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WATER FRAMEWORK DIRECTIVE COMPLIANCE REPORT

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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT

CURRAGLASS WIND FARM, CO. CORK

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT CURRAGLASS WIND FARM, CO. CORK**
Issue Date:	**4th September 2025**
Project Number:	**P1483-3**
Project Reporting History:	**P1483-0 - P1483-0**
Current revision no:	**FINAL_F0**
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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO to complete a Water Framework Directive (WFD) Compliance Assessment for the Proposed Development.

The purpose of this WFD Compliance Assessment is to determine if any specific components or activities associated with the Proposed Development will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures and determine if the project is in compliance with the objectives of the WFD.

This WFD Compliance Assessment is written to accompany Chapter 9 (Hydrology and Hydrogeology) of the Environmental Impact Assessment Report (EIAR) for the Proposed Development. The Proposed Development is described in full in Chapter 4 (Description of the Proposed Development) of the EIAR. For the purposes of this WFD, and consistent with the EIAR, the various components are described and assessed.

As detailed in Section 1.1.1 in Chapter 1 (Introduction), for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Development', 'proposed turbines', the 'Site', the '2020 Application' and the 'Kealkill Wind Farm'. Please see Section 1.1.1 of this EIAR for further details. A detailed description of the Proposed Development is provided in Chapter 4 (Description of the Proposed Development) of this EIAR.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including wind farms.

This WFD assessment was prepared by Michael Gill, David Broderick and Nitesh Dalal.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Civil/Environmental Engineer and Hydrogeologist with over 24 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. Michael has completed over 30 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water, and for private developments across the country in a wide variety of hydrogeological settings. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, karst hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Slievecallan Wind Farm, Seven Hills Wind Farm, Carrownagowan Wind Farm, and over 100 other wind farm related projects across the country. Michael worked on his first wind energy project in 2003, and he has continued to work on similar projects since then.

David Broderick (P. Geo., BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with over 19 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies

David moved into the private sector. David has a strong background in groundwater resource assessment, karst hydrology and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed over 25 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water and for private developments across the country in a wide variety of hydrogeological settings. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Ardderroo Wind Farm, Knockalough Wind Farm, and Oweninny Wind Farm, and over 60 other wind farm related projects across the country. David worked on his first wind energy project in 2010, and he has continued to work on similar projects since then.

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

1.3 WATER FRAMEWORK DIRECTIVE

Directive 2000/60/EC of the European Parliament and of the Council of 23rd October 2000 Establishing a Framework for Community Action in the Field of Water Policy (European Parliament 2000) is known as the Water Framework Directive (WFD).

The WFD requires all waterbodies (surface water bodies and groundwater bodies) to achieve both good chemical status and good ecological status (GES). For each River Basin District (RBD), a River Basin Management Plan (RBMP) outlines the actions required to enable natural waterbodies to achieve this (**Table A**: taken from the Directive 2000/60/EC). Waterbodies that are designated in the RBMP as Heavily Modified Water Bodies (HMWB) or Artificial Water Bodies (AWB) may be prevented from reaching GES by the physical modifications for which they are designated or the purpose for which they were constructed (e.g., navigation, flood defence, urbanisation). Instead, they are required to achieve good ecological potential (GEP), through implementation of a series of mitigation measures outlined in the applicable RBMP (and in some cases updated since the publication of the RBMP).

Table A: WFD Environmental Objectives

WFD Objectives:	
1	Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water.
2	Member States shall protect, enhance and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status by 2027.
3	Member States shall protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve good status by 2021 or 2027.
4	Progressively reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances.
5	Prevent Deterioration in Status and prevent or limit input of pollutants to groundwater.
6	Member States shall protect, enhance and restore all bodies of groundwater, ensure a balance between abstraction and recharge of groundwater, with the aim of achieving good groundwater status at the latest 15 years after the date of entry into force of this Directive, in accordance with the provisions laid down in Annex V, subject to the application of extensions determined in accordance with paragraph 4 and to application of paragraphs 5, 6 and 7 without prejudice to paragraph 8 of this Article and subject to the application of Article 11(3)(j).
7	Member States shall implement the measures necessary to reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order progressively to reduce pollution of groundwater.

Any activity which has the potential to have an impact on ecology will need consideration in terms of whether it could cause deterioration in the ecological status or potential of a waterbody. This requires the preparation of a compliance assessment to ascertain no deterioration to the waterbody status as a result against the following objectives:

- No changes affecting high status sites.
- No changes that will cause failure to meet surface water Good Ecological Status or Potential or result in a deterioration of surface water Ecological Status or Potential.
- No changes which will permanently prevent or compromise the Environmental Objectives being met in other waterbodies.
- No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those surface water, groundwater bodies and protected areas with potential to be affected by the Proposed Development and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

The majority of the Site (including all proposed 3 no. turbines) is located in the Dunmanus-Bantry-Kenmare water catchment within Hydrometric Area 21 of the Southwestern River Basin District (SWRBD) while the area in the northeast of the Site is located in the Lee, Cork Harbour and Youghal Bay water catchment within Hydrometric Area 19 of the Southwestern River Basin District (SWRBD).

Within the Dunmanus-Bantry-Kenmare water catchment, the Site is located in Coomhola_SC_010 sub-catchment with western portion located in Owenbeg (Owvane)_010 river sub-basin and eastern portion located in Owvane (Cork)_010 river sub-basin while within the Lee, Cork Harbour and Youghal Bay water catchment, the Proposed Development is located within the Lee[Cork]_SC_010 sub-catchment and Lee (Cork)_010 river sub-basin.

Within the Owenbeg (Owvane)_010 river sub-basin, the tributaries of the Owenbeg (Owvane)_010 flows through the Site towards southwest and drains out into the Owvane(Cork)_020 river. Within Owvane (Cork)_010 river sub-basin, the tributaries of Owvane (Cork)_010 river flows through the Proposed Development towards east and then southwest and drains out into the Owvane(Cork)_020 river. The Owvane(Cork)_020 river flows down into the Owvane(Cork)_030 river which drains out into the Inner Bantry Bay transitional waterbody.

With Lee (Cork)_010 river sub-basin, the tributaries of the Lee (Cork)_010 river flows through the Proposed Development towards northeast and drains out into the Lee (Cork)_020 river. The Lee(Cork)_020 flows down into the Lee(Cork)_030 which drains out into Lee(Cork)_040. The Lee(Cork)_040 passes through the Allua Lake waterbody and drains out into the Lee(Cork)_050. The Lee(Cork)_050 flows down into Carrigdrohid Lake waterbody. Further downstream of the Carrigdrohid Lake, the Inniscarra Lake is present and Lee (Cork)_090 originates from it and rains out into Lee (Cork) Estuary Upper transitional waterbody.

Table B presents the total upstream sub-catchment area that drains the Site and the total sub-catchment area of the rivers downstream from the Site as far as the Owvane (Cork)_030 and Lee(Cork)_050 rivers. The total upstream sub catchment area is ~78km² for Owvane(cork)_030 and more than 164 km² for the Lee(Cork)_050. Therefore, the river waterbodies which are in close proximity to the Site that have relatively smaller catchment areas (Owenbeg (Owvane)_010 and Lee(crok)_010) will be more susceptible to water quality impacts as a result of the Proposed Development in comparison to the downstream river bodies, located downstream of the Site.

A regional hydrology map of the area is shown below in Figure A and a local hydrology map as Figure B

.

Table B: Upstream Catchment Size for River Waterbodies

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Dunmanus-Bantry-Kenmare WFD Catchment	
Owenbeg (Owvane)_010	~8
Owvane (Cork)_010	~18
Owvane (Cork)_020	~72
Owvane (Cork)_030	~78
Lee, Cork Harbour and Youghal Bay WFD Catchment	
Lee (Cork)_010	~5
Lee (Cork)_020	~25
Lee (Cork)_030	~117
Lee (Cork)_040	~164
Lee (Cork)_050	>164

