HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

WATER FRAMEWORK DIRECTIVE ASSESSMENT
PROPOSED CARRIG RENEWABLE ENERGY WIND FARM, CO. TIPPERARY

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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Author:	**MICHAEL GILL DAVID BRODERICK JENNY LAW**
Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO to complete a Water Framework Directive (WFD) Compliance Assessment for a planning application for the proposed Carrig Renewables Wind Farm, Co. Tipperary.

In summary, the "Proposed Development" site which includes 7 no. turbines, substation, underground grid connection and turbine delivery route (TDR) works is located at Sharragh (and surrounding townlands), situated approximately 2km south of the village of Carrig and 9km to the northeast of Borrisokane, Co. Tipperary. The proposed grid connection route extends into Co. Offaly and terminates at the existing Dallow 110kV substation.

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

This WFD Assessment is intended to supplement the EIAR submitted as part of the Proposed Development planning application.

1.2 STATEMENT OF AUTHORITY

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

This WFD assessment was prepared by David Broderick, Michael Gill and Jenny Law.

David Broderick P.Geo (BSc, H. Dip Env Eng, MSc) is a hydrogeologist with over 17 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Derrykillew WF, Croagh WF, and Oweninny WF, and over 60 other wind farm related projects across the country.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Slievecallan WF, Cahermurphy (Phase I & II) WF, Carrownagowan WF, and Croagh WF and over 100 other wind farm related projects across the country.

Jenny Law (BSc) (MSc) is a recent master's graduate student in Applied Environmental Geosciences. Since joining HES Jenny has been involved in the preparation of a number of EIAR projects on various project types including wind farms and commercial and housing developments. Jenny has also completed several Water Framework Directive Assessments and Flood Risk Assessments for various project types.

1.3 WATER FRAMEWORK DIRECTIVE

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

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status[1] 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 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed wind farm development, 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 for the third cycle.

Furthermore, the Department of Housing, Local Government and Heritage are currently reviewing the submissions made on the Draft River Basin Management Plan (2022 - 2027) which was out for public consultation in Q4 of 2021 and Q1 of 2022. The draft was to be updated with a view to finalization and publication in Q3/Q4 of 2022. As of August 2023, the plan has not been published while the draft plan is available to view at https://www.gov.ie/en/consultation/2bda0-public-consultation-on-the-draft-river-basin-management-plan-for-ireland-2022-2027/.

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

[1] WFD status ranges from Bad to High

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

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

2.2 SURFACE WATERBODY IDENTIFICATION

Regionally the site of the Proposed Development is located in the Lower Shannon surface water catchment within Hydrometric Area 25B of the Shannon Lower Irish River Basin District. All 7 no. turbines are located in the Little Brosna sub-catchment (LittleBrosna_SC_020) and the Little Brosna_040 River sub-basin.

On a more local scale, tributaries of the Little Brosna_040 river waterbody drain the site, including the Faddan Beg (EPA Code: 25F29) tributary which drains the northern portion of the site and the Holy Well Clohaskin (EPA Code: 25H28) tributary that chiefly drains the southern portion of the site. The Faddan Beg tributary meets with the Holy well Clohaskin tributary channel approximately 3km east of the Proposed Development site. The Holy Well Clohaskin tributary continues east and confluences with the main channel of the Little Brosna River approximately 5km east and downstream of the wind farm site. All watercourses mentioned above, in the vicinity of the Proposed Development are part of the Little Brosna_040 river waterbody.

Generally, the Little Brosna River drains from the wind farm site in an easterly direction and turns north to run along the county border between County Tipperary and County Offaly. The Little Brosna River (Little Brosna_050 & Little Brosna_060) then begins to veer northwest near Birr and continues into the Incherky_010 river waterbody, which in turn drains into the Shannon (Lower)_030 River approximately 22km downstream of the wind farm site. The River Shannon then continues to flow to the southwest for approximately 12.7km before it discharges into Lough Derg (Derg TN lake waterbody). **Figure A** below is a local hydrology map of the area.

Error! Reference source not found. Presents the total upstream catchment area downstream of the Proposed Development site as far as the Shannon (Lower) River to which the waterbodies drain to. The Shannon (Lower)_030 river segment has a total upstream catchment area of approximately 9633.6km². The total upstream catchment area for the onsite Little Brosna_040 River is significantly less than its downstream counterparts at 317.54km². Therefore, the Little Brosna River waterbody in the vicinity of the Proposed Development has a relatively small catchment area and hence will be more susceptible to water quality impacts as a result of the Proposed Development in comparison to the downstream river waterbodies.

Table A: Downstream Catchment Size for River Waterbodies

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Lower Shannon River Catchment	
Little Brosna_040	317.54
Little Brosna_050	476.94
Little Brosna_060	490.99
Incherky_010	577.34
Shannon (Lower)_030	> 9633.6

The grid connection route (13.7km) travels through the Little Brosna_040 and Little Brosna_050 river sub basins and reaches the Dallow substation within the Little Brosna_060 river sub basin.

The grid connection route travels through the Little Brosna_SC_020 (5.8km) and Shannon(Lower)_SC_060 (7.6km) sub-catchments. The are 4 no. EPA mapped watercourses along the grid connection route.

