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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
MOANMORE WIND FARM
CO. CLARE

FINAL REPORT

Prepared for:

GREENSOURCE

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT MOANMORE WIND DEVELOPMENT,CO. CLARE**
Issue Date:	**6th March 2025**
Project Number:	**P1723-0**
Project Reporting History:	**-**
Current Revision No:	**P1648-0_WFD_REV D0**
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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by Jennings O'Donovan (JOD), on behalf of GreenSource, to complete a Water Framework Directive (WFD) Compliance Assessment for the Moanmore Wind Farm (i.e. 'the Project').

The purpose of this WFD assessment is to determine if any specific components or activities associated with the 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 wind farm planning application. As detailed in Section 1.1.1 in Chapter 1 of the EIAR, the various project components are described and assessed using the following references: the 'Project', the 'Site', the Turbine Deliver Route ('TDR'), and the Grid Connection Route ('GCR').

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, Conor McGettigan and Ciara Rodahan.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 22 years' environmental consultancy experience in Ireland. 22 years' environmental consultancy experience in Ireland. Michael has a degree in Civil and Environmental Engineering, a MSc in Engineering hydrology from TCD and a MSc in Applied Hydrogeology from Newcastle University. Michael has completed numerous (60+) hydrological and hydrogeological assessments relating to bedrock quarries and sand and gravel pits. Recent examples include Ardfert quarry in County Kerry and Middleton Quarry in County Cork.

Conor McGettigan (MSc, BSc) is an Environmental Scientist with over 4 years' experience in the environmental sector in Ireland. Conor holds an MSc in Applied Environment Science and a BSc in Geology. Conor routinely completed hydrological and hydrogeological impact assessment, flood risk assessments and WFD compliance assessments for a range of proposed developments including wind farms, residential developments, industrial developments, and quarries.

Ciara Rodahan is a Junior Environmental Scientist. Ciara holds a BSc in Environmental Science from UCC. Ciara is currently in the process of completing an MSc in Applied Environmental Geoscience.

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), as amended.

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. RBMPs include 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 2009 to 2015 with the second cycle plan covering the period from 2016 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 Project and include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge during the third cycle.

[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 AND CLASSIFICATION

2.1 INTRODUCTION

This section identifies those Surface Waterbodies (SWBs), Groundwater Bodies (GWBs) and protected areas with potential to be affected by the Project and reviews all available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

2.2.1 Wind Farm

On a regional scale, the Site is located within the Shannon Estuary North surface water catchment and Hydrometric Area 27 of the Shannon River Basin District. More locally the Site is located in the Wood River WFD sub-catchment (Wood_SC_010) and the Moyasta_010 WFD river sub-basin.

The Moyasta River (Moyasta_010 SWB) flows to the northwest along the northern boundary of the Site. The Moyasta_010 SWB discharges into the Mouth of the Shannon coastal water body (HAs 22:23) ~1.5km northwest and downstream of the Site (straight-line distance).

2.2.2 Grid Connection Route

The Grid Connection Route (GCR) is also mapped in the Wood River WFD sub-catchment (Wood_SC_010) and the Moyasta_010 WFD river sub-basin.

Within the Moyasta_010 WFD river sub-basin, the GCR crosses the Moyasta River (Moyasta_010 SWB) ~0.2km to the northeast of the Site along the L2024. All watercourses draining the area of the GCR form part of the Moyasta_010 SWB.

2.2.3 Turbine Delivery Route

The proposed work areas along the Turbine Delivery Route (TDR) are located in 2 no. regional WFD catchments. The Blade Transfer Area is located in the Shannon Estuary North catchment whilst the proposed road widening and strengthening works are proposed in both the Shannon Estuary North catchment and the Mal Bay catchment (Hydrometric Area No. 28).

The majority of the temporary road widening and verge strengthening works (~3.2km) are mapped within the Mal Bay surface water catchment. Within this catchment, the works are located in the Doonbeg River WFD sub-catchment (Doonbeg_SC_010). On a more local level the work areas are mapped in the Doonbeg_030 WFD river sub-basin. There are 2 no. crossings in this river sub-basin over the Tullagower River and the Brisla East Stream, both of which form part of the Doonbeg_030 SSWB. The Doonbeg River flows to the northwest for ~8.5km (straight line distance) before the Doonbeg_050 SWB discharges into the Doonbeg Estuary Transitional Waterbody. The Doonbeg Estuary then discharges into the Doonbeg Bay coastal waterbody ~10.7km from the TDR.

Meanwhile, the Blade Transfer Area, the vertical realignment area on the L6132 and the other remaining temporary works along the TDR are located in the Wood River sub-catchment (Wood_SC_010) and the Moyasta_010 WFD river sub-basin. There is 1 no. crossing over the Goerhass Stream along the TDR in this river sub-basin.

A local hydrology map is presented as

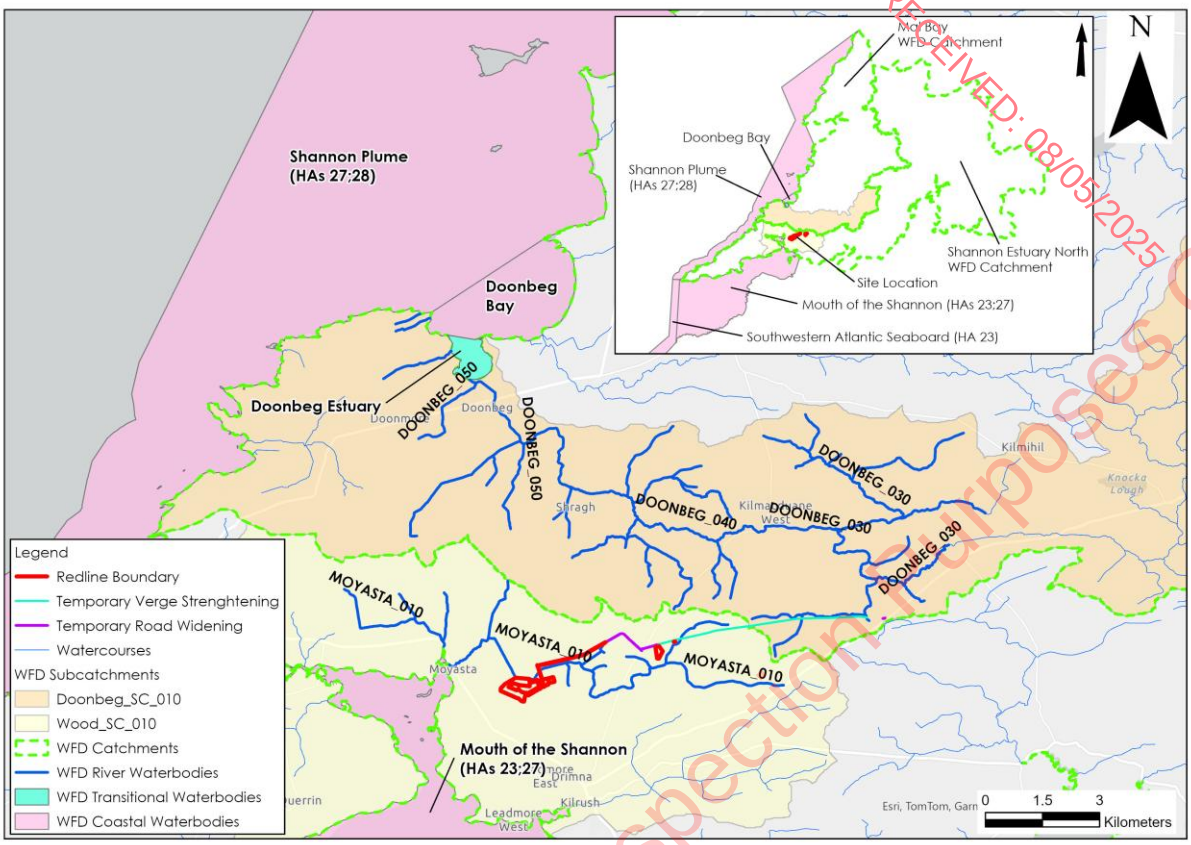

Figure A below.