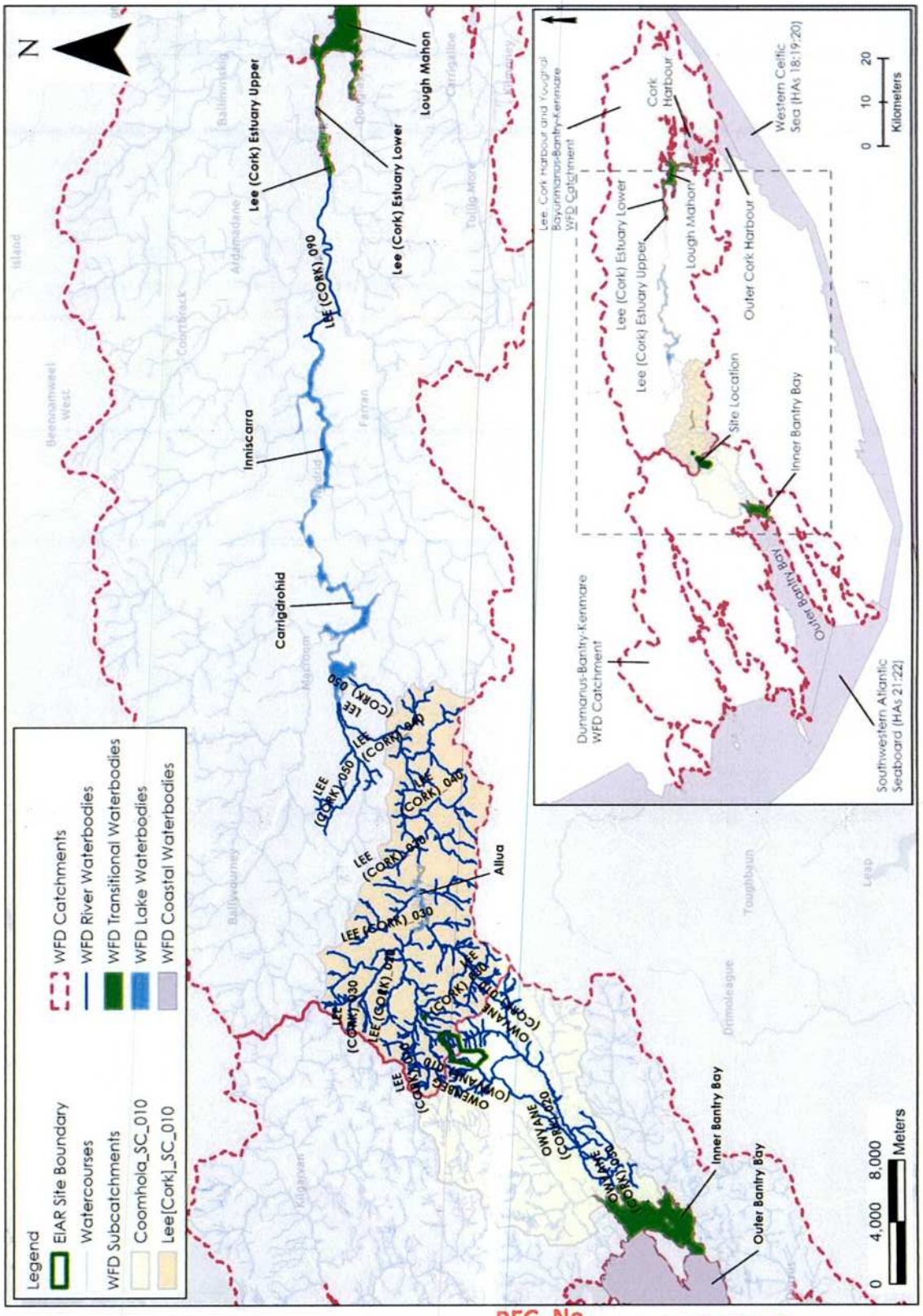

Figure A: Regional Hydrology Map

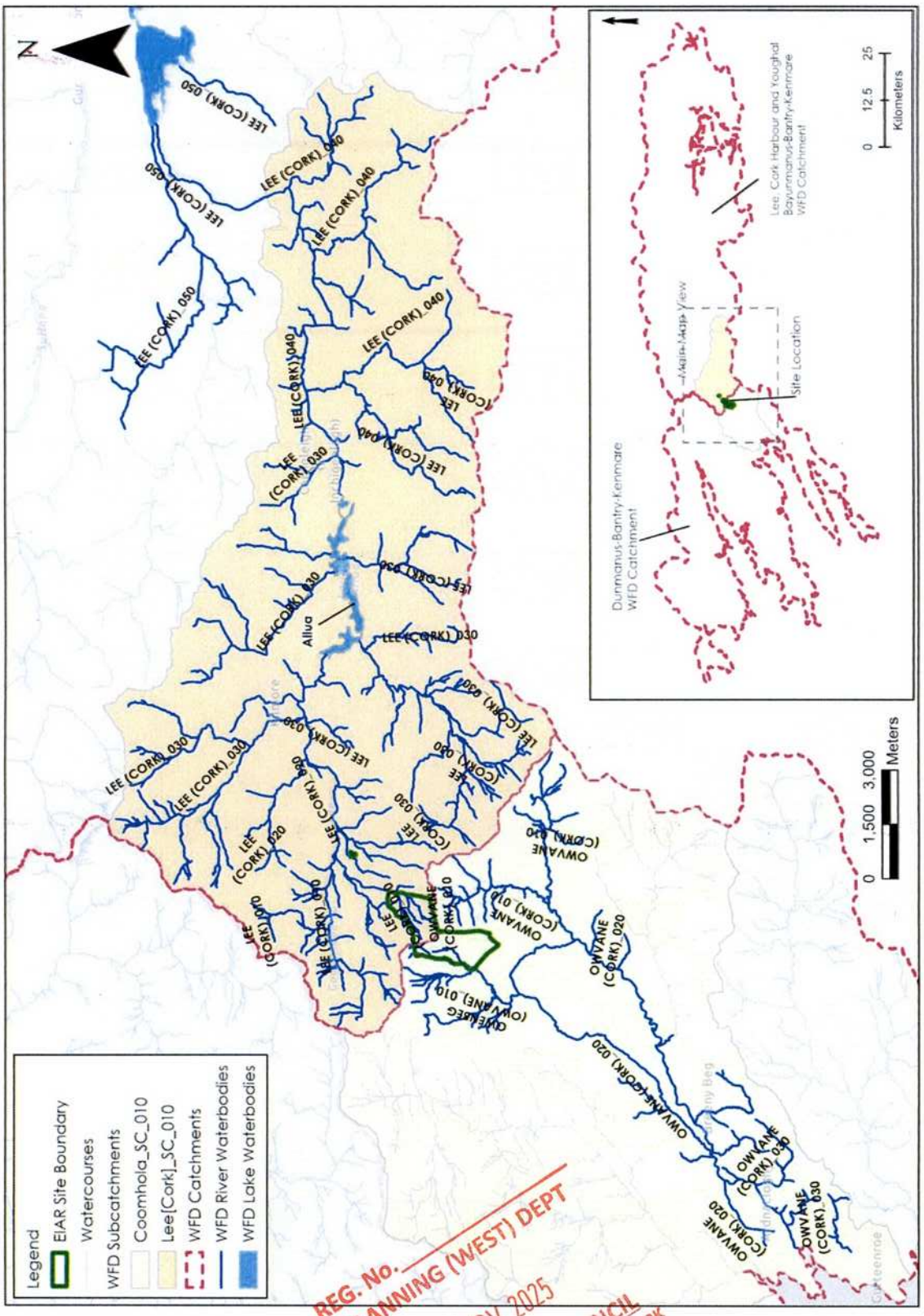

Figure B: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the Site are shown in **Table C**. The overall status of SWBs is based on the ecological, chemical and quantitative status of each SWB.

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

Within the Dunmanus-Bantry-Kenmare WFD Catchment, the Site is drained by the Owenbeg (Owvane)_010 in the west and by the Owvane (Cork)_010 in the east. The SWBs have achieved a "High" status in the latest WFD cycle and are "not at risk" of failing to achieve their WFDs 2027 objectives, with no significant pressure on these SWBs. Further downstream, these SWBs drains out into the Owvane (Cork)_020 river which have achieved "Good" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFDs 2027 objectives, with no significant pressure on it. The Owvane (Cork)_020 river flows down in the Owvane (Cork)_030 which have achieved "Good" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFDs 2027 objectives, with no significant pressure on it. In terms of transitional waterbodies, the Inner Bantry Bay have achieved a "High" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFD objectives with no significant pressure identified on this SWB. In terms of Coastal waterbodies, the Outer Bantry Bay and the Southwestern Atlantic Seaboard (HAs 21;22) have achieved "High" status in the latest WFD cycle and are "not at risk" of failing to achieve their WFD objectives with no significant pressure identified on these SWBs.