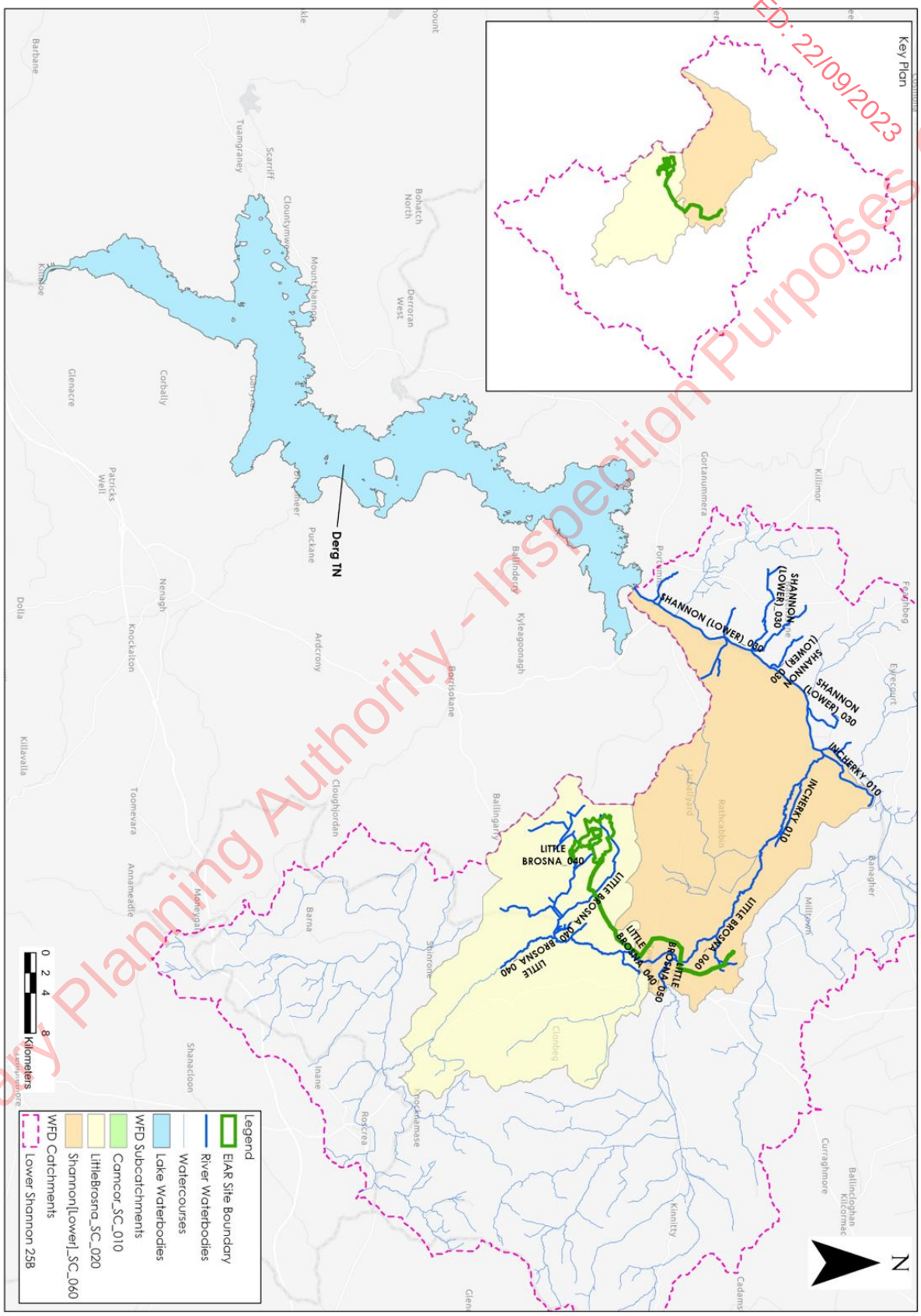

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

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

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

As stated above, the Proposed Development Site is located in the Little Brosna_SC_020 (25b_7) sub-catchment and the Little Brosna_040 River sub-basin. The Proposed Development is drained by the Little Brosna_040 SWB which achieved "Moderate" status in both all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021). Further downstream the Little Brosna_050 SWB achieved "Moderate" status and the Little Brosna_060 achieved "Good" status in the latest WFD cycle. The Little Brosna River feeds into the Incherky_010 river water body which achieved "Moderate" status in the 2013-2018 WFD cycle and improved in status in the 2016-2021 WFD cycle by achieving "Good" status.

The Little Brosna_040 river segment has been deemed to be "At risk" of failing to meet its WFD objectives in the future. Agriculture, hydromorphology and Peat Drainage and Extraction have been listed as significant pressures on this river body according to the 3rd Cycle Draft Lower Shannon Catchment Report. The risk status of the Little Brosna_050 and the Little Brosna_060 River have been classified as "at risk" and "Not at risk" respectively. Meanwhile the Incherky_010 river waterbody's risk status is currently under "Review".

The Incherky_010 SWB feeds into the Shannon (Lower)_030 SWB which has achieved "Moderate" status in the latest WFD cycle. The Shannon (Lower)_030 River discharges into the Derg TN lake waterbody just southeast of Portumna, which achieved "Moderate" status also.

The risk status of the Shannon (Lower)_030 river waterbody is currently under "Review", whilst the Derg TN lake waterbody has been deemed to be "At risk" of failing to meet its WFD objectives. Agriculture and hydromorphology have been listed as the significant pressures on the Derg TN lake waterbody. Furthermore the presence of zebra mussels, Asian clams and up to 14 other alien species have been noted within the Derg TN waterbody, which have been identified as a significant pressure.

The grid connection route is mapped within the Little Brosna_040, Little Brosna_050 and Little Brosna_060 river sub-basins, whose waterbodies have been described above with regards their WFD status. The SWB status for the 2016-2021 WFD cycle are shown on **Figure B**.

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Risk Status (2nd Cycle)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3rd Cycle)	Pressures
	Lower Shannon River Catchment					
Little Brosna_040	Moderate	At risk	Moderate	Moderate	At risk	Agriculture, hydromorphology & Peat Drainage and Extraction
Little Brosna_050	Good	Not at risk	Good	Moderate	At risk	Not identified as of yet
Little Brosna_060	Good	Not at risk	Good	Good	Not at risk	-
Incherky_010	Unassigned	Review	Moderate	Good	Review	-
Shannon (Lower)_030	Unassigned	Review	Moderate	Moderate	Review	-
Derg TN	Poor	At risk	Moderate	Moderate	At risk	Agriculture & hydromorphology

2.4 GROUNDWATER BODY IDENTIFICATION

The wind farm site is underlain by 2 no. Ground Waterbodies (GWBs). The north of the wind farm site including 3 no. turbines are underlain by the Banagher GWB (IE_SH_G_040). Meanwhile, the majority of the wind farm site and all other key Proposed Development infrastructure are underlain by the Birr GWB (IE_SH_G_041).

The GSI's Birr Groundwater Body Characterisation Report (GSI, 2004) states that this GWB is composed of typically high transmissivity (2-20m^2/day) limestone bedrock and is characterized by a karstic flow regime. Diffuse recharge to the bedrock aquifer will occur though rainfall percolating through the subsoil. The bedrock in this GWB is devoid of intergranular permeability with flow being concentrated in the epikarst layer and along fractures, faults and bedding planes. Due to karstification flowpaths may be up to several kilometres in length. Regional groundwater flowpaths are towards Lough Derg. Groundwater will also discharge to streams and rivers crossing the GWB.

The GSI's Banagher GWB Characterisation Report (GSI, 2004) states that this GWB is characterised by poorly productive bedrock with low transmissivities and low storativity. These rocks are devoid of intergranular permeability, with groundwater flowing along fractures, joints and major faults. Due to the low permeability of the bedrock aquifers a proportion of potential recharge will discharge rapidly to surface watercourses. Groundwater flow paths are short (30-300m) with local flow directions being controlled by surface topography. Groundwater will discharge to gaining streams and rivers which cross this GWB.

The grid connection route is also underlain by both the Birr and Banagher GWBs. Furthermore, to the north of Birr Town, the grid connection route overlies the Birr Gravels GWB (IE_SH_G_244). This gravel GWB radiates to the northwest and northeast from Birr town. The permeable gravel subsoils in this aquifer store groundwater and contribute to the storage of the underlying bedrock aquifers.

2.5 GROUNDWATER BODY CLASSIFICATION

The Birr (IE_SH_G_041), the Banagher (IE_SH_G_040) and the Birr Gravels (IE_SH_G_244) groundwater bodies that underly the Proposed Development are all currently assigned 'Good Status', which is defined based on the quantitative status and chemical status of the GWB. Each of the Birr (IE_SH_G_041), the Banagher (IE_SH_G_040) and the Birr Gravels (IE_SH_G_244) GWB's are deemed to be "Not at risk" of failing to meet their WFD objectives.