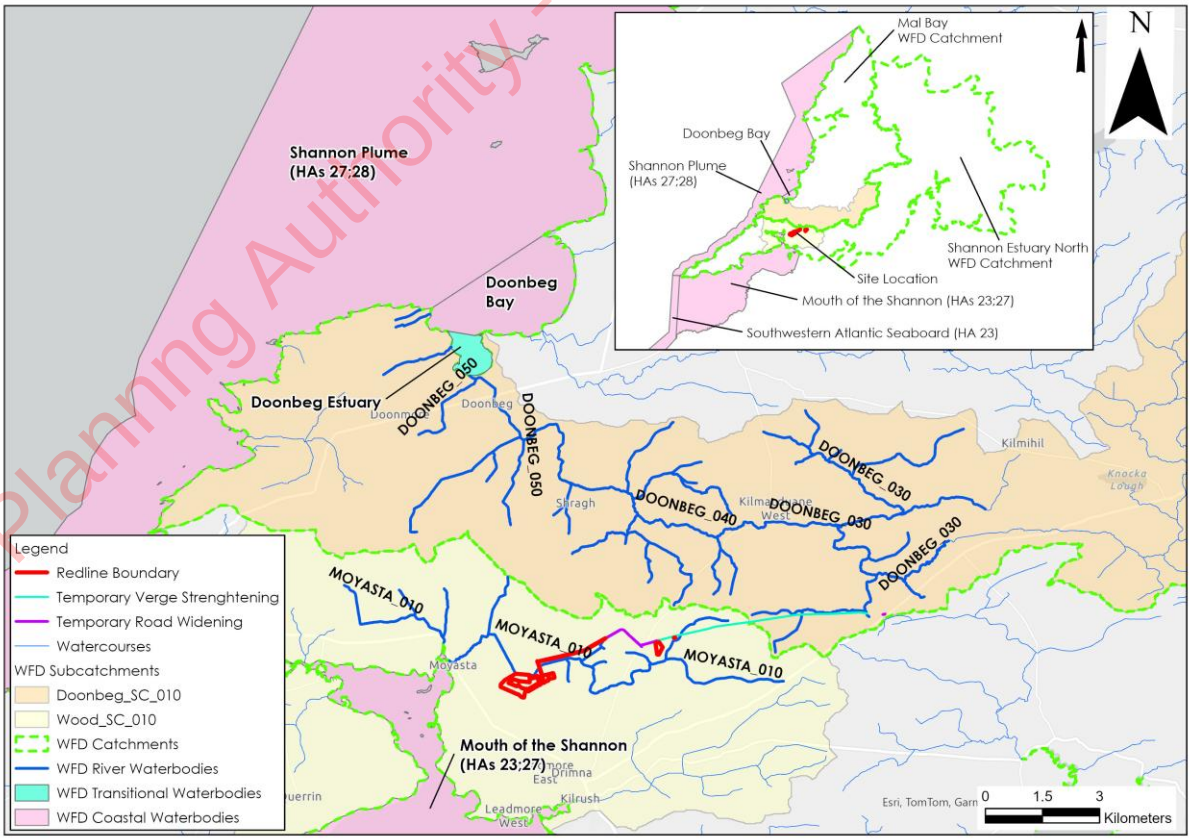

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for SWBs downstream of the Project are shown in **Table A**. The overall status of SWBs is based on the ecological, chemical and quantitative status of each SWB. Local SWB status information is available from (www.catchments.ie).

The Site, GCR and the Blade Transfer Area are mapped in the Moyasta_010 WFD river sub-basin. This SWB achieved 'Moderate' status in the latest WFD cycle (2016-2021). This was a decrease from the "Good" status which was achieved in the 2nd WFD cycle (2013-2018). The risk status of the Moyasta_010 SWB is currently under review. Agriculture has been identified to be a significant pressure impacting upon this SWB.

The Moyasta_010 SWB discharges into the Mouth of the Shannon (HAs 23;27) ~1.4km downstream of the Site. The Mouth of the Shannon (HAs 23;27) coastal waterbody achieved "Good" status in the latest WFD Cycle (2016 – 2021). This SWB is deemed to be 'not at risk' and no significant pressures have been identified.

With respect to the temporary works along the TRD in the Doonbeg River sub-catchment, the Doonbeg_030 SWB achieved a "Poor" status in the latest WFD Cycle. This is in line with the "Poor" status achieved in both the 1st and 2nd WFD Cycles. The Doonbeg_030 is considered to be "at risk" of failing to meet its WFD objectives in the future. Forestry and hydromorphology have been identified as significant pressures impact on this SWB. Further downstream, the Doonbeg_040 and _050 SWBs achieved "Good" status in the 3rd WFD Cycle. The Doonbeg_040 SWB is "not at risk" of failing to meet its WFD objectives, while the risk status of the Doonbeg_050 SWB is currently "under review". There are no significant pressures acting on this SWB.

The Doonbeg Estuary transitional SWB achieved a "Moderate" status in the latest WFD Cycle, and its risk status is currently "under review". There are no significant pressures acting on this transitional waterbody. The Doonbeg Estuary flows into the Doonbeg Bay coastal SWB which achieved "Good" status in the latest WFD cycle and is "not at risk" of failing to meet its WFD objectives in the future. The Doonbeg Bay SWB is connected to the Shannon Plume (HAs 27;28) coastal SWB which achieved "High" status in the 2nd and 3rd WFD cycles. The Shannon Plume SWB is "not at risk" of failing to meet its WFD objectives, and the EPA has not identified any significant pressures acting on this coastal waterbody.

The SWB status for the 2016-2021 WFD cycle are shown on

Figure B.

Table A: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	WFD Risk	Pressures
Wood_SC_010 Sub Catchment					
Moyasta_010	Unassigned	Good	Moderate	Under review	Agriculture
Mouth of the Shannon (HAs 23;27)	Moderate	Good	Good	Not at risk	None
Southwestern Atlantic Seaboard (HA 23)	Unassigned	High	High	Not at risk	None
Doonbeg_SC_010 Sub Catchment					
Doonbeg_030	Poor	Poor	Poor	At risk	Forestry, Hydromorphology,
Doonbeg_040	Good	Good	Good	Not at risk	None
Doonbeg_050	Good	Moderate	Good	Under Review	None
Doonbeg Estuary	Unassigned	Unassigned	Moderate	Under Review	None
Doonbeg Bay	Unassigned	High	Good	Good	None
Shannon Plume (HAs 27;28)	Unassigned	High	High	Good	None

2.4 GROUNDWATER BODY IDENTIFICATION

The Site is mapped to overlie the Kilrush GWB, while a portion of the proposed TDR is mapped to overlie the Milltown Malbay GWB.

The Kilrush GWB (IE_SH_G_123) underlies the Site, the GCR, the Blade Transfer Area and the western section of the L6132 where works are proposed. Meanwhile, the eastern section of the L6132 to the junction with the N68 is underlain by the Miltown Malbay GWB (IE_SH_G_167).

The bedrock underlying the Site, the GCR and the proposed works areas along the TDR is classified by the GSI as being Locally Important Aquifers – Bedrock which is Moderately Productive only in Local Zones.

2.5 GROUNDWATER BODY CLASSIFICATION

The Kilrush and Miltown Malbay GWBs achieved 'Good' status in all 3 no. WFD cycles. The status of these GWBs is defined based on the quantitative status and chemical status of each GWB. The Miltown Malbay and Kilrush GWBs have been deemed to be 'not at risk' of failing to meet their respective WFD objectives. Furthermore, no significant pressures have been identified on these GWBs.

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

Table B: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	WFD Risk	Pressures
Kilrush	Good	Good	Good	Not at risk	None
Milltown Malbay	Good	Good	Good	Not at risk	None

2.6 ZONE OF INFLUENCE

The potential Zone of Influence (ZoI) extends to the following SWBs and GWBs:

- River waterbodies: Moyasta_010, Doonbeg_030, Doonbeg_040 and Doonbeg_050.
- Transitional waterbodies: Doonbeg Estuary.
- Coastal waterbodies: Mouth of the Shannon (HAs 23;27), Southwestern Atlantic Seaboard (HA 23), Doonbeg Bay and the Shannon Plume.
- GWBs: Kilrush and Mal Bay GWBs.