Within the Lee, Cork Harbour and Youghal Bay WFD Catchment, the Site is drained by the Lee (Cork)_010 which have achieved a "Good" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFDs 2027 objectives, with no significant pressure on this SWB. The Lee(Cork)_010 drains out into the Lee(cork)_020 which have achieved a "High" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFDs 2027 objectives, with no significant pressure on this SWB. Further downstream, the Lee(Cork)_030 and Lee(Cork)_040 have achieved "Good" status in the latest WFD cycle. The Lee(Cork)_030 is "not at risk" of failing to achieve its WFD objectives with no significant pressure identified on this SWB while the Lee(Cork)_040 is "at risk" of failing to achieve its WFD objectives with Hydromorphology as identified significant pressure on this SWB. The Lee(Cork)_040 passes through the Allua Lake and drains out into the Lee(Cork)_050. The Allua Lake have achieved "Poor" status in the latest WFD cycle and is "at risk" of failing to achieve its WFD objectives with Agriculture, Forestry and Urban Wastewater identified as significant pressure on this SWB. The Lee(Crok)_050 have achieved "Moderate" status and is "at risk" of failing to achieve its WFD objectives with Agriculture and Hydromorphology identified as significant pressure on this SWB. Further downstream, the Carrigdrohid Lake waterbody have achieved "Moderate" status and is "at risk" of failing to achieve its WFD objectives with Hydromorphology identified as significant pressure on this SWB while the Inniscarra Lake waterbody and Lee(Cork)_090 river waterbody have achieved "Good" status in the latest WFD cycle and are "not at risk" of failing to achieve its WFD objectives with no significant pressure identified on these SWBs. In terms of transitional waterbodies, the Lee (Cork) Estuary Upper and the Lough Mahon have achieved a "Moderate" status in the latest WFD cycle and are "at risk" of failing to achieve their WFD objectives with Urban Wastewater and Urban Run-Off as identified significant pressure on Lee (Cork) Estuary Upper and Urban Wastewater as identified significant pressure on the Lough Mahon. In terms of Coastal waterbodies, the Cork Harbour and the Outer Cork Harbour have achieved "Moderate" status in the latest WFD cycle and are "at risk" of failing to achieve their WFD objectives with Urban Run-Off and Urban Wastewater identified as significant pressure identified on Cork Harbour and Agriculture identified as significant pressure on Outer Cork Harbour while the Western Celtic Sea (HAs 18;19;20) have achieved "High" status in the latest WFD cycle and is "not at risk" of failing to achieve its WFD objectives with no significant pressure identified on this SWB.

The SWB status for the 2016-2021 WFD cycle are shown on **Figure C.**

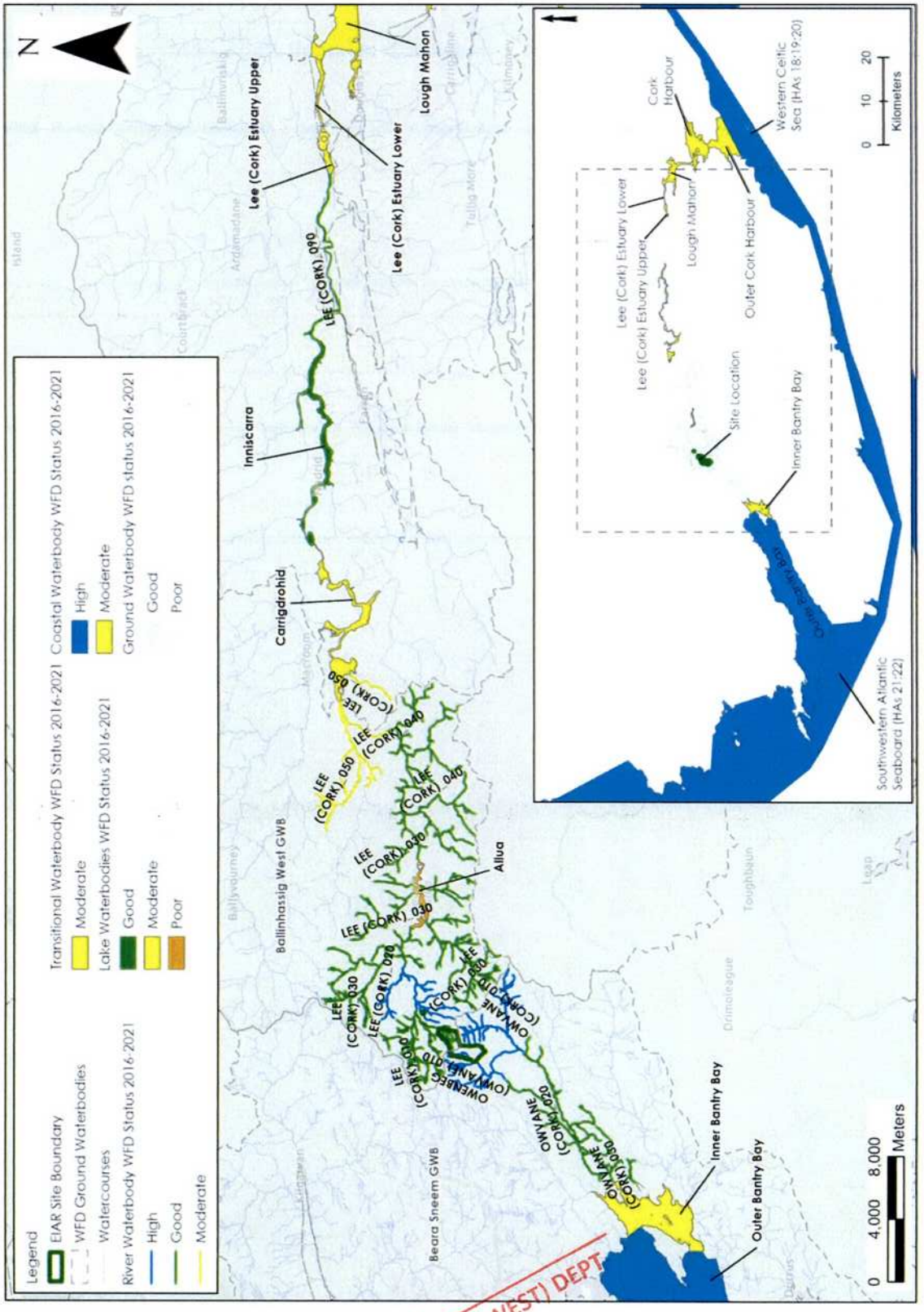

Figure C: WFD Surface Waterbody and Groundwater Body Status (2016-2021)

Table C: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Dunmanus-Bantry-Kenmare WFD Catchment					
Owenbeg (Owvane)_010	High	High	High	Not at Risk	None
Owvane (Cork)_010	High	High	High	Not at Risk	None
Owvane (Cork)_020	Good	Good	Good	Not at Risk	None
Owvane (Cork)_030	Unassigned	High	Good	Not at Risk	None
Inner Bantry Bay	Unassigned	Good	High	Not at Risk	None
Outer Bantry Bay	High	High	High	Not at Risk	None
Southwestern Atlantic Seaboard (HAs 21;22)	Unassigned	High	High	Not at Risk	None
Lee, Cork Harbour and Youghal Bay WFD Catchment					
Lee (Cork)_010	Good	High	Good	Not at Risk	None
Lee (Cork)_020	Moderate	Moderate	High	Not at Risk	None
Lee (Cork)_030	Good	Good	Good	Not at Risk	None
Lee (Cork)_040	High	High	Good	At Risk	Hydromorphology
Allua	Poor	Poor	Poor	At Risk	Agriculture, Forestry and Urban Wastewater
Lee (Cork)_050	Unassigned	Good	Moderate	At Risk	Agriculture and Hydromorphology
Carrigdrohid	Poor	Moderate	Moderate	At Risk	Hydromorphology
Inniscarra	Moderate	Moderate	Good	Not at Risk	None
Lee (Cork)_090	Moderate	Moderate	Good	Not at Risk	None
Lee (Cork) Estuary Upper	Moderate	Moderate	Moderate	At Risk	Urban Wastewater and Urban Run-Off
Lough Mahon	Moderate	Moderate	Moderate	At Risk	Urban Wastewater
Cork Harbour	Good	Moderate	Moderate	At Risk	Urban Run-Off and Urban Wastewater
Outer Cork Harbour	Good	Good	Moderate	At Risk	Agriculture
Western Celtic Sea (HAs 18;19;20)	Unassigned	High	High	Not at Risk	None

2.4 GROUNDWATER BODY IDENTIFICATION

Based on the GSI Bedrock Geology 100k mapping (www.gsi.ie), the northern part of the Site is underlain by Caha Mountain Formation described as Purple & green sandstone & siltstone. The southern part is underlain by Gun Point Formation described as Green-grey sandstone & purple siltstone while a very small area in the southernmost is underlain by Castlehaven Formation described as Purple mudstone and siltstone. The Caha Mountain Formation and Castlehaven Formation bedrock aquifer is described as Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones (Pl) while the Gun Point Formation bedrock aquifer is described as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll). There are 2 faults mapped in the southern part of the Site that run from east to west and one fault mapped running from northeast to southwest. This GSI map the occurrence of several areas of bedrock outcrop in the Site.

In terms of bedrock Groundwater Bodies (GWBs), the majority of the Site is underlain by Beara Sneem GWB while the area in the northeast of the Site is underlain by Ballinhassig West GWB.