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

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Risk Status (2nd Cycle)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3rd Cycle)	Pressures
Birr	Good	Review	Good	Good	Not at risk	-
Banagher	Good	Not at risk	Good	Good	Not at risk	-
Birr Gravels	Good	Review	Good	Good	Not at risk	-

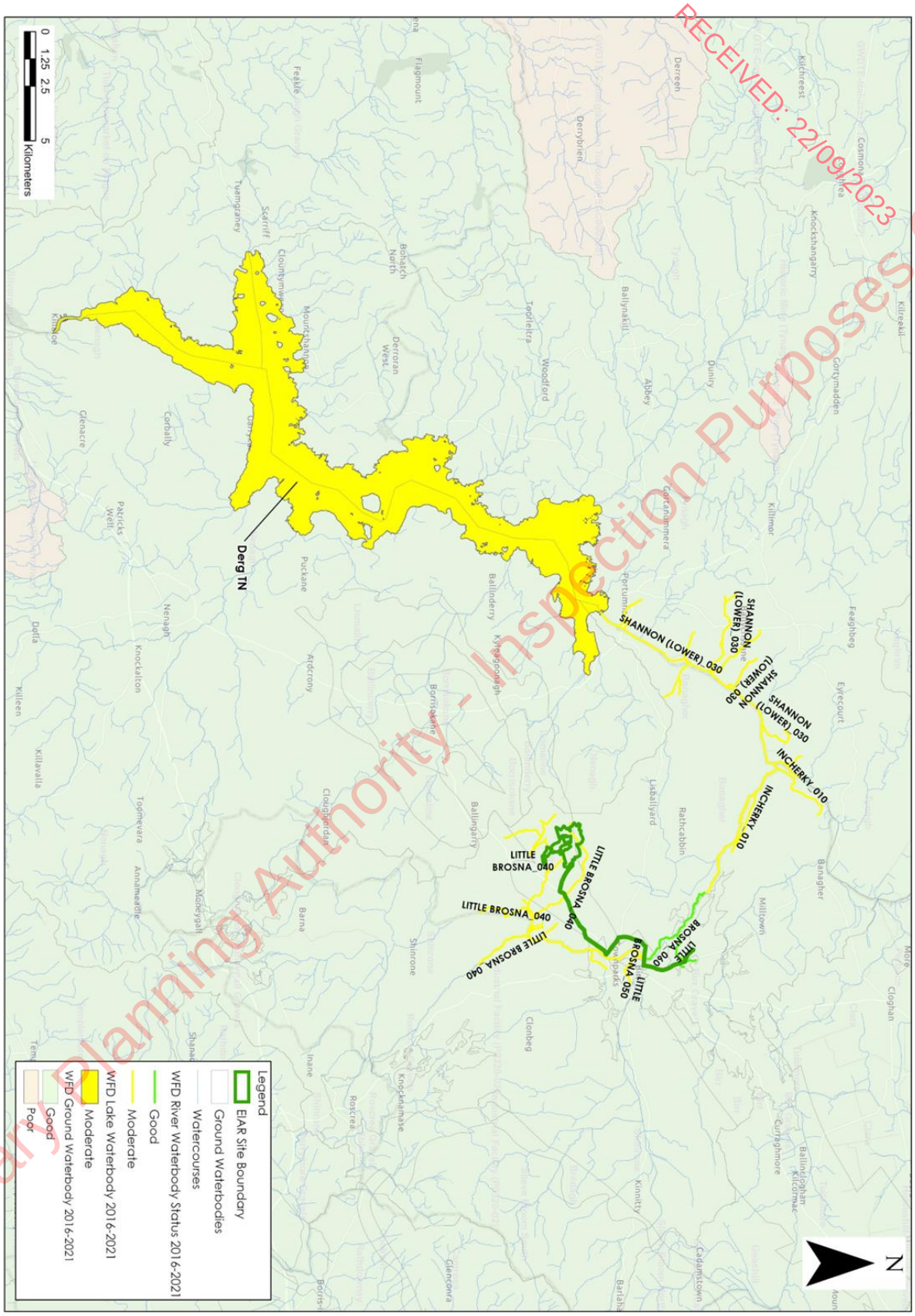

Figure B: WFD Groundwater and Surface Waterbody Status (2016 – 2021)

2.6 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, nutrient Sensitive areas (NSA), shellfish areas and drinking water protected area's (DWPA) are looked at as part of the assessment.

2.6.1 Nature Conservation Designations

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

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

The land surrounding the wind farm site has several designations due to the presence of numerous raised bogs which were once interconnected but have now been separated by roads and areas of reclaimed cutover bog. These boglands include the following designated sites:

- The Ballyduff/Clonfinane Bog SAC and pNHA (Site Code: 000641) is mapped approximately 130m to the north of the windfarm site.
- Further northeast (~2.3km) from the Proposed Development the Killeen Bog NHA (Site Code: 000648) is mapped.
- The Arragh More (Derrybreen) Bog SAC (Site Code: 002207) is located approximately 0.5km west of the wind farm site. The Arragh More Bog has also been designated as an NHA (Site Code: 000640) and has a greater mapped extent than the Arragh More (Derrybreen) Bog SAC. The Arragh More Bog NHA is located immediately adjacent the wind farm site to the west. The boundaries of the NHA are mapped ~200m east of T5.
- Approximately 1.8km west from the Proposed Development is the Kilcarren-Firville Bog SAC and pNHA (Site Code: 000647), described as a lowland raised bog complex containing a large area of uncut high bog.
- Sharavogue Bog SAC (Site Code: 000585) exists ~3.9km southeast of the wind farm site. The little Brosna River marks the western margin of the Sharavogue Bog SAC.

Other designated sites located within 5km and/or downstream of the wind farm site are outlined below.

- Liskeenan Fen SAC (Site Code: 001683) exists ~3km southwest of the wind farm site.
- Lorrha Bog NHA (Site Code: 001684) is located ~5km northwest of the wind farm site.
- Dovegrove Callows SPA (Site Code: 004137) and pNHA (Site Code: 000010) is located ~6.5km northeast of the wind farm. Direct hydrological connections exist between the wind farm site and the SPA via the Little Brosna River.
- The Little Brosna Callow SPA (Site Code:004086) and NHA (Site Code: 000564) is situated ~6.3km north of the wind farm site. This designated site is located downstream of the wind farm site via the Little Brosna River.
- The River Shannon Callows SAC (Site Code: 000216) is located ~11km northwest of the wind farm site. This designated site hydrologically connected with the wind farm site and grid route options via the Little Brosna River and its associated tributaries.

- The Middle Shannon Callows SPA (Site Code: 004096) is located ~11km northwest of the wind farm site. This designated site hydrologically connected with the wind farm site and grid route options via the Little Brosna River and its associated tributaries.
- Lough Derg, North-East Shore SAC (Site Code: 002241) is located ~7.5km west of the wind farm site. This SAC is located downstream of the wind farm site as the River Shannon discharges into Lough Derg (Derg TN).