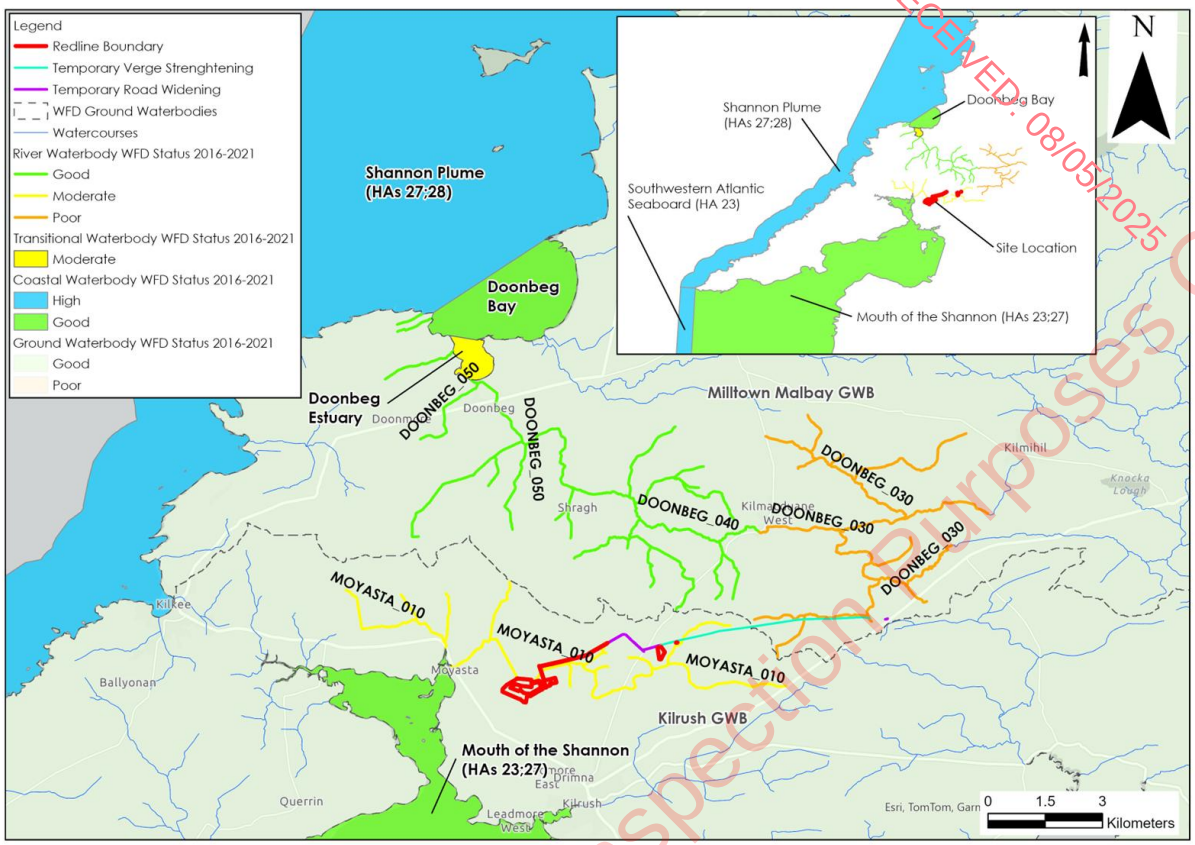

Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)

2.7 PROTECTED AREAS IDENTIFICATION

The WFD requires that the Project (for this report the wind farm, grid connection, and associated turbine delivery route works) are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, nutrient Sensitive areas (NSA), shellfish areas and drinking water protected area's (DWPA) 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), and European Sites.

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

The Site is not located within any designated conservation site. However, there are designated sites located within close proximity of the Site as described below:

- The Lower River Shannon SAC (Site Code: 002165) is located ~1.2km downstream of the Site, the GCR and the proposed works along the TDR in the Shannon Estuary North catchment. The Project is connected to this designated site via the Moyasta River. The length of the hydrological flowpath between the Site and the SAC is approximately 2.7 km.

- The River Shannon and River Fergus Estuaries SPA (Site Code: 004077) which is located ~1.2km downstream of the Site via the Moyasta River. The length of the hydrological flowpath between the Site and the SPA is approximately 2.7 km; and,
- The Poulnasherry Bay pNHA (Site Code: 000065) is also located ~2.7km downstream of the Site via the Moyasta River; and

Meanwhile, within the Mal Bay catchment, the proposed works along the TDR are hydrologically connected to the Mid-Clare Coast SPA (Site Code: 004182) and the Carrowmore Dunes SAC (Site Code: 002250). The length of the hydrological connection between the proposed work areas and these designated sites is approximately 17 km via the Tullagower and Doonbeg rivers.

The Tullaher Lough and Bog SAC/pNHA (Site Code: 000070) is located ~3.9km northwest of the Site. There is no hydrological connection between the Site and this pNHA. The Moyasta River acts as a hydrological barrier.

2.7.2 Bathing Waters

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

There are no designated bathing waters in the immediate vicinity of the Site, the GCR or the proposed work areas along the TDR.

The closest downstream designated bathing waters in the Shannon Estuary North catchment are located at Cappagh Peir, Kilrush and are associated with the Mouth of the Shannon coastal SWB. These bathing waters are ~3.4km south of the Site (Straight line distance).

Meanwhile, the closest downstream designated bathing waters in the Mal Bay catchment are located at White Strand, Doonbeg and are associated with the Doonbeg Bay coastal SWB.

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).

There are no NSAs within close proximity or downstream of the Site, the GCR or the proposed work areas along the TDR.

2.7.4 Shellfish Areas

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

There is 1 no. designated shellfish protected area downstream of the Site. The West Shannon Poulnasherry Bay designated shellfish area is located ~1.6km to the west and downstream of the Site via the Moyasta_010 SWB. The shellfish area is hosted in the Mouth of the Shannon coastal waterbody.

There are no designated shellfish areas located downstream of the proposed work areas along the TDR in the Mal Bay catchment.

2.7.5 Freshwater Pearl Mussel

The freshwater pearl mussel (*Margaritifera margaritifera*) is a bivalve mollusc found in clean, fast-flowing rivers, and occasionally in lakes. It is listed under Annex II and Annex V of the E.U Habitats Directive (Council Directive 92/43/EEC).

The Doonbeg River sub-catchment (Doonbeg_SC_010) is listed as being a Margaritifera sensitive area with extant populations of the freshwater pearl mussel. The only works proposed in this catchment are temporary road widening and verge strengthening works along the TDR.

2.7.6 Drinking Water

There are no listed/mapped surface water abstractions for drinking water in the ZOI.

All GWB's in Ireland are considered as DWPAs. The Kilrush and Mal Bay GWBs are used for the abstraction of drinking water for local supplies. No public or group water schemes are located in the local area.

3. WFD SCREENING

3.1 SURFACE WATER BODIES

With consideration for the construction, operational and decommissioning phases of the Project, it is considered that the Moyasta_010, and Doonbeg_030 SWBs will be included in the WFD Compliance Assessment due to the occurrence of components of the Project within the Moyasta_010 and Doonbeg_030 river sub-basins. The Doonbeg_040 SWB has also been included due to its location direction directly downstream of the Doonbeg_030 SWB. The Project must not in any way result in a deterioration in the status of these river waterbodies and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

Meanwhile, the Doonbeg_050 SWB has been screened out due to its distant location from the Project and the small scale of the proposed works in the Doonbeg River sub-catchment (limited to temporary works along the TDR). The Project has no potential to cause deterioration of the WFD status of the Doonbeg_050 SWB.

In terms of the downstream transitional and coastal waterbodies, within the Shannon Estuary North Catchment, no effects associated with the Project will occur downstream where the Moyasta River discharges into the Mouth of the Shannon coastal waterbody. There is very limited potential for effects downstream of this point due to the large volumes of saline waters within the coastal waterbody. Therefore the Mouth of the Shannon coastal SWB has been screened out of the WFD Compliance Assessment. Meanwhile, within the Mal Bay catchment, the Doonbeg Estuary and Doonbeg Bay transitional and coastal waterbodies have been screened out of the WFD Compliance Assessment. The components of the proposed Project would have no potential to cause deterioration of the WFD status of these SWBs.

Note that the Project does not in any way rely on dilution or the assimilative capacity of any downstream waterbody. The mitigation measures prescribed in the EIAR, and summarised in Section 4.3, are the primary method for surface water quality and quantity protection and ensure that there will be no impact on any downstream SWB.

3.2 GROUNDWATER BODIES

With respect to GWBs, the Kilrush GWB has been screened in due to its location directly underlying the Site, the GCR and the Blade Transfer Area. The Milltown Malbay GWB has been screened in due to its location underlying the proposed works along the TDR. The proposed works must not in any way result in a deterioration in the status of these GWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

3.3.1 Nature Conservation Designations

The following designated sites downstream of the Site are included in the WFD Compliance Assessment:

- The River Shannon and River Fergus Estuaries SPA (Site Code: 004077);
- The Poulnasherry Bay pNHA (site Code: 000065); and,
- The Lower River Shannon SAC (Site Code: 002165).

The potential for effects on these designated sites is limited given the assimilative capacity of the Mouth of the Shannon coastal SWB within which these designated sites are located. However, for the purposes of a conservative assessment, these designated sites are included in the WFD Compliance Assessment.

Meanwhile, the Mid-Clare Coast SPA and the Carrowmore Dunes SAC are screened out of the impact assessment due the length of the hydrological flowpath between the TDR work areas and these designated sites, the large volumes of water with the transitional and coastal SWBs associated with these designated sites and the small scale and transient nature of the works along the TDR in the Mal Bay surface water catchment. There is no potential for effects on these designated sites.

All other designated sites have been screened out of the WFD Compliance Assessment.

3.3.2 Bathing Waters

The bathing waters at Cappagh Pier, Kilrush and Carrigaholt have been screened out of the WFD Compliance Assessment due to their distant location downstream of the Site (~3.4km and ~13.9km respectively), and the large volume of saline waters within the coastal waterbodies associated with these bathing waters.

3.3.3 Nutrient Sensitive Areas

As no NSAs are currently defined within or downstream of the Project, therefore no NSAs are included in the WFD Compliance Assessment.

