume of mud returns.
- A comprehensive monitoring system will be established to closely oversee any procedures involving bentonite, encompassing the careful observation of pumping pressure, the precise formulation of drilling mud (including drilling fluid volume), and the accurate measurement of mud returns.

12.12.4 Proposed Mitigation Measures for Operation and Maintenance Stage

The Surface Water Management Plan, included in Appendix 2.1 – CEMP (Appendix D thereof – SWMP), in Volume III, will ensure that there is no effect on water quality as a result of the Proposed Development. The proposed drainage system will provide several stages of treatment to surface water runoff from constructed areas, which follows the concept of a multi-stage SuDS 'treatment train'.

Interceptor drains installed upslope of access tracks and areas of hardstanding will divert surface water runoff from undeveloped land around the constructed areas to disperse naturally within open ground without mixing with the construction drainage.

The proposed swales will intercept surface water runoff from access tracks and areas of hardstanding. The grass within the swales will provide some filtration to remove a portion of silt and suspended solids. Silt traps will be provided upstream of outfalls from roadside swales.

The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to discharge. Additional treatment will be provided upstream of the settlement pond with the use of drainage stone at the inlet to provide filtration. In an emergency, the outfall from a settlement pond will be blocked to provide a temporary holding area for accidental spillages on site.

As stated in the SWMP, to adhere to CIRIA C753, part of the maintenance routine that will mitigate issues relating to surface water will be the inspection of the following: drains, check-dams, cross-drains and culverts for blockages; outfalls to existing field drains and watercourses, existing roadside swales for obstructions; progress of re-vegetation.

12.12.5 Proposed Mitigation Measure for Decommissioning Stage

The access tracks will remain in situ for land management purposes, after the end of the operational period. Additionally, the turbine foundations and hardstanding will remain in situ and be covered over with soil from the site to re-vegetate naturally. This inherently mitigates disturbance through decommissioning process. Silt protection procedures, similar to during construction will be re-instated for decommissioning. If there is perceived to be risk of erosion during inspection of the revegetated hardstanding then erosion control measures will be taken.

12.13 Residual Effects

12.13.1 Residual Effects during Construction Stage

Effects on hydrology and water quality will be mitigated with measures outlined in Section 12.12. This will ensure that the residual impacts of the construction stage are **Not significant** and there will be no perceivable impact on the Colligan River and the Nier River which are highly sensitive receptors that are hydrologically connected to the Site, GCR and TDR. Furthermore, the Proposed Development will not result in the deterioration of the status of any waterbody under the WFD or jeopardise the achievement of waterbody objectives (good / high status) of any such waterbody.

12.13.2 Residual Effects during Operation and Maintenance Stage

The unmitigated potential effects during the operational phase of the site was not significant. Visual monitoring and water quality monitoring at appropriate intervals will be undertaken as precautionary measures to inform any required contingency mitigation measures during operation. The main risk to surface water is the release of hydrocarbons, such as fuel into surface waterbodies via runoff. The residual risk is **Not Significant.**

12.13.3 Residual Effects during Decommissioning Stage

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

Turbine bases and hardstanding areas will be covered with soil to encourage vegetation growth and reduce run-off and sedimentation.

Mitigated with measures outlined in Section 12.12 will ensure that the residual impacts of the decommissioning stage are **Not significant** and there will be no perceivable effect on the Colligan River, Nier River and all the relevant waterbodies.

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