With regards to the grid connection route the following designated sites are within the vicinity of the grid route:

- Woodville Woods pNHA (Site Code: 000927) is adjacent to the proposed route on the eastern side at the northern end of the route, with approximately ~110m of the route located within the Woodville Woods pNHA site boundary along the existing R439 road.
- The Ross And Glenns Eskers pNHA (Site Code: 000920) are approximately 220m north from the very northern end of the proposed route.
- The Dovegrove Callows SPA (Site Code: 004137) is located roughly 200m southwest of the proposed route at the very northern end. The Dovegrove Callows pNHA (Site Code: 000010) is ~250m further southwest.

All watercourses draining the grid route flow in a westerly direction before discharging into the River Shannon. In this area the Shannon has the following designations: River Shannon Callows SAC and pNHA (Site Code: 000216) and Middle Shannon Callows SPA (Site Code: 004096).

2.6.2 Bathing Waters

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

There are no bathing water sites located within 10km of the Proposed Development site. The Proposed Development site is ~12km east of the Bathing Place at Portumna (IESHBWL25_191a_0100), the nearest bathing water site (as the crow flies).

2.6.3 Nutrient Sensitive Areas

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

The Derg TN NSA (IELK_SH_1994_0007) is the only NSA downstream of the Proposed Development. The NSA objective for Derg TN NSA is being met.

2.6.4 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 are no Shellfish areas located in the vicinity of the Proposed Development site. The Proposed Development site is ~62km east of Clarinbridge/Kinvara Bay (IEPA2_0005), the nearest shellfish area site (as the crow flies).

2.6.5 Drinking Water

Lough Derg is designated as the Derg TN DWPA ((IEPA1_SH_25_191a) downstream of the proposed development. Meanwhile, all GWBs within the catchment are listed as DWPAs.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 5 no. river water bodies that are located in the vicinity or downstream of the Proposed Development Site (including the grid connection route). In addition, there is 1 no. lake water body located downstream. Furthermore, the Proposed Development Site (including the grid route connection) is underlain by 3 no. groundwater bodies. Several protected areas are also located within the vicinity and downstream of the proposed development.

3.1 SURFACE WATER BODIES

As shown in **Figure A** above, there are 5 no. SWBs located in the vicinity or downstream of the Proposed Development Site.

With consideration for the construction, operational and decommissioning phases of the proposed development, it is considered that the Little Brosna_040, Little Brosna_050, Little Brosna_060, Incherky_010 and the Shannon (Lower)_030 rivers in the vicinity and downstream of the Proposed Development are carried through into the WFD Impact Assessment. These SWBs have been screened in due to their close proximity to the Proposed Development Site and the occurrence of proposed infrastructure within their respective catchments. The Proposed Development works must not in any way result in a deterioration in the status of these SWBS and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

Further downstream, The Derg TN lake waterbody has been screened out due to the large volumes of water within the lake and its relatively large catchment area, making it less susceptible to potential water quality impacts associated with the Proposed Development. The Proposed Development has no potential to cause a deterioration in status of this SWBs and/or jeopardise the attainment of good surface water status in the future.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, The Birr GWB, the Banagher GWB and the Birr Gravels GWB have been screened in due to their location directly underlying the Proposed Development Site. The Proposed Development works must not in any way result in a deterioration in the status of this GWB and/or prevent it from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

With consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that all of the following designated sites are screened in due to their proximal locations in the vicinity and downstream of the wind farm site and grid connection route:

- Ballyduff/Clonfinane Bog SAC and pNHA
- Arragh More (Derrybreen) Bog SAC & Arragh More Bog NHA
- Dovegrove Callows SPA and pNHA
- The Little Brosna Callow SPA and NHA
- The River Shannon Callows SAC/pNHA
- Middle Shannon Callows SPA
- Woodville Woods pNHA

Although the Killeen Bog NHA is situated just 2.3km northeast of the site, there are no surface water pathways between the wind farm site and Killeen Bog NHA. Groundwater flows within the wind farm site are to the southeast, towards the Little Brosna River. The NHA will not

receive drainage from the Proposed Development site, therefore has been screened out as the Proposed Development has no potential to cause a deterioration in the status of the Killeen Bog NHA.

Kilcarren-Firville Bog SAC and pNHA is approximately 1.8km west and upgradient from the Proposed Development. The designated site is located in the Lorrha Stream_010 and Kilfadda Castle Stream_010 River sub-basins where surface waters drain in a westerly direction towards Lough Derg (Derg TN). This designated site is therefore hydrologically and hydrogeologically removed from the Proposed Development and has been screened out as the Proposed Development has no potential to cause a deterioration to the Kilcarren-Firville Bog SAC and pNHA.

Sharavogue Bog SAC is ~3.9km southeast of the wind farm site. The Little Brosna River, located along the western margin of the SAC acts as a hydrological barrier between the wind farm site and this designated site. This designated site is therefore hydrologically and hydrogeologically removed from the wind farm site and has been screened out as the Proposed Development has no potential to cause a deterioration to the Sharavogue Bog SAC.

The Liskeenan Fen SAC exists ~3km southwest of the wind farm site. The Holy Well Clohaskin Stream acts as a hydrological barrier between the wind farm site and this designated site and is therefore neither hydrologically or hydrogeologically connected with the wind farm site. The SAC will not receive drainage from the proposed project site, therefore has been screened out as the Proposed Development has no potential to cause a deterioration in the status of this SAC.

The Lorrha Bog NHA is located ~5km northwest of the wind farm site. This designated site is located in the Lorrha stream river sub-basin and no direct surface water pathways are mapped between the Proposed Development and Lorrha Bog SAC. Therefore, the Lorrha Bog NHA has been screened out as the Proposed Development has no potential to cause a deterioration in the status of this NHA.

Lough Derg, North-East Shore SAC is located ~7.5km west of the wind farm site, but it is approximately 35km downstream of the wind farm site as the River Shannon discharges into Lough Derg (Derg TN). This designated site has been screened out due to its distal location downstream of the proposed works and the large volumes of water within the Derg TN lake waterbody. The Proposed Development has no potential to cause a deterioration in status of this designated site.

The Ross And Glenns Eskers pNHA is approximately 220m north from the very northern end of the proposed grid connection route. The proposed works will be contained within the existing roads along the route. Therefore, the Ross And Glenns Eskers pNHA has been screened out as the Proposed Development has no potential to cause a deterioration in the status of this pNHA.

The bathing waters at Bathing Place at Portumna and Shellfish areas at Clarinbridge/Kinvara Bay, have been screened out due to their distal location from the Proposed Development site. The Proposed Development has no potential to cause a deterioration to the bathing, or shellfish areas.