3.3.4 Shellfish Areas

The West Shannon Poulnasherry Bay designated shellfish area has been included in the WFD Compliance Assessment as it is directly downstream of the Site via the Moyasta River. The potential for effects on this shellfish area is limited given the assimilative capacity of the Mouth of the Shannon coastal SWB within which these designated sites are located. However, for the purposes of a conservative assessment, this shellfish area is included in the WFD Compliance Assessment.

3.3.5 Freshwater Pearl Mussel

The Doonbeg River Freshwater Pearl Mussel sensitive area will be included in the assessment as the Doonbeg river and its tributaries are located in close proximity to the works along the TDR in the Mal Bay catchment.

3.3.6 Drinking Water Protected Areas

There are no SWB DWPAs within or adjacent to the Site, the GCR or the proposed work areas along the TDR.

The GWBs underlying the Project are DWPAs and will be assessed (in this report) in the overall assessment of the Project on the Kilrush GWB and the Milltown Malbay GWB.

3.4 WFD SCREENING SUMMARY

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

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

Type	WFD Classification	Water body Name/ID	Inclusion in Assessment	Justification
Wood_SC_010 Sub Catchment				
Surface Water Body	River	Moyasta_010	**Yes**	The Site, the GCR (including 1 no. crossing), the Blade Transfer Area and the proposed temporary works along the TDR (including 1 no. crossing) are located within the Moyasta_010 river sub-basin. An assessment is required to consider whether the potential impacts associated with the Project will cause a deterioration in the status of this SWB.
	Coastal	Mouth of the Shannon (HAs 23;27)	No	The Mouth of the Shannon (HAs 23;27) has been screened out due to the saline nature of its waters and the large volumes of water within the SWB. The Project has no potential to impact the status of this SWB.
	Coastal	Southwestern Atlantic Seaboard (HA 23)	No	The Southwestern Atlantic Seaboard (HA 23) has been screened out due to the saline nature of its waters and the large volumes of water within the SWB. The Project has no potential to impact the status of this SWB.
Doonbeg_SC_010 Sub Catchment				
Surface Water Body	River	Doonbeg_030	**Yes**	Temporary works along the TDR, including 2 no. watercourse crossings, are located within the Doonbeg_030 river sub-basin. An assessment is required to consider whether the potential impacts associated with the Project will cause a deterioration in the status of this SWB.
	River	Doonbeg_040	**Yes**	The Doonbeg_040 is located directly downstream of the Doonbeg_030 SWB. This SWB has been screened in due to its proximal location downstream and hydrological connection to the TDR work areas. An assessment is required to consider whether the potential impacts associated with the Project will cause a deterioration in the status of this SWB.
	River	Doonbeg_050	No	The Doonbeg_050 SWB has been screened out due to its distant location downstream of the proposed work areas, the intervening lands, and increasing volumes of water within the Doonbeg River. The Project therefore has no potential to result in a deterioration in the status of this SWB.
	Transitional	Doonbeg Estuary	No	The Doonbeg Estuary Transitional water body has been screened out due to its distant location downstream, the intervening lands, increasing volumes of water, and the saline nature of this waterbody. The Project therefore have no potential to result in a deterioration in the status of this SWB.
	Coastal	Doonbeg Bay	No	The Doonbeg Bay coastal water body has been screened out due to its distant location downstream, the intervening lands, increasing volumes of water, and the saline nature of this waterbody. The Project therefore has no potential to result in a deterioration in 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 its distant location downstream, the intervening lands, increasing volumes of water, and the saline nature of the waterbody. The Project therefore has no potential to result in a deterioration in the status of this SWB.
Groundwater Bodies				
Ground Water Body	Groundwater	Kilrush	Yes	The Kilrush GWB will be brought forward into the WFD Compliance Assessment as it lies directly underneath the Site and the GCR. An assessment is required to consider whether the potential impacts associated with the Project will cause a deterioration in the status of this GWB.

	Groundwater	Milltown Malbay	**Yes**	The Milltown Malbay GWB will be brought forward into the WFD Compliance Assessment as it lies directly underneath the works areas along the TDR. An assessment is required to consider whether the potential impacts associated with the Project will cause a deterioration in the status of this GWB.
Protected Area	Nature Conservation Site	River Shannon and River Fergus Estuaries SPA	**Yes**	For the purposes of a conservative assessment, the River Shannon and River Fergus Estuaries SPA has been included in the WFD Compliance Assessment.
		Poulnasherry Bay pNHA	**Yes**	For the purposes of a conservative assessment, the Poulnasherry Bay pNHA has been screened into the WFD Compliance Assessment.
		Lower River Shannon SAC	**Yes**	For the purposes of a conservative assessment, the Lower River Shannon SAC has been screened into the WFD Compliance Assessment.
		Tullaher Lough and Bog SAC and pNHA	No	The Tullaher Lough and Bog SAC and pNHA has been screened out due to the lack of any hydrological or hydrogeological connection between the Project and the SAC/pNHA. The proposed works have no potential to degrade the ecological quality of these protected sites.
	Shellfish Waters	West Shannon Poulnasherry Bay	**Yes**	For the purposes of a conservative assessment, the West Shannon Poulnasherry Bay designated shellfish waters have been screened into the WFD Compliance Assessment.
	Freshwater Pearl Mussel	Doonbeg River	**Yes**	The Doonbeg River Freshwater Pearl Mussel protected area has been screened in due to its direct location downstream from the proposed works areas along the TDR. An assessment is required to consider whether the potential impacts associated with the Project will cause a deterioration in the status of this protected area.
	Bathing Waters	Cappagh Pier, Kilrush	No	The bathing waters at Cappagh Pier, Kilrush have been screened out of the WFD Compliance Assessment due to their distant location (~3.4km), intervening lands, increasing volume of water downstream, and the saline naturel of the coastal waterbody associated with these bathing waters. The proposed works therefore have no potential to degrade the ecological quality of these shellfish waters.

4. WFD COMPLIANCE ASSESSMENT

4.1 DEVELOPMENT PROPOSALS

The Project is described in full in Chapter 2 of the EIAR.

In summary the Project comprises of a 3 no. turbine wind farm, associated turbine hardstands and access tracks, an onsite substation, spoil storage area, flood compensation areas, a grid connection route to the existing Tullabrack 110kV Substation and works along the TDR including a blade transfer area.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects

Construction phase activities including site levelling, upgrade of the existing Site entrance, construction of new site access tracks, upgrades of existing site access tracks, construction of turbine hardstand areas, turbine foundations, the proposed substation compound, the proposed construction compound, internal grid cabling, flood compensation areas, and spoil management area will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils within the Site. Furthermore, construction of the Blade Transfer Area will require the felling of ~0.85ha of coniferous forestry along the TDR. The works along the GCR will also result in the excavation and disturbance of soils/subsoils. The above works have the potential to impact water quality in this SWB. The main risk will be from surface water runoff from bare soil and spoil storage areas during the construction works.

Hydrocarbons and cement-based compounds will also be used during the construction phase. The unintended release of effluent from temporary welfare facilities used during the construction phase also has the potential to impact on surface water quality. Hydrocarbon storage will not occur during construction of the GCR or the TDR as these works are transient.

These 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 waterbodies.

There is also a requirement for a watercourse crossing over an EPA mapped watercourse along the GCR, over the Moyasta River (Moyasta_010 SWB). In addition, there are 3 no. watercourses crossings occur where temporary works are proposed along the TDR with 1 no. crossing over the Moyasta_010 SWB and 2 no. crossings over the Doonbeg_030 SWB. Due to the close proximity of works to streams and rivers at these crossing locations, there is a potential for surface water quality effects during trench excavation along the GCR and verge strengthening works along the TDR, due to runoff from the road surface. This runoff may contain elevated concentration of suspended solids, cementitious materials and/or hydrocarbons. The crossing over the Moyasta River along the GCR will be achieved by horizontal directional drilling (HDD).

Some minor groundwater/surface water seepages will likely occur in turbine base excavations, substation compound excavations, sections of the internal cabling trenches, and this will create additional volumes of water to be treated by the runoff management system. With respect to the GCR, some minor groundwater/surface water seepages will also occur in shallow trench excavations. Inflows will require management and treatment to reduce suspended sediments.

However, construction activities along the TDR only have the potential for short-term effects due to the minor and transient nature of the works.

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

Table D: Potential Deterioration in Surface Waterbody Status During the Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Moyasta_010	IE_SH_27M040900	Moderate	Moderate
Doonbeg_030	IE_SH_28D020650	Poor	Poor
Doonbeg_040	IE_SH_28D020725	Good	Good

4.2.1.2 Potential Groundwater Quality/Quantity Effects

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a major pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Chemicals such as cement-based compounds also pose a threat to the groundwater environment. Runoff from concrete works can impact on groundwater quality. These sources of contamination have the potential to impact on groundwater quality in the underlying groundwater bodies in the area of the Onshore Site. These sources of contamination have the potential to impact on groundwater quality in the underlying GWBs.

In terms of groundwater quantity, no significant dewatering is being proposed. Due to the shallow, short-term and transient nature of the proposed works along the GCR and the TDR, there is no potential for effects on the qualitative status of the underlying GWBs.

Furthermore, due to the low permeability of the bedrock aquifers and the shallow nature of the proposed works, there is limited potential for the Project to result in a deterioration in the overall quantitative status of the underlying GWBs. The potential for the Project to result in a deterioration in the status of the GWBs is further limited by the scale of the Project in comparison to the overall size of the Miltown Malbay (770km^2) and Kilrush (440km^2) GWBs.

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

Table E: Potential Deterioration of Groundwater Body Status during the 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

4.2.1.3 Potential Effects on Protected Areas

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

The Lower River Shannon SAC

Due to the length of the hydrological flowpath between the Site and the SAC being 2.7km and given that the SAC is associated with the Mouth of the Shannon coastal waterbody which contains significant volumes of saline water, there is limited potential for effects on the SAC. Note that the Project does not rely on the assimilative capacity of any downstream waterbody and that the primary protection of all surface waters is provided by the detailed mitigation measures which are prescribed in **Section 4.3**). Nevertheless, for the purposes of a conservative assessment, the SAC has been included in the impact assessment. Any potential deterioration in water quality associated with the Project in the Moyasta_010 river sub-basin would have the potential to impact on the Lower River Shannon SAC.

The River Shannon and River Fergus Estuaries SPA

Due to the length of the hydrological flowpath between the Site and the SPA being 2.7km and given that the SPA is associated with the Mouth of the Shannon coastal waterbody which contains significant volumes of saline water, there is limited potential for effects on the SPA. Note that the Project does not rely on the assimilative capacity of any downstream waterbody and that the primary protection of all surface waters is provided by the detailed mitigation measures which are prescribed in **Section 4.3**). Nevertheless, for the purposes of a conservative assessment, the SPA has been included in the impact assessment. Any potential deterioration in water quality associated with the Project in the Moyasta_010 river sub-basin would have the potential to impact on the River Shannon and River Fergus Estuaries SPA.

The Poulnasherry Bay pNHA

Due to the length of the hydrological flowpath between the Site and the pNHA being 2.7km and given that the pNHA is associated with the Mouth of the Shannon coastal waterbody which contains significant volumes of saline water, there is limited potential for effects on the pNHA. Note that the Project does not rely on the assimilative capacity of any downstream waterbody and that the primary protection of all surface waters is provided by the detailed mitigation measures which are prescribed in **Section 4.3**). Nevertheless, for the purposes of a conservative assessment, the pNHA has been included in the impact assessment. Any potential deterioration in water quality associated with the Project in the Moyasta_010 river sub-basin would have the potential to impact on the Poulnasherry Bay pNHA.

West Shannon Poulnasherry Bay designated shellfish waters

Due to the length of the hydrological flowpath between the Site and the designated shellfish waters being 3.7km and given that these waters are associated with the Mouth of the Shannon coastal waterbody which contains significant volumes of saline water, there is limited potential for effects on the pNHA. Note that the Project does not rely on the assimilative capacity of any downstream waterbody and that the primary protection of all surface waters is provided by the detailed mitigation measures which are prescribed in **Section 4.3**). Nevertheless, for the purposes of a conservative assessment, these designated shellfish waters have been included in the impact assessment. Any potential deterioration in water quality associated with the Project in the Moyasta_010 river sub-basin would have the potential to impact on the West Shannon Poulnasherry Bay designated shellfish waters.

Doonbeg River Freshwater Pearl Mussel Sensitive Area

The Doonbeg River sub-catchment within which temporary works along the TDR are proposed is listed as a sensitive area for the Freshwater Pearl Mussel.

Any potential deterioration in surface water quality associated with the Project may impact water quality in the Doonbeg River and its tributaries and have an adverse impact on the Freshwater Pearl Mussel populations. However, given the scale of the proposed works in this

catchment, limited to temporary road widening and verge strengthening works along the TDR, there is limited potential for effects on the downstream water quality.

4.2.2 Operational Phase (Unmitigated)

4.2.2.1 Potential Surface Water Quantity Effects

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

There will be limited potential for effects on surface water quantity in the Doonbeg_030 SWB as the only works proposed in this WFD river sub-basin are temporary works along the TDR. Therefore, there will be no quantitative change to runoff volumes during the operational phase.

The greatest potential for effects on surface water quantity and flow volumes is associated with the works proposed within the Site in the Moyasta_010 WFD river sub-basins respectively. The replacement natural surfaces with impermeable surfaces, associated with hardstands and access tracks has the potential to increase runoff rates to local watercourses and can increase downstream flow volumes. However, the addition runoff volume will be low due to the fact that runoff from the Site is naturally high and that all hardstand areas will be constructed of permeable stone aggregate.

Furthermore, T1 and its associated hardstand area and access tracks are mapped within the 100-year fluvial flood zone associated with flooding along the Moyasta River. The proposed infrastructure in the flood zone would have the potential to displace floodwaters and alter flow regimes during times of flood. However, flood compensation areas of equivalent volume to the flood capacity which will be lost due to the proposed infrastructure within the flood zones are included as part of the Project and will ensue there is no displacement of floodwaters. Culverts will also be installed along access tracks within the flood zone to ensure that flood water flow routes will not be completely impeded.

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

Table F: Potential Deterioration in Surface Waterbody Status Due to Quantitative Effects During Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Moyasta_010	IE_SH_27M040900	Moderate	Moderate
Doonbeg_030	IE_SH_28D020650	Poor	Poor
Doonbeg_040	IE_SH_28D020725	Good	Good

4.2.2.2 Potential Surface Water Quality Effects

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 along the GCR, and 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 road material is added during maintenance works.

A summary of potential status change to SWBs arising from surface water quality effects during the operation phase of the Project in the unmitigated scenario are outlined in **Table G**.

Table G: Potential Deterioration in Surface Waterbody Status due to Qualitative Effects During Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Moyasta_010	IE_SH_27M040900	Moderate	Moderate
Doonbeg_030	IE_SH_28D020650	Poor	Poor
Doonbeg_040	IE_SH_28D020725	Good	Good

4.2.2.3 Potential Groundwater Quality/Quantity Effects

The potential for effects on groundwater quality is reduced in comparison with the construction phase. Any leakage of oils or wastewater at the Site would have the potential to result in a deterioration in the qualitative status of local groundwater. However, due to the nature of the operational phase and the overall scall of the underlying GWBs, there is no potential for a deterioration in the overall qualitative status of the underlying GWBs to be impacted.

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

Table H: Potential Deterioration in Groundwater Body Status Due to Qualitative and Quantitative Effects 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

4.2.2.4 Potential Effects on Protected Areas

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

Therefore, the risk of any operational phase activities that may affect the conservation objectives of the protected areas is reduced from that defined for the construction phase (i.e. the greatest potential for the deterioration in the status of downstream protected areas occurs during the construction phase).

4.3 MITIGATION MEASURES

In order to mitigate against any deterioration of surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction and operational phases of the Project. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Potential Effects from Earthworks Resulting in Suspended Sediment Entrainment in Surface Waters

Mitigation by Avoidance:

The key mitigation measure during the construction phase is the avoidance of sensitive hydrological features, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains).

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and the associated release of sediment.
- Avoid excavations within close proximity to surface watercourses.
- Avoid the entry of suspended sediment from earthworks into watercourses.
- 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:
The Project design has been optimised to utilise the existing infrastructure (existing site access tracks) where practicable. This design prevents the unnecessary disturbance of peat and spoil, significantly reducing the potential for elevated concentrations of suspended solids in runoff.

- Source controls:
  - Interceptor drains, diversion drains, erosion and velocity control measures such as the use of sand bags, oyster bags filled with gravel, filter fabrics and other similar/equivalent or appropriate systems.
  - Small working areas, covering temporary stockpiles, weathering off temporary stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.

- In-Line controls:
  - Interceptor drains/swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps, sediment traps, temporary pumping systems, settlement ponds, or other similar/equivalent or appropriate systems.

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

It should be noted that the existing network of drains present in some areas will be integrated and enhanced as required and used within the Project drainage system. The integration of the existing drainage network and the proposed wind farm network is relatively simple. The key elements are the upgrading and improvements to water treatment elements, such as in-line controls and treatment systems, including silt traps, settlement 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 wind

farm drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion.
- Temporary silt traps will be placed in the existing drains downstream of construction works, and these will be diverted into proposed interceptor drains, or culverted under/across the works area.
- During the operational phase of the Wind Farm, runoff from individual turbine hardstanding areas will be not discharged directly into the existing drainage network but discharged locally at each turbine location through field drains, main drains, and existing settlement ponds.
- Buffered outfalls which will be numerous over the Site will promote percolation of drainage waters across the bog surface and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site.
- Velocity and silt control measures such as check dams, sandbags, oyster bags, straw bales, silt fences will be used during the upgrade construction works.
- Existing culverts will be lengthened where necessary to facilitate access road widening.