As per the Beara Sneem GWB initial characterisation report, these rocks have no intergranular permeability; groundwater flow occurs in fractures and faults. Permeability is highest in the upper few metres but generally decreases rapidly with depth. In general, groundwater flow is concentrated in the upper 15 m of the aquifer, although deeper inflows from along fault zones or connected fractures can be encountered. Significant yields can be obtained where boreholes are drilled into known fault zones. However, yields are not necessarily sustainable, as the fracture networks are generally not extensive or wellconnected but primarily concentrated in the vicinity of the fault zones. Springs occur in some instances on fault zones. Groundwater levels are about 1.5-15 m below ground level,and will generally follow the topography. Close to the rivers and streams, water levels will be near ground level. Surface water features are considered to be in hydraulic continuity with the water table. Groundwater flow will be local. Groundwater flow paths are generally short, typically 30-300 m, with groundwater discharging to small springs, or to the streams and rivers that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. Groundwater is generally unconfined. Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low.

As per the Ballinhassig West GWB initial characterisation report, the Devonian ORS and Dinantian Mudstones & Sandstones of this GWB have no intergranular permeability; groundwater flow occurs in fractures and faults; in-filling of fractures is to be expected. The permeability of individual fractures and the degree of interconnection will be generally low, with fracturing confined to local zones. Permeability is highest in the upper few metres but generally decreases rapidly with depth. In general, groundwater flow is concentrated in the upper 15 m of the aquifer, although deeper inflows from along fault zones or connected fractures can be encountered. Significant yields can be obtained where boreholes are drilled into known fault zones. In these rocks groundwater flow paths are expected to be relatively short, typically from 30-300 m, with groundwater discharging to small springs, or to the streams that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. Groundwater is generally unconfined. Groundwater in the Devonian ORS and Dinantian Mudstones & Sandstones (Cork Groups) will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low.

2.5 GROUNDWATER BODY CLASSIFICATION

The Beara Sneem (IE_SW_G_019) and Ballinhassig West (IE_SW_G_005) Groundwater Bodies (GWBs) underlie the Site. The Beara Sneem and Ballinhassig West GWBs have achieved "Good" status in the latest WFD cycle and is "not at risk" of failing to meet its WFD objectives with no significant pressure on these GWBs.

The GWB status for the 2016-2021 WFD cycles are shown on **Figure C.**

Table D: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Beara Sneem	Good	Good	Good	Not at risk	-
Ballinhassig West	Good	Good	Good	Not at risk	-

2.6 ZONE OF INFLUENCE

The zone of influence of the Site extend to the following SWBs, GWBS, Lake and Transitional and Coastal water bodies:

- SWBs – Owenbeg (Owvane)_010, Owvane (Cork) River (Owvane (Cork)_010 to 030) and Lee(Cork) River (Lee(Cork)_010 to 050 and 090).
- GWBs – Beara Sneem GWB and Ballinhassig West GWB.
- Lake Waterbodies – Allua, Carrigdrohid and Inniscarra
- Transitional and Coastal waterbodies – Inner Bantry Bay, Outer Bantry Bay, Southwestern Atlantic Seaboard (HAs 21;22), Lee (Cork) Estuary Upper, Lough Mahon, Cork Harbour, Outer Cork Harbour and Western Celtic Sea (HAs 18;19;20).

2.7 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, Nutrient Sensitive Areas (NSA's), shellfish protected areas and Drinking Water Protected Area's (DWPA) within the vicinity of the Proposed Development are considered as part of the assessment.

2.7.1 Nature Conservation Designations

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

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The Site is not located within any designated site. The closest designated site to the Proposed Development is the Conigar Bog NHA (Site Code: 002386) located adjacent to the Site in the west. Designated Sites located in the area include:

- Conigar Bog NHA (Site Code: 002386), is located approximately 0.8km to the west of the Site
- Lough Allua pNHA (Site Code: 001065), is located approximately 4.2km to the northeast of the Site;
- Gouganebarra Lake pNHA (Site Code: 001057), is located approximately 2.2km to the north of the Site;

- Ballagh Bog pNHA (Site Code: 001886) is located approximately 2.3km to the northwest of the Site;
- Derryclogher (Knockboy) Bog SAC (Site Code: 001873), is located approximately 3.8km to the west of the Site; and,
- The Gearagh SAC (Site Code: 000108), is located approximately 19.5km to the northeast of the Site.

2.7.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There are no bathing waters in directly adjacent or downstream to the Site identified under the Bathing Water Regulations 2008.

2.7.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

The Lee(Cork)_090, Lee (Cork) Estuary Upper, Lough Mahon and Cork Harbour downstream of the Site are listed as NSAs.

2.7.4 Shellfish Waters

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There is no shellfish area mapped downstream of the Site. The closest shellfish area is Bantry Bay (IE_SW_170_0100) located ~10.5 southwest of the Site.

2.7.5 Salmonid Waters

The Salmonid Regulations (S.I. 293 / 1988) identifies the protected rivers that are designated as Designated Salmonid Waters under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations 1988, 14th August 1988. The Council Directive 78/659/EEC of 18th July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life and the Council Directive 92/42/EEC of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora was transposed into Irish law under the Fish Directive S.I. 293/1988 and Habitats Directive S.I. 477/2011.

The Lee (Cork) river (Lee(Cork)_010 to 050 and 090), Carrigdrohid and Inniscarra Lake waterbodies are identified as designated Salmonid Waters and are located downstream of the Proposed Development.

2.7.6 Drinking Water

The Lee(Cork)_030 and Lee(Cork)_090 downstream of the Site are listed as Drinking Water Protected Areas (DWPA's). All GWB's in Ireland are considered as DWPAs.

An abstraction point is present at Inchigeelagh at eastern (downstream) end of Lough Allua (Lee(Cork)_030). Only the northern section of the Site (entrance, access road and proposed turbine component turning area) drains into Lough Allua.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 21 no. surface waterbodies which are located in the vicinity and downstream of the Site. These include 10 no. river waterbodies, 3 no. lake waterbodies, 3 no. transitional waterbodies and 5 no. coastal waterbodies. In addition, 2 no. groundwater bodies underlie the Site. Furthermore, there are a number of protected areas in the vicinity and downstream of the Site.

3.1 SURFACE WATER BODIES

As shown in Figure A above, there are 21 no. SWBs are located in the vicinity or downstream of the Site.

Within Dunmanus-Bantry-Kenmare WFD Catchment, with consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that the Owenbeg (Owvane)_010 and Owvane (Cork)_010 to 030 will be brought through to the WFD Impact Assessment as elements of the Proposed Development are located within these river sub basins. Further downstream, the transitional waterbodies and the coastal waterbodies have been screened out due to their distant location, increase volume of water and saline nature of the water within these SWBs.

Within Lee, Cork Harbour and Youghal Bay WFD Catchment, with consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that the Lee (Cork)_010 to 030 will be brought through to the WFD Impact Assessment as elements of the Proposed Development is located within these river sub basins. Further downstream, the Lee (Cork)_040, 050 and 090, the lake waterbodies, the transitional waterbodies and the coastal waterbodies have been screened out due to their distant location, increase volume of water and saline nature of the water within these SWBs.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Beara Sneem and the Ballinhassig West GWBs have been screened in due to their location directly underlying the Site. Site works must not in any way result in a deterioration in the status of these GWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

The Gearagh SAC/SPA and Lough Allua pNHA have been screen in due to proposed works upstream of these sites.

The Conigar Bog NHA has been screened out as the NHA is separated from the Site by the Lackavane River valley and therefore there is no groundwater or surface water connectivity.

All other designated sites have been screened out due to their distant location from the Proposed Development, the increasing volumes of water or lack of hydrological connection between the designated site and the Site.

The Lee(Cork)_090, Lee (Cork) Estuary Upper, Lough Mahon and Cork Harbour NSAs has been screened out due to its distant location from the Proposed Development, increasing volumes of water within the Lee (Cork) river and saline nature of the water.

The Bantry Bay Shellfish Areas has been screened out as there is no hydrological connection between this Shellfish Areas and the Site.

The Lee(Cork)_010 and 030 Salmonid waters have been screened in as the salmonid waters are present directly downstream of the Site. The Lee(Cork)_040, 050 and 090, Carrigdrohid and Inniscarra Lake Salmonid Waers has been screened out due to its distant location from the Proposed Development and the increasing volumes of water within the Lee (Cork) river.

The Lee (Cork)_030 DWPA is located directly downstream of the Lee (Cork)_020 river. The Lee (Cork)_090 DWPS has been screened out due to its distant location from the Site and the increasing volumes of water within the Lee (Cork) river as well as the lack of proposed turbine locations within the River Lee catchment.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table E**.

