APPENDIX 9-3

WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT

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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
PROPOSED CAHERMURPHY WEST WIND FARM, CO. CLARE

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

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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 Cahermurphy West Wind Farm and Proposed Grid Connection (Proposed Project) near Kilmihil in Co. Clare.

The Proposed Project (Proposed Wind Farm and Proposed Grid Connection) is described in full in Chapter 4 of the accompanying EIAR.

For the purpose of this assessment, where the 'Proposed Wind Farm' is referred to, this relates to all components within the Wind Farm Application under Section 37E of the Planning and Development Act 2000, as amended, as described in Section 4.1 of Chapter 4 of the EIAR and all associated lands. The Proposed Wind Farm works also includes the Turbine Delivery Route (TDR) work areas and Hen Harrier Enhancement Plan areas.

Where the 'Proposed Grid Connection' is referred to, this relates to all components within the Proposed Grid Connection Application under Section 182A of the Planning and Development Act 2000, as amended, as described in Section 4.1 of Chapter 4 of the EIAR and all associated lands. Refer to Section 4.1 below for a summary of the Proposed Project.

The purpose of this WFD assessment is to determine if any specific components or activities associated with the Proposed Project 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 Assessment is intended to supplement the EIAR submitted as part of the Proposed Project planning application.

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 Environmental Engineer 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. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland 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 WF, Cahermurphy (Phase I & II) WF, Carrownagowan WF, and Croagh WF and over 100 other wind farm related projects across the country.

David Broderick (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 and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. 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 several wind farms in Co. Clare (Booltiagh WF, Cahermurphy WF, Glenmore WF and Crossmore WF) as well as over 60 other wind farm related projects across the country.

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

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. The RBMP includes identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021, and the third cycle covers the period from 2022 to 2027[1]. The RBMPs are forward looking.

The Water Action Plan 2024 is Ireland's 3rd River Basin Management Plan (2022 - 2027). The objectives of the Water Action Plan 2024 have been integrated into the design of the Proposed Project and include:

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

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.

[1] *The WFD RBMP cycles are forward looking plans, so 2009-2015 (1st Cycle), 2016-2021 (2nd Cycle), and 2022-2027 (3rd Cycle) are the plans and they use status from the previous 6 years.*
The EPA updates status every three years, but they also complete an additional assessment mid-RBMP cycle. The mid-cycle status does not get reported to the Commission.
The linkage between the two is that the 2nd Cycle plan uses the 2009-2015 status, the 3rd Cycle plan uses the 2016-2021 status. The 2013-2018 status was not used in the RBMP and the 2019-2024 status will not be used in the next RBMP.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

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

Figure A below is a local hydrology map of the study area.

2.2 SURFACE WATERBODY IDENTIFICATION

Proposed Wind Farm:

Regionally the Proposed Wind Farm site is located in the Mal Bay WFD catchment within Hydrometric Area 28 of the Shannon River Basin District.

On a local scale the northern section of the Proposed Wind Farm site (2 no. of 8 turbines) is located within the Annageeragh River sub-catchment (Annageeragh_SC_010) and the Annageeragh_030 river sub basin while the southern section of the site (6 no. of 8 turbines) is located within the Creegh River sub-catchment (Kiltumperstream_SC_010) and the Creegh_020 river sub basin. The southwestern section in the Kiltumperstream_SC_010 sub-catchment is mapped within the Creegh_010 river sub basin.

Within the Annageeragh_030 river sub-basin, the Annageeragh_030 River passes through the northwestern section and also along the northeastern boundary of the Proposed Wind Farm site. The Annageeragh_030 river drains into the Shannon Plume (HAs 27;28) coastal waterbody via Lough Donnell.

Within the Creegh_020 river sub-basin, the Creegh_020 river flows west in the central part of the Proposed Wind Farm site. The Creegh_020 river drains out into the Doonbeg Bay coastal waterbody via Creegh_030 river. Within the Creegh_010 river sub-basin, the Creegh_010 river flows towards west ~300 south of the Proposed Wind Farm site.

Table A presents the catchment area of each waterbody downstream of the Proposed Wind Farm site as far as the Coastal waterbodies. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the SWBs. Therefore, those waterbodies which are located in close proximity to the Proposed Wind Farm site are more susceptible to water quality impacts as a result of activities associated with the Proposed Wind Farm site. The potential for the Proposed Wind Farm site to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table A: Catchment Area Downstream of Proposed Wind Farm

WFD River Sub-Basin	Total Upstream Catchment Area (km^2)
Annageeragh_SC_010 sub-catchment	
Annageeragh_030	~66
KiltumperStream_SC_010 sub-Catchment	
Creegh_010	~10
Creegh_020	~71
Creegh_030	~87

Proposed Grid Connection:

The northern section of the Proposed Grid Connection route is mapped within the Mal Bay Catchment (HA: 28) and the southern section of the route is mapped within the Shannon Estuary North Catchment (HA:27) of the Shannon River Basin District.

On a local scale, within the Mal Bay Catchment, the northern section is mapped within the KiltumperStream_SC_010 sub-catchment and southern section is mapped within the Doonbeg_SC_010 sub-catchment. Within the Shannon Estuary North Catchment, the northern section of the Proposed Grid Connection route is mapped within the Wood_SC_010 sub-catchment and the southern section is mapped within the Cloon[Clare]_SC_010 sub-catchment.

Within the KiltumperStream_SC_010 sub-catchment, the Proposed Grid Connection route is mapped within the Creegh_010 and Creegh_020 river sub-basins. Within the Doonbeg_SC_010 sub-catchment, the Proposed Grid Connection route is mapped within the Doonbeg_030 river sub-basin. Within the Wood_SC_010 sub-catchment, the Proposed Grid Connection route is mapped within the Moyasta_010, Wood_010 and Tarmon Lough Stream_010 river sub-basins. Within the Cloon[Clare]_SC_010 sub-catchment, the Proposed Grid Connection route is mapped within the Tonavoher_010 river sub-basin.

Within the Creegh_010 river basin, the Creegh_010 river flows towards west. Within the Creegh_020 river sub-basin, the Creegh_020 river crosses the Proposed Grid Connection route twice. Within the Doonbeg_030 river sub-basin, the Doonbeg_030 river crosses the Proposed Grid Connection route six times. Within the Moyasta_010 river sub-basin, the Moyasta_010 river cross the Proposed Grid Connection route. Within the Wood_010 river sub-basin, the Wood_010 river crosses the Proposed Grid Connection route crosses four times. Within the Tarmon Lough Stream_010 river sub-basin, the Tarmon Lough Stream_010 flows ~400m east of the Proposed Grid Connection route. Within the Tonavoher_010 river sub-basin, the Tonavoher_010 river crosses the Proposed Grid Connection route twice.

The Creegh_010 river drains into the Doonbeg Bay coastal waterbody via Creegh_020 to Creegh_040 rivers. The Doonbeg_030 river drains out into the Doonbeg Estuary transitional waterbody via Doonbeg_040 to Doonbeg_050 rivers. The Moyasta_010 river drains into the Mouth of the Shannon (HAs 23;27) coastal waterbody. The Wood_010 river drains into the Mouth of the Shannon (HAs 23;27) coastal waterbody via Wood_020 river. The Tarmon Lough Stream_010 river drains into the Clonderalaw Bay transitional water body via Crompaun West_(020) river. The Tonavoher_010 river drains into the Lower Shannon Estuary transitional water body.

Table B presents the catchment area of each waterbody downstream of the Proposed Grid Connection route as far as the Coastal waterbodies. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the SWBs. Therefore, those waterbodies which are located in close proximity to the Proposed Grid Connection route are more susceptible to water quality impacts as a result of activities associated with the Proposed Grid Connection route. The potential for the Proposed Grid Connection route to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table B: Catchment Area Downstream of Proposed Grid Connection

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Mal Bay Catchment	
Kiltumper Stream_SC_010 Sub-catchment	
Creegh_010	~10
Creegh_020	~71
Creegh_030	~87
Doonbeg_SC_010 sub-catchment	
Doonbeg_030	~73
Doonbeg_040	~91
Doonbeg_050	~113
Shannon Estuary North Catchment	
Wood_SC_010 sub-catchment	
Moyasta_010	~26
Wood_010	~13
Wood_020	~21
Tramon Lough Stream_010	~9
Crompaun (West)_020	~23
Cloon [Clare]_SC_010 sub-catchment	
Tonavoher_010	~28

Turbine Delivery Route:

The Turbine Delivery Route (TDR) is mapped within the Mal Bay Catchment (HA: 28) of the Shannon River Basin District.

On a local scale, the northern section of the TDR is mapped within the KiltumperStream_SC_010 sub-catchment while the southern section is mapped within the Doonbeg_SC_010 sub-catchment. Within the KiltumperStream_SC_010 sub-catchment, the TDR is mapped within the Creegh_010 and Creegh_020 river sub-basin. Within the Doonbeg_SC_010 sub-catchment, the TDR is mapped within the Kilmihil Stream_010 and Doonbeg_020 river sub-basins.

Within the Creegh_010 river basin, the Creegh_010 river flows towards west. Within the Creegh_020 river sub-basin, the Creegh_020 river crosses the TDR three times. Within the Kilmihil Stream_010 river sub-basin, Kilmihil Stream_010 river flows ~100m south of the TDR. Within the Doonbeg_020 river sub-basin, the Doonbeg_020 river flows ~400m south of the TDR.

The Creegh_010 river drains out into the Doonbeg Bay coastal waterbody via Creegh_020 to Creegh_040 rivers. The Kilmihil Stream_010 river drains out in the Doonbeg_030 river. The Doonbeg_020 river drains out into the Doonbeg Estuary transitional waterbody via Doonbeg_030 to Doonbeg_050 rivers.

Table C presents the catchment area of each waterbody downstream of the TDR as far as the Coastal waterbodies. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the SWBs. Therefore, those waterbodies which are located in close proximity to the TDR are more susceptible to water quality impacts as a result of activities associated with the TDR. The potential for the TDR to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table C: Catchment Area Downstream of Turbine Delivery Route (TDR)

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Mal Bay Catchment	
Kiltumper Stream_SC_010 Sub-catchment	
Creegh_010	~10
Creegh_020	~71
Creegh_030	~87
Doonbeg_SC_010 sub-catchment	
Kilmihill Stream_010	~8
Doonbeg_020	~35
Doonbeg_030	~73
Doonbeg_040	~91
Doonbeg_050	~113

Proposed Hen Harrier Enhancement Lands:

The Proposed Hen Harrier Enhancement Lands are mapped within the Mal Bay Catchment (HA: 28) of the Shannon River Basin District.

On a local scale, the majority of the Proposed Hen Harrier Enhancement Lands are mapped within the KiltumperStream_SC_010 sub-catchment the Annageeragh_SC_010 sub-catchment with a very small area mapped within the KiltumperStream_SC_010 sub-catchment. Within the Annageeragh_SC_010 sub-catchment, the Proposed Hen Harrier Enhancements lands are mapped within the Annageeragh_030, Annageeragh_020 and Annageeragh_010 river sub-basin and within the KiltumperStream_SC_010 sub-catchment, the Proposed Hen Harrier Offsetting & Enhancement Lands are mapped within the Creegh_010 river sub-basin.