The Derg TN NSA and Derg TN DWPA downstream of the Proposed Development, has been screened out due to its distal location downstream from the proposed works and the large volumes of water within the lake waterbody. The Proposed Development has no potential to cause a deterioration in status of this NSA and DWPA

3.4 WFD SCREENING SUMMARY

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

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

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	River	Little Brosna_040	**Yes**	The proposed development including all 7 no. turbines and a portion of both grid route options is mapped within the Little Brosna_040 river sub-basin. An assessment is required to consider the potential impacts of the proposed development on this SWB.
	River	Little Brosna_050	**Yes**	The Little Brosna_050 SWB is located directly downstream of the Little Brosna_040 river sub basin where the majority of proposed infrastructure for the Proposed Development is situated. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Little Brosna_060	**Yes**	The Little Brosna_060 SWB is located proximally to the wind farm site and directly downstream of the Little Brosna_050 SWB. An assessment is required to consider the potential impacts of the proposed development on this SWB.
	River	Incherky_010	**Yes**	The Incherky_010 SWB is located proximally to the wind farm site and directly downstream of the Little Brosna_060 SWB. An assessment is required to consider the potential impacts of the proposed development on this SWB.
	River	Shannon (Lower)_030	**Yes**	The Shannon (Lower)_030 SWB is located proximally to the wind farm site and directly downstream of the Incherky_010 SWB. An assessment is required to consider the potential impacts of the proposed development on this SWB.
	Lake	Derg TN	No	Derg TN SWB has been screened out due to its distal location downstream from the proposed development site and the large volume of water within the Lake. The Proposed Development has no potential to impact the status of this SWB
	Groundwater Bodies			
Groundwater Body	Groundwater	Birr	**Yes**	The Birr GWB underlies the majority of the Proposed Development and 4 no. turbines. An assessment is required to consider potential impacts of the proposed development on this GWB.
	Groundwater	Banagher	**Yes**	The Banagher GWB underlies the northern portion of the proposed Development and 3 no. of turbines. An assessment is required to consider potential impacts of the proposed development on this GWB.
	Groundwater	Birr Gravels	**Yes**	The grid connection route options are both mapped to overlie the Birr Gravels GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
	Protected Areas			
Protected Areas	Nature Conservation Designation	Ballyduff/Clonfinane Bog SAC & pNHA	**Yes**	The Ballyduff/Clonfinane Bog SAC & pNHA is located north of the wind farm site, ~330m northeast of T06. An assessment is required to consider the potential impacts of the proposed development on this designated site.

		Killeen Bog NHA	No	The Killeen Bog NHA is located ~2.3km northeast of the wind farm site, however there are no surface or groundwater pathways between the site and the NHA. Therefore, the proposed development has no potential to cause a deterioration in the status of this NHA.
		Arragh More (Derrybreen) Bog SAC & Arragh More Bog NHA	**Yes**	The Arragh More (Derrybreen) Bog SAC & Arragh More Bog NHA are located ~500m and immediately to the west of the wind farm site respectively. An assessment is required to consider the potential impacts of the proposed development on this designated site.
		Kilcarren-Firville Bog SAC and pNHA	No	The Kilcarren-Firville Bog SAC and pNHA is located 1.8km west and upgradient of the wind farm site. This designated site is hydrologically and hydrogeologically removed from the wind farm site. The proposed development has no potential to cause a deterioration in the status of this SAC/pNHA.
		Sharavogue Bog SAC	No	The Little Brosna River acts as a hydrological barrier between the wind farm site and this designated site and is therefore hydrologically and hydrogeologically removed. The proposed development has no potential to cause a deterioration in the status of this SAC.
		Dovegrove Callows SPA and pNHA	**Yes**	The Dovegrove Callows SPA and pNHA is situated downstream of the proposed development and grid route Option A. An assessment is required to consider the potential impacts of the proposed development on this designated site.
		The Little Brosna Callow SPA and NHA	**Yes**	The Little Brosna Callow SPA and NHA is situated downstream of the proposed development via the Little Brosna River. An assessment is required to consider the potential impacts of the proposed development on this designated site.
		The River Shannon Callows SAC & pNHA	**Yes**	The River Shannon Callows SAC/ pNHA is situated downstream of the proposed development via the Little Brosna River. An assessment is required to consider the potential impacts of the proposed development on this designated site.
		Middle Shannon Callows SPA	**Yes**	The Middle Shannon Callows SPA is situated downstream of the proposed development via the Little Brosna River. An assessment is required to consider the potential impacts of the proposed development on this designated site.
		Woodville Woods pNHA	**Yes**	The Woodville Woods pNHA is located in the immediate vicinity of the grid route connection. An assessment is required to consider the potential impacts of the proposed development on this designated site.
		Liskeenan Fen SAC	No	The Liskeenan Fen SAC is ~3km southwest of the wind farm site, within the Kilfadda Castle Stream river sub-basin and is not hydrologically connected with the wind farm site. The site will not receive drainage from the proposed project site, therefore has no potential to cause a deterioration in the status of this SAC.
		Lorrha Bog NHA	No	The Lorrha Bog NHA is located ~5km northwest of the wind farm site, within the Lorrha stream river sub-basin and no direct surface water pathways are mapped between the proposed development and Lorrha Bog SAC. Therefore, the proposed development has no potential to cause a deterioration in the status of this NHA.

		Lough Derg, North-East Shore SAC	No	Lough Derg, North-East Shore SAC is located ~35km downstream of the wind farm site as the River Shannon discharges into Lough Derg (Derg TN). Due to its distal location from the proposed works and the large volumes of water within the Derg TN lake waterbody. The proposed development has no potential to cause a deterioration in status of this designated site.
		Ross And Glenns Eskers pNHA	No	The Ross And Glenns Eskers pNHA is ~220m north from the very northern end of the proposed grid route. As Proposed works will be contained within the existing roads along the route, the proposed development has no potential to cause a deterioration in the status of this pNHA.
	Bathing Waters	Bathing Place at Portumna	No	The Bathing Place at Portumna has been screened out due to its distal location from the proposed development site. The proposed development has no potential to impact these bathing waters.
	Nutrient Sensitive Areas	Derg TN NSA	No	Derg TN NSA has been screened out due to its distal location from the proposed development site and the large volume of water within the Lake. The proposed development has no potential to impact the status of this NSA.
	Shellfish Area	Clarinbridge/Kinvara Bay	No	Clarinbridge/Kinvara Bay Shellfish waters have been screened out due to its distal location from the proposed development site. The proposed development has no potential to impact this designated shellfish area.
	Drinking Water	Derg TN	No	Derg TN DWPA has been screened out due to its distal location from the proposed development site and the large volume of water within the Lake. The proposed development has no potential to impact the DWPA.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

The Proposed Development includes 7 no. turbines, 1 no. temporary construction compound, 110kV substation, spoil and peat storage areas, underground grid connection, TDR works and all associated site development works including tree felling, drainage infrastructure and landscaping.

Due to the nature of wind farm developments (and associated grid connections and TDR works), being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risks to groundwater at the site will be from cementitious materials, hydrocarbon spillage and leakages, and potential piling works.

The primary risk to surface waters will be entrained suspended sediments (peat and soil particles) in site runoff during earthworks and tree felling along with cement-based compounds.

The Proposed Development includes works over and in close proximity to waterbodies. There are a number of potential adverse effects to both surface and groundwater.

The primary risks of degradation of surface water bodies include:

- Changes in surface runoff flow volumes and flow patterns;
- Entrainment of suspended solids in surface waters; and,
- Chemical pollution of surface waters by concrete, oil and or fuels.