Table E: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	**Dunmanus-Bantry-Kenmare WFD Catchment**			
	River	Owenbeg (Owvane)_010	**Yes**	The west side of the Site is mapped within the Owenbeg (Owvane)_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Owvane (Cork)_010	**Yes**	The east side of the Site is mapped within the Owvane (Cork)_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Owvane (Cork)_020	**Yes**	The Owvane (Cork)_020 is located directly downstream of the Owenbeg (Owvane)_010 and Owvane (Cork)_010 rivers. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Owvane (Cork)_030	**Yes**	The Owvane (Cork)_030 is located directly downstream of the Owvane (Cork)_020 river. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	Transitional	Inner Bantry Bay	No	The Inner Bantry Bay transitional waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Coastal	Outer Bantry Bay	No	The Outer Bantry Bay coastal waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Coastal	Southwestern Atlantic Seaboard (HAs 21;22)	No	The Southwestern Atlantic Seaboard (HAs 21;22) coastal waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Lee, Cork Harbour and Youghal Bay WFD Catchment			
	River	Lee (Cork)_010	**Yes**	The north side of the Proposed Development is mapped within the Lee (Cork)_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Lee (Cork)_020	**Yes**	The Lee (Cork)_020 is located directly downstream of the Lee (Cork)_010 river. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Lee (Cork)_030	**Yes**	The Lee (Cork)_030 is located directly downstream of the Lee (Cork)_020 river. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Lee (Cork)_040	No	The Lee (Cork)_040 SWB has been screened out due to its distant location from the

				Proposed Development and the increasing volumes of water within the Lee (Cork) river. This SWB has an upstream catchment area of ~164km². Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Lake	Allua	No	The Allua Lake waterbody has been screened out due to its distant location from the Proposed Development and the increasing volumes of water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	River	Lee (Cork)_050	No	The Lee (Cork)_050 SWB has been screened out due to its distant location from the Proposed Development and the increasing volumes of water within the Lee (Cork) river. This SWB has an upstream catchment area of more than 164km². Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Lake	Carrigdrohid	No	The Carrigdrohid Lake waterbody has been screened out due to its distant location from the Proposed Development and the increasing volumes of water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Lake	Inniscarra	No	The Inniscarra Lake waterbody has been screened out due to its distant location from the Proposed Development and the increasing volumes of water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	River	Lee (Cork)_090	No	The Lee (Cork)_090 SWB has been screened out due to its distant location from the Proposed Development and the increasing volumes of water within the Lee (Cork) river. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Transitional	Lee (Cork) Estuary Upper	No	The Lee (Cork) Estuary Upper transitional waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Transitional	Lough Mahon	No	The Lough Mahon transitional waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Coastal	Cork Harbour	No	The Cork Harbour coastal waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Coastal	Outer Cork Harbour	No	The Outer Cork Harbour coastal waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.
	Coastal	Western Celtic Sea (HAs 18;19;20)	No	The Western Celtic Sea (HAs 18;19;20) coastal waterbody has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SWB.

Groundwater Body	Groundwater	Beara Sneem	**Yes**	The majority of the Proposed Development is mapped to overlie the Beara Sneem GWB. Therefore, an assessment is required to consider the impacts of the Proposed Development on this GWB.
	Groundwater	Ballinhassig West	**Yes**	The northeastern portion of the Proposed Development is mapped to overlie the Ballinhassig West GWB. Therefore, an assessment is required to consider the impacts of the Proposed Development on this GWB.
Protected Areas	Designated Sites	Conigar Bog NHA	No	The Conigar Bog NHA has been screened out due to lack of hydrological/hydrogeological connections.
		Lough Allua pNHA	**Yes**	Lough Allua pNHA is screened in due to the Proposed Development being located upstream of this pNHA within the River Lee catchment.
		Boylegrove Wood pNHA	No	The Boylegrove Wood pNHA has been screened out due to its distant location from the Proposed Development and the increasing volumes of water. Therefore, the Proposed Development has no potential to impact the status of this pNHA.
		The Gearagh SAC and pNHA	**Yes**	The Gearagh SAC and pNHA is screened in due to the Proposed Development being located upstream of this SAC within the River Lee catchment
		The Gearagh SPA	**Yes**	The Gearagh SPA is screened in due to the Proposed Development being located upstream of this SAC within the River Lee catchment.
		Lee Valley pNHA	No	The Lee Valley pNHA has been screened out due to its distant location from the Proposed Development and the increasing volumes of water. Therefore, the Proposed Development has no potential to impact the status of this pNHA.
		Derryclogher (Knockboy) Bog SAC and pNHA	No	The Derryclogher (Knockboy) Bog SAC and pNHA has been screened out as there is no hydrological connection between this SAC and pNHA and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this SAC and pNHA.
		Gouganebarra Lake pNHA	No	The Gouganebarra Lake pNHA has been screened out as there is no hydrological connection between this pNHA and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this pNHA.
		Ballagh Bog pNHA	No	The Ballagh Bog pNHA has been screened out as there is no hydrological connection between this pNHA and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this pNHA.
		Sillahertane Bog NHA	No	The Sillahertane Bog NHA has been screened out as there is no hydrological connection between this NHA and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this NHA.
		Kilgarvan Wood pNHA	No	The Kilgarvan Wood pNHA has been screened out as there is no hydrological connection between this pNHA and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this pNHA.

		Glanlough Woods SAC	No	The Glanlough Woods SAC has been screened out as there is no hydrological connection between this SAC and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this SAC.
		Slaheny River Bog NHA	No	The Slaheny River Bog NHA has been screened out as there is no hydrological connection between this NHA and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this NHA.
		Kilgarvan Icehouse SAC	No	Kilgarvan Icehouse SAC has been screened out as there is no hydrological connection between this SAC and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this SAC
		Glengarriff Harbour and Woodland SAC	No	Glengarriff Harbour and Woodland SAC has been screened out as there is no hydrological connection between this SAC and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this SAC
		Great Island SAC	No	Great Island SAC has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SAC.
		Cork Harbour SPA	No	The Cork Harbour SPA has been screened out due to large volume of water, distant location from the Proposed Development and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of this SAC.
	Nutrient Sensitive Areas	Lee(Cork)_090, Lee (Cork) Estuary Upper, Lough Mahon and Cork Harbour	No	The Lee(Cork)_090, Lee (Cork) Estuary Upper, Lough Mahon and Cork Harbour NSAs has been screened out due to its distant location from the Proposed Development, increasing volumes of water within the Lee (Cork) river and saline nature of the water. Therefore, the Proposed Development has no potential to impact the status of these NSAs.
	Shellfish Areas	Bantry Bay	No	The Bantry Bay Shellfish Areas has been screened out as there is no hydrological connection between this Shellfish Areas and the Proposed Development. Therefore, the Proposed Development has no potential to impact the status of this Shellfish Areas.
	Salmonid Waters	Lee(Cork)_010 and 030	**Yes**	The Lee(Cork)_010 and 030 Salmonid waters have been screened in as the salmonid waters are present directly downstream of the Proposed Development. An assessment is required to consider the potential impacts of the Proposed Development on these salmonid waters.
		Lee(Cork)_040 to 050 and 090, Carrigdrohid and Inniscarra Lake	No	The Lee(Cork)_040, 050 and 090, Carrigdrohid and Inniscarra Lake Salmonid Waers has been screened out due to its distant location from the Proposed Development and the increasing volumes of water within the Lee (Cork) river. Therefore, the Proposed Development has no potential to impact the status of these Salmonid Waters.
	Drinking Water Protected	Lee(Cork)_030	**Yes**	The Lee (Cork)_030 DWPA is located directly downstream of the Lee (Cork)_020 river. An assessment is required to consider the potential impacts of the Proposed Development on this DWPA.

	Areas	Lee(Cork)_090	No	The Lee (Cork)_090 DWPS has been screened out due to its distant location from the Proposed Development and the increasing volumes of water within the Lee (Cork) river. Therefore, the Proposed Development has no potential to impact the status of this DWPA.

4. WFD COMPLIANCE ASSESSMENT

4.1 DEVELOPMENT PROPOSALS

The Proposed Development is described in full in Chapter 4 of the EIAR.
Works will typically involve tree felling, removal of shallow soil, peat and subsoils for upgrade of existing access roads including the turbine component turning area, proposed new internal access roads, internal cable network, hardstanding emplacement, turbine foundations, crane hardstands, temporary construction compound, borrow pit and met mast installation. The construction grade granular fill and the higher quality surfacing granular fill will be sourced from the proposed on-site borrow pit.

The primary risk to surface waters will be entrained suspended sediments (soil particles) in Proposed Development runoff during earthworks and tree felling along with potential release of cement-based compounds and/or hydrocarbons. The Proposed Development may also result in changes to surface water runoff volumes and flow patterns.