Within the Annageeragh_010 river sub-basin, the Annageeragh_010 river passes through the Proposed Hen Harrier Enhancement Lands. Within the Annageeragh_020 river sub-basin, the Annageeragh_020 river passes through the Proposed Hen Harrier Enhancement Lands. Within the Annageeragh_030 river sub-basin, the Annageeragh_030 river passes through the Proposed Hen Harrier Enhancement Lands. Within the Creegh_010 river sub-basin, the Creegh_010 river flows ~700m south of the Proposed Hen Harrier Enhancement Lands.

The Annageeragh_010 and 020 drains out into the Doo Lough and another Annageeragh_020 stream originates from the Doo Lough which drains out into the Shannon Plume (HAs 27;28) coastal waterbody via Annageeragh_030 and Lough Donnell. The Creegh_010 river drains out into the Doonbeg Bay coastal waterbody via Creegh_020 to Creegh_040 rivers.

Table D presents the catchment area of each waterbody downstream of the Proposed Hen Harrier Enhancement Lands as far as the Coastal waterbodies. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the SWBs. Therefore, those waterbodies which are located in close proximity to the Proposed Hen Harrier Enhancement Lands are more susceptible to water quality impacts as a result of activities associated with the works.

The potential for the Proposed Hen Harrier Enhancement Lands to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table D: Catchment Area Downstream of Proposed Hen Harrier Enhancement Lands

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Mal Bay Catchment	
Annageeragh_SC_010 sub-catchment	
Annageeragh_010	~5
Annageeragh_020	~33
Annageeragh_030	~66
Kiltumper Stream_SC_010 Sub-catchment	
Creegh_010	~10
Creegh_020	~71
Creegh_030	~87

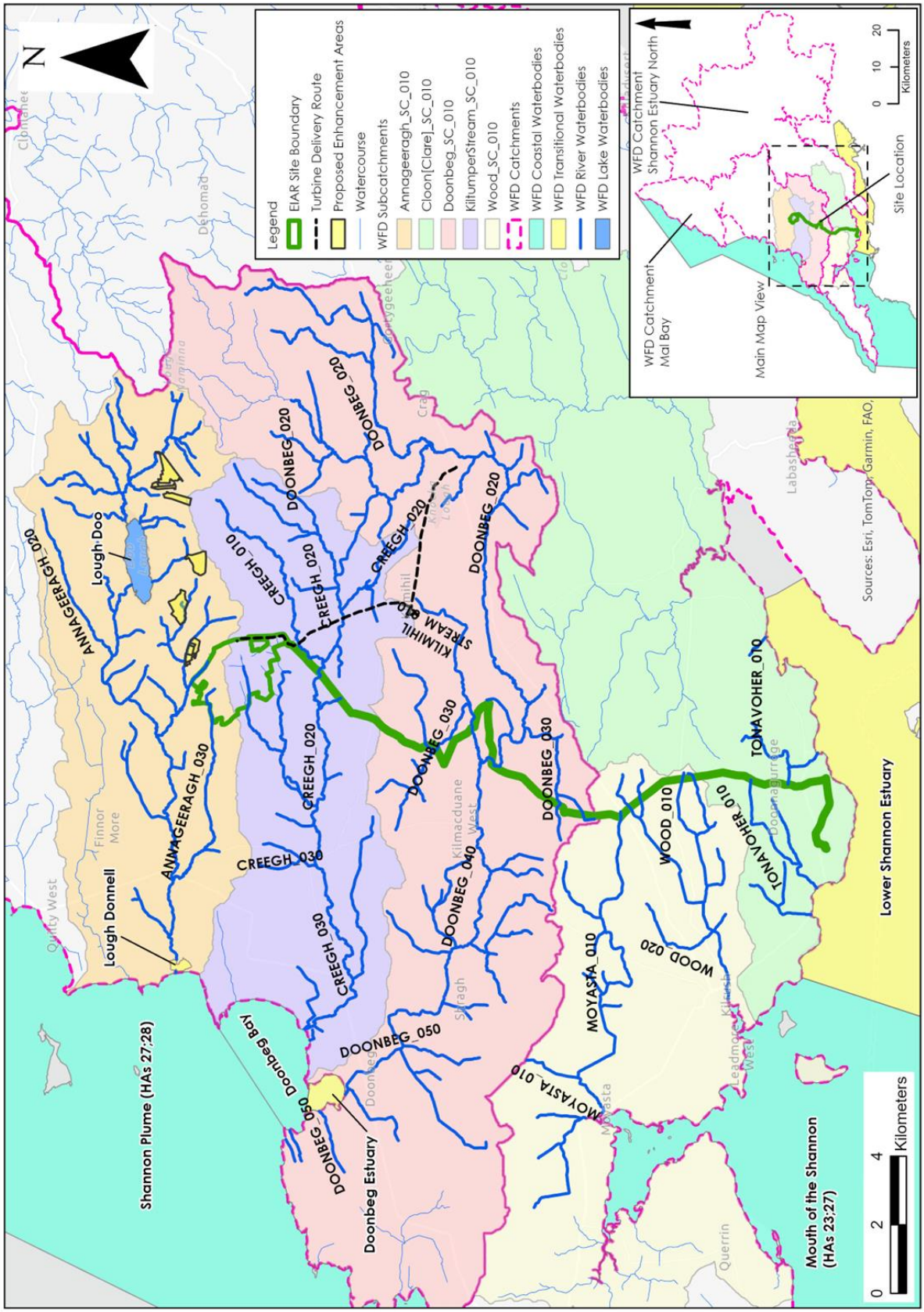

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the Proposed Project are shown in **Table E**. The overall status 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 May Bay Catchment, the Annageeragh river (010 to 030) have achieved "Good" status in the latest WFD cycle (2019 – 2024). The Annageeragh_010 is under review, the Annageeragh_020 is 'at risk' and the Annageeragh_030 is 'not at risk' of failing to achieve its WFD objectives. Forestry is identified as a significant pressure on the Annageeragh_020 SWB. The Doo CE Lough have achieved "Moderate" status in the latest WFD cycle and is 'at risk' of failing to achieve its WFD objectives with Forestry, Hydromophology and Abstraction identified as significant pressures on this SWB. The Creegh_010 and Creegh_030 have achieved "Good" status in the latest WFD cycle and are 'not at risk' of failing to achieve its WFD objectives while the Creegh_020 have achieved "Moderate" status and is 'at risk' with Forestry and Hydromorphology identified as significant pressures on this SWB. The Kilmihill Stream_010 have achieved "Poor" status in the latest WFD cycle ad is 'at risk' of failing to achieve its WFD objectives with Urban wastewater identified as a significant pressure on this SWB. The Doonbeg_020 have achieved "Good" status in the latest WFD cycle and is 'not at risk' of failing to achieve its WFD objectives while the Doonbeg_030 have achieved "Poor" status and is 'at risk' with Forestry and hydromophology identified as significant pressures on this SWB. The Doonbeg_040 and 050 have achieved "Moderate" status in the latest WFD cycle and is 'not at risk' of failing to achieve its WFD objectives.

In terms of transitional waterbodies, Lough Donnel has achieved "Poor" status in the latest WFD cycle while the Doonbeg Estuary has achieved "Moderate" status. Both transitional waterbodies are 'under review' for the WFD objectives. In terms of Coastal waterbodies, the Doobeg Bay and the Shannon Plume (HAs 27;28) have achieved "High" status in the latest WFD cycle and are 'not at risk' of failing to achieve its WFD objectives.

Within the Shannon Estuary North Catchment, the Moyasta_010 have achieved "Moderate" status in the latest WFD cycle and is 'under review'. The Wood_010 have achieved "Poor" status in the latest WFD cycle and is 'at risk' of failing to achieve its WFD objectives with agriculture identified as a significant pressure while the Wood_020 have achieved "Moderate" status in the latest WFD cycle and is 'at risk' of failing to achieve its WFD objectives with Urban run-off, Waste, Agriculture and Forestry identified as significant pressures.

The Tranmon Lough Stream_010 have achieved "Good" status in the latest WFD cycle and is 'not at risk' of failing to achieve its WFD objectives while the Crompaun (West)_020 and the Tonavoher_010 have achieved "Moderate" status and is under review.

In terms of transitional waterbodies, the Clonderalaw Bay have achieved "Moderate" in latest WFD cycle and is 'under review' while the Lower Shannon Estuary have achieved "Good" status and is 'not at risk' of failing to achieve its WFD objectives. In terms of Coastal waterbodies, the Mouth of the Shannon (HAs 23;27) have achieved "Good" status in the latest WFD cycle and are 'not at risk' of failing to achieve its WFD objectives.

The SWB status for the 2019 – 2024 WFD cycle is shown on **Figure B.**

Table E: Summary WFD Information for River Water Bodies

SWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	Risk Status 3rd Cycle	Pressures
Mal Bay Catchment					
Annageeragh_010	Moderate	Good	Good	Under Review	-
Annageeragh_020	Poor	Poor	Good	At risk	Forestry
Doo CE Lough	Good	Moderate	Moderate	At risk	Forestry, Hydromorphology and Abstraction
Annageeragh_030	Good	Good	Good	Not at risk	None
Creegh_010	Moderate	Good	Good	Not at risk	None
Creegh_020	Poor	Poor	Moderate	At Risk	Forestry and Hydromorphology
Creegh_030	Good	Good	Good	Not at risk	None
Kilmihill Stream_010	Bad	Poor	Poor	At Risk	Urban wastewater
Doonbeg_020	Moderate	Good	Good	Not at risk	None
Doonbeg_030	Poor	Poor	Poor	At Risk	Forestry and Hydromorphology
Doonbeg_040	Good	Good	Moderate	Not at risk	None
Doonbeg_050	Moderate	Good	Moderate	Not at risk	None
Lough Donnell	Poor	Poor	Poor	Under review	-
Doonbeg Estuary	Moderate	Moderate	Moderate	Under review	-
Doonbeg Bay	High	Good	High	Not at risk	None
Shannon Plume (HAs 27;28)	High	High	High	Not at risk	None
Shannon Estuary North Catchment					
Moyasta_010	Good	Moderate	Moderate	Under review	-
Wood_010	Poor	Poor	Poor	At Risk	Agriculture

Wood_020	Moderate	Moderate	Moderate	At Risk	Urban run-off, Waste, Agriculture and Forestry
Tramon Lough Stream_010	Moderate	Good	Good	Not at risk	None
Crompaun (West)_020	Moderate	Moderate	Moderate	Under review	-
Tonavoher_010	Moderate	Moderate	Moderate	Under review	-
Clonderalaw Bay	Moderate	Moderate	Moderate	Under review	-
Lower Shannon Estuary	Good	Good	Good	Not at risk	None
Mouth of the Shannon (HAs 23;27)	Good	Good	Good	Not at risk	None

2.4 GROUNDWATER BODY IDENTIFICATION

The majority of the Proposed Wind Farm site and small areas of Proposed Grid Connection route, TDR and Hen Harrier Enhancement Lands are mapped within the Gull Island Formation which is described as Grey siltstone & sandstone.