The primary risks of degradation of groundwaters include:

- Chemical pollution of groundwaters by concrete, oils and fuels.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects from Works within the Wind Farm Site

Construction phase activities including tree felling, site levelling/construction and building turbine foundation excavation and the borrow pit will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils. A total of ~6ha of forestry will be permanently felled.

The main risk will be from surface water runoff from bare soil, spoil storage areas and borrow pit drainage/dewatering during construction works.

Hydrocarbons and cement-based compounds will also be used during the construction phase. The release of effluent from the on-site wastewater treatment systems also has the potential to impact on surface water quality.

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 water bodies such as the Little Brosna River.

These contaminants have the potential to cause a deterioration in the overall status of the Little Brosna_040, Little Brosna_050 and the Little Brosna_060 Rivers due to their proximal

location to the proposed development. Further downstream the status of the Incherky_010 and the Shannon (Lower)_030 river waterbodies are unlikely to be impacted even in an unmitigated scenario due to the distal location of the SWB from the Proposed Development and the increasing catchment areas within these rivers, as outlined above in **Table A**.

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Little Brosna_040	IE_SH_25L020700	Moderate	Poor
Little Brosna_050	IE_SH_25L020800	Moderate	Poor
Little Brosna_060	IE_SH_25L021000	Good	Moderate
Incherky_010	IE_SH_25I020930	Good	Good
Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate

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. Furthermore, the accidental release of effluent from the on-site wastewater treatment systems also has the potential to 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 proposed development.

The dewatering deep excavations such as turbine bases have the potential to impact local groundwater levels. However, groundwater level impacts are not anticipated to be significant due to the local hydrogeological regime. Due to the dominance of moderate to low permeability glacial till subsoils and lacustrine deposits below the wind farm site and overlying the aquifers, effects on groundwater levels will be localized to the excavation areas and only for a temporary basis during the construction work. Water level impacts will be temporary and are unlikely to be significant beyond 50m from any excavation.

No groundwater level impacts are predicted from the construction of the grid connection route, internal cabling trench, access roads, substation, compound or met mast due to the shallow nature of the excavation (i.e. 0 -~1.2m).

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

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

GWB	WFD Code	Current Status	Assessed Potential Status Change
Birr GWB	IE_SH_G_041	Good	Moderate
Banagher GWB	IE_SH_G_040	Good	Moderate
Birr Gravels	IE_SH_G_244	Good	Good

4.2.1.3 Potential Surface Water Quality Effects along the Grid Connection Route

The grid connection route is 13.7km in length and is located in the catchment of the Little Brosna River.

There is a total of 4 no. EPA mapped proposed watercourse crossings along the route along with 3 no. drain culverts. These crossings occur at existing bridge and culvert locations.

No in-stream works are required at any of these watercourse crossings, however due to the close proximity of local waterbodies to construction activities at the crossing locations, there is a potential for surface water quality impacts during trench excavation work due to runoff from the road surface and during directional drilling works. This runoff may contain elevated concentrations of suspended sediment, cementitious runoff and/or hydrocarbons. Construction activities along the grid route therefore have the potential to adversely impact the status of these SWBs.

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Little Brosna_040	IE_SH_25L020700	Moderate	Poor
Little Brosna_050	IE_SH_25L020800	Moderate	Poor
Little Brosna_060	IE_SH_25L021000	Good	Moderate

4.2.1.4 Potential Effects on Protected Areas

Ballyduff/Clonfinane Bog SAC & pNHA

The Ballyduff/Clonfinane Bog SAC/pNHA is located ~330m northeast from T06. Clonfinane is a large, flat lowland raised bog largely bordered by drains and, except in the immediate vicinity of the drains, is wet and quaking. Ballyduff is a smaller, domed bog, with a ridge at the north-eastern end.

The Ballyduff/Clonfinane Bog SAC/pNHA is located upgradient of all proposed wind farm infrastructure and proposed works areas. Surface and groundwater flows within the wind farm site are to the southeast, towards the Little Brosna River. Therefore, there is no potential for water quality (surface and groundwater) effects to occur to the Ballyduff/Clonfinane Bog SAC and pNHA.

In terms of groundwater levels, the designated sites are located a sufficient distance from proposed works areas. Any potential water level effects associated with temporary dewatering works are unlikely to be significant beyond 50m from any excavation due to the dominance of moderate to low permeability glacial till subsoils and lacustrine deposits below the wind farm site. Therefore, the distances between the proposed works areas and the designated sites are sufficient to ensure that the Proposed Development has no potential to effect groundwater levels within these adjacent designated sites.

Arragh More (Derrybreen) Bog SAC & Arragh More Bog NHA

The Arragh More (Derrybreen) Bog SAC & Arragh More Bog NHA are located to the west of the wind farm site. The Arragh More (Derrybreen) Bog SAC comprises 90.58 ha of raised bog which occupies the north-western section of Arragh More Bog NHA. Arragh More Bog NHA developed originally in at least 3 basins, which were initially separated by low ridges of relatively impermeable glacial till overlying limestone bedrock. The SAC occupies the western parts of the 2 most northerly basins. The bogs are now separated by roads and cutover that has been reclaimed for agriculture.

These designated sites are located upgradient of all proposed wind farm infrastructure and proposed works areas. Surface and groundwater flows within the wind farm site are to the southeast, towards the Little Brosna River. Therefore, there is no potential for water quality (surface and groundwater) effects to occur to the Arragh More Bog NHA or Arragh More (Derrybreen) Bog SAC.

In terms of groundwater levels, the designated sites are located a sufficient distance from proposed works areas as Arragh More Bog NHA is located ~180m from the closest works area (i.e. T5) and Arragh More Bog SAC is located >900m from T5.

Any potential water level effects associated with temporary dewatering works are unlikely to be significant beyond 50m from any excavation due to the dominance of moderate to low permeability glacial till subsoils and lacustrine deposits below the wind farm site. Therefore, the distances between the proposed works areas and the designated sites are sufficient to ensure that the Proposed Development has no potential to effect groundwater levels within these adjacent designated sites.

It can be concluded that the Proposed Development has no potential to affect the conservation interests of the Arragh More (Derrybreen) Bog SAC & Arragh More Bog NHA in an unmitigated scenario throughout the construction phase.

Dovegrove Callows SPA and pNHA

Dovegrove Callows SPA and pNHA is located ~5km northeast of the wind farm along the Little Brosna River and downstream of the grid connection route. During the construction phase there is potential for contaminants, mainly suspended solids, to enter the local watercourses and ultimately the Little Brosna River.

The Greenland White-fronted Goose is the only Conservation Interest of the SPA. The objective of the SPA is to maintain or restore the favourable conservation condition of the bird species. This objective is not directly associated with the Little Brosna River and hence even if some material was to enter the local watercourses and the Little Brosna River, the actual Conservation Interests of the SPA, would not be affected.

It can be concluded that the Proposed Development has no potential to affect the conservation interests of the Dovegrove Callows SPA and pNHA in an unmitigated scenario throughout the construction phase.

The Little Brosna Callow SPA and NHA

The Little Brosna Callows SPA and NHA is situated ~3.3km north of the wind farm site on the Little Brosna River.