Pre-Commencement Temporary Drainage Works: Prior to the commencement of road upgrades (or new road/hardstand or turbine base installs) 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 forestry 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 forestry drains that have surface water flows and also along existing forestry roadside drains.
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

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

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

Settlement Ponds:
The Project footprint will be divided into drainage catchments (based on topography, outfall locations, catchment size) and stormwater runoff rates based on the 10-year return period rainfall event will be calculated for each catchment. These flows will then be used to design settlement ponds for each drainage catchment. The settlement ponds will either be designed for 4.1hr or 24hr retention times used to settle out medium silt (0.01mm) and fine silt (0.004mm) respectively (EPA, 2006). Settlement ponds along Site Access Tracks and at Turbine Hardstands will have 4.1hr retention as there is additional in-line drainage controls proposed along Site Access Tracks and at hardstands.

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 Wind Farm 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).

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

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

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

- General Forecasts: Available on a national, regional and county level from the Met Éireann website (www.met.ie). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates.
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale.
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events.
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Éireann website (www.met.ie). 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.
- Consultancy Service: Met Éireann provide 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 planned works to be safely executed (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Earthworks will be suspended if forecasting suggests any of the following is likely to occur:
- >10 mm/hr (i.e. high intensity local rainfall events).
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

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

- All open peat/spoil excavations will be secured and sealed.
- Temporary or emergency drainage will be created to prevent back-up of surface runoff.
- Working during heavy rainfall and for up to 24 hours after heavy events will not be allowed to ensure drainage systems are not overloaded.

Management of Runoff from Spoil Storage Area:
It is proposed that excavated peat/subsoil will be stored in a spoil storage area to the east of the L2034 or used for landscaping throughout the Site. The proposed spoil storage area is located outside of the delineated 50m hydrological buffer zone which was applied to EPA mapped watercourses.

The waterlogged Spoil Storage Area will be drained to increase load bearing capacity of the underlying soil prior to constructing the edge berms which will be brought down to competent ground. A rock berm and silt fencing will be installed around the spoil storage area (Drawing No. 6778-JOD-MM-XX-DR-C-1401). The runoff from the spoil area, will be directed to an oversized swale and a number of stilling ponds with appropriate storage and settlement designed for a 1 in 10 year return period before discharge to an existing drain that flows for 640m before entering the Order 1 Durha stream.

Where applicable the vegetative topsoil layer of the spoil storage area will be rolled back to facilitate placement of excavated spoil, following which the vegetative topsoil later will be reinstated. Where reinstatement is not possible, the spoil storage area will be sealed with a digger bucket and seeded as soon as possible to reduce sediment entrainment in runoff.

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.

Proposed Drainage and Water Quality Monitoring:
The monitoring programme during the course of construction works (unless otherwise specified by any required planning condition) will include:

- One baseline monitoring visit (in advance of construction), including upstream and downstream biological Q value sampling and reporting.
- Once daily general visual inspections by site EM at all sample sites identified.
- Weekly grab sample inspections by site EM (Sample parameters will include, suspended solids, and on-site measurement of: turbidity, pH, temperature, electrical conductivity). At two locations within the WF site in man-made drains, and at SW3 and SW4.
- Monthly grab sampling by site EM at locations SW3, and SW4 (refer to Figure 9.3). Analysis suite will include (same as Table 9.12 including suspended solids, BOD, nitrite, nitrate, ammonia, orthophosphate and chloride).
- Monthly inspections and grab sampling during post construction for 3 months.
- Annual upstream and downstream biological Q value sampling and reporting, including one post construction event.

The Site Environmental Manager (EM) will have a stop works authority. Weekly site meeting will include for scheduling of works according to weather forecast. Suitable locations (further downstream) for biological Q-Value sampling will be identified by Site EM.

Allowance for Climate Change:
Climate Change rainfall projections are typically for a mid-century (2050) timeline. The projected effects of climate change on rainfall are therefore modelled towards the end of

the life cycle of the Project, as the turbines have a life span of 40 years. It is likely that the long-term effects of climate change on rainfall patterns will not be observed during the lifetime of the proposed wind farm. As outlined in the above sections we have designed settlement ponds for a 1 in 10 year return flow. This approach is conservative given that the project will likely be built over a much shorter period (12-18 months), and therefore this in-built redundancy in the drainage design more than accounts for any potential short term climate change rainfall effects.

Additional Measures for Works within Buffer Zone:
In addition to the above mitigation measures, where works are proposed within the delineated hydrological buffer zones the following additional mitigation measures will be implemented:

- Double row silt fences will be emplaced immediately down-gradient of the construction areas.

Additional Measures along the GCR:
The GCR will require excavation of cable trenches in existing roadways. These works are transient in nature with very limited excavation at any one time. Any excess spoil from trenches in public roadways will be removed as it is excavated and transported to a licenced facility. A silt fencing filtration system will be installed on all existing drainage channels for the duration of the cable construction to prevent contamination of any watercourse. Full mitigation measures prescribed for works along the GCR are detailed in Section 9.7.2.7.

Additional Measures along the TDR:
Verge and road strengthening (rock aggregate) along the L2036 will involve removing the verge material, placing geotextile and geogrid at the base of the verge and backfilling the verge with granular material compacted in layers. Silt fencing will be placed around works areas and at watercourse crossings steel plates will be placed on the verge for 10m each side of watercourse crossings to avoid excavation and disturbance of the existing ground.

4.3.1.2 Potential Effects from Clear Felling

A felling licence will be obtained prior to the commencement of felling activities.

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

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

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

These forestry buffer zones will ensure that water quality is protected during the felling operations. However, all of the proposed felling as part of the Project at the Blade Transfer Area is located outside of the 50m self-imposed hydrological buffer zone, thereby limiting the felling which will occur in close proximity to natural watercourses.

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

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

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.
- 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. 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.
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing peat and mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.
- Silt fences will be installed at the outfalls of existing drains downstream of felling areas. No direct discharge of such drains to watercourses will occur. Sediment traps and silt fences will be installed in advance of any felling works and will provide surface water settlement for runoff from work areas and will prevent sediment from entering downstream watercourses. Accumulated sediment will be carefully disposed of at pre-selected peat and spoil repository areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground.
- In areas particularly sensitive to erosion it will be necessary to install double or triple sediment traps and increase buffer zone width. These measures will be reviewed on site during construction.
- Double silt fencing will also be put down slope of felling areas which are located in close proximity to streams and/or relevant watercourses.

- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded.
- Timber will be stacked in dry areas, and outside watercourse buffer zones. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites.
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water runoff.
- Refuelling or maintenance of machinery will not occur within 50m of an aquatic zone or within 20m of any other hydrological feature. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

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

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

Drain Inspection and Maintenance:

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

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines.
- Inspection of all areas reported as having unusual ground conditions.
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Ideally the pre-felling inspection will be carried out during rainfall.
- Following tree felling all main drains will be inspected to ensure that they are functioning.
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground.
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked.
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

4.3.1.3 Potential Effects from Excavation Dewatering and Potential Effects on Surface Water Quality

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

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place.
- If required, pumping of excavation inflows will prevent build-up of water in the excavation.
- The interceptor drainage will be discharged to the 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 Siltbuster unit.
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur.
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken.
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available onsite 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

4.3.1.4 Potential Effects from the Release of Hydrocarbons

- During construction, where possible, all refuelling on site will be within the temporary compound within the dedicated re-fuelling area.
- All plant will be inspected and certified to ensure they are leak free and in good working order prior to use onsite.
- Site vehicles will be refuelled offsite where possible.
- Only essential refuelling will be completed outside of the dedicated re-fuelling area but not within 50m of any watercourses. Onsite re-fuelling of plant and machinery will be carried out using a mobile double skinned fuel bowser:
    - The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located;
    - The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages.
    - The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site.
    - Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
    - A non-permeable High-Density Polyethylene (HDPE) membrane will be provided beneath connection points to catch any residual oil during filling and disconnection. These membrane will be inspected and if there is any sign of oil contamination will be removed from the site by a specialist waste contractor.
- Onsite refuelling will be carried out by trained personnel only;
- A permit to fuel system will be put in place;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. Fuels will be stored in the Temporary Construction Compound and bunded to at least 110% of the storage capacity of fuels to be stored. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The electrical control building (at the substation) will be bunded appropriately to 110% of the volume of oils that will be stored, and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages is included within the Construction and Environmental Management. Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

4.3.1.5 Potential Effects from the Release of Cement-Based Products

- No batching of wet-cement products will occur onsite. Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place.
- Where possible pre-cast elements for culverts and concrete works will be used.
- Vehicles will undergo a visual inspection prior to being permitted to drive into the wind farm Site to ensure that there is no excess cementitious material which could be deposited on site.
- Where concrete is delivered onsite, only the chute will be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. A dedicated bunded area will be created to cater for concrete wash-out and this will be located in the Temporary Construction Compound.
- The contractor will use weather forecasting to plan dry days for pouring concrete.
- The contractor will ensure pour site is free of standing water and plastic covers will be ready in case of a sudden rainfall event.
- No surplus concrete will be stored or deposited anywhere on Site.
- Raw or uncured waste concrete will be disposed of by removal from the Site and returned to the source location or disposed of appropriately at a suitably licensed facility.
- Where shuttering is required to be installed in order contain the concrete during pouring, it will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure minimal potential of leaking, these measures are the use of plastic sheeting and the use sealing products at joints.

4.3.1.6 Potential Effects from Wastewater Disposal

- During the construction phase, the Project will include an enclosed wastewater management system at the temporary compound capable of handling the demand during the construction phase with 50 construction workers on site at peak
- A self-contained port-a-loo with an enclosed wastewater holding tank will be used at the on-site temporary construction compound area, maintained by the providing contractor, and removed from the site on completion of the construction works.
- Water supply for the site office and other sanitation will be brought to site and removed after use by a licensed contractor to be discharged at a suitable offsite treatment location
- Wastewater/sewerage from the staff welfare facilities located in the temporary construction compound will be collected and held in a sealed storage holding tank, fitted with a high-level alarm. The high-level alarm is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank.
- All wastewater will be emptied periodically, tankered off-site by a licensed waste collector to the local Kilrush wastewater sanitation plant for treatment and disposal, or to other suitable facilities for treatment and disposal. There will be no onsite treatment of wastewater.
- No water or wastewater will be sourced on the Site, nor discharged to the site.

4.3.1.7 Potential Effects from Morphological Changes to Surface Watercourses

Mitigation measures for the upgrade of the existing drain crossings and new proposed drain crossings at the Site are detailed below:

- The crossing upgrades and the new proposed drain crossings will be constructed using pre-cast concrete and pre-formed plastic pipe culverts and the existing banks will remain undisturbed as much as possible.
- No instream excavation works are proposed in any natural watercourses and therefore there will be no direct effect on natural watercourses.

- Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be 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 guidance document "Guidelines on protection of fisheries during construction works in and adjacent to waters", that is, May to September inclusive (IFI, 2016). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates and the risk of entrainment of suspended sediment in runoff.
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area. There will be no batching or storage of cement allowed on-site.

Grid Connection Route

In regard to the GCR, 1 no. watercourse crossing is proposed which will be completed via HDD or by laying the cables in the curtilage of the carriageway within the bridge. Mitigation measures in relation to HDD are detailed below. There are also several crossings of drains and non-EPA mapped hydrological features.

All spoil generated along the public roadways along the GCR will be disposed of at a licenced facility. The remaining spoil generated along the GCR, not located in public roads, will be disposed of in the designated spoil storage area.

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

- All existing roadside drains 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 will also be temporarily blocked.
- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside the watercourse 50m buffer zone.

The following mitigation measures are proposed for the crossing works:

- No stockpiling of construction materials will take place along the grid route
- The crossing upgrades and the new proposed drain crossings will be constructed using pre-cast concrete and pre-formed plastic pipe culverts and the existing banks will remain undisturbed as much as possible.
- No instream excavation works are proposed in any natural watercourses and therefore there will be no direct effect on natural watercourses.
- Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be 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 guidance document "Guidelines on protection of fisheries during construction works in and adjacent to waters", that is, May to September inclusive (IFI, 2016). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates and the risk of entrainment of suspended sediment in runoff.
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area. There will be no batching or storage of cement allowed on-site.

Turbine Delivery Route:

With regard to the TDR, upgrades are proposed on 3 no. watercourse crossings (1 no. crossing over the Moyasta_010 SWB and 2 no. crossings over the Doonbeg_030 SWB). At these locations, steel plates will be placed on the verge for 10m each side of watercourse crossings to avoid excavation and unnecessary disturbance of the existing ground (reducing the potential for the entrainment of suspended solids in runoff). An Ecological Clerk of Works ("ECoW") will be employed from the commencement to completion of construction works

and will be onsite to oversee the crossings of the watercourses during the turbine deliveries. The steel plates will only be in use for the duration of the turbine delivery and will be removed afterwards leaving no significant effect on the surrounding area. This approach for crossing will ensure that there is no physical effect on the watercourses and the potential for effects on the Freshwater Pearl Mussels in the lower Doonbeg catchment is negligible.

4.3.1.8 Potential Effects on Groundwater Levels During Excavation Works

The Site is underlain by a Locally Important Aquifer.

No significant groundwater dewatering will be required due to the relatively shallow nature of the excavations. 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.

In terms of locally mapped and unmapped wells, the implementation of the drainage design measures will ensure that the recharge to the aquifers will not be altered, thus downgradient water levels will not be altered. As such there are no well supplies down-gradient of the Site that can be affected by temporary dewatering during turbine base construction.

4.3.1.9 Potential Effects on Groundwater Quality

The potential for effects is negligible for the following conclusive reasons:

- The Site is underlain by low permeability soils and subsoils.
- Groundwater flowpaths are typically short (~300m maximum).
- Groundwater flows within the Site emerge as springs/seeps along drains and leave the Site as surface water flows and not groundwater flows.
- Groundwater flow directions will mimic surface topography and flow towards the Moyasta River.
- Therefore, the potential to effect groundwater quality is very low as groundwater flowpaths are very short.
- Nevertheless, mitigation is provided in the EIAR to deal with typical construction phase groundwater hazards such as oils and fuels.

4.3.1.9 Potential Effects from the Use of 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 does not 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.
- Use of biodegradable chemical agents can be used at very sensitive sites (i.e. adjacent to SACs).

4.3.1.10 Potential Effects Associated with Directional Drilling

- Although no in-stream works are proposed, the drilling works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (dryer) ground conditions.

- The crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance.
- There will be no storage of material / equipment or overnight parking of machinery inside the 15m buffer zone.
- Before any ground works are undertaken, double silt fencing will be placed upslope of the watercourse channel along the 15m buffer zone boundary.
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the watercourse.
- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered.
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages.
- Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area.
- Spills of drilling fluid will be clean up immediately and stored in an adequately sized skip before been taken offsite.
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works).
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed percolation area at least 50m from the watercourse.
- The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water. The entire percolation area will be enclosed by a perimeter of double silt fencing.
- Any sediment laden water from the works area will not be discharged directly to a watercourse or drain.
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.
- Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse.
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved, and the cause of the elevated source is remedied.
- sue is resolved, and the cause of the elevated source is remedied.
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded at the soonest opportunity to prevent soil erosion.
- The silt fencing upslope of the river will be left in place and maintained until the disturbed ground has re-vegetated.
- There will be no batching or storage of cement allowed at the watercourse crossing.
- There will be no refuelling allowed within 100m of the watercourse crossing.
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing.

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

- 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 watercourses.
- 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.
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

4.3.1.11 Potential Effects Associated with Biodiversity Enhancement Proposals

To maximise the effectiveness of the re-wetting proposals in the cutover area and to increase the chances of future success, any works undertaken as part of the enhancement plan will be based on approaches and methods that were successful at other peatland sites in Ireland.

Peat water level monitoring, by means proposed piezometer installs, will also be carried out to monitor the effectiveness of the bog re-wetting. The monitoring will continue through the lifetime of the Project.

4.3.1.12 Potential Effects on Surface Water Quality Due to High Rainfall Events and/or Fluvial Flooding During Construction

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

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

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

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

- Cessation of all construction works until the storm event, including the storm runoff has passed. All construction works will cease during storm events such as yellow warning rainfall events. Following heavy rainfall events, and before construction works recommence, the Site will be inspected and corrective measures implemented to ensure safe working conditions e.g. dewatering of standing water in open excavations, etc.
- Exposed soils/peat (exposed temporary stockpiles) will be covered with plastic sheeting during all relatively heavy rainfall events and during periods where works have temporarily ceased before completion at a particular area (e.g., overnight and weekends).

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

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

4.3.2 Operational Phase

4.3.2.1 Potential Effects from the Replacement of Natural Surfaces with Lower Permeability Surfaces

The Project design has been optimised to use the existing infrastructure (roads and hardstands) where practicable. A total of 420m of existing site access tracks within the Site will be upgraded as part of the Project. These works in these areas will not alter the existing runoff and recharge rates. This design prevents the unnecessary creating of additional hardstand areas which would increase surface water runoff from the Site.

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

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

4.3.2.2 Potential Effects on Downstream Flood Risk

Proposed Flood Resilience Measures include:

- The turbine finished base level will be at an elevation of 9.6 mOD which includes a 0.3m freeboard above the 1 in 100-year plus climate change flood level. This will ensure that the T1 can still be accessed for essential maintenance during flood events if required.

- Analysis has shown that the volume of the proposed permanent infrastructure within the flood zone equates to 3,150m3 in a 1 in 100-year flood event plus climate change (plus 30%). The Project includes 2 no. flood compensation areas which involve reducing ground levels in the floodplain to replace the lost flood zone capacity. This will ensure that there is no displacement of floodwaters or increase in the downstream flood risk associated with the Project.
- In addition, a number of culverts along access tracks within the flood zone will be installed to ensure that flood water flow routes will not be completely impeded. This will ensure that the flood hydrological regime and flowpaths are not completely blocked by the proposed access tracks and hardstands during flood events.
- Furthermore, the SWMP has been designed to ensure that surface water runoff at the Site is managed effectively and does not exacerbate flood risk to the surrounding areas upstream and downstream.
- The associated drainage will be attenuated for greenfield run-off, the proposed Development will not increase the risk of flooding elsewhere in the catchment.

With the use of the 2 no. proposed compensation area and the proposed wind farm drainage control measures/SuDs, no additional mitigation measures are required with regard to flood risk.

4.3.2.3 Potential Effects from Runoff Resulting in Contamination of Surface Waters

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

Mitigation measures for the control of hydrocarbons during maintenance works are the same as those outlined in **Section 4.3.1.4**.

4.3.2.4 Potential Effects Due to Wastewater Contamination

It is proposed to install a sealed underground holding tank for effluent (wastewater) from the Substation compound. The tank shall be routinely emptied by a licensed contractor.

A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. If the level of the tank contents rise to a predetermined 'high level' a warning shall appear on the overall SCADA system for the site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the Site, and therefore there is no potential to impact groundwater or surface water quality.

4.3.1 Decommissioning Phase

The Project is expected to have a lifespan of ~40 years. Upon decommissioning, the wind turbines will be dismantled and all above ground components would be removed off-site for recycling.

The potential effects associated with decommissioning 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. Turbine foundations will remain and will be covered with earth and allowed to revegetate. Site access tracks will continue to be used as amenity pathways and will therefore not be removed. The underground cables will be cut and tied, and the ducting will be left in place. Excavation and removal of this infrastructure would result in considerable disturbance to the local environment in terms of disturbance to underlying soils and an increased sedimentation (if turbine foundations and hardstands are being reinstated there is a risk of silt-laden run-off entering receiving waters) and an increased possibility of contamination of local groundwater.

Prior to the Decommissioning work, a comprehensive plan will be drawn up that takes account of the findings of this EIAR and the contemporary best practice at that time, to manage and control the component removal and ground reinstatement.

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

According to the SNH guidance, it is, therefore: "best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".

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 phase of the Project.

4.3.2 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 I** below.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change (Unmitigated)	Assessed Potential Status Change (Mitigated)
Doonbeg_030	IE_SH_28D020650	Good	Good	Good
Doonbeg_040	IE_SH_28D020725	Good	Good	Good
Moyasta_010	IE_SH_27M040900	Moderate	Moderate	Moderate
Miltown Malbay GWB	IE_SH_G_167	Good	Good	Good
Kilrush GWB	IE_SH_G_123	Good	Good	Good

4.4 CUMULATIVE ASSESSMENT

This section presents an assessment of the potential cumulative effects associated with the onshore components of the Project and other developments (existing and/or proposed) on the hydrological and hydrogeological environment (i.e. the ZOI defined in Section 2.6).

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

The primary potential for cumulative effects will occur during the construction phase as this is when earthworks and excavations will be undertaken at the Site. The potential for cumulative

effects during the operational phase 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 lesser degree with less ground disturbance.

4.4.1 Cumulative Effects with Agriculture

Agriculture is the largest pressure on water quality in Ireland (EPA, 2024). Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative effect on local and downstream surface water quality.

In an unmitigated scenario the onshore components of the Project would have the potential to interact with these agricultural activities and contribute to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However, the mitigation measures detailed above in Section 4.3 will ensure the protection of downstream surface water quality.

For these reasons, and with the implementation of the referenced mitigation measures, it is considered that there will be no deterioration in WFD status of SWBs arising from cumulative effects associated with agricultural activities.

4.4.2 Cumulative Effects with Forestry

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

Given the occurrence of several forestry blocks within the vicinity of the Site and in the surrounding lands, and given that they drain to the Moyasta River, the potential cumulative effects on downstream water quality and quantity need to be assessed. Note that no forestry felling is proposed within the Site. The only proposed felling is located at the blade Transfer Area.

However, the mitigation measures detailed in Section 4.3 for the construction, operation and decommissioning phases of the Project will ensure the protection of downstream surface water quality.

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

4.4.3 Cumulative Effects with Other Wind Farm Developments

A total of 3 no. existing and/or proposed wind farm developments have been identified within the Moyasta_010 WFD river sub-basin, including a total of 12 no. wind turbines (Ballykett WF, Moanmore Wind Farm and Tullabrack Wind Farm). The greatest potential for cumulative effects to occur would be if the construction phase of these permitted and/or proposed wind farms and the construction phase of the Project overlapped. In an unmitigated scenario, there may be potential for some cumulative effects on downstream watercourses.

However, the Moanmore and Tullabrack wind farms are already operational and therefore the construction phase of these wind farms cannot overlap with that of the Project. The greatest potential for cumulative effects associated with these wind farms would be associated with the operational and decommissioning phases. However, the EIARs for the above wind farm developments detail potential hydrological and hydrogeological issues

relating to the operation and decommissioning phases of these developments and propose a suite of best practice mitigation measures designed to ensure that the developments do not in any way have a negative effect on downstream surface water quality and quantity. Similarly, the mitigation and best practice measures proposed in this EIAR chapter will ensure that the Project does not have the potential to result in significant effects on the hydrological/hydrogeological environment (water quality and/or quantity).

With regards to potential cumulative effects associated with the proposed Ballykett Wind Farm. The EIAR for Ballykett Wind Farm and the EIAR for the project detail strict mitigation measures for the protection of surface water quality and quantity during all phases of this proposed development.

Therefore, with the implementation of the proposed mitigation measures (both for the Project and for the other wind farms) there will be no cumulative effects associated with the construction, operational or decommissioning phases of the Project and other wind farms within the cumulative study area.

4.4.4 Potential Cumulative Effects with Other Wind Farm Grid Connections

A study was completed to identify any grid connection routes associated with other proposed wind farm development which overlap with the GCR. The greatest potential for cumulative effect to occur would be if the construction phase of the underground grid connection routes overlapped with each other.

No significant overlap occurs between the GCR and the proposed grid options for Ballykett Wind Farm. Whilst Grid Route Option 1 for Ballykett Wind Farm joins the existing Tullabrack 110kV Substation, this route approaches the substation from the east. Therefore, the only overlap with the GCR will occur within the Tullabrack 110kV Substation compound. Practicalities will make it highly unlikely that the construction phase of the grid connections in the vicinity of Tullabrack 110kV Substation would occur at the same time as this would result in road closures (two trenches being excavated at the same time).

Furthermore, the EIARs for Ballykett Wind Farm and the EIAR for the Project detail strict mitigation measures for the protection of surface water quality during the construction of the grid connections. Therefore, with the implementation of the prescribed mitigation measures there will be no cumulative effects.

An overlap of ~570m was identified between the GCR and the proposed onshore grid connection route for the proposed Sceirde Rocks Offshore Wind Farm along the L2034 to the east of the Site. Similarly, practicalities (and road safety issues) will make it highly unlikely that the construction phase of the overlapping sections of the grid connections would occur at the same time as this would result in road closures (two trenches being excavated at the same time). Furthermore, the EIARs for onshore elements of Sceirde Rocks Wind Farm and the EIAR for the Project detail strict mitigation measures for the protection of surface water quality during the construction of the grid connections. Therefore, with the implementation of the prescribed mitigation measures there will be no cumulative effects.

5. SUMMARY

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

The Project does not involve the abstraction of groundwater, therefore, the quantitative status (i.e., the available quantity (volume) of groundwater locally) of the receiving GWBs will remain unaltered by the Project.

There is no direct discharge from the Site to downstream receiving surface waters. Mitigation for the protection of surface water during the construction, operation and decommissioning phases of the Project will ensure the qualitative status of the receiving waters will not be altered by the Project. Flood compensation measures have been proposed to ensure that there is no displacement of floodwaters as a result of the Project. These measures will ensure that the quantitative status of the receiving SWB will remain unaltered.

There is also mitigation proposed to protect groundwater quality. These mitigation measures will ensure the qualitative status of the underlying GWBs will not be altered during the construction, operation or decommissioning phases of the Project.

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

As such, the Project will not impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

As such, the Project, alone or in combination with other developments:

- will not cause a deterioration in the status of any surface and groundwater bodies;
- will not jeopardise the achievement of 'Good' quality 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 ecological potential;
- 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 and not likely to compromise the ability of any water bodies to meet the objectives of the Water Framework Directive (2000/60/EC) as amended and its transposing legislation;
- does not degrade the ecological quality of the protected sites associated with connected waterbodies nor jeopardise the goals and/or targets set out for these protected sites: 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 9.3.1 of the EIAR).

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