There are a number of potential adverse effects to both surface and groundwater.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects from Works Associated with the Proposed Development

Construction phase activities including tree felling, site levelling, roadway construction and turbine foundation/ hardstand excavation will require earthworks resulting in removal of vegetation cover and excavation of peat, soil and subsoils. The main risk will be from surface water runoff from bare soil and spoil areas during construction works.

Hydrocarbons and cement-based compounds will be used during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to surface waters at all construction sites. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Release of effluent from wastewater treatment systems also has the potential to impact on surface waters.

Construction phase activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks in the downstream SWBs.

The SWB with potential to be most impacted by these activities is the Owenbeg (Owvane)_010 and Owvane (Cork)_010 to 030 and Lee(Cork)_010 to 030 SWBs. Further downstream, the potential for water quality effects will decrease downstream due to the increasing volumes of water within the respective SWBs.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table F**.

Table F: Surface Water Quality Impacts during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Dunmanus-Bantry-Kenmare WFD Catchment			
Owenbeg (Owvane)_010	IE_SW_21O030200	High	Good
Owvane (Cork)_010	IE_SW_21O070200	High	Good
Owvane (Cork)_020	IE_SW_21O070400	Good	Moderate
Owvane (Cork)_030	IE_SW_21O070500	Good	Moderate
Inner Bantry Bay	IE_SW_170_0100	High	High
Outer Bantry Bay	IE_SW_170_0000	High	High
Southwestern Atlantic Seaboard (HAs 21;22)	IE_SW_150_0000	High	High
Lee, Cork Harbour and Youghal Bay WFD Catchment			
Lee (Cork)_010	IE_SW_19L030040	Good	Moderate
Lee (Cork)_020	IE_SW_19L030100	High	Good
Lee (Cork)_030	IE_SW_19L030200	Good	Moderate
Lee (Cork)_040	IE_SW_19L030300	Good	Good
Allua	IE_SW_19_4	Poor	Poor
Lee (Cork)_050	IE_SW_19L030360	Moderate	Moderate
Carrigdrohid	IE_SW_19_139	Moderate	Moderate
Inniscarra	IE_SW_19_138	Good	Good
Lee (Cork)_090	IE_SW_19L030800	Good	Good
Lee (Cork) Estuary Upper	IE_SW_060_0950	Moderate	Moderate
Lough Mahon	IE_SW_060_0750	Moderate	Moderate
Cork Harbour	IE_SW_060_0000	Moderate	Moderate
Outer Cork Harbour	IE_SW_050_0000	Moderate	Moderate
Western Celtic Sea (HAs 18;19;20)	IE_SW_010_0000	High	High

4.2.1.2 Potential Groundwater Quality/Quantity Effects

The accidental spillage of hydrocarbons, the release of effluent from wastewater treatment systems and the release of cement-based products have the potential to negatively impact on groundwater water quality at and in the vicinity of the Site.

Any contaminants which may be accidently released on-site are more likely to reach the bedrock rather than nearby streams and rivers across the majority of the Site. In addition, very minor groundwater seepages may occur in turbine base excavations will create additional small volumes of water to be treated by the drainage management system. Furthermore, temporary dewatering of excavations (turbine bases etc) may drawdown the local groundwater table.

Groundwater flows in the bedrock of the borrow pit will be limited to localised flows in the upper weathered bedrock layers or localised weaknesses. No regional groundwater flows will be intercepted during the excavation of the borrow pit.

Nevertheless, groundwater level impacts due to the Proposed Development are not anticipated to be significant due to the local hydrogeological regime. No groundwater level impacts are predicted from the construction of the collector cabling trench, access roads,

temporary construction compound or met mast due to the relatively shallow nature of the excavation (i.e. 0 -~2m).

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table G.**

Table G: Groundwater Quality Impacts during Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Beara Sneem	IE_SW_G_019	Good	Good
Ballinhassig West	IE_SW_G_005	Good	Good

4.2.1.3 Potential Protected Area Impacts

The hydrological and hydrogeological water connections from the Proposed Development could transfer poor quality surface water that may affect the conservation objectives of these designated sites.

The Gearagh SAC/SPA/pNHA is located downstream of the Proposed Development in the River Lee catchment. However, due to the lack of the Proposed Development in the River Lee catchment (i.e. works limited to site entrance, access road and turbine component turning area) as well as the potential for large flows in the River Lee, no significant effects on the Gearagh SAC/SPA/pNHA will occur.

Therefore, the Proposed Development has no potential to impact on downstream, designated sites such as the Gearagh SAC/SPA/pNHA.

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the Proposed Development will be much reduced in comparison to the construction phase.

4.2.2.1 Potential Surface Water Quantity Effects Downstream of Proposed Development

Progressive replacement of the soil or vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the Site and increase flood risk downstream of the Proposed Development.

During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and causing hydromorphological effects.

A summary of potential status change to SWBs arising from increased runoff during the operation stage of the Proposed Development in the unmitigated scenario are outlined in **Table H.**

Table H: Potential Impact on Surface Water Flows during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Dunmanus-Bantry-Kenmare WFD Catchment			
Owenbeg (Owvane)_010	IE_SW_21O030200	High	Good
Owvane (Cork)_010	IE_SW_21O070200	High	Good
Owvane (Cork)_020	IE_SW_21O070400	Good	Moderate
Owvane (Cork)_030	IE_SW_21O070500	Good	Moderate
Inner Bantry Bay	IE_SW_170_0100	High	High
Outer Bantry Bay	IE_SW_170_0000	High	High
Southwestern Atlantic Seaboard (HAs 21;22)	IE_SW_150_0000	High	High
Lee, Cork Harbour and Youghal Bay WFD Catchment			
Lee (Cork)_010	IE_SW_19L030040	Good	Moderate
Lee (Cork)_020	IE_SW_19L030100	High	Good
Lee (Cork)_030	IE_SW_19L030200	Good	Moderate
Lee (Cork)_040	IE_SW_19L030300	Good	Good
Allua	IE_SW_19_4	Poor	Poor
Lee (Cork)_050	IE_SW_19L030360	Moderate	Moderate
Carrigdrohid	IE_SW_19_139	Moderate	Moderate
Inniscarra	IE_SW_19_138	Good	Good
Lee (Cork)_090	IE_SW_19L030800	Good	Good
Lee (Cork) Estuary Upper	IE_SW_060_0950	Moderate	Moderate
Lough Mahon	IE_SW_060_0750	Moderate	Moderate
Cork Harbour	IE_SW_060_0000	Moderate	Moderate
Outer Cork Harbour	IE_SW_050_0000	Moderate	Moderate
Western Celtic Sea (HAs 18;19;20)	IE_SW_010_0000	High	High

4.2.2.2 Surface Water Quality Impacts from Operational Site Drainage

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of the site entrance, internal roads and hardstand areas. These works are of a very minor scale and very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the Proposed Development in the unmitigated scenario are outlined in Table I.

Table I: Surface Water Quality Impacts during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Dunmanus-Bantry-Kenmare WFD Catchment			
Owenbeg (Owvane)_010	IE_SW_21O030200	High	Good

Owvane (Cork)_010	IE_SW_21O070200	High	Good
Owvane (Cork)_020	IE_SW_21O070400	Good	Moderate
Owvane (Cork)_030	IE_SW_21O070500	Good	Moderate
Inner Bantry Bay	IE_SW_170_0100	High	High
Outer Bantry Bay	IE_SW_170_0000	High	High
Southwestern Atlantic Seaboard (HAs 21;22)	IE_SW_150_0000	High	High
Lee, Cork Harbour and Youghal Bay WFD Catchment			
Lee (Cork)_010	IE_SW_19L030040	Good	Moderate
Lee (Cork)_020	IE_SW_19L030100	High	Good
Lee (Cork)_030	IE_SW_19L030200	Good	Moderate
Lee (Cork)_040	IE_SW_19L030300	Good	Good
Allua	IE_SW_19_4	Poor	Poor
Lee (Cork)_050	IE_SW_19L030360	Moderate	Moderate
Carrigdrohid	IE_SW_19_139	Moderate	Moderate
Inniscarra	IE_SW_19_138	Good	Good
Lee (Cork)_090	IE_SW_19L030800	Good	Good
Lee (Cork) Estuary Upper	IE_SW_060_0950	Moderate	Moderate
Lough Mahon	IE_SW_060_0750	Moderate	Moderate
Cork Harbour	IE_SW_060_0000	Moderate	Moderate
Outer Cork Harbour	IE_SW_050_0000	Moderate	Moderate
Western Celtic Sea (HAs 18;19;20)	IE_SW_010_0000	High	High

4.2.2.3 Potential Protected Area Impacts

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete.

Therefore, the risk of any operational phase activities that may affect the conservation objectives of the protected areas is greatly reduced and therefore no effects are expected.

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction, operational and decommissioning phases of the Proposed Development. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures for Clear Felling of Coniferous Plantation

Best practice methods relating to water protection incorporated into the forestry management and mitigation measures (listed below) have been derived from:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;

- Coillte (2009): Forest Operations and Water Protection Guidelines;
- Coillte (2009): Methodology for Clear Felling Harvesting Operations;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures; and,
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in **Table J**.

Table J: Minimum Buffer Zone Widths (Forest Service, 2000)

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

Approximately 8.8ha of forestry will require felling as part of the Proposed Development. During the wind turbine construction phase a self-imposed buffer zone of 50 metres will be maintained for all streams where possible. Less than 1ha of the proposed tree felling is inside a 50m watercourse buffer zone.

Additional mitigation (detailed below) will be carried out where tree felling is required inside the buffer zones.

The large distance between most proposed felling areas (which are outside the 50m buffer zone) and sensitive aquatic zones means that potential poor-quality runoff from felling areas will be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes.

The following additional mitigation measures will be employed during tree felling. Additional measures are indicated for felling inside the 50m buffer zone.

Mitigation by Design:

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

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Inside the 50m buffer silt fencing will be placed downslope of the felling areas;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as

required, where there are steep gradients, and should avoid being placed at right angles to the contour;

- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50 meter buffer is required, it will be necessary to install double or triple sediment traps;
- Double silt fencing will also be put down slope of felling areas which are located inside the 50 meter buffer zone;
- All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- No crossing of streams by machinery will be permitted and only travel perpendicular to and away from stream will be allowed;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted at the Site; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Silt Traps:

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

Drain Inspection and Maintenance:

The following items shall be carried out during pre-felling inspections and after:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections the main drainage ditches shall be identified. Ideally the pre-felling inspection shall be carried out during rainfall;

- Following tree felling all main drains shall be inspected to ensure that they are functioning;
- Extraction tracks nears drains need to be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the Site will be unblocked; and,
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

4.3.1.2 Mitigation Measures to Earthworks Resulting in Suspended Solids

Proposed Mitigation by Avoidance:

The key mitigation measure during the construction phase is the avoidance of sensitive hydrological features where possible, by application of suitable buffer zones (i.e. 50m to main watercourses). The majority of the key Proposed Development areas are located away from the delineated 50m watercourse buffer zones with the exception of the upgrading of the existing access roads. Additional control measures, which are outlined further on in this section, will be undertaken at these locations.

The proposed riparian replanting will naturally occur inside the 50m buffer zone, but due to the minimal requirement for excavations/digging, no generation of spoil or exposure of subsoils will occur.

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

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

Proposed Mitigation by Design:

Presented below are temporary and long-term drainage control measures that will be utilised during the construction phase of the development. As stated above, there is an existing forestry drainage network at the Site. The measures outlined below will be used in conjunction with the existing drainage network to ensure protection of all rivers and streams downstream of the Site.

Source controls:

- Interceptor drains, vee-drains, diversion drains.
- Small working areas, covering temporary stockpiles, weathering off of side-cast peat/spoil and cessation of works.

In-Line controls:

- Interceptor drains, vee-drains, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.

Treatment systems:

- Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as "Siltbuster", and/or other similar/equivalent or appropriate systems.

There is an extensive network of forestry drains already existing at the Site, and these will be integrated and enhanced as required and used within the wind farm development drainage system. The key elements being the upgrading and improvements to water treatment elements, such as in-line controls and treatment systems, including silt traps and settlement ponds.
The main elements of interaction with existing drains will be as follows:

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the Proposed Development drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works / tree felling is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;
- During the construction phase of the wind farm, runoff from individual turbine hardstanding areas will not be discharged into the existing drain network but discharged locally at each turbine location through stilling ponds and buffered outfalls onto vegetated surfaces;
- Buffered outfalls which will be numerous over the Site will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the Site; and,
- Drains running parallel to the existing roads that requiring widening will be upgraded, widening will be targeted to the opposite side of the road. Velocity and silt control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.

Water Treatment Train:

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

Silt Fences:

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to the existing drainage network of sand and gravel-sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be placed downstream of works inside the 50m buffer zone.

Silt Bags:

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

Watercourse crossings:

There are no proposed new watercourse crossings at the Site. There are 2 no. existing stream crossings along existing roads that are proposed for upgrade. The upgrade works will be limited to extending the existing culvert.

There are also 5 no. existing watercourse crossings along forestry roads that will be used by the Proposed Development but will not require upgrading.

During the 2-no. culvert upgrade works at the Site, the follow mitigation measures will be employed:

- All guidance / mitigation measures required by the OPW and/or the Inland Fisheries Ireland (IFI)1 is incorporated into the design of the proposed crossing upgrades;
- All drainage measures will be installed in advance of the works;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by IFI for in-stream works according to the IFI (2016) guidance document "Guidelines on protection of fisheries during construction works in and adjacent to waters", i.e., July to September inclusive. This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);
- A double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- At the proposed culvert upgrade locations temporary damming and over pumping will be undertaken to manage flows in the watercourse if required; and,
- All new river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

Pre-emptive Site Drainage Management:

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

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

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

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

- Consultancy Service: Met Éireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

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

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

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

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

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

Management of Runoff from Peat and Subsoil Storage Areas:

It is proposed that excavated peat/soil will be used for landscaping and/or biodiversity enhancement throughout the Site and any excess peat/spoil will be used to reinstate the 1 no. proposed borrow pit as well as placed permanently at 3 no. dedicated peat/spoil management areas. The borrow pit and 3 no. dedicated peat/spoil management areas are all located outside of 50m watercourse buffer zones.

During the initial placement of peat and subsoil, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the reinstatement areas.

Drainage from peat/spoil management areas will ultimately be routed to an oversized swale and a number of stilling ponds pond with appropriate storage and settlement designed for a 1 in 10 year 6 hour return period, before being discharged to the on-site drains.

Peat/subsoil reinstatement areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil reinstatement areas will no longer be a potential source of silt laden runoff.

4.3.1.3 Groundwater Effects Levels during Excavation Works

The proposed borrow pit is located in siltstone bedrock which is generally unproductive in terms of groundwater flow. This was confirmed by the investigation drilling carried out at the proposed borrow pit location (refer to drilling log for RC-01 in Appendix 8-1 of the EIAR) which encountered very strong siltstone bedrock throughout the full drilling depth (10.4m below ground level).

The topographical and hydrogeological setting of the proposed borrow pit location means no significant groundwater dewatering is anticipated to be required during the operation of the borrow pit. Moreover, direct rainfall and surface water runoff will be the main inflows that will require water volume and water quality management. For the avoidance of doubt, we would generally define dewatering as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g. as would be required for the operation of a bedrock quarry in a valley floor. We consider that this example is very different in scale and operation from the proposed operation of a temporary shallow borrow pit on the side of a hill. In order to explain this thoroughly we will outline our reasoning in a series of bullet points as follows:

- Firstly, the borrow pit area is located on the side of rocky local hills where the ground elevation is 315m OD and therefore are rock outcrops;

- These elevations are above the elevations of the local valleys and streams;
- The proposed borrow pit will be between approximately 8 – 10m below ground level which is notable. However, in the context of the topographical/elevated setting of the borrow pits, this depth range is relatively shallow;
- The local bedrock comprises SILTSTONE and is known to be generally unproductive. This means that groundwater flows will be relatively minor;
- The flow paths (i.e. the distance from the point of recharge to the point of discharge) in this type of geology is short, localised, and will also be relatively shallow;
- No regional groundwater flow regime, i.e. large volumes of groundwater flow, will be encountered at these elevations;
- Therefore shallow groundwater inflows will largely be fed by recent rainfall, and possibly by limited groundwater seepage form localised shallow bedrock;
- The sloping nature of the ground on the hills where the borrow pit is proposed along with the coverage of soil means groundwater recharge is going to be very low;
- As such the shallow groundwater flow system will be small in comparison to the expected surface water flows from the bog surface;
- This means that there will be a preference for high surface water runoff as opposed to groundwater recharge and flow; and,
- Hence, the management of surface water will form the largest proportion of water to be managed and treated.

4.3.1.4 Mitigation Measures to excavation dewatering and potential impacts on Surface Water Quality

Management of groundwater seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build up of water in the excavation;
- The interceptor drainage will be discharged to the constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

4.3.1.5 Mitigation Measures for Release of Hydrocarbons during construction

The proposed mitigation measures include:

- All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site;

- Wherever possible, vehicles will be refuelled off-site, particularly for regular road-going vehicles. On-site refuelling of machinery will be carried out at designated refuelling areas at various locations throughout the Site.
- Heavy plant and machinery will be refuelled on-site by a fuel truck that will come to the Site as required on a scheduled and organised basis. Other refuelling will be carried out using mobile double skinned fuel bowser. The fuel bowser will be parked on a level area on-site when not in use.
- All refuelling will be carried out outside designated watercourse buffer zones.
- Only designated trained and competent operatives will be authorised to refuel plant on-site. Mobile measures such as drip trays and fuel absorbent mats will used during refuelling operations as required.
- All plant and machinery will be equipped with fuel absorbent material and pads to deal with any event of accidental spillage.
- Fuels stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction;
- The plant used will be regularly inspected for leaks and fitness for purpose;
- A permit to refuel system will be employed;
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

4.3.1.6 Mitigation Measures to Prevent Groundwater and Surface Water Contamination from Wastewater Disposal

The proposed mitigation measures include:

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at the Site compound, maintained by the providing contractor, and removed from Site on completion of the construction works;
- Water supply for the Site office and other sanitation will be brought to site and removed after use from the Site to be discharged at a suitable off-site treatment location; and,
- No water or wastewater will be sourced on the Site, nor discharged to the Site.

4.3.1.7 Mitigation Measures from Release of Cement-Based Products

The proposed mitigation measures include:

- No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be isolated in temporary lined wash-out pit. These temporary lined wash-out pit will be removed from the Site at the end of the construction phase;
- Will use weather forecasting to plan dry days for pouring concrete; and,
- Will ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.8 Mitigation Measures for Hydrologically connected Designated Sites:

The potential for material to enter the downstream protected areas is negligible as mitigation controls as described above will be implemented. These measures include the use of silt

fences, silt traps and check dams. Emphasis will also be placed on prevention of hydrocarbon releases to local watercourses.

It can be concluded that with best practice methods adhered to during the construction of the Proposed Development, the potential to affect the qualifying interests of downstream designated sites is not significant.

4.3.1.9 Effects on the Lough Allua Water Supply Abstraction (Lee(Cork)_030 DWPA)

A comprehensive surface water management plan (Appendix 4-7) and drainage plan (Appendix 4-4) has been prepared for the Proposed Development, and this will ensure that surface water runoff from the developed areas of the Site will be of a high quality and will therefore not impact on the quality of downstream rivers and lakes. During the layout optimisation process, all surface waters at the Site were classified as very sensitive. Very sensitive surface waters are receptors of high environmental importance such as designated sites (i.e. NHA or SAC), or public drinking water supplies. The surface waters at the Site were applied the highest possible sensitivity rating and appropriate mitigation measures which include avoidance and best practice engineering design measures are proposed to avoid significant impacts.

In addition, large lakes by their nature are natural sinks for suspended sediments that are transported in by rivers and streams. The retention time of water in lakes the size of Lough Allua (area of approximately 1.3km^2) would be significant and this would ensure that the majority of suspended sediments would settle out prior to the water leaving the lake (it should be noted that the Lough Allua abstraction is at the outfall end of the lake and therefore water which enters via streams must pass through the entire length of the lake before it is abstracted and therefore attenuation is maximised).

To demonstrate the retention capacity of Lough Allua the volume of the lake is estimated using a conservative average depth of 1.5m.

Based on a plan area of 1.3km^2 the total lake volume is calculated at 1,950,000m^3. Based on a 10%ile flow of 49,320m^3/hr (EPA Hydro-tool) for the River Lee at the lake outfall, there would be a retention time 39.5 hours. Based on a 50%ile flow of 11,520m^3/hr, the retention time would be 169 hours.

For comparison purposes, the EPA guidance document - *Environmental Management in the Extractive Industry (Non-Scheduled Minerals)* recommends for the removal of fine sized silt particles (0.004mm) settlement ponds should have a minimum 24-hour retention period.

It should be noted that the Proposed Development drainage design does not rely on the assimilative capacity of streams or lakes to reduce potential water quality impacts. The potential impacts on surface water quality of local streams were determined to be imperceptible to slight and only on a temporary basis. Therefore, surface water quality impacts on the downstream Lough Allua will not occur.

4.3.2 Operational Phase

4.3.2.1 Mitigation Measures for Progressive Replacement of Natural Surface with Lower Permeability Surfaces

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

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed into downstream field drains;
- Collectors drains will be used to gather runoff from access roads and turbine hardstanding areas, likely to have entrained suspended sediment, and channel it to new local settlement ponds for sediment settling;
- On sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/roadside drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of access road sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing drains;
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures for Runoff Resulting in Suspended Solids

Mitigation measures for sediment control are the same as those outlined in Section 4.3.1.1.

Mitigation measures for control of hydrocarbons during maintenance works are similar to those outlined in Section 4.3.1.5.

4.3.3 Decommissioning Phase

The potential impacts associated with decommissioning of the Proposed Development will be similar to those associated with construction but of a reduced magnitude, due to the reduced scale of the proposed decommissioning works in comparison to construction phase works.

During decommissioning, it may be possible to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine base areas.

This will be done by covering with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation. Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude. However, as noted in the Scottish Natural Heritage report (SNH) *Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms* (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is, therefore:

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

Some of the impacts will be avoided by leaving elements of the Proposed Development in place where appropriate. The turbine bases will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects. All access roads and hardstanding areas forming part of a site roadway network will be required by the ongoing forestry operations and therefore will be left in situ for future use.

As per the original grant of permission (PL04.127297/ ABP Ref. 04.127297), the existing onsite 38kV substation will be decommissioned. The underground cabling in the existing onsite 38kV substation footprint will be cut at either end and left in situ. The existing onsite 38kV substation and access footprint will be covered with soil and allowed to revegetate naturally, in a similar

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

No significant effects on the hydrological and hydrogeological environment are envisaged during the decommissioning stage of the Proposed Development.

4.3.4 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3.3** will allow all relevant waterbodies to maintain their existing status and meet future WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table K** below.

Table K: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	Current Status	Assessed Potential Status Change – Unmitigated	Assessed Potential Status Change – Mitigated
Surface Water Bodies				
Dunmanus-Bantry-Kenmare WFD Catchment				
Owenbeg (Owvane)_010	IE_SW_21O030200	High	Good	High
Owvane (Cork)_010	IE_SW_21O070200	High	Good	High
Owvane (Cork)_020	IE_SW_21O070400	Good	Moderate	Good
Owvane (Cork)_030	IE_SW_21O070500	Good	Moderate	Good
Inner Bantry Bay	IE_SW_170_0100	High	High	High
Outer Bantry Bay	IE_SW_170_0000	High	High	High
Southwestern Atlantic Seaboard (HAs 21;22)	IE_SW_150_0000	High	High	High
Lee, Cork Harbour and Youghal Bay WFD Catchment				
Lee (Cork)_010	IE_SW_19L030040	Good	Moderate	Good
Lee (Cork)_020	IE_SW_19L030100	High	Good	High
Lee (Cork)_030	IE_SW_19L030200	Good	Moderate	Good
Lee (Cork)_040	IE_SW_19L030300	Good	Good	Good
Allua	IE_SW_19_4	Poor	Poor	Poor
Lee (Cork)_050	IE_SW_19L030360	Moderate	Moderate	Moderate
Carrigdrohid	IE_SW_19_139	Moderate	Moderate	Moderate
Inniscarra	IE_SW_19_138	Good	Good	Good
Lee (Cork)_090	IE_SW_19L030800	Good	Good	Good
Lee (Cork) Estuary Upper	IE_SW_060_0950	Moderate	Moderate	Moderate
Lough Mahon	IE_SW_060_0750	Moderate	Moderate	Moderate
Cork Harbour	IE_SW_060_0000	Moderate	Moderate	Moderate
Outer Cork Harbour	IE_SW_050_0000	Moderate	Moderate	Moderate
Western Celtic Sea (HAs 18;19;20)	IE_SW_010_0000	High	High	High
Groundwater Body				
Beara Sneem	IE_SW_G_019	Good	Good	Good
Ballinhassig West	IE_SW_G_005	Good	Good	Good

5. WFD ASSESSMENT CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the Site are defined in **Section 2** above.

The Proposed Development does not involve any abstraction of groundwater or alteration of drainage patterns. Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during the construction, operational and decommissioning phase of the Proposed Development.

There will be no direct discharge from the Proposed Development to downstream receiving waters. Mitigation for the protection of surface water during the construction, operation and decommissioning phases of the Proposed Development will ensure the qualitative status of the receiving waters will not be altered by the Proposed Development.

There is also mitigation proposed to protect groundwater quality within the Site during the construction, operational and decommissioning phases of the Proposed Development. These mitigation measures will ensure the qualitative status of the underlying GWB will not be altered by the Proposed Development.

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

As such, the Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC).

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