The main habitat present is the extensive area of lowlying callow grassland along the floodplain of the river. During the construction phase there is potential for contaminants, mainly suspended solids, to enter the local watercourses and ultimately the Little Brosna River.

However, it is noted that even if some material was to enter the local watercourses and the Little Brosna River, the actual Conservation Interests of the SPA, as listed below, and the rare, raised bog habitat of the NHA, would not be affected as these are not associated with watercourses:

- A038 Whooper Swan
- A050 Wigeon
- A052 Teal
- A054 Pintail
- A056 Shoveler
- A140 Golden Plover
- A142 Lapwing
- A156 Black-tailed Godwit
- A179 Black-headed Gull
- A395 Greenland White-fronted Goose

It can be concluded that the Proposed Development has no potential to affect the conservation interests of the Little Brosna Callows SPA and NHA in an unmitigated scenario throughout the construction phase.

The River Shannon Callows SAC & pNHA and the Middle Shannon Callows SPA

Both the River Shannon Callows SAC and the Middle Shannon Callows SPA are located ~8.5km west of the wind farm site within the River Shannon, downstream of the Little Brosna River.

The River Shannon Callows and Middle Shannon Callows SPA is a long and diverse site which consists of seasonally flooded, semi-natural, lowland wet grassland, along and beside both sides of the river.

During the construction phase there is potential for contaminants, mainly suspended solids, to enter the local watercourses such as the Little Brosna River and ultimately to the River Shannon. The entry of contaminants to the River Shannon could potentially affect the water associated qualifying interests of the SAC (i.e. the Otter (Lutra lutra)). The qualifying interests of the Middle Shannon Callows SPA consist of mainly bird species which are less likely to be affected as these are not water dependant species.

However, as outlined in **Table A** above, the catchment area for the Shannon (Lower)_030 river segment (9633.6km²) downstream of the Little Brosna_060 (490.99km²) increases dramatically. Downstream, surface water quality effects are unlikely to be significant at the location of the SAC/ pNHA and SPA due to dilution/assimilation capacity effects over such distances, particulary in the River Shannon itself.

Therefore, it can be concluded that the Proposed Development has a reduced potential to affect the qualifying interests of the River Shannon Callows SAC/ pNHA and the Middle Shannon Callows SPA even in an unmitigated scenario throughout the construction phase due to the distal location of the Shannon River downstream of the site and the large catchment area within the Shannon River itself.

Woodville Woods pNHA

Woodville Woods pNHA is adjacent to the proposed grid connection route on the eastern side at the northern end of the route. Approximately ~110m of the route is located within the Woodville Woods pNHA site boundary along the existing R439 road. While within the designated area, the road itself carries no ecological value. Therefore, it can be concluded that the Proposed Development has no potential to affect the conservation interests of the Killeen Bog NHA in an unmitigated scenario throughout the construction phase.

4.2.2 Operational Phase (Unmitigated)

4.2.2.1 Increased Site Runoff and Hydromorphology Effects on River Water Bodies

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 Proposed Development Site and increase flood risk downstream of the development.

Emplacement of the Proposed Development infrastructure could result in an average total increase in surface water runoff. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and causing hydromorphological effects.

The emplacement of the proposed permanent development footprint, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials as a worst-case scenario) could result in an average total site increase in surface water runoff of approximately 351m^3/month or 11.3m^3/day (Refer to **Error! Reference source not found.** of the EIAR). This represents a potential increase of approximately 0.16% in the average daily/monthly volume of runoff from the site area in comparison to the baseline pre-development site runoff conditions. This is a very small increase in average runoff and results from the naturally high surface water runoff rates and the relatively small area of the site being developed, the proposed total permanent development footprint being approximately 6.5ha, representing ~2% of the EIAR Site Boundary area of 314ha.

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Little Brosna_040	IE_SH_25L020700	Moderate	Moderate
Little Brosna_050	IE_SH_25L020800	Moderate	Moderate
Little Brosna_060	IE_SH_25L021000	Good	Good
Incherky_010	IE_SH_25I020930	Good	Good
Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate

4.2.2.2 Surface Water Quality Impacts from Operational Site Drainage

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

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

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Little Brosna_040	IE_SH_25L020700	Moderate	Moderate
Little Brosna_050	IE_SH_25L020800	Moderate	Moderate
Little Brosna_060	IE_SH_25L021000	Good	Good
Incherky_010	IE_SH_25I020930	Good	Good
Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate

4.2.2.3 Groundwater Quality Impacts from Operational Site Drainage

The risks to groundwater quality are the same as those described in **Section 4.2.1.2** but of a lesser extent than during the construction phase due to the limited activity at the proposed site with only minor maintenance required during the operational phase. There will be no groundwater quality impacts along the proposed grid connection route.

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

Table J: Groundwater Quality Impacts during the Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Birr GWB	IE_SH_G_041	Good	Good
Banagher GWB	IE_SH_G_040	Good	Good
Birr Gravels	IE_SH_G_244	Good	Good

4.2.2.4 Potential Impacts on Protected Areas During Operational Phase

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 any nearby or downstream designated sites is greatly reduced.

4.3 MITIGATION MEASURES

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

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Surface Water Quality during Felling Operations

All felling of coniferous plantations will be done in accordance with the current best practice methods.

A suite of mitigation measures relating to clear felling of coniferous plantations are summarised in **Table K** below. These include avoidance controls and mitigation by design which includes source controls, in-line controls, water treatment controls, and outfall controls.

In addition to these mitigation measures, drains in the vicinity and downstream of the proposed felling areas will be subject to frequent inspection both pre and post-felling. Additionally, surface water quality monitoring shall be completed before, during (if the operation is conducted over a protracted time period) and after felling operations and until the water quality has returned to pre-activity status if an impact has occurred. Daily surface water monitoring forms will also be utilised at every works location in close proximity to a watercourse.

Table K: Summary of Mitigation Measures Associated with Proposed Felling Operations

Management Type	Description of drainage control method	Applicable Works Area
Avoidance Controls:	• A self-imposed 50m buffer will be maintained where possible for all streams; • The large separation distance between the proposed felling areas and sensitive aquatic zones means that potential poor runoff can be adequately managed and attenuated prior to reaching sensitive watercourses; • Works will be completed during periods of no or low rainfall	Felling areas where sediment is being generated.
Mitigation by Design	• Machine combinations will be chosen to minimise soil disturbance; • Crossing of streams will not be permitted; • Removing soil from roads during wet periods and dust suppression during dry periods; • Ditches draining from the proposed felling area towards existing watercourses will be blocked and temporary silt traps constructed i.e. no direct discharge to surface watercourses will occur. • Double silt traps will be installed where felling is inside the 50m aquatic buffer zone; • Discharge channels will taper out before entering 50m buffer zone allowing for further sediment filtration by ground vegetation' • All drains and sediment traps will be maintained during the felling works; • Brash mats will be used to support vehicles on soft ground; • Timber will be stacked in dry areas outside of the buffer zone with straw bales and check dams places downstream of these storage areas; • Trees will be cut manually from along streams and	Felling areas where sediment is being generated.

	using machinery to extract the tree; • Travel will only be permitted perpendicular to and away from a watercourse; and,	
	• Using small working areas; • Covering stockpiles; and, • Timber will be stacked in dry areas outside of the buffer zone with straw bales and check dams places downstream of these storage areas.	Timber stockpile areas

4.3.1.2 Mitigation Measures to Protect Surface Water Quality during Earthworks

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in **Table L** below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls.