The majority of the Proposed Grid Connection route, TDR and Hen Harrier Enhancement Lands and a small area of the Proposed Wind Farm site is mapped within the Central Clare Group described as Sandstone, siltstone & mudstone. The Gull Island Formation and the Central Clare Group are classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll) by GSI (www.gsi.ie).

In terms of groundwater bodies, the Proposed Wind Farm site, TDR, the Hen Harrier Offsetting & Enhancement Lands and the northern section of the Proposed Grid Connection route is mapped within the Milltown Malbay GWB (IE_SH_G_167) while the southern section of the Proposed Grid Connection route is mapped within the Kilrush GWB (IE_SW_G_123).

Overall, these GWBs are classified by the WFD as Poorly Productive.

The GWB status for the 2019 – 2024 WFD cycle is shown on **Figure B.**

2.5 GROUNDWATER BODY CLASSIFICATION

The GWB is assigned a status based on the assessment of groundwater chemical and quantitative values. The Milltown Malbay GWB (GWB: IE_SH_G_167) and the Kilrush GWB (GWB: IE_SH_G_123) have achieved "Good" status in the latest WFD Cycle (2019 – 2024) and deemed to be "not at risk" of failing to achieve its WFD objectives. No significant pressures have been identified for these GWBs.

Table F: Summary WFD Information for Groundwater Bodies

GWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	Risk Status 3rd Cycle	Pressures
Milltown Malbay	Good	Good	Good	Not at risk	-
Kilrush	Good	Good	Good	Not at risk	-

2.6 ZONE OF INFLUENCE

The potential Zone of Influence (ZOI) for the Proposed Project extends to the following SWBs, GWBs, and transitional and coastal waterbodies.

- River waterbodies: Annageeragh (010 to 030), Creegh (010 to 030) Kilmihil Stream_010, Doonbeg (020 to 050), Moyasta_010, Wood (010 and 020), Tramon Lough Stream_010, Crompaun (West)_020 and Tonavoher_010;
- Lake waterbodies: Doo CE Lough;
- GWBs: Milltown Malbay and Kilrush GWBs; and,
- Transitional and Coastal Waterbodies: Lough Donnell, Doonbeg Estuary, Clonderalaw Bay, Lower Shannon Estuary, Doonbeg Bay, Shannon Plume (HAs 27;28) and Mouth of the Shannon (HAs 23;27).

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 Site 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 Proposed Wind Farm Site, Proposed Grid Connection Route and TDR is not located within any designated conservation site, however 1 no. small block area of the Proposed Hen Harrier Enhancement Lands is mapped within the Cragnashingaun Bogs NHA (Site Code: 002400). The proposed enhancement measures will essentially provide an extension to the peatland habitat protected by the NHA and functionally will increase its size.

St. Senan's Lough pNHA (Site Code: 001025) is also mapped ~0.5km west of the southern part of the Proposed Grid Connection route and connected via Tonavoher river. Other designated site located downstream of the Proposed Project are:

- River Shannon and River Fergus Estuaries SPA (Site Code: 004077) is located downstream of the southern part of the Proposed Grid Connection route and is connected via Crompaun and Tonavoher rivers;
- Mid-Clare Coast SPA (Site Code: 004182) is located ~7.5km west of the Proposed Wind Farm Site and is connected via Annageeragh, Creegh and Doonbeg rivers;
- Carrowmore Point to Spanish Point and Islands SAC and pNHA (Site Code: 001021) is located ~7.5km west of the Proposed Wind Farm Site and is connected via Annageeragh and Creegh rivers;
- Carrowmore Dunes SAC (Site Code: 002250) is located ~7.5km west of the Proposed Wind Farm Site and is connected via Creegh and Doonbeg rivers;
- Lower River Shannon SAC (Site Code: 002165) is located downstream of the southern part of the Proposed Grid Connection route and is connected via Crompaun and Tonavoher rivers;
- White Strand/Carrowmore Marsh pNHA (Site Code: 001007) is located ~7.5 west of the Proposed Wind Farm site and connected via Creegh and Doonbeg rivers;
- Poulnasherry Bay pNHA (Site Code: 000065) is located ~8.4km west of the southern section of the Proposed Grid Connection route and connected via Moyasta river; and,
- Scattery Island pNHA (Site Code: 001911) is located ~6km west of the southern section of the Proposed Grid Connection route and connected via Wood River and Mouth of the Shannon (HAs 23;27).

Other designated site located within 10km of the Proposed Project but don't have hydrological connections are:

- Tullaher Lough and Bog SAC (Site Code: 002343) and pNHA (Site Code: 000070) is located ~9.2km west of the southern section of the Proposed Grid Connection route;
- Clonderalaw Bay pNHA (Site Code: 000027) is located ~3km east of the southern section of the Proposed Grid Connection route;
- Tarbert Bay pNHA (Site Code: 001386) is located ~2.7km southeast of the southern section of the Proposed Grid Connection route;
- Ballylongford Bay pNHa (Site Code: 001332) is located ~3.8km southeast of the southern section of the Proposed Grid Connection route;

- Derrygeeha Lough pNHa (Site Code: 000050) is located ~9.2km east of the southern section of Proposed Grid Connection route;
- Cloonsnaghta Lough pNHA (Site Code: 001004) is located ~7km southeast of the Turbine Delivery route;
- Lough Naminna Bog NHA (Site Code: 002367) is located ~1.7km east of the Proposed Hen Harrier Enhancement Lands;
- Lough Acrow Bogs NHA (Site Code: 002421) is located ~3.6km southeast of the Proposed Hen Harrier Enhancement Lands; and,
- Slievecallan Mountain Bog NHA (Site Code: 002397) is located ~5km north of the Proposed Hen Harrier Enhancement Lands.

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).

The closest bathing waters is Quilty Bathing waters (IESHBWC070_0000_0330) located ~7.5km northwest of the Proposed Wind Farm Site. The Seafield, Quilty (IESHBWC070_0000_0350) is located ~8.8km northwest of the Proposed Wind Farm Site. The bathing waters are not hydrologically connected with the Proposed Project.

The White Strand, Doonbeg (IESHBWC080_0000_0100) is located ~12km west of the Proposed Wind Farm site and is associated with the Doonbeg coastal waterbody and connected via Creegh and Doonbeg rivers.

The Cappagh Pier, Kilrush (IESHBWC060_0000_0100) is located ~5.5km west of the southern part of the Proposed Grid Connection route and is associated with the Mouth of the Shannon (HAs 23;27) coastal waterbody and connected via Wood River.

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.

There are no Nutrient Sensitive Areas in the Mal Bay catchment. The nearest downstream NSA is the Mouth of the Shannon (HAs 23;27) located downstream of the Proposed Grid Connection route in the Shannon Estuary North WFD catchment.

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 are no designated shellfish areas in the Mal Bay WFD catchment. The nearest shellfish waters is West Shannon Poulnasherry Bay (IE_SH_060_0000) located ~7.4km west of the southern section of the Proposed Grid Connection route associated with the Mouth of the Shannon (HAs 23;27) coastal waterbodies connected via Moyasta River.

2.7.5 Salmonid Waters

There are no salmonid waters mapped within the zone of influence of the Proposed Project.

2.7.6 Drinking Water

The nearest Drinking Water Protected Area is Doo CE Lough located downstream of the Proposed Hen Harrier Enhancement Lands and ~2.5km northeast of the Proposed Wind Farm Site. The Naminna DWPA is located ~2.2km east of the Proposed Hen Harrier Enhancement Lands. Meanwhile, all GWBs in Ireland are mapped as the Drinking Water Protected Areas. Only parts of the Proposed Hen Harrier Enhancement Lands drain into Doo Lough.

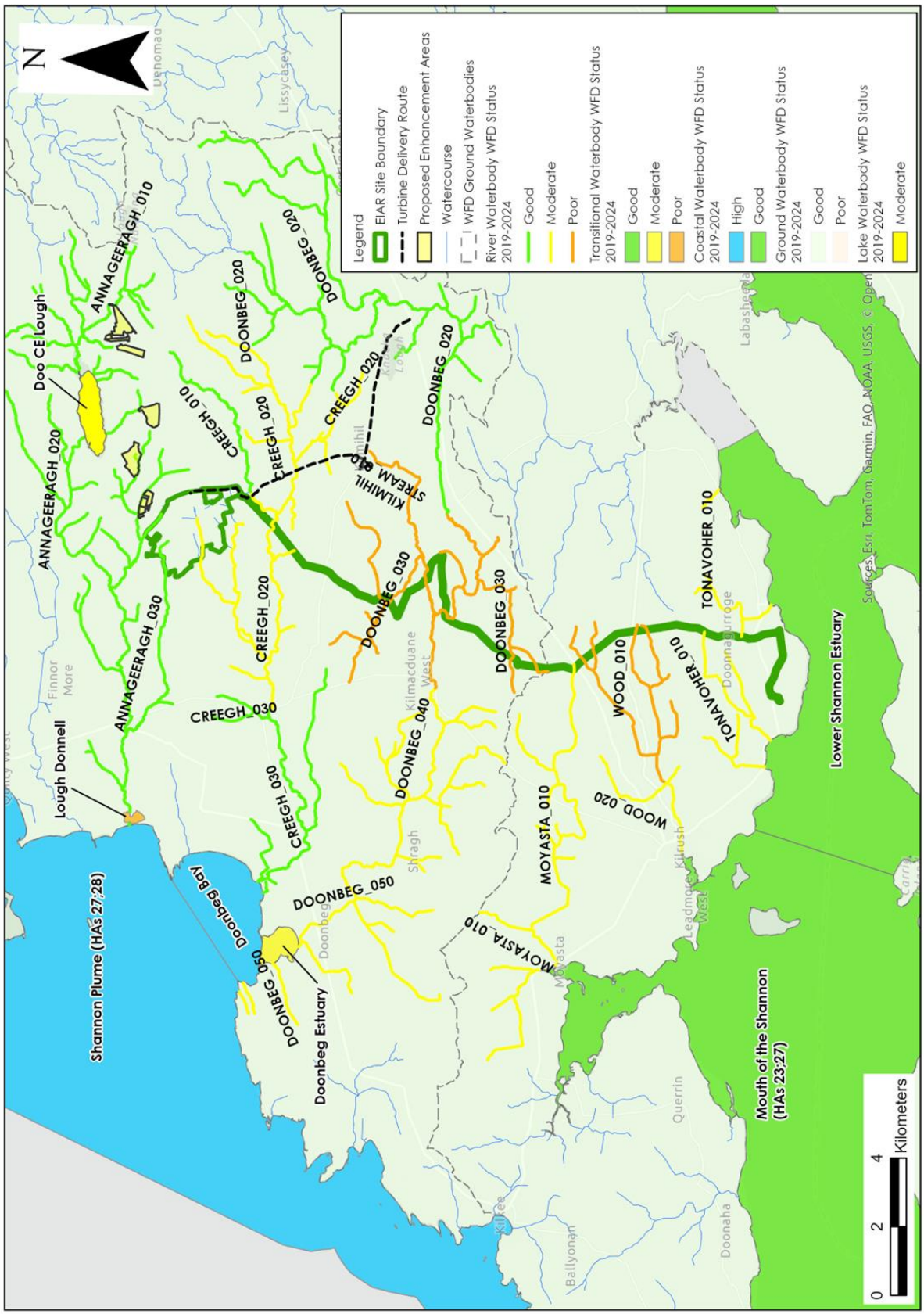

Figure B: WFD Groundwater and Surface Waterbody Status (2019 – 2024)

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 25 no. surface waterbodies which are located in the water study area of the Proposed Project. There are 17 no. river waterbodies, 1 no. lake waterbody, 4 no. transitional waterbodies, and 3 no. coastal waterbodies downstream of the Proposed Project. In addition, 2 no. groundwater bodies underlie the Proposed Wind Farm site, the Proposed Grid Connection route, TDR and the Proposed Hen Harrier Offsetting and Enhancement Lands. Furthermore, there are a number of designated sites downstream of the Proposed Project.

3.1 SURFACE WATER BODIES

The SWBs in the immediate vicinity and downstream of the Proposed Project site are shown in **Figure A** and described in **Section 2.2** above.

With consideration for the construction, operational and decommissioning phases of the Proposed Project, the Annageeragh River (010 to 030), Doo CE Lough, Creegh River (010 to 030), Kilmihil Stream_010, Doonbeg (020 to 040), Moyasta_010, Wood_010 & 020, Tramon Lough Stream_010, Crompaun (West)_020 and Tonavoher_010 will be screened into the WFD Impact Assessment due to their proximal location downstream of the Proposed Wind Farm site, the Proposed Grid Connection route, TDR and the Proposed Hen Harrier Offsetting and Enhancement Lands.

The Doonbeg_050 has been screened out due to distant location and increased volume of water within the SWB associated with increased catchment area upstream (~113 km^2). Only the Proposed Grid Connection route is located in the Doonbeg River catchment.

The Lough Donnell, Doonbeg Estuary, the Clonderalaw Bay and the Lower Shannon Estuary transitional waterbodies have been screened out due to distant location, increased volume of water and saline nature of the water within the transitional waterbodies.

Further downstream the Doonbeg Bay, Shannon Plume (HAs 27;28) and Mouth of the Shannon (HAs 23;27) coastal waterbodies have also been screened out due to their distant location, increased volume of water and saline nature of the water within the coastal waterbodies.

3.2 GROUNDWATER BODIES

With respect to GWBs, the Miltown Malbay and Kilrush GWBs have been screened in due to their location directly underling the Proposed Wind Farm site, the Proposed Grid Connection route, TDR and the Proposed Hen Harrier Offsetting and Enhancement Lands. The Proposed Project works must not in any way result in a deterioration in the status of these GWB and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

The Cragnashingaun Bogs NHA (Site Code: 002400) is mapped within 1 no. of the Proposed Hen Harrier Offsetting and Enhancement Land areas/blocks.

A number of animal species listed under the Irish Red data book are found within the designated site. Examples include Hen Harrier, which nest nearby and use this site for hunting, while Red Grouse and Common Frog are also recorded. Sand Martin use the peat banks of Lough Nacrag for nesting. The Cragnashingaun Bogs NHA has been screened in due to its close proximity to the Proposed Hen Harrier Offsetting and Enhancement Lands.

Therefore, an assessment must be conducted to ensure that the Proposed Project does not impact this designated site, and thus the Cragnashingaun Bogs NHA has been screened in.

The St. Senan's Lough pNHA (Site Code: 001025) is located ~0.5km west and directly downstream of the southern section of the Proposed Grid Connection route. St. Senan's Lough pNHA has been screened in due to its location downstream and hydrological connection to the Proposed Project via Tonavoher_010 SWB. Therefore, an assessment must be conducted to ensure that the Proposed Project does impact this designated site, and thus the St. Senan's Lough pNHA has been screened in.

The following designated sites (which are estuarine/coastal habitats and not freshwater dependant) are also scoped in for assessment as they are located downstream of river waterbodies that drain the Proposed Project:

- River Shannon and River Fergus Estuaries SPA (Site Code: 004077);
- Mid-Clare Coast SPA (Site Code: 004182);
- Carrowmore Point to Spanish Point and Islands SAC and pNHA (Site Code: 001021);
- Carrowmore Dunes SAC (Site Code: 002250);
- Lower River Shannon SAC (Site Code: 002165);
- White Strand/Carrowmore Marsh pNHA (Site Code: 001007);
- Poulnasherry Bay pNHA (Site Code: 000065); and,
- Scattery Island pNHA (Site Code: 001911).

All other designated sites have been screened out due to distant location and lack of hydrological connectivity.

In terms of Bathing waters, the Qulity and the Seafield, Quilty have been screened out due to lack of hydrological connection between the Bathing waters and the Proposed Development, while the White Strand, Doonbeg and the Cappagh Pier, Kilrush have been screened out due to distant location, increased volume of water and saline nature of water within the associated SWBs. Therefore, the Proposed Project has no potential to impact the status of these bathing waters.

The Mouth of the Shannon (HAs 23;27) NSA has also been screened out due to increased volume of water and saline nature of the water within the NSA. Therefore, the Proposed Project has no potential to impact the status of this NSA.

The West Shannon Poulnasherry Bay Shellfish areas has also been screened out due to increased volume of water and saline nature of the water within associates SWB. Therefore, the Proposed Project has no potential to impact the status of these Shellfish areas.

In terms of the Drinking Water Protect Areas, the Doo CE Lough DWPA is mapped immediately downstream of the Annageeragh_020 river and has been screened in for further assessment while the Naminna Lough DWPA has been screened out of the assessment due to lack of hydrological connection between the Proposed Project and this DWPA.

3.4 WFD SCREENING SUMMARY

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

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

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	Miltown Malbay WFD Catchment			
	River	Annageeragh_010	**Yes**	The Proposed Hen Harrier Offsetting & Enhancement Lands are mapped within the Annageeragh_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Annageeragh_020	**Yes**	The Proposed Hen Harrier Offsetting & Enhancement Lands are mapped within the Annageeragh_020 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	Lake	Doo CE Lough	**Yes**	The Doo CE Lough is mapped immediately downstream of the Annageeragh_020 river. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Annageeragh_030	**Yes**	The Proposed Wind Farm site and the Proposed Hen Harrier Offsetting & Enhancement Lands are mapped within the Annageeragh_030 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Creegh_010	**Yes**	The Proposed Project (the Proposed Wind Farm site, the Proposed Grid Connection route, Turbine Delivery route and the Proposed Hen Harrier Offsetting and Enhancement Lands) is mapped within the Creegh_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Creegh_020	**Yes**	The Proposed Wind Farm site and the Proposed Grid Connection route is mapped within the Creegh_020 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Creegh_030	**Yes**	The Creegh_030 river is mapped directly downstream of the Creegh_020 river. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Kilmihil Stream_010	**Yes**	The Turbine Delivery route is mapped within the Kilmihil Stream_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Doonbeg_020	**Yes**	The Turbine Delivery route is mapped within the Doonbeg_020 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Doonbeg_030	**Yes**	The Proposed Grid Connection route is mapped within the Doonbeg_030 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Doonbeg_040	**Yes**	The Doonbeg_040 river is mapped directly downstream of the Doonbeg_030 river. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Doonbeg_050	No	The Doonbeg_050 has been screened out due to distant location and increased volume of water within the SWB associated with increased catchment area upstream (~113 km^2). Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Transitional	Lough Donnell	No	The Lough Donnel transitional water body has been screened out due to distant location, increased volume of water and saline nature of the water within the transitional water body.

				Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Transitional	Doonbeg Estuary	No	The Doonbeg Estuary transitional water body has been screened out due to distant location, increased volume of water and saline nature of the water within the transitional water body. Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Coastal	Doonbeg Bay	No	The Doonbeg Bay coastal water body has been screened out due to distant location, increased volume of water and saline nature of the water within the coastal water body. Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Coastal	Shannon Plume (HAs 27;28)	No	The Shannon Plume (HAs 27;28) coastal water body has been screened out due to distant location, increased volume of water and saline nature of the water within the coastal water body. Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Shannon Estuary North WFD Catchment			
	River	Moyasta_010	**Yes**	The Proposed Grid Connection route is mapped within the Moyasta_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Wood_010	**Yes**	The Proposed Grid Connection route is mapped within the Wood_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Wood_020	**Yes**	The Wood_020 river is mapped directly downstream of the Wood_010 river. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Tramon Lough Stream_010	**Yes**	The Proposed Grid Connection route is mapped within the Tramon Lough Stream_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Crompaun (West)_020	**Yes**	The Crompaun (West)_020 river is mapped directly downstream of the Tramon Lough Stream_010river. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Tonavoher_010	**Yes**	The Proposed Grid Connection route is mapped within the Tonavoher_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	Transitional	Clonderalaw Bay	No	The Clonderalaw Bay transitional water body has been screened out due to increased volume of water and saline nature of the water within the transitional water body. Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Transitional	Lower Shannon Estuary	No	The Lower Shannon Estuary transitional water body has been screened out due to increased volume of water and saline nature of the water within the transitional water body. Therefore, the Proposed Project has no potential to impact the status of this SWB.
	Coastal	Mouth of the Shannon (HAs 23;27)	No	The Mouth of the Shannon (HAs 23;27) coastal water body has been screened out due to increased volume of water and saline nature of the water within the coastal water body. Therefore, the Proposed Project has no potential to impact the status of this SWB.
Groundwater Bodies				
Groundwater Body	Groundwater	Miltown Malbay	**Yes**	The Proposed Wind Farm site, the Turbine Delivery route, the Proposed Hen Harrier Offsetting & Enhancement Lands and the northern section of the Proposed Grid Connection routes are mapped to overlie the Miltown Malbay GWB. An assessment is required to consider the potential impacts of the Proposed Project on this GWB.
	Groundwater	Kilrush	**Yes**	The southern section of the Proposed Grid Connection Route is mapped to overlie the Kilrush

				GWB. An assessment is required to consider the potential impacts of the Proposed Project on this GWB.
Protected Areas				
Protected Areas	Nature Conservation Sites	Cragnashingaun Bogs NHA	**Yes**	The Proposed Hen Harrier Offsetting & Enhancement Lands is mapped within the Cragnashingaun Bogs NHA. An assessment is required to consider the potential impacts of the Proposed Project on this NHA.
		St.Senan's Lough pNHA	**Yes**	The Proposed Grid Connection route and is connected via the Tonavoher river. An assessment is required to consider the potential impacts of the Proposed Project on this pNHA.
		River Shannon and River Fergus Estuaries SPA	**Yes**	The Proposed Grid Connection route is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this SPA.
		Mid-Clare Coast SPA	**Yes**	The Proposed Project is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this SPA.
		Carrowmore Point to Spanish Point and Islands SAC and pNHA	**Yes**	The Proposed Project is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this SAC/SPA.
		Carrowmore Dunes SAC	**Yes**	The Proposed Project is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this SAC.
		Lower River Shannon SAC	**Yes**	The Proposed Grid Connection route is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this SAC.
		White Strand/Carrowmore Marsh pNHA	**Yes**	The Proposed Project is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this pNHA.
		Poulnasherry Bay pNHA	**Yes**	The Proposed Grid Connection route is located upstream. An assessment is required to consider the potential impacts of the Proposed Project on this pNHA.
		Scattery Island pNHA	No	The Scattery Island pNHA has been screened out due to distant location, increased volume of water and saline nature water within the associated SWB. The Proposed Project has no potential to impact the status of this pNHA.
		Tullaher Lough and Bog SAC and pNHA	No	The Tullaher Lough and Bog SAC and pNHA has been screened out due to lack of hydrological connection between this SAC and pNHA. Therefore, the Proposed Project has no potential to impact the status of this SAC and pNHA.
		Clonderalaw Bay pNHA	No	The Clonderalaw Bay pNHA has been screened out due to lack of hydrological connection between this pNHA. Therefore, the Proposed Project has no potential to impact the status of this pNHA.
		Tarbert Bay pNHA	No	The Tarbert Bay pNHA has been screened out due to lack of hydrological connection between this pNHA. Therefore, the Proposed Project has no potential to impact the status of this pNHA.
		Ballylongford Bay pNHA	No	The Ballylongford Bay pNHA has been screened out due to lack of hydrological connection between this pNHA. Therefore, the Proposed Project has no potential to impact the status of this pNHA.

		Derrygeeha Lough pNHA	No	The Derrygeeha Lough pNHA has been screened out due to lack of hydrological connection between this pNHA. Therefore, the Proposed Project has no potential to impact the status of this pNHA.
		Cloonsnaghta Lough pNHA	No	The Cloonsnaghta Lough pNHA has been screened out due to lack of hydrological connection between this pNHA. Therefore, the Proposed Project has no potential to impact the status of this pNHA.
		Lough Naminna Bog NHA	No	The Lough Naminna NHA has been screened out due to lack of hydrological connection between this NHA. Therefore, the Proposed Project has no potential to impact the status of this NHA.
		Lough Acrow Bogs NHA	No	The Lough Acrow Bogs NHA has been screened out due to lack of hydrological connection between this NHA. Therefore, the Proposed Project has no potential to impact the status of this NHA.
		Slievecallan Mountain Bog NHA	No	The Slievecallan Mountain Bog NHA has been screened out due to lack of hydrological connection between this NHA. Therefore, the Proposed Project has no potential to impact the status of this NHA.
	Bathing Waters	Quilty	No	The Quilty bathing waters has been screened out due to lack of hydrological connection between the Proposed Project and the bathing waters. Therefore, the Proposed Project has no potential to impact the status of these bathing waters.
		Seafield, Quilty	No	The Seafield, Quilty bathing waters has been screened out due to lack of hydrological connection between the Proposed Project and the bathing waters. Therefore, the Proposed Project has no potential to impact the status of these bathing waters.
		White Strand, Doonbeg	No	The White Strand, Doobeg bathing waters have been screened out due to distant location, increased volume of water and saline nature of water within the associated SWB. Therefore, the Proposed Project has no potential to impact the status of these bathing waters.
		Cappagh Pier, Kilrush	No	The Cappagh Pier, Kilrush bathing waters have been screened out due to distant location, increased volume of water and saline nature of water within the associated SWB. Therefore, the Proposed Project has no potential to impact the status of these bathing waters.
	Nutrient Sensitive Areas	Mouth of the Shannon (HAs 23;27)		The Mouth of the Shannon (HAs 23;27) NSA has been screened out due to increased volume of water and saline nature of the water within the NSA. Therefore, the Proposed Project has no potential to impact the status of this NSA.
	Shellfish Area	West Shannon Poulnasherry Bay	No	The West Shannon Poulnasherry Bay Shellfish areas has been screened out due to increased volume of water and saline nature of the water within associates SWB. Therefore, the Proposed Project has no potential to impact the status of these Shellfish areas.
	Drinking Water Protected Areas	Doo CE lough	**Yes**	The Proposed Hen Harrier Offsetting & Enhancement Lands are mapped within the Doo Lough catchment. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
		Naminna	No	The Naminna Lough DWPA has been screened out of the assessment due to lack of hydrological connection between the Proposed Project and the DWPA. Therfore, the Proposed Project has no potential to affect this DWPA.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

Please refer to Chapter 4, Section 4.1 of the EIAR for a description of the Proposed Project.

The main characteristics of the Proposed Wind Farm that could impact on hydrology and hydrogeology are:

- Establishment of 2 no. temporary construction compound, which will involve minor regrading of soil/subsoil and the emplacement of hardstands. Welfare facilities will be provided at the primary temporary construction compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licenced contractor;
- Construction of the site access tracks will predominantly use the excavate and replace technique. This will involve the use of aggregate from 2 no. on-site borrow pits;
- Construction of the 8 no. crane hardstand areas and turbine assemblage areas will utilise ground bearing foundations;
- Settlement ponds where constructed will be volume neutral, i.e. all material excavated will be used to form side bunds and landscaping around the ponds. There will be no excess material from settlement pond construction. The proposed settlement pond locations have been assessed for peat instability risks;
- Grey water will be supplied by rainwater harvesting at the substation and water tankered to site where required. Bottled water will be used for potable supply;
- Construction of 8 no. turbine foundations, which are expected to be gravity foundation design due to shallow depths to underlying bedrock;
- Cabling between turbine locations and the on-site 110kV substation will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling;
- Construction of 1 no. new watercourse crossing (clear span bridge design) and upgrade of 1 no. existing crossing (also upgrade to clear span bridge design);
- Tree felling (total 78.17) for the purposes of Proposed Wind Farm construction and also for the Hen Harrier Offsetting and Enhancement Plan;
- Establishment of 6 no. dedicated peat/spoil storage areas as well as utilising the 2 no. exhausted borrow pits for permanent peat storage;
- Upgrade of 4.5km of existing access forestry tracks and construction of 5.4km of new access tracks using the excavate and replace method which is most appropriate technique for shallow peat;
- Construction of the on-site 110kV substation and control building with a subsoil bearing foundation. Welfare facilities will be provided at the substation along with a temporary construction compound;
- Turbine Delivery Route upgrade works including 2 no. temporary and 1 no. permanent roads through agricultural land as well as minor road widening works at 3 no. locations; and,
- Enhancement of ~123.7ha of habitats such as heath/bog, forestry, scrub and grassland, for the benefit of hen harrier, through the removal of forestry (felling), retention and reinstatement of beneficial landscape features (e.g. scrub and hedgerows), through rush management, and through the management of grazing timing and intensity.

The main characteristics of the Proposed Grid Connection that could impact on hydrology and hydrogeology are:

- Approximately 25km of an underground cabling route between the proposed 110kV substation at the Proposed Wind Farm site and the existing Moneypoint 110kV substation involving the excavation of a double shallow trench (approximately 1.2m

deep), placement of ducting and backfilling with aggregate, lean-mix concrete, and excavated material, as appropriate (depending on the location of the cable trench);
- 24 no. existing watercourse culvert/bridge crossings along the public road section of the cable route (14 no. of these are EPA mapped watercourses);
- At 12 no. of these crossing locations the cable will be placed either underneath or above the culvert by open trench method;
- At 12 no. of these crossing locations (i.e. mainly bridges) the cable will be placed by means of Horizontal Directional Drilling (HDD); and,
- No in-stream are proposed at any existing crossing location.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Clear Felling and Potential Surface Water Quality Impacts at Proposed Wind Farm Site and Hen Harrier Enhancement Area

Felling works only relate to the Proposed Wind Farm element (inclusive of the Hen Harrier Offsetting & Enhancement lands) and not the Proposed Grid Connection. Only the Proposed Wind Farm is assessed herein.

A total of 83.37 hectares of forestry will be felled for the Proposed Project. This includes a total of 21 hectares to be permanently removed and approximately 0.79 hectares temporarily felled within the footprint of the proposed Wind Farm site and 56.3 hectares to be permanently deforested as part of the Hen Harrier Offsetting and Enhancement Plan (outside of the Proposed Wind Farm site).

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

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 of downstream water bodies such as the Annageeragh and Creegh Rivers.

The potential for the Proposed Project to impact the transitional and coastal waterbodies downstream of the Proposed Project decreases due to the greater downstream distances from the wind farm site, the large volumes of water within these waterbodies and the saline nature of these waters.

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

Table H: Clear Felling Surface Water Quality Impacts during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Mal Bay Catchment			
Annageeragh_010	IE_SH_28A020010	Good	Moderate
Annageeragh_020	IE_SH_28A020100	Good	Moderate
Doo CE Lough	IE_SH_28_82	Moderate	Poor
Annageeragh_030	IE_SH_28A020300	Good	Moderate
Creegh_010	IE_SH_28C020400	Good	Good
Creegh_020	IE_SH_28C021400	Moderate	Poor
Creegh_030	IE_SH_28C021700	Good	Moderate
Doonbeg Bay	IE_SH_080_0000	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.1.2 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water at Proposed Wind Farm Site)

Construction phase activities including site levelling/construction and building turbine foundation excavation and the borrow pits 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/peat, spoil storage areas and borrow pit drainage/dewatering 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. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Release of effluent from wastewater treatment systems also has the potential to impact on surface waters if site conditions are not suitable for an on-site percolation unit. There are 2 no. temporary construction compounds proposed.

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 of downstream water bodies such as the Annageeragh and Creegh Rivers.

The potential for the Proposed Project to impact the transitional and coastal waterbodies downstream of the Proposed Project decreases due to the greater downstream distances

from the wind farm site, the large volumes of water within these waterbodies and the saline nature of these waters.

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

Table I: Earthworks and Surface Water Quality Impacts (WF Site) during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Mal Bay Catchment			
Annageeragh_030	IE_SH_28A020300	Good	Moderate
Creegh_010	IE_SH_28C020400	Good	Good
Creegh_020	IE_SH_28C021400	Moderate	Poor
Creegh_030	IE_SH_28C021700	Good	Moderate
Doonbeg Bay	IE_SH_080_0000	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.1.3 Potential Surface Water Quality Effects along the Proposed Grid Connection Route

The Proposed Grid Connection route passes through 7 no. WFD river sub-basins (Creegh_010, Creegh_020, Doonbeg_030, Moyasta_010, Wood_010, Tarmon Lough Stream_010, and Tonavoher_010) and there are 24 no. existing watercourse crossings along public roads. 14 no. of the watercourses are EPA mapped watercourses with the rest being small unmapped watercourses and drains.

Horizontal Directional Drilling (HDD) will be used to negotiate 12 no. bridge structures and open trenching will be used to place the cable above or below the culvert at the 12 no. other crossing locations.

No in-stream works are required at any of these watercourse crossings, however due to the close proximity of local waterbodies to the grid construction work at the crossing locations, there is a potential for surface water quality impacts during trench excavation work due to runoff from the road surface.

Construction activities along the Proposed Grid Connection only have the potential for short term effects due to the minor and transient nature of the works. This limits the potential for the Proposed Project to alter the overall status of a SWB.

Table J: Surface Water Quality Impacts (Proposed Grid Connection) during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Mal Bay Catchment			
Creegh_010	IE_SH_28C020400	Good	Good
Creegh_020	IE_SH_28C021400	Moderate	Moderate
Creegh_030	IE_SH_28C021700	Good	Good
Kilmihill Stream_010	IE_SH_28D020100	Poor	Poor
Doonbeg_020	IE_SH_28D020500	Good	Good
Doonbeg_030	IE_SH_28D020650	Poor	Poor
Doonbeg_040	IE_SH_28D020725	Moderate	Moderate
Doonbeg_050	IE_SH_28D020770	Moderate	Moderate
Lough Donnell	IE_SH_090_0100	Poor	Poor
Doonbeg Estuary	IE_SH_080_0100	Moderate	Moderate
Doonbeg Bay	IE_SH_080_0000	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High
Shannon Estuary North Catchment			
Moyasta_010	IE_SH_27M040900	Moderate	Moderate
Wood_010	IE_SH_27W010100	Poor	Poor
Wood_020	IE_SH_27W010200	Moderate	Moderate
Tramon Lough Stream_010	IE_SH_27T020300	Good	Good
Crompaun (West)_020	IE_SH_27C051300	Moderate	Moderate
Tonavoher_010	E_SH_27T230880	Moderate	Moderate
Clonderalaw Bay	IE_SH_060_1200	Moderate	Moderate
Lower Shannon Estuary	IE_SH_060_0300	Good	Good
Mouth of the Shannon (HAs 23;27)	IE_SH_060_0000	Good	Good

4.2.1.4 Morphological Changes due to New Watercourse Crossing Works at Proposed Wind Farm Site

New watercourse crossings (i.e. bridges/culverts) or upgrades of existing crossings will only be required at the proposed Wind Farm site and not along the proposed Grid Connection. Only the proposed Wind Farm is assessed herein.

Diversion, culverting and bridge crossing of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. Construction of structures over water courses has the potential to significantly interfere with water quality and flows during the construction phase.

Construction of 1 no. new watercourse crossing and 1 no. upgrade of an existing crossing (clear span bridge design proposed for both locations) will be required to facilitate the proposed Wind Farm site development infrastructure. Both crossings are located in the Creegh River catchment.

Table K: Morphological Changes to surface waters due to New Watercourse Crossing Works at Proposed Wind Farm Site

SWB	WFD Code	Current Status	Assessed Potential Status Change
Mal Bay Catchment			
Creegh_020	IE_SH_28C021400	Moderate	Moderate
Creegh_030	IE_SH_28C021700	Good	Good
Doonbeg Bay	IE_SH_080_0000	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.1.5 Potential Groundwater Quality Impacts

The Proposed Project is located in the Miltown Malbay and Kilrush GWBs.

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 the Proposed Project site.

In addition, groundwater seepages may occur in turbine base excavations, particularly those on lower elevations and this will create additional volumes of water to be treated by the drainage management system.

Furthermore, temporary dewatering of excavations may drawdown the local groundwater table.

However, due to the shallow nature of the proposed works, and the small scale of the Proposed Project in comparison to the GWBs, there is no potential for works at the Proposed Project site to change the overall status of the underlying GWBs.

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

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

GWB	WFD Code	Current Status	Assessed Potential Status Change
Miltown Malbay	IE_SH_G_167	Good	Good
Kilrush	IE_SH_G_123	Good	Good

4.2.1.6 Potential Protected Area Impacts

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

The designated sites included in this assessment which have been deemed to have the potential to be impacted by the Proposed Project include:

Cragnashingaun Bogs NHA

The Cragnashingaun Bogs NHA is mapped in the within the Proposed Hen Harrier Offsetting & Enhancement Lands. The surface water connections from the Proposed Hen Harrier Offsetting & Enhancement Lands could transfer poor quality surface water that may affect the conservation objectives of the Cragnashingaun Bogs NHA.

However, only 1 no. Proposed Hen Harrier Offsetting & Enhancement Area block is located inside Cragnashingaun Bogs NHA. As there is no proposal for excavations or drainage alteration as part of the enhancement works, no negative effects on the status of the Cragnashingaun Bogs NHA will occur.

St. Senan's Lough pNHA

The St.Senan's Lough pNHA is mapped in the immediate downstream of the Proposed Grid Connection route and connected via Tonavoher River. Therefore, the surface water connections from the Proposed Grid Connection route could transfer poor quality surface water that may affect the conservation objectives of the St.Senan's Lough pNHA.

However, due to the lack of instream works at the proposed watercourse crossing locations and the transient nature of the works within the carriageway of public roads no effects on the status of St. Senan's Lough pNHA will occur.

All other designated sites have been screened out due to their distant location, increased volume of water within associated SWB, saline nature of the water within the associated SWB or lack of hydrological connection between these designated sites and the Proposed Project.

Therefore, the Proposed Project has no potential to impact the status of these designated sites.

Listed underneath are estuarine/coastal designated sites that are scoped in for assessment. However, from a hydrological perspective there will be low risk of impact on these marine/estuarine designated sites as they are not freshwater dependant ecosystems and therefore much less sensitive to sediment input which is the main potential pollutant from the Proposed Project, particularly during construction.

Coastal environments are high energy environments that transport tonnes of marine sediments on a daily basis. However, as described in this WFD assessment, measures will be put in place to prevent surface water quality impacts.

- River Shannon and River Fergus Estuaries SPA (Site Code: 004077);
- Mid-Clare Coast SPA (Site Code: 004182);
- Carrowmore Point to Spanish Point and Islands SAC and pNHA (Site Code: 001021);
- Carrowmore Dunes SAC (Site Code: 002250);
- Lower River Shannon SAC (Site Code: 002165);
- White Strand/Carrowmore Marsh pNHA (Site Code: 001007); and,
- Poulnasherry Bay pNHA (Site Code: 000065).

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the Proposed Project will be much reduced in comparison to the construction phase. Any effects will occur at the Proposed Wind Farm site and will be associated with minor maintenance works.

No maintenance works will be required along the Proposed Grid Connection route and therefore there is no potential to impact on the status of downstream SWBs or underlying GWBs.

The Hen Harrier Enhancement works will have a positive effect on the conservation objectives of the cragnashingaun bogs NHA, as it's reinstating the underlying peatland habitat.

4.2.2.1 Increased Wind Farm Site Runoff and Potential Hydromorphology Effects at the Proposed Wind Farm Site

Hardstand emplacement will only be required at the Proposed Wind Farm site and not at the Proposed Grid Connection. Only the Proposed Wind Farm site assessed herein.

The potential for increased surface water runoff is the primary potential impact during the operational phase of the Proposed Project.

Progressive replacement of the vegetated surface with impermeable surfaces will decrease the permeability of the ground within the Proposed Wind Farm footprint (i.e., turbine bases, hardstandings, substation and to a lesser extent the new access roads).

It should be noted that approximately 5km of the Proposed Wind Farm site roads already exist and are proposed for upgrade. The permeability along the internal underground cabling route through the Proposed Wind Farm site will not be significantly altered, as the fill material will not be compacted.

The emplacement of the Proposed Wind Farm footprint, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials as a worst-case scenario) could result in an average total site increase in surface water runoff of approximately 780m^3/month. This represents a potential increase of approximately 0.075% in the average daily/monthly volume of runoff from the Proposed Wind Farm site area in comparison to the baseline pre-development site runoff conditions.

This is a very small increase in average runoff and results from a relatively small area of the overall proposed Wind Farm site being developed. Specifically, the permanent Proposed Wind Farm footprint is approximately 15.5ha, representing only 4.1% of the Proposed Wind Farm component of the EIAR Study Area of 375ha.

The additional volume is low due to the fact that the runoff potential from the Proposed Wind Farm site is naturally high (96%). Also, this calculation assumes that all hardstanding areas will be impermeable which is considered to be a worst-case scenario. The increase in runoff from most of the development catchment will therefore be imperceptible and this is before mitigation measures will be put in place. This water balance assessment demonstrates that even in the absence of mitigation, the potential to alter the water balance of the Site or downstream hydrology/morphology is imperceptible.

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

Table M: Potential Hydromorphology Effects of Proposed Wind Farm Site Runoff during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Mal Bay Catchment			
Annageeragh_030	IE_SH_28A020300	Good	Good
Creegh_010	IE_SH_28C020400	Good	Good
Creegh_020	IE_SH_28C021400	Moderate	Moderate
Creegh_030	IE_SH_28C021700	Good	Good
Doonbeg Bay	IE_SH_080_0000	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.2.2 Surface Water Quality Impacts from Proposed Wind Farm Site Operational Runoff

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

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

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

Table N: Surface Water Quality Effects at Proposed Wind Farm Site during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Mal Bay Catchment			
Annageeragh_030	IE_SH_28A020300	Good	Good
Creegh_010	IE_SH_28C020400	Good	Good
Creegh_020	IE_SH_28C021400	Moderate	Moderate
Creegh_030	IE_SH_28C021700	Good	Good
Doonbeg Bay	IE_SH_080_0000	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.2.3 Groundwater Quality Impacts at the Proposed Wind Farm Site during Operation

The risks to groundwater quality are the same as those described in **Section 4.2.1.5** but of a much lesser extent than during the construction phase due to the limited activity at the wind farm site with only minor maintenance required during the operational phase.

There will be no work proposed within the Proposed Grid Connection route during the operation phase. Therefore, no impacts are anticipated.

A summary of potential status change to GWBs arising from groundwater quality impacts during the operation stage of the Proposed Project in the unmitigated scenario are outlined in **Table O**.

Table O: Groundwater Quality Impacts (WF Site) During Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Miltown Malbay	IE_SH_G_167	Good	Good
Kilrush	IE_SH_G_123	Good	Good

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 and operational phases of the Proposed Project. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures for Clear Felling

All felling operations will conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and DAFM guidance documents, including the specific guidelines listed below to ensure that felling, planting and other forestry operations result in minimal potential negative effects to the receiving environment.

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

Mitigation by Avoidance:

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

Table P: 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%)	10m	15m
Steep	(15-30%)	15m	20m
Very Steep	(>30%)	20m	25m

During the wind turbine construction phase a self-imposed buffer zone of 50 metres will be maintained for all streams where possible.

With the exception of existing road upgrades and proposed new roads, all proposed tree felling areas at the proposed Wind Farm site are located outside of imposed buffer zones (<1ha inside of buffers). Additional mitigation (detailed below) will be carried out where tree felling is required inside the buffer zones.

The large distances between most of the 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 which are set out as follows:

- Machine combinations (i.e., handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- All machinery will be operated by suitably qualified personnel;
- Daily checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Machines will traverse the Site along specified off-road routes (referred to as racks);

- The location of racks will be chosen to avoid wet and potentially sensitive areas;
- 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 (approximately 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 will 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;
- All drainage channels will taper out before entering the 50m 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;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will solely occur at the temporary construction compounds within the Proposed Wind Farm site. Drip kits and qualified personnel will be used where refuelling is required. Refuelling of vehicles used to construct the Proposed Grid Connection and Hen Harrier Enhancement Lands will be refuelled off-site;
- A permit to refuel system will be adopted;
- 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;
- Crossing of streams will not be permitted;
- Trees will be cut manually from along streams and using machinery to extract whole tree; and,
- Travel only perpendicular to and away from stream.

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.

Daily 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 in the Site will be unblocked; and,
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring:

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4 weeks of the felling activity commencing, preferably in medium to high water flow conditions. The "during" sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e., where an impact has been shown).

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

- Avoid man-made ditches and drains, or watercourses that do not have year-round flows, i.e. avoid ephemeral ditches, drains or watercourses;
- Select sampling points upstream and downstream of the forestry activities;
- It is advantageous if the upstream location is outside/above the forest in order to evaluate the impact of land-uses other than forestry;
- Where possible, downstream locations will be selected: one immediately below the forestry activity, the second at exit from the forest, and the third some distance from the second (this allows demonstration of no impact through dilution effect or contamination by other land-uses where impact increases at third downstream location relative to second downstream location); and,
- The above sampling strategy will be undertaken for all on-site sub-catchments streams where tree felling is proposed.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.

4.3.1.2 Mitigation Measures for Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

Mitigation by Avoidance:

The key mitigation measure during the construction phase of the proposed Wind Farm is the avoidance of sensitive aquatic areas where possible. All of the key areas of the proposed Wind Farm site infrastructure are located at significant distance from the 50m delineated buffer zones with the exception of 2 no. proposed watercourse crossing locations (1 no. already existing and 1 no. newly proposed).

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 operated effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface water courses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Mitigation by Design:

- Source controls:
  - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.
  - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls:
  - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, 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 a Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted that a network of bog, agricultural and roadside drains already exist at the proposed Wind Farm site, and these will be integrated and enhanced as required and used within the Proposed Project drainage system. The integration of the existing drainage network and the Proposed Project network is relatively simple. The key elements being the upgrading and improvements to water treatment elements, such as in line controls and treatment systems, including silt traps, stilling ponds and buffered outfalls.

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 Project 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;
- Runoff from individual turbine hardstanding areas will be not 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 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.

Pre-commencement Temporary Drainage Works:

Prior to the commencement of new road/hardstand (or road upgrades) the following key temporary drainage measures will be installed:

- All existing dry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using temporary check dams/silt traps;
- Clean water diversion drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the 50m watercourse and 10m drain buffer zones such as at watercourse crossings.

Water Treatment Train:

A final line of defence will be provided by a water treatment train such as a "Siltbuster". If the discharge water from construction areas fails to be of a high quality during regular 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 water courses 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 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 within drains down-gradient of all construction areas inside the 50m hydrological buffer zones.

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, the majority of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats Sediment entrapment mats, consisting of coir or jute matting, will be placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

Settlement Ponds:

The proposed Wind Farm infrastructure footprint has been divided into drainage catchments (based on topography, outfall locations, and catchment size) and stormwater runoff rates based on the 10-year return period rainfall event were calculated for various catchment areas in order to size the settlement ponds as shown in **Table Q** below.

The 10-year return period rainfall event is a recommendation of the IFI relating to the previous application at this Site (i.e. Cahermurphy 2 Wind Farm, Co. Clare - Planning Ref P20/658) and has been applied to this current application also.

The location and dimensions of proposed settlement ponds are shown on the proposed Wind Farm site drainage plan drawings included in the Surface Water Management Plan (**Appendix 4-7**).

All proposed settlement pond locations have been thoroughly assessed from a geotechnical and peat stability perspective (refer to **Appendix 8-1** for the Geotechnical and Peat Stability Assessment Report).

Table Q: Settlement Pond Design

Pond Size W [m] x L [m] x D [m]			Track/Hardstand Catchment Size (m^2)		
Return Period	*10 yrs*	Storm Duration	500	1000	2000
6hr retention for coarse silt		6 hrs	3.4 x 10.6 x 1 m	4.8 x 15.0 x 1 m	6.9 x 21.0 x 1 m
11hr retention for medium silt		12 hrs	3.8 x 12.0 x 1 m	5.5 x 16.5 x 1 m	7.5 x 24.2 x 1 m
24hr retention for fine silt		24 hrs	4.2 x 13.8 x 1 m	6.2 x 18.6 x 1 m	8.6 x 27.0 x 1 m

Level Spreaders and Vegetation Filters:

The purpose of level spreaders is to release treated drainage flow in a diffuse manner, and to prevent the concentration of flows at any one location thereby avoiding erosion. Level spreaders are not intended to be a primary treatment component for development surface water runoff. They are not stand-alone but occur as part of a treatment train of systems that will reduce the velocity of runoff prior to be released at the level spreader. In the absence of level spreaders, the potential for ground erosion is significantly greater than not using them.

Vegetation filters are essentially end-of-line polishing filters that are located at the end of the treatment train. In fact, vegetation filters are ultimately a positive consequence of not discharging directly into watercourses which is one of the mitigation components of the drainage philosophy. This makes use of the natural vegetation of the Site to provide a polishing filter for the Wind Farm drainage prior to reaching the downstream watercourses.

Again, vegetation filters are not intended to be a single or primary treatment component for treatment of works area runoff. They are not stand alone but are intended as part of a treatment train of water quality improvement/control systems (i.e. source controls → check dams → silt traps → settlement ponds → level spreaders → silt fences → vegetation filters).

Pre-emptive Site Drainage Management

The works programme for the entire construction stage of the Proposed Project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation 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 basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann 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 Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of

current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provides a 24-hour telephone consultancy service. The forecaster will provide an interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event. Works will be suspended if forecasting suggests either 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 works being suspended the following control measures will be completed:
- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

Management of Runoff from Peat and Spoil Repository Areas:
It is proposed that excavated spoil and peat will be used for landscaping where required. The excess material will then be placed in 6 no. dedicated peat/spoil deposition areas as well as placement of peat in the 2 no. proposed borrow pits once the rock is fully extracted.

All proposed peat and spoil storage areas including borrow pits have been thoroughly assessed from a geotechnical and peat stability perspective (refer to **Appendix 8-1** for the Geotechnical and Peat Stabilty Assessment Report).

All proposed 6 no. peat and spoil storage, including the 2 no. borrow pits are located outside of 50m watercourse buffer zones.

During the initial construction of repository/deposition areas, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from works areas.

Where applicable, the vegetative top-soil layer of the peat and spoil management areas will be rolled back to facilitate placement of excavated spoil, following which the vegetative-top soils layer will be reinstated. Where reinstatement is not possible, spoil and peat management areas will be sealed with a digger bucket and seeded as soon possible to reduce sediment entrainment in runoff.

Drainage from peat and spoil storage 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 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.

Therefore, at each stage of the peat and spoil management area development the above mitigation measures will be deployed to ensure protection of downstream water quality.

Timing of Site Construction Works:
Construction of the site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation

features associated with the drainage system will be in place and operational for all subsequent construction works.

Monitoring:
An inspection and maintenance plan for the on-site construction drainage system will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. Checks will be carried out on a daily basis.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (as per the CEMP is included in **Appendix 4-5** of this EIAR).

4.3.1.3 Mitigation Measures for Groundwater Levels during Excavation works

The proposed 2 no. borrow pits are located in competent SILTSTONE/SANDSTONE bedrock which is unproductive in terms of groundwater flow. This was confirmed by drilling to a depth of 17mbgl at the proposed borrow pit locations.

Bedrock drilling encountered competent, strong SILTSTONE or SANDSTONE at shallow depths ranging from 2.6 to 3.9mbgl. No bedrock joints, fissures, fractures, faults (groundwater bearing structures) were identified by the investigation drilling.

The drilling demonstrates that the bedrock for extraction at the proposed 2 no. borrow pits is strong, competent, of intrinsic low permeability and that no groundwater inflows of any significance will occur during the excavation works. The 8 no. turbine bases are also located in the same bedrock geology albeit excavations will be shallower (3 – 3.5mbgl) and any inflows will be limited to subsoil seepage.

Also, the topographical and hydrogeological setting of the proposed borrow pits and turbine locations means no significant groundwater dewatering is anticipated to be required during the operation of the borrow pit or turbine base construction.

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 proposed borrow pit areas are located on the top of rocky local hills/ridges where the ground elevation is >120mOD and therefore are rock outcrops (which are visible to the eye);
- These elevations are above the elevations of the local valleys and streams;
- The proposed borrow pits will be between approximately 8 – 10mbgl which is notable. However, in the context of the topographical/elevated setting of the proposed borrow pits, this depth range is relatively shallow;

- The local bedrock comprises SILTSTONE/SANDSTONE and is confirmed to have low intrinsic permeability due to the competency of the rock. This means that groundwater flows will be limited to seepages at worst;
- 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/ridges on the hills where the borrow pits 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, we consider that the management of surface water will form the largest proportion of water to be managed and treated.

Similarly, no significant groundwater dewatering is anticipated to be required during the construction of the turbine bases.

4.3.1.4 Mitigation Measures for Surface Water Quality from Excavation Dewatering

Management of excavation inflows 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 site 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 silt bags or silt buster;
- 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;
- At the turbine locations and borrow pits adequately sized settlement ponds will be constructed to treat pumped water prior to discharge into a local manmade drain; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system can be made available at turbine locations 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 Hydrocarbons

Mitigation measures proposed to avoid release of hydrocarbons at the Site are as follows:

- On site re-fuelling of machinery will be carried out at the temporary construction compounds only. Fuel absorbent material and pads will be stored at the compounds in the event of any accidental spillages;
- Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;

- On-site refuelling will be carried out by trained personnel only;
- A permit to fuel system will be put in place;
- Fuels stored on site will be minimised. Fuel storage areas if required will be confined to the temporary construction compounds, bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be inspected daily for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be included within the Construction and Environmental Management Plan (**Appendix 4.5**). Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.

4.3.1.6 Mitigation Measures for Wastewater

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

4.3.1.7 Mitigation Measures for Cement-Based Products

- 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;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined cement washout ponds located outside 50m watercourse buffer zones);
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of a sudden rainfall event.

4.3.1.8 Mitigation Measures for New Watercourse crossing works

- The proposed 1 no. new stream crossing and 1 no. crossing upgrade will be bottomless or clear span structures and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing location;
- Where the proposed cable route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road;
- All guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland[2] is incorporated into the design of the proposed crossings;
- As a further precaution, near stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", i.e., May 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);
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the

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

construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas;
- All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- All crossings will be designed to accommodate a 100-year design flood with allowance for 300mm freeboard.

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

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

In relation to the new proposed culverts and proposed culvert upgrades at forestry drain crossings, the culverts will be suitably sized (approx 900mm) for the expected peak flows in the relevant drain. All culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary.

4.3.1.9 Mitigation Measures for Designated Sites

Drainage mitigation measures for surface water quality protection during the construction phase are summarised again below: (Please refer to Sections 4.3.1.1, 4.3.1.2 & 4.3.1.4 above for the full description of these measures and how they will be applied).
- The proposed mitigation measures which will include 50m buffer zones for avoidance of sensitive hydrological features (streams and rivers);
- Pre-construction drainage control measures (Section 4.3.1.2);
- Robust drainage control measures (i.e. interceptor drains, swales, settlement ponds and treatment trains such as a Siltbuster) will ensure that the quality of runoff from Proposed Project areas will be very high; and,
- Best practice measures with regard use of oils, fuels (Section 4.3.1.5) and cement based compounds (Section 4.3.1.7).

As stated in Section 4.3.1.1 above, there could potentially be a residual "imperceptible, short term, likely effect" on local streams and rivers but this would be very localised and over a very short time period (i.e. hours). Therefore, significant direct, or indirect impacts on the downstream designated sites will not occur.

4.3.1.10 Mitigation Measures for Turbine Delivery Route Works

- All works are minor and localised and cover very small areas;
- These works are distributed over a wide area;
- All works are temporary in nature;
- All areas will be reinstated shortly after the works and reseeded; and,
- Application of the Pre-Construction Drainage Measures (see Section 4.3.1.2) for surface water quality protection.

4.3.1.11 Mitigation Measures for WFD Status

Comprehensive surface water mitigation and drainage controls are outlined in Section 4.3.1.1 (Felling of Coniferous Plantations), Section 4.3.1.4 (Earthworks), Section 4.3.1.4 (Excavation Dewatering), Section 4.3.1.5 (Hydrocarbons), Section 4.3.1.7 (Cement-based Products) and Section 4.3.1.8 (Morphological Changes to Watercourses). These will ensure the protection of surface water quality and flows in all downstream receiving watercourses.

4.3.1.12 Mitigation Measures for Siltbuster

Measures employed to prevent overdosing and potential chemical carryover:

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

4.3.1.13 Mitigation Measures for Earthworks and Watercourse Crossings

Pre-commencement Temporary Drainage Works:

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

- All existing roadside drains (where present) that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Culverts, manholes and other drainage inlets (where present) will also be temporarily blocked; and,
- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside a watercourse 50m buffer zone.

The following mitigation measures are proposed for the underground cabling watercourse crossing works:

- No stock-piling of construction materials will take place along the grid route;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
- Local road drainage, culverts and manholes will be temporarily blocked during the works;
- Machinery deliveries will be arranged using existing structures along the public road;
- All machinery operations will take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur;
- Any excess construction material will be immediately removed from the area and sent to a licenced waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits will be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

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

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

4.3.1.14 Mitigation Measures for Proposed Hen Harrier Offsetting & Enhancement Lands

All proposed habitat management and enhancement works will be in accordance with the best practice Forest Service regulation, policies and strategic guidance documents as well as Coillte, DAFM and NatureScot guidance documents to ensure minimal potential negative effects on the local peat, soil and subsoil environment.

Given the nature of the restoration measures the following mitigation measures are proposed:

- A hydrology/hydrogeology study will be undertaken to map the movement of ground and surface water to inform the requirement for drain blocking;
- Before any works are completed silt fences will be installed to limit the movement of entrained sediment in surface water runoff;
- Proposed off-road routes will be walked in advance of any machinery;
- All machinery operators will be experienced;
- The proposed areas will be walked before a machine goes off-road;
- Bog mats will be used where the excavator is required to travel over wet ground;
- A low ground pressure excavator with wide tracks (1.9m or greater) will be used to reduce compaction of the peat and subsoils.; and,
- Standard tree felling water quality protection mitigation as presented in Section 4.3.1.1 above will be employed.

4.3.2 Operational Phase

4.3.2.1 Mitigation Measures for Replacement of Natural Surface with Low Permeability Surfaces

The proposed drainage philosophy states that runoff control and drainage management are key elements in terms of mitigation against impacts on surface water bodies. Two distinct methods will be employed to manage drainage water within the Proposed Development. The first being 'keeping clean water clean' and the second involving the collection of any drainage waters from work areas and to route them towards stilling ponds prior to controlled diffuse release over vegetated surfaces. The second method relates to proposed design measures that will prevent road surface and other hardstand areas acting as preferential flowpaths. All development site runoff will be collected, attenuated, treated and then released in a diffuse and regular manner that does not significantly change the natural drainage regime/hydrology of the site.

The operational phase drainage system of the Proposed Project will be installed and constructed in conjunction with the road and hardstanding construction work as described below and as shown on the drainage drawings (included in **Appendix 4-7**) submitted with this planning application:

- Interceptor drains will be maintained 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 will be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep 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/road side 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 road swale 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 watercourses; and,
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

These measures will ensure all surface water runoff from upgraded roads and new road surfaces (including hardstands and turbine base areas) will be captured and treated prior to discharge/release. Settlement ponds, check dams and buffered outfalls will prevent roads acting as preferential flowpaths by providing attenuation and water quality treatment.

4.3.2.2 Mitigation Measures for Runoff

The mitigation measures outlined in Sections 4.3.1.2 and 4.3.2.1 will ensure all surface water runoff from upgraded roads and new road surfaces (including hardstand and turbine base areas) will be captured and treated prior to discharge/release. Settlement ponds, checks dams and buffered outfalls will prevent roads acting as preferential flowpaths by providing attenuation and water quality treatment.

It is proposed that bedrock from on-site borrow pits will be used to construct the sub-base layer of proposed upgraded and new access roads, hardstand areas and turbine base areas. Once installed the subbase layer will be overlain by a clean capping layer of high-grade stone material which will be sourced from local quarries also.

4.3.2.3 Mitigation Measures for WFD status

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

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

4.3.3 Decommissioning Phase

The potential impacts associated with decommissioning of the Proposed Project 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. A description of the decommissioning works is contained in Chapter 4 of this EIAR.

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

The Site roadways will be kept and maintained following decommissioning of the turbine infrastructure, as these will be utilised by ongoing forestry works and by local farmers.

The electrical cabling connecting the site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site. The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the Site.

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

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

According to the SNH guidance, it is, therefore:

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

Some of the impacts will be avoided by leaving elements of the Proposed Project in place where appropriate. The substation will be retained by EirGrid as a permanent part of the national grid. The turbine bases will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects.

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** are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table R** below.

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

SWB	WFD Code	Current Status	Assessed Status – Unmitigated	Assessed Status with Mitigation Measures
Mal Bay Catchment				
Annageeragh_010	IE_SH_28A020010	Good	Moderate	Good
Annageeragh_020	IE_SH_28A020100	Good	Moderate	Good
Doo CE Lough	IE_SH_28_82	Moderate	Poor	Moderate
Annageeragh_030	IE_SH_28A020300	Good	Moderate	Good
Creegh_010	IE_SH_28C020400	Good	Good	Good
Creegh_020	IE_SH_28C021400	Moderate	Poor	Moderate
Creegh_030	IE_SH_28C021700	Good	Moderate	Good
Kilmihill Stream_010	IE_SH_28D020100	Poor	Poor	Poor
Doonbeg_020	IE_SH_28D020500	Good	Good	Good
Doonbeg_030	IE_SH_28D020650	Poor	Poor	Poor
Doonbeg_040	IE_SH_28D020725	Moderate	Moderate	Moderate
Doonbeg_050	IE_SH_28D020770	Moderate	Moderate	Moderate
Lough Donnell	IE_SH_090_0100	Poor	Poor	Poor
Doonbeg Estuary	IE_SH_080_0100	Moderate	Moderate	Moderate
Doonbeg Bay	IE_SH_080_0000	High	High	High
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High	High
Shannon Estuary North Catchment				
Moyasta_010	IE_SH_27M040900	Moderate	Moderate	Moderate
Wood_010	IE_SH_27W010100	Poor	Poor	Poor
Wood_020	IE_SH_27W010200	Moderate	Moderate	Moderate
Tramon Lough Stream_010	IE_SH_27T020300	Good	Good	Good
Crompaun (West)_020	IE_SH_27C051300	Moderate	Moderate	Moderate
Tonavoher_010	E_SH_27T230880	Moderate	Moderate	Moderate
Clonderalaw Bay	IE_SH_060_1200	Moderate	Moderate	Moderate

Lower Shannon Estuary	IE_SH_060_0300	Good	Good	Good
Mouth of the Shannon (HAs 23;27)	IE_SH_060_0000	Good	Good	Good
Ground Waterbodies				
Miltown Malbay	IE_SH_G_167	Good	Good	Good
Kilrush	IE_SH_G_123	Good	Good	Good

4.3.5 Cumulative Effects

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

The main likelihood of cumulative effects is assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the local hydrogeological setting (i.e. poorly productive bedrock and localised groundwater flowpaths) and the near-surface nature of construction activities, cumulative effects with regard groundwater quality or quantity arising from the Proposed Project are assessed as not likely.

The potential for cumulative effects will typically be much higher during the construction phase of the Proposed Project as this is when earthworks and excavations will be undertaken at the Site. Similarly, when assessing other developments for cumulative effects (i.e. proposed wind farms in the same catchment where the construction phase could overlap with the construction phase of the Proposed Project), the construction phase will be the worst case period for potential effects.

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

The cumulative Water Study area is delineated by the catchments of the Anngeeragh River, Creegh River, Doonbeg River, Crompaun River and Wood River catchments.

As stated previously, the proposed Wind Farm site only occupies the Anngeeragh River and Creegh River catchments, with the Grid Connection also passing through the other catchments as listed above.

The fact that the Proposed Project is spread across these several catchments is very positive from a hydrological cumulative impact scenario as works are not concentrated in one catchment. This is a significant mitigating factor against significant cumulative effects occurring.

5. SUMMARY AND CONCLUSION

5.1 SUMMARY

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

The Proposed Project 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 and operational phase of the Proposed Project.

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

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

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

Mitigation proposed for the protection of protected areas during the construction, operation and decommissioning phases of the Proposed Project will ensure the qualitative and quantitative status of the receiving ground and surface waters will not be altered by the Proposed Project and thereby reduces the potential for the Proposed Project to negatively impact upon any designated site downstream.

As such, the Proposed Project:

- 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) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in Section 9.1.4 of EIAR Chapter 9).

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