Table L: Summary of Drainage Mitigation & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Application of 50m buffer zones to natural watercourses where possible to avoid excavations in close proximity to watercourses and avoid the release of suspended sediment into watercourses; • Using small working areas; and, • Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Construction work areas where sediment is being generated.
Source Controls:	• Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	• Using small working areas; • Covering stockpiles; • Weathering off / sealing stockpiles and promoting vegetation growth.	Stockpiles areas
In-Line Controls:	• Interceptor drains, vee-drains, oversized swales/collector drains; • Erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o filter fabrics; o straw bales; o flow limiters; o weirs or baffles; o and/or other similar/equivalent or appropriate systems. • Silt fences, filter fabrics; • Collection sumps, temporary sumps, pumping systems; • Attenuation lagoons; • Sediment traps, stilling / settlement ponds.	Interceptor and collection drainage systems
Water Treatment Controls:	• Temporary sumps; • Attenuation ponds; • Temporary storage lagoons; • Sediment traps, Stilling / Settlement ponds, silt bags; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Surface water treatment locations

Outfall Controls:	• Levelspreaders; • Buffered outfalls; • Vegetation filters; • Silt bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

Each element of the wind farm development (*i.e.*, access roads, turbines, borrow pit and peat repository) will have an array of drainage control measures to ensure protection of downstream watercourses. Each drainage control element is not stand alone but occurs as part of a treatment train of control systems (i.e., check dams, silt traps, settlement ponds etc).

4.3.1.3 Mitigation Measures to Water Quality during Excavation Dewatering

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

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the 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 (ECoW or Project Hydrologist) will occur during the construction phase. If high levels of seepage inflow occur, excavation work should immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as a final line of defence if needed.

4.3.1.4 Mitigation Measures to Protect Against the Release of Hydrocarbons

Mitigation measures proposed to avoid the release of hydrocarbons at the wind farm site and along the grid connection route include:

- Minimal refuelling or maintenance of vehicles or plant will take place on-site. Off-site refuelling will occur where possible;
- On site re-fuelling of 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;
- Onsite refuelling will be carried out by trained personnel only;

- Fuels stored on site will be minimized and will be appropriately bunded;
- Surface water runoff from temporary construction compounds will be collected and drained via silt traps and hydrocarbons interceptors prior to recharge to ground;
- A permit to fuel will be put in place;
- 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 Plan;
- Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

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

Mitigation measures proposed to avoid the release of wastewater at the wind farm site include:

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at each of the site construction compounds, 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 off-site treatment location; and,
- No water or wastewater will be sourced on the site, nor discharged to the site.

4.3.1.6 Mitigation Measures to Prevent the Release of Cement-Based Products

Best practice methods for cement-based compounds:

- No batching of wet-concrete products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of concrete contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.7 Mitigation Measures to Prevent Morphological Changes to Surface Water Crossing and Drainage Patterns

The proposed mitigation measures include:

- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed.
- No in-stream excavation works are proposed;
- Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road;

- All guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland[2] (IFI) is incorporated into the design of the proposed crossings;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", i.e., May to September inclusive.
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase.
- All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

The crossing methodologies employed at the other culvert and manmade drain crossings along the underground electrical cabling route, will be selected from the suite of watercourse crossing options outlined below, as appropriate, depending on culvert type, depth, size and local ground conditions.

- Option A - Standard Formation Crossing over Culvert- Where adequate cover exists above a culvert, the standard aforementioned trench arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or water course. Where no crossing currently exists, the cable will pass over the watercourse in a bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement.

- Option B - Standard Formation Crossing under Culvert - Where the culvert consists of a socketed concrete or sealed plastic pipe and sufficient depth is not available over the crossing, a trench will be excavated beneath the culvert and cable ducts will be installed in the standard formation 300mm below the existing pipe.

- Option C - Shallow Formation Crossing over Culvert - Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location.

- Option D - In the event that none of the above methods are appropriate, directional drilling (DD) will be utilised. DD is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible.

4.3.1.8 Mitigation Measures to Protect Groundwater Quality

The potential pollution of groundwater during the construction phase will be mitigated by the provision of appropriate controls and working methods. These include best practice methods for storage and handling of fuels and chemicals and wastewater outlined in Sections 4.3.1.4, 4.3.1.5 and 4.3.1.6 above.

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

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

The operational phase drainage system of the Proposed Development will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will have been 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 over the ground by means of a level spreader;
- Swales/road-side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds have been designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Development are the same as those outlined in **Section 4.3.1.2** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlined in **Section 4.3.1.4** above.

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

4.3.2.4 Mitigation Measures for Protected Areas

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Development are the same as those outlined in **Section 4.3.1.2** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlined in **Section 4.3.1.4** above.

It can be concluded that with best practice methods adhered to during the operation phase of the proposed wind farm development, the potential for the project to impact upon the qualifying interests of the local designated sites is not significant.

4.3.1 Decommissioning Phase

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

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

The wind farm site roadways will be kept and maintained following decommissioning of the wind farm infrastructure, as these will be utilised by ongoing forestry works and by other participating landowners.

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

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

Other impacts such as possible soil contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site. Similar mitigation implemented during the construction phase will be utilised during the decommissioning phase to ensure no impacts of receiving waters.

Some of the potential impacts of water bodies will be avoided by leaving elements of the Proposed Development in place where appropriate. The substation will be retained by EirGrid as a permanent part of the national grid. The turbine bases will be rehabilitated by covering with local topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

With the implementation of the mitigation measures outlined above no significant effects on the hydrological and hydrogeological environment will occur during the decommissioning stage of the proposed development

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 M** below.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change- Unmitigated	Assessed Status with Mitigation Measures
Little Brosna_040	IE_SH_25L020700	Moderate	Poor	Moderate
Little Brosna_050	IE_SH_25L020800	Moderate	Poor	Moderate
Little Brosna_060	IE_SH_25L021000	Good	Moderate	Good
Incherky_010	IE_SH_25I020930	Good	Moderate	Good
Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate	Moderate
Birr GWB	IE_SH_G_041	Good	Moderate	Good
Banagher GWB	IE_SH_G_040	Good	Moderate	Good
Birr Gravels	IE_SH_G_244	Good	Good	Good

5. WFD ASSESSMENT CONCLUSION

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

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

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

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

The potential for the project to impact upon nearby and downstream designated sites and protected areas is not significant due to the physical, hydrological and hydrogeological separations between them, as explained individually in **Section 4.2.1.4**. Nevertheless, best practice methods will be adhered to throughout regarding the preservation of the protected areas.

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

As such, the Proposed Development will not 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 Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive(2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in Section 9.1.4 of EIAR Chapter 9).

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22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie