

9 AQUATIC ECOLOGY

This chapter has been reviewed and updated where necessary considering any subsequent modifications, updates and additional information acquired for the Further information Request issued by Louth County Council (LCC) on the 6th February 2025 (Reference No: 2460766). It is noted that for ease of reference all changes from the original chapter are shown in orange. Where text has been removed it is shown as ~~strikethrough~~.

Following a review of the proposed development based on the Request for Further Information, it has been determined that site entrance 4 is not required for the construction, operation and decommissioning of the proposed development, as all works can be accommodated via the proposed site entrances 1-3. Therefore, it is proposed that entrance 4 will not be taken forward as part of the proposed development, and the initially proposed use of entrance 4 will instead be accommodated at entrance 2. The author of this chapter has reviewed the revision, and no implications for the assessment presented in this chapter have been identified.

9.1 INTRODUCTION

This chapter describes the baseline ecological conditions within the Site and the potential significant effects, direct and indirect, if any, that could arise in the receiving environment from the project. This chapter presents the zone of influence of the development, screens the aquatic ecology receptors that could be affected and assesses the significance of effects on these receptors arising from the development, through construction, operation and decommissioning. All elements of the design proposals have been assessed in the context of aquatic ecological sensitivities of the receiving environment.

The aquatic ecology receptors considered in the assessment include fisheries and biological water quality, as well as protected aquatic species and habitats within the Red Line Boundary and in the vicinity of the project. This chapter also considers the potential impacts of the project on the receiving aquatic environment based on its known sensitivities (i.e. quality of water, ecological status, presence of protected species etc.) along with proposed mitigation measures, as well as post-mitigation in-combination impacts of the project. An assessment of the hydrological impacts of the project on the receiving aquatic environment is discussed in Chapter 11 (Hydrology and Hydrogeology) of the EIAR.

Please refer to **Chapter 2 (Description of the Proposed Development)** for a comprehensive overview of the site and the Development description. The project site,

hereafter referred to as “the Site” is located approximately 9 km inland from Clogher Head, 2.5 km west of the village of Kellystown in Co. Louth. The proposal for the Site is mapped in Figure 9.1. The wider Development includes the Turbine Delivery Route (TDR) and Grid Connection Route (GCR), which are also considered in this chapter.

This Chapter of the EIA Report is supported by the Technical Appendix provided in 9.1:

- APEM (2023) *Kellystown Wind Farm Aquatic Ecology Surveys Report*. Final, November 2023.

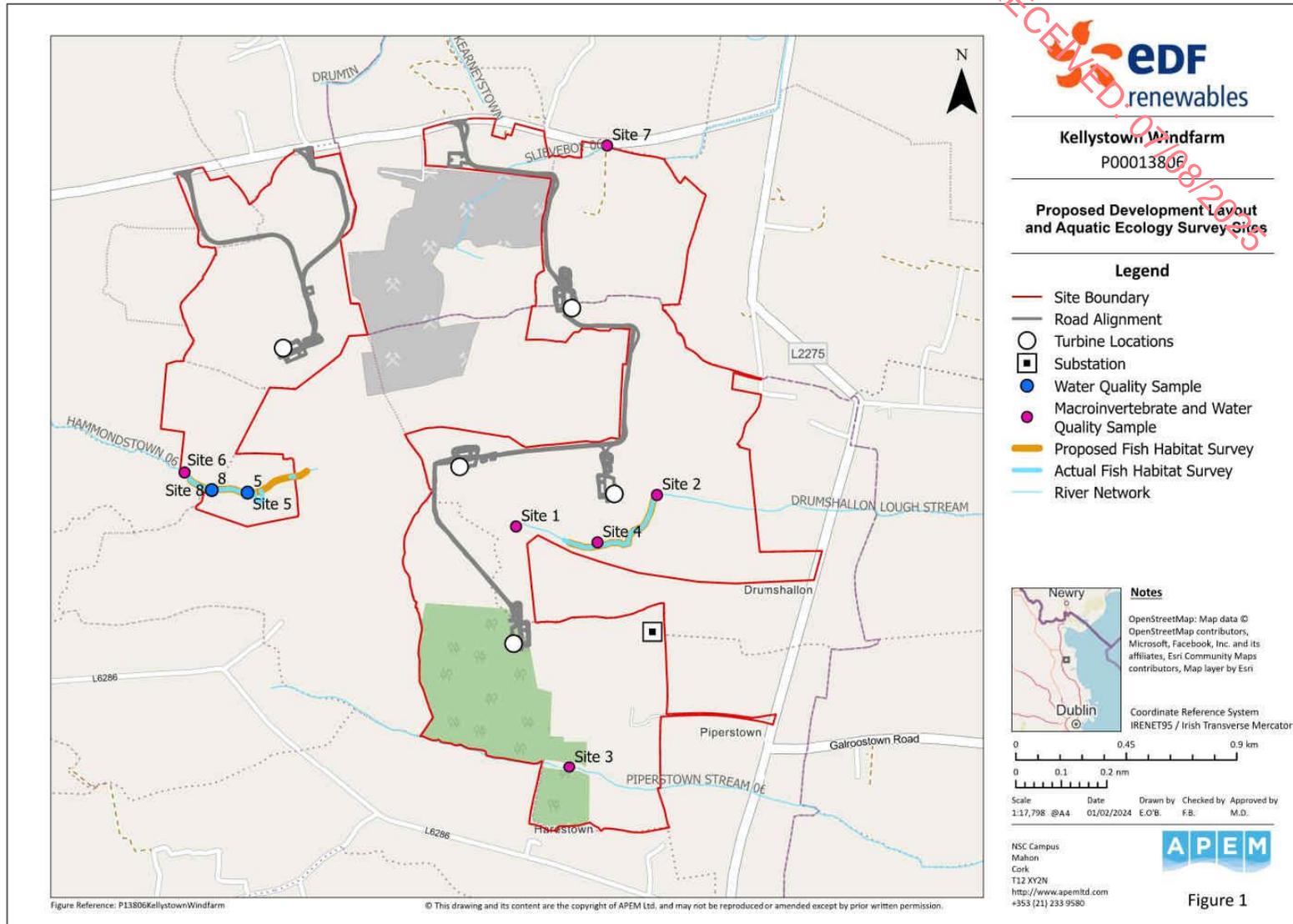


Figure 9.1. Kellystown Site Layout and Aquatic Ecology Survey Sites

9.1.1 Statement of Authority

Woodrow Sustainable Developments Ltd (Woodrow), which includes APEM Ireland as a trading name, has many years' experience in baseline ecological assessments and ecological impact assessment in relation to wind farm development. Part of the APEM Group, the company more widely has worked extensively on both onshore and offshore wind farm proposals in Ireland and globally.

This report has been prepared by Elizabeth O'Brien, with later additions relating to the TDR and GCR options added by Dr Michael Dobson. Field surveys were carried out by Gráinne Keogh and Dr Adon McFarlane. The technical review was provided by Dr Michael Dobson.

Elizabeth O'Brien - Consultant Ecologist has a First Class Hons. BSc in Zoology from NUIG and a First Class Hons. MA in Ecological Design Strategy. She is experienced in a range of research and technical survey skills in terrestrial, marine, ornithology, mammals, habitats and phylogenetics. She has a good knowledge of environmental legislation with reference to Ireland as well as the EU and the Habitats Directive. She has also previously spent time at sea conducting UWTV and Deep-Sea Trawling fisheries surveys with the Marine Institute. As a consultant ecologist for APEM, she contributes towards Ecological Impact Assessments (EclA), Appropriate Assessments Screenings (AA Screenings) and Preliminary Ecological Appraisals (PEAs).

Dr Adon McFarlane is a freshwater biologist, specialising in protected species whose PhD research was into white-clawed crayfish ecology. He is an experienced field scientist, with extensive skills in the fields of freshwater habitat assessment; freshwater pearl mussel survey; white-clawed crayfish survey, macroinvertebrate survey, fish habitat assessment and electrofishing survey. He has built up skills in the collection of data both in the field and laboratory, analysis of data using statistical software programs such as R, BORIS, RAVEN and Minitab, creation of distribution maps using GIS. Adon has very strong technical skills in both freshwater and marine laboratory and fieldwork instrumentation and equipment usage. Adon has worked on a number of ecological reports, including Appropriate Assessments, Ecological Impact Assessments (EclA), Preliminary Ecological Appraisal Reports (PEAR) and Invasive Species Reports.

Gráinne Keogh, a Senior Ecologist at APEM Ireland has a MSc in Marine Biology and a BSc in Ecology and Environmental Biology. Gráinne carried out field and lab work across marine, terrestrial, and freshwater environments; these include habitat surveys and mapping, species identification, freshwater pearl mussel surveys, electrofishing surveys

and chemical and biological water quality analysis including SSRS and Q Value assessments. She has previously worked on the Climate Change Mitigation Research Project in Inland Fisheries Ireland, and she has also spent time at sea on research vessels conducting fisheries surveys with the Marine Institute. Grainne has a robust understanding of the impact assessment processes, and Irish and EU wildlife legislation and has written a number of Appropriate Assessments, Natura Impact Statements and Ecological Impact Assessments to support planning applications.

Dr Michael Dobson FLS MCIEEM is a freshwater biologist with over 35 years' experience. He spent 20 years as a research scientist, specialising in ecology and management of rivers and freshwater wetlands throughout Europe and East Africa, along with developing biotic indices for river quality assessment in Central America. He was Director of the Freshwater Biological Association for six years before joining APEM in 2013, working initially in the limnology and water quality team before setting up its dedicated invasive species team in 2019 and moving to APEM Ireland in 2022. Mike has written many peer-reviewed papers in ecology and biogeography, along with two undergraduate textbooks for Oxford University Press (both in their second editions) and seven identification guides to freshwater invertebrates of Britain and Ireland. He has extensive experience of survey design, data analysis and reporting, including publication and verbal reporting for non-technical audiences. He has written and reviewed Habitats Directive assessments in both Ireland and the UK.

This Chapter was reviewed considering any subsequent modifications, updates and additional information acquired for the Further information Request issued by Louth County Council (LCC) on the 6th February 2025 (Reference No: 2460766) by Harvey Walsh an Associate Director at APEM Groups. Changes which were relevant to the aquatic ecological assessment are contained in the revised surface water management plan.

After a review of the revised surface water management plan, due to the amendments being minor in nature no significant impacts are anticipated.

9.1.2 Assessment Structure

This chapter includes the following elements:

- Assessment methodology and significance criteria;
- Description of baseline aquatic ecological conditions at the Site;

- Identification and assessment of impacts to aquatic ecology associated with the project during the construction, operational and decommissioning phases;
- Mitigation measures to avoid or reduce the impacts identified;
- Identification of cumulative impacts if and where applicable, post-mitigation; and
- Summary of any residual effects of the project considering mitigation measures.

9.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

9.2.1 Assessment Methodology

The approach to assessing effects arising from the project is consistent with EIA requirements and notably the information outlined in Schedule 6 and Schedule 7 of the Planning and Development Regs 2001 (as amended)). Furthermore, the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018) have been used to support this assessment, which aligns with the required approach as set out under the Planning and Development Regs 2001 (as amended)).

The importance of an ecological feature should be considered within a defined geographical context (CIEEM 2018). The following frame of reference has been used in this case, relying on known/ published accounts of distribution and rarity where available, and professional judgement:

- International (European);
- National (Ireland);
- Regional (Leinster);
- County (Louth);
- Local Upper Importance - Townland (Ardee);
- Local Lower Importance - Intermediate between the Site and Townland;
- Site ("the Site").

The above frame of reference is applied to the ecological features identified during the desk study and surveys to inform this report.

In assigning a level of value to a species it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. The relevant lists and criteria used to assign species value were:

- Species of European conservation importance (as listed on Annexes II, IV and V of the Habitats Directive and Annex I of the Birds Directive);
- Species protected under the Wildlife Acts 1976 – 2021;
- IUCN Red List of Mammals and associated criteria (Extinct, EX Extinct in the Wild, EW Critically Endangered, CR Endangered, EN Vulnerable, VU Near Threatened, NT Least Concern, LC Data Deficient, DD Not Evaluated, NE).

To this end, ecological features (habitats, species, ecosystems and their functions/ processes) that are considered to be important and potentially affected by the project, through the desk study and field surveys, are carried forward to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to impacts from the project and will remain viable and sustainable. Therefore, for the purposes of this report, only ecological features of Local importance or greater and/ or subject to legal protection have been subject to detailed assessment.

This chapter is an EIA of the Proposed Development on aquatic ecology. A full description of the Proposed Development is outlined in section 2.3 of Chapter 2 and includes one TDR (the Proposed TDR) and one GCR (the proposed GCR). Other viable GCR/TDRs have also been assessed as part of the EIAR. Although planning permission is not being sought for these viable routes (GCR option 2 and TDR option 2 and TDR option 3) they have been fully assessed. All EIA aspects of GCR option 2 and TDR option 2 and 3 are documented in Appendix 3.1. Refer to section 6 of Appendix 3.1 for the aquatic ecology assessment for GCR option 2 and TDR option 2 and 3.

9.2.1.1 Impact Assessment

The impact assessment was carried out with regard to the criteria outlined in CIEEM (2018) and EPA (2022).

The impact assessment process involves the following steps:

- Identifying and characterising potential effects and overall significance of the effects; Incorporating measures to avoid and mitigate (reduce) these impacts;
- Assessing the significance of any residual effects after mitigation;

- Identifying appropriate compensation measures to offset significant residual effects (if required)
- Identifying opportunities for ecological enhancement.

When describing impacts, reference has been made to the following characteristics, as appropriate:

- **Positive or negative** - impacts/ effects should be determined according to whether the change is in accordance with nature conservation objectives and policy;
- **Extent** - should be predicted in a quantified manner and relates to the area over which the impact occurs;
- **Magnitude** - refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population;
- **Nature** - the nature and the transboundary nature of the impact;
- **Duration** - is intended to refer to the time during which the impact is predicted to continue, until recovery or re-instatement (which may be longer than the impact-causing activity). Duration should be defined in relation to ecological characteristics (such as a species' lifecycle);
- **Timing and Frequency** - timing of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and associated impacts) would take place can be an important determinant of the impact on receptors and should also be assessed and described; and
- **Reversibility** - an irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.
- **In-combination** - the cumulation of the impact with the impact of other existing and/ or approved projects.

The impact assessment process considers both direct and indirect impacts: direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process.

Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or feature, e.g. the creation of roads that cause hydrological changes which, in the absence of mitigation, could lead to the drying out of wet grassland.

Consideration of conservation status is important for evaluating the effects of impacts on individual habitats and species and assessing their significance:

- **Habitats** – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.
- **Species** – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

The CIEEM Guidelines define a significant effect as, “an effect that either supports or undermines biodiversity conservation objectives for ‘important ecological features’...or for biodiversity in general”. The criteria for describing the significance of the impact effects are presented in **Error! Reference source not found..**

Table 9.1: Criteria for describing the Significance of effects (EPA, 2022)

Significance of effects	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment

Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound Impact	An impact which obliterates sensitive characteristics

9.2.1.2 *Avoidance, Mitigation, Compensation and Enhancement*

Where potentially significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the CIEEM Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible, the application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.

It is important for the EIAR to clearly differentiate between avoidance, mitigation, compensation and enhancement and these terms are defined here as follows:

- **Avoidance** is used where an impact has been avoided, e.g. through changes in scheme design;
- **Mitigation** is used to refer to measures to reduce or remedy a specific negative impact in situ;
- **Compensation** describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible; and
- **Enhancement** is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

9.2.1.3 *Cumulative Effects*

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. Cumulative effects can occur where a project results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects.

9.2.2 **Study Area – wind farm**

The study areas for the desk study and field surveys were identified through considering the nature of the project, the size and location of the project and the ecological features likely, or known, to be present.

This study area used for the field surveys is shown in Figure 1. Within this area aquatic sampling points were chosen based on the location of the proposed turbines in relation to the local streams (Figure 1). Initially seven turbines were proposed and the sampling programme was based on this design. The number of turbines has subsequently been reduced to five and the sample sites are adequate for the current design, as all watercourses recognised by the EPA within the Site have been assessed.

Sites 1, 2, and 4 are located on the Drumshallon Lough Stream. Site 3 is located on the Piperstown Stream. Both of these are part of EPA Coded watercourse reference Termonfeckin_010, which flows east from the Site.

Sites 5, 6, and 8 are located on the Hammondstown Stream which is part of the EPA Coded watercourse reference White (Louth)_010, which flows west from the Site.

Site 7 is located on The Slieveboy Stream which is part of the EPA Coded watercourse reference Slieveboy_010, which flows north east from the Site.

9.2.3 Study area – turbine delivery and grid connection routes

The study area for the turbine delivery route (TDR) and grid connection route (GCR) is based on river crossings and other water bodies along the proposed routes. The route options all follow existing roads.

There is a single turbine delivery haul route from Galway port to the M1 junction 10 (route 1), following established motorways (Figure 2-7), and this is considered to be unaffected by the vehicle movements and not assessed. Once close to the site there are three TDR options under consideration, which are shown in Figure 9.2 in relation to water bodies.

The GCR will connect the Site to Drybridge 110 kV substation west of Drogheda. There are two options for the GCR, which are shown in Figure 9.2 in relation to water bodies. This map also includes the proposed location of Joint Bays along the cable routes. All TDR and GCR options have been assessed in this chapter.

9.2.4 Desk Study Methods

A desk study was carried out (in November 2023) to collate the available existing ecological information for the project, as shown in Figure 9.1 (Wind Farm Study Area). The Site (wind

farm area) and the surrounding landscape were viewed using available aerial imagery¹. The desk study aimed to identify records of protected or notable habitats and species that may potentially be affected by the proposed works. The information required to undertake the impact assessment (including cumulative impacts) of the proposed turbine delivery route (TDR) and grid connection route (GCR) options was gathered via a desk study.

Inland Fisheries Ireland (IFI)² data centre website was accessed for information on fisheries data. Other online sources available from Agency (EPA)³, geological survey of Ireland⁴ and Office of Public Works (OPW)⁵ were accessed for other environmental information, such as surface water features, flood data and catchment details relevant to the preparation of this report.

Only records for the past 10 years are included within this report as older records are unlikely to still be relevant given their age and possibility of changes in land management that may have occurred in the intervening period.

The absence of rare or protected species from the NPWS and NBDC databases does not necessarily imply that it does not occur within the area, rather it has not formally been recorded as present. Similarly, the presence of a recent record within the study area does not imply it is present within the Site, rather it is known to be present within the study area chosen for desk study.

A previous aquatic ecology report (APEM 2023), which describes the results of a series of baseline aquatic ecology surveys completed in June 2023 for the Site, was also reviewed during the desktop survey.

9.2.5 Field Survey Methods

The methodology for aquatic survey assessment of the Site is described below. Full details are provided in the Technical Appendix (APEM, 2023).

Surveys at the seven aquatic sampling points depicted in **Figure 9.1** were carried out during June 2023 as follows:

- Water quality physico-chemical measurements including water samples;

¹ <https://earth.google.com/web> (last accessed 21/11/2023)

² <https://opendata-ifigis.hub.arcgis.com/>

³ <https://gis.epa.ie/EPAMaps/> and www.catchments.ie/data/ (last accessed 21/11/2023)

⁴ www.gsi.ie (last accessed 21/11/2023)

⁵ www.floodinfo.ie - www.waterlevel.ie - www.opw.ie/hydro-data (last accessed 21/11/2023)

- A macroinvertebrate survey and associated Q-value rating of streams within the Site;
- A macroinvertebrate survey of the small lake within the Site at sample Site 1; and,
- Fish habitat walkover surveys to identify suitable habitat for the key fish species and life stages of importance.

Sightings or evidence of protected or invasive species were also noted if present. For the purposes of this report, "invasive species" are those which are subject to Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) as listed in Part 1 and Part 2 of the Third Schedule.

Water Quality Survey Methods

Water quality measurements of temperature, conductivity, oxygen concentration and saturation, and pH were taken in the field using a field probe. Water samples were taken for chemical analysis of selected parameters at an INAB accredited laboratory. Water quality survey was carried out at all seven sites (sites 1-3 and 5-8) on 21 June 2023.

Macroinvertebrate (Q Value) Survey Methods

Five of the sites used for water quality analysis were also sampled for macroinvertebrates (sites 1-3, 6 and 7). Kick-sampling was carried out at 4 river sites on 19-21 June 2023 according to the standard methodology used by the EPA (Toner et al., 2005) whereby a two-minute macroinvertebrate kick sample and one-minute hand search was conducted at each site.

A three-minute pond net sweep sample was taken in the Drumshallon Lough (Site 1) as it is a static lake rather than a flowing watercourse as with Sites 2-7. This methodology taken from the Predictive System for Multi-metrics (PSYM: Howard, 2002) which was designed for habitat survey and the assessment of standing waters by the Freshwater Habitats Trust and Environment Agency in the UK.

Samples were preserved in the field and specimens were identified in the laboratory to either genus or family level, according to the requirements of the Q-value method, using the standard range of identification keys published by the Freshwater Biological Association, AIDGAP and others. An EPA Q-value classification was assigned to each river site based on the presence and relative abundance of sensitive groups and the consideration of additional qualifying criteria as described by Toner et al. (2005).

Fish Habitat Survey Methods

Fish habitat walkover surveys were conducted to identify suitable habitat for the key fish species and life stages of importance. These took place along reaches of Drumshallon Lough Stream and Hammondstown Stream. Walkover habitat surveys were conducted on 20 June 2023. Weather conditions were dry and sunny with c. 40% cloud cover, light wind, air temperature 21 °C. The river flow at this time was considered low and therefore allowed for good visibility during habitat surveys. The methodology applied to the habitat survey follows Hendry & Cragg-Hine (1997). Invasive species were noted where present.

9.2.6 Limitations

9.2.6.1 Desk Study

Conditions at or near to the route can be subject to change over time with species movement both into and out of the study area. Therefore, this report and its recommendations reflect the conditions recorded at the time of the project-specific surveys and most recent desk study data available. For highly mobile species it has been assumed that individuals of any of the species that have been recorded previously in the study area could be present; therefore, this represents a precautionary approach to the assessment.

Interpretation of maps and aerial photography has been conducted in good faith, using recent imagery, but it has not been possible to verify the accuracy of any statements relating to land use and habitat context outside of the field study area. Additionally, there is little or no good quality status ecological data available for each of the rivers, individually (see Table 9.4 and Table 9.5).

However, overall, it is not considered that such limitations materially impact the completed assessment.

9.2.6.2 Field Survey

A potential limitation is the number of water quality readings available. Water quality can be variable, and will change under different flow and runoff conditions, so a single sample or set of readings can only give an indication of conditions at that point of time. Ideally, continuous water quality monitoring, on any investigated site, would be undertaken to provide a complete water quality record over a period of, say, one year to capture any variabilities which may occur under different runoff conditions. However, given the relatively small footprint of the project and the similarity of catchment characteristics across the area (APEM, 2023), the completed water quality sampling is considered acceptable to inform the assessment. Water quality sampling (and a macroinvertebrate survey) could not be completed at proposed Site 4, due to the

absence of water on the survey dates. Further water quality sampling should be completed as part of the scheme monitoring, should the project progress to construction.

The macroinvertebrate dataset is from a single sampling event and while it will integrate environmental conditions over the several months covered by the life cycles of the taxa recorded, it cannot give an indication of interannual variation. Where possible it is always preferable to take repeat samples in multiple years (e.g. annually in spring, autumn), to provide a long-term dataset. However, the completed macroinvertebrate sampling is considered acceptable to inform the assessment. Further macroinvertebrate sampling should be completed as part of the scheme monitoring, should the project progress to construction.

Conditions were suitable for carrying out fish habitat surveys. Some reaches of the streams surveyed were inaccessible due to bankside vegetation. Based on the survey results from the accessible areas of the streams it is considered likely that the overgrown reaches with impassible bankside vegetation also have poor habitat suitability, as that found in the surveyed reaches. Therefore, it is considered that the fisheries habitat data is acceptable to inform the assessment.

9.3 BASELINE CONDITIONS

9.3.1 Desk Study

Inland Fisheries Ireland (IFI) electrofishing data is available for the White (Louth) catchment, of which the Hammondstown Stream is part. The closest IFI electrofishing point is ca 5 km downstream of the fish habitat survey site on the Hammondstown Stream. There are further data available ca 8.5 km downstream of this point. The available data is summarised in Table 9-2 and Table 9-3. The White (Louth) River was assigned a fish ecological status of moderate in 2017 (Matson et al. 2018).

Records of species that undertake migratory movements through and/ or take residency in freshwater habitats were returned from the desk study. This includes lamprey species (*Lampetra* sp.), Atlantic salmon (*Salmo salar*) and European eel (*Anguilla anguilla*).

European eel are classified as 'critically endangered', while lamprey are classified as 'near threatened' in 'Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish' (King et al., 2011). All three of Ireland's lamprey species are protected under Annex II of the EU habitats directive, with River Lamprey classified under Annex II and Annex V. Salmon (in freshwater) is listed on Annexes II and V of the EU Habitats Directive, and is listed as "Vulnerable," on the King et al. (2011) Red list.

Table 9-2: IFI Electrofishing Data for White (Louth) River, ca 5 km Downstream of Hammondstown Stream Fish Habitat Surveys

Year	Brown trout	European eel	Lamprey Sp.	Minnow	Salmon	Stone loach	Three-spined stickleback
2013	✓	✓		✓		✓	✓
2014	✓			✓		✓	✓
2015	✓			✓		✓	✓
2016	✓			✓		✓	✓

Table 9-3: IFI Electrofishing Data for White (Louth) River, ca 8.5 km Downstream of Hammondstown Stream Fish Habitat Surveys

Year	Brown trout	European eel	Lamprey Sp.	Minnow	Salmon	Stone loach	Three-spined stickleback
2013	✓	✓	✓	✓	✓	✓	✓
2014	✓	✓	✓	✓	✓	✓	
2015	✓	✓		✓	✓	✓	✓
2016	✓			✓	✓	✓	✓

No fish species were returned for the NBDC desk search of grid squares O08 and O18. Likewise, no records of white clawed crayfish (*Austropotamobius pallipes*) were returned from NBDC squares O08 and O18.

The EPA Appropriate Assessment tool and the NPWS Margaritifera Sensitive Area map⁶ (Version 8, 2017 last updated 10/09/2021) were consulted during the desk study. The site is not located in a freshwater pearl mussel sensitive catchment and there is no surface water connectivity between the project site and any Margaritifera catchment.

Rivers crossed or adjacent to the proposed TDR and GCR routes are listed in Table 9.4 and Table 9.5. There is little or no ecological quality status data available for each of these rivers individually, so a summary of the Water Framework Directive (WFD) status of each of the water bodies in which they are situated is provided. Fisheries data are only available for the White (Louth) catchment on the IFI portal, and these have been reported above. All

⁶ [NPWS.maps.arcgis.MargaritiferaSensitiveAreas](https://www.npws.gov.ie/npws/maps/arcgis/MargaritiferaSensitiveAreas)

of the rivers are classified as Moderate or Poor WFD status. No sensitive receptor species were identified from these catchments, other than the fish described above.

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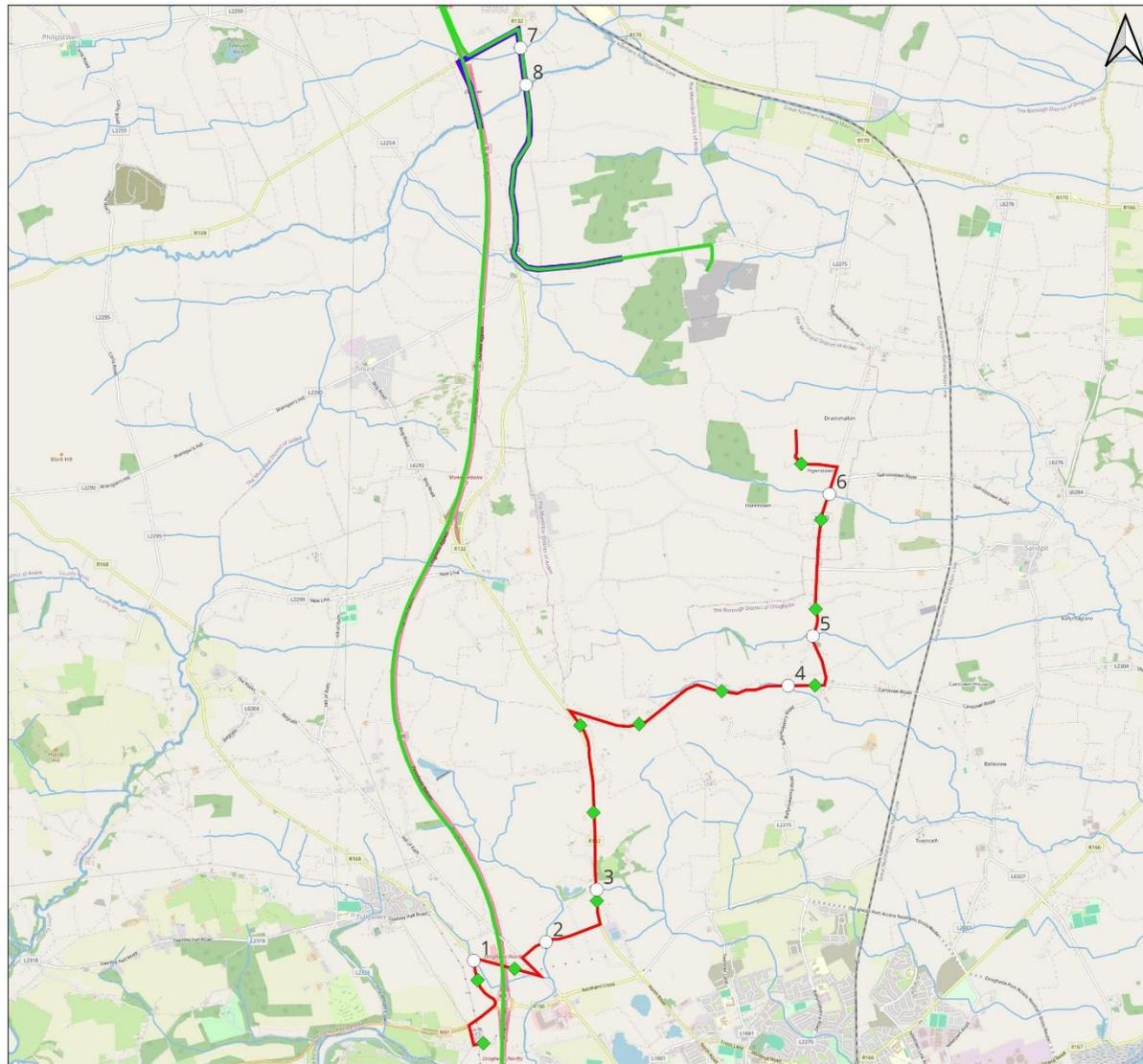


Figure Reference: [P00015573 Kellystown Windfarm TDR and GCR River Crossing Points Map] © This drawing and its content are the copyright of APTEM Ireland, and may not be reproduced or amended except by prior written permission.

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APTEM Group

Kellystown TDR and GCR
P00015573

Kellystown Windfarm TDR and GCR River Crossing Points

- Legend**
- Turbine Delivery Route - Option 2
 - Turbine Delivery Route - Option 3
 - Grid connection - Option 2
 - Water Crossing
 - ◆ Joint Bay
 - River Network

Notes

Basemap:
OpenStreetMaps (2023).

Coordinate System:
WGS 84 /
Pseudo-Mercator

0 1 2 km
0 0.5 1 NM

Scale: 1:100000 @ A4
APTEM Ireland

Date: 05/11/2024
RC

Drawn by: HW
Checked by: HW
Approved by: HW

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Figure 9.2: TDR and GCR options, showing water body crossings.

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Table 9.4: Waterbodies affected and their ecological status for Grid Connection Route - Option 2.

Crossing Point	River waterbody code	EPA code	Nature of interaction	WFD Water body name	WFD status	Q-value (and survey year)	Assessment Technique
1	IE_EA_07T270880	07T27	River crossing via existing culvert	TULLYESKAR_010	Moderate	N/A	Modelling
2	IE_EA_07T270880	07T27	River crossing via existing culvert and bridge	TULLYESKAR_010	Moderate	N/A	Modelling
3	IE_EA_07T270880	07T27	River crossing via existing culvert	TULLYESKAR_010	Moderate	N/A	Modelling
4	IE_EA_07T270880	07T27	River crossing via existing culvert	TULLYESKAR_010	Moderate	N/A	Modelling
5	IE_NB_06T010400	06T01	River crossing via existing culvert	TERMONFECKIN_020	Moderate	1997 - 3 (Poor)	Monitoring
6	IE_NB_06T010250	06T01	River crossing via existing culvert	TERMONFECKIN_010	Poor	1978 - 3 (Poor)	Monitoring

Table 9.5: Waterbodies affected and their ecological status for Turbine Delivery Routes - Option 2 and Option 3.

Crossing Point	River waterbody code	EPA code	Nature of interaction	WFD Water body name	WFD status	Q-value (and survey year)	Assessment Technique
7	IE_NB_06W010400	06W01	River crossing via existing culvert	WHITE (LOUTH)_020	Moderate	N/A	Monitoring
8	IE_NB_06W010400	06W01	Crossing of White River via existing culvert and bridge	WHITE (LOUTH)_020	Moderate	2018 - 3/4 (Moderate)	Monitoring

9.3.2 Field Survey

The field survey results are discussed in this section and displayed in summary form in Table 9.6. The locations of the sites surveyed can be seen in Figure 9.1. Relevant field survey reports can be found in the Technical Appendix (APEM, 2023).

9.3.2.1 Water Quality

Results

The field and laboratory water quality results are summarised in this section (from APEM, 2023). Physiochemical data was collected in situ during the field surveys in June 2023. The dissolved Oxygen (DO) was recorded as varied between Sites. Site 1 (Drumshallon Lough) returned a saturation exceeding 100%. Site 2 (Drumshallon Lough Stream), Site 5 and Site 8 (Hammondstown Stream), had saturation levels close to 50%. The low DO concentrations recorded at the Hammondstown Stream Sites was deduced to be a natural phenomenon due to the extensive emergent vegetation. The low DO concentrations recorded at Site 2 are unexplained. Site 1, located upstream of Site 2 had high DO levels, likely due to daytime photosynthesis by aquatic plants and / or algae.

Conductivity was recorded as consistent across all Sites, excluding Site 7 (Slieveboy Stream), which had higher conductivity. This may be related to the quarry present upstream.

BOD⁷ was recorded as low across most Sites excluding Site 5, which was moderately high. This combined with the low DO level suggests an issue with organic pollution at this site. Suspended solids were low at all Sites bar Site 5, likely reflecting a localised increase in organic matter.

Ammonia and Nitrogen concentrations were low across the sites. Total Oxidised Nitrogen (TON) as N was high at Site 3, but otherwise low. Total Nitrogen followed a similar trend, high levels at Site 3 and lowest at Sites 5 and 8; however, the highest concentration was found at Site 7.

Nitrate levels followed a similar trend, high at Site 3 and at Site 7 (levels considered indicative of poor / bad water quality; EPA, 2023). Nitrate levels were lowest at Sites 5 and 8. Nitrate concentrations at all Sites bar Sites 3 and 7 were considered indicative

⁷ Biochemical Oxygen Demand (BOD) is an indicator of organic matter breakdown often associated with pollution.

of relatively good water quality. These results indicate issues with Nitrogen and Nitrate at Sites 3 and 7.

Site 8 had the highest orthophosphate levels, representing moderate water quality. All other Sites met the thresholds for good or high-water quality status (S.I. 272, Surface Water Regulations, 2009). Total phosphorus levels were low at all Sites except for an exceptionally high reading at Site 5, potentially indicating a point source for orthophosphate.

Total Petroleum Hydrocarbons (TPH), which highlight the presence of oil-based fuels, were found at low concentrations across all Sites. Most Sites displayed an 'Unknown pattern' which indicates the presence of naturally forming hydrocarbons. There was no evidence for oil-based fuel contamination.

Full details of the water quality survey results can be found in the Technical Appendix (APEM, 2023).

Conclusion

The results show that there are significant differences in the chemical water quality of the surveyed water bodies. The Slieveboy Stream (Site 7) has high levels of nitrogen and nitrates. Although EPA mapping indicates that the underlying soils are poorly drained it is very close to an area mapped as well-drained to the west, which may be causing runoff of nitrogen from pasture in the area.

The Drumshallon Lough (Site 1) and its outflowing stream (Site 2) do not have significant water quality issues despite the low DO levels at Site 2. The small lough and stream are located on a small patch of peaty soils which may explain the low DO levels. The Hammondstown Stream has significant phosphorus and phosphate related water quality issues (Site 5) where low DO, high suspended solids and very high total phosphorus concentrations suggest a point source. Site 8, located upstream of a tributary, also had low DO and high levels of orthophosphate present, indicating a potential diffuse or possibly point source nearby. Soil mapping suggests that the soils here are well drained, but not far from poorly drained soils which may be contributing phosphorus/phosphate through overland flow off agricultural pasture. Site 4 was unsuitable for water quality or kick sampling, due to the absence of water on the survey dates.

9.3.2.2 *Macroinvertebrates*

Results

Macroinvertebrate survey results are described in this section (from APEM, 2023).

All Sites were classified as Q3, indicating moderate pollution (and representing poor ecological status). The greatest taxa richness was found at Site 6.

All Sites had small numbers of the less sensitive cased caddis (*Agapetus sp.*) from Group B. The least number of taxa were found at Site 7, which had a higher number of very tolerant taxa such as the water louse (*Asellus aquaticus*) and the bivalve Sphaeriidae. Large numbers of the non-native mud snail (*Potamopyrgus antipodarum*) were also present.

WHPT scores were highest at Site 6 and lowest at Site 7. Averaged scores were highest at Site 2, only slightly higher than Sites 6 and 3, but with all scores showing Site 7 to have the lowest score overall. This suggests there are slight differences in ecological quality between Sites 2, 3 and 6 but that Site 7 is of worse ecological quality than the other Sites.

The PSI (Proportion of Sediment-sensitive Invertebrates) Score uses macroinvertebrate community composition as a proxy to describe the extent to which riverbeds are composed of, or covered by, fine sediment, with a higher score indicating less sedimentation. PSI scores indicated that Sites 3 and 6 were un-sedimented, with Site 2 displaying slight sedimentation, and Site 7 being considered 'sedimented'.

There was low taxonomic diversity within the pond sample from Drumshallon Lough, mostly from pollution tolerant taxa. Common blue damselfly (*Enallagma cyathigerum*) larvae were recorded as relatively abundant in the sample, three dragonfly species were also present: Common darter (*Sympetrum striolatum*), Four-spotted chaser (*Libellula quadrimaculata*) and Hairy dragonfly (*Brachytron pratense*). No rare species were present in the sample.

Conclusion

The results indicate that all Sites sampled are moderately polluted, with Site 6 on the Hammondstown Stream displaying evidence of slightly better water quality than that of the others, and Site 7 on the Slieveboy Stream displaying slightly worse. This trend is consistent with the chemical water quality results. Site 7 (Slieveboy Stream) displays strong evidence of nutrient pollution (from nitrogen /nitrates) in both its water chemistry and its macroinvertebrate results.

Drumshallon Lough and its outflow stream (Sites 1 and 2 respectively) showed low taxonomic diversity and Q value scores, indicating moderate pollution. Though, the water chemistry here did not highlight any specific water quality issues, except for low DO at Site 2, the Q-value score indicates an absence of sensitive macroinvertebrates and suggests it also has water quality issues. The Q-value results from Piperstown Stream (Site 3) indicated moderate ecological pollution, corroborating the water chemistry results showing nutrient pollution from nitrogen/nitrates.

Full details of the macroinvertebrate survey results can be found in the Technical Appendix (APEM, 2023).

9.3.2.3 Fish Habitat

Fish habitats present within the Site, as recorded during the field survey, are described in this section (APEM, 2023). The location of these habitat surveys is shown in Figure 9.1.

Drumshallon Lough Stream

The fish habitat survey covered ca. 515 m of the Drumshallon Lough Stream. This was recorded as a first order modified stream / drain, surrounded by agriculture lands. The channel was largely overgrown with instream vegetation including watercress (*Nastium officinalis*), common rush (*Juncus effusus*), speedwell (*Veronica sp.*), horsetail (*Equisetum arvense*) and willowherb (*Epilobium sp.*). It was not possible to see the substrate in this section of the stream. Where water was visible it was still or very slow flowing. At the corner of the downstream end of the survey area the stream began to flow. A short section of riffle was recorded here. Three outflows from the northern bank enter the stream at this point.

There were no ideal habitats for salmonids or lamprey observed during this survey.

Hammondstown Stream

The fish habitat survey covered ca. 400 m of the Hammondstown Stream. This was recorded as a first order stream / modified drain in areas and surrounded by agriculture on both banks. The channel was heavily vegetated with up to 100% macrophyte cover in areas.

At the upstream end of the fish habitat survey there was a U-shaped stagnant pool with cattail (*Typha latifolia*) and horsetail. Rudd (*Scardinius erythrophthalmus*) were observed swimming in this area. Access further upstream of this area was limited due to vegetation cover. The channel was accessible for a spot check approximately 150 m upstream of this area where it was overgrown with macrophytes.

The channel was approximately 1.5 m wide and covered by brambles in areas. In stream vegetation throughout the channel included water mint (*Mentha aquatica*), watercress, pondweed (*Lemna sp.*), common water starwort (*Callitriche stagnalis*) and willowherb. There was a stone bridge structure approximately 300 m downstream of the fish habitat survey start point. Upstream of this bridge the channel was mainly stagnant and heavily vegetated with a silty substrate. Bankside vegetation consisted of a mature treeline of ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*) and bramble along the channel.

Downstream of this structure an unmapped channel joined the stream from the left-hand bank. This channel was ca. 2 m wide and flowing at the confluence. At the confluence the substrate was mainly boulder and cobble. Stickleback (Gasterosteidae) were observed in this area. Downstream of this confluence the channel varied between pockets of riffle, glide and slow/stagnant areas with emergent vegetation.

The unmapped channel was well shaded and flowing across riffle habitat just upstream of the confluence. Further upstream this channel became more stagnant with a silty substrate. Upstream was inaccessible due to a conifer plantation.

There were no ideal habitats for salmonids or lamprey observed during this survey.

Conclusion

The areas surveyed on both the Drumshallon Lough Stream and the Hammondstown Stream are not suitable for salmonid spawning with little value for anything other than passageway.

Lack of observed lamprey ammocete habitat does not mean it is absent from the Site. Ideal lamprey ammocoete habitat is areas of stable fine sediment or sand which is greater than 15 cm deep with a low water velocity. The substrate was not fully visible throughout both Sites due to in stream vegetation and overgrown bankside vegetation in places, and therefore suitable areas of ammocete habitat may have been present but not recorded. However, there was no extensive habitat of this type in either stretch surveyed.

Full details of the fish habitat survey can be found in the Technical Appendix (APEM, 2023).

9.3.2.4 Invasive species

While on Site there were incidental sightings of two invasive riparian plant species: Japanese knotweed, (*Fallopia japonica*), and Himalayan balsam, (*Impatiens glandulifera*). The locations

of these sightings were recorded and have been mapped in in the Technical Appendix (APEM, 2023).

The mud snail *Potamopyrgus antipodarum* recorded in the streams is widespread and abundant throughout Ireland and its presence in the Site is to be expected.

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Table 9.6: Summary Results of the Aquatic Surveys that were undertaken at the Site on 19-21 June 2023

Sample Site	Site 1	Site 2	Site 3	Site 5	Site 6	Site 8	Site 7
River/Stream Name	Drumshallon Lough	Drumshallon Lough Stream	Piperstown Stream	Hammondstown Stream			Slieveboy Stream
River Sub-basin	TERMONFECKIN_010			WHITE (LOUTH)_010			SLIEVEBOY_010
River/Stream Order	Lake	1 st Order	1 st Order	1 st Order	1 st Order	1 st Order	1 st Order
Q-Value	Q3	Q3	Q3	Not measured	Q3	Not measured	Q3
Fish Habitat Walkover	N/A	No ideal habitats for salmonids or lamprey observed	N/A	No ideal habitats for salmonids or lamprey observed	No ideal habitats for salmonids or lamprey observed	No ideal habitats for salmonids or lamprey observed	N/A
Dissolved Oxygen %	107.1	49.7	92.6	54.3	82.8	50.7	74.8
Dissolved Oxygen mg/l	9.68	4.85	9.28	5.01	8.15	4.81	7.4
Conductivity	422	414	442	449	452	450	1457
Suspended Solids	<2	<2	2	208	<2	<2	3
Temperature	19.9	16.3	14.8	18.5	15.8	16.8	15.8
Ammonia as N	0.011	0.032	0.023	0.024	0.027	0.035	0.014
TON as N	0.953	0.919	4.43	<0.1	1.88	<0.1	0.571
Total Nitrogen as N	1.34	1.11	3.91	0.500	2.01	0.526	5.5
Nitrate as NO ₃	3.91	4.02	27.1	<0.44	8.57	<0.44	16.8
Nitrite as NO ₂	0.021	<0.017	0.023	<0.017	0.102	<0.017	0.019
Orthophosphate as PO ₄ -P	<0.01	<0.01	0.01	0.011	0.022	0.045	0.03
Total Phosphorus as P	<0.05	0.1	<0.05	0.64	<0.05	0.09	0.05

Sample Site	Site 1	Site 2	Site 3	Site 5	Site 6	Site 8	Site 7
River/Stream Name	Drumshallon Lough	Drumshallon Lough Stream	Piperstown Stream	Hammondstown Stream			Slieveboy Stream
TPH (>C5 - C44) by GC-FID (**=naturally occurring hydrocarbons)	22**	22**	<20	26**	<20	34**	22**
Site Plate References	Plate 1	Plate 2	Plate 3	Plate 5	Plate 6	Plate 8	Plate 7

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9.3.3 Summary of Important Ecological Features

The baseline aquatic ecology surveys conducted revealed the watercourses on Site to be small overgrown streams with little value for salmonid or lamprey spawning. The Q-value scores showed the watercourses within the Site to be moderately polluted.

From a water chemistry perspective, no consistent pollution patterns were observed, however the Piperstown Stream (Sites 3), Hammondstown Stream (Site 5) and Slieveboy Stream (Site 7) all recorded high levels of nutrients, corroborating the macroinvertebrate results.

Site 7 on the Slieveboy stream displayed the worst macroinvertebrate metrics and the water quality results, with strong evidence of nutrient pollution (in the form of nitrogen/ nitrates) in its water chemistry, consistent with its macroinvertebrate results. Further investigations of the Slieveboy Stream, upstream of the quarry, may provide a greater understanding of the baseline water quality of the Slieveboy Stream, which would allow separation of any potential impacts on water quality caused by windfarm construction from those caused by the quarry. Further water quality sampling (and laboratory analysis) should be completed prior to, during and post construction, to inform the assessment of the potential impact from the windfarm construction.

A summary of important ecological features that require detailed assessment are outlined in Table 9.7. The geographical scale of importance for the ecological features within the Site are summarised along with their legal status and a rationale, where appropriate, for carrying forward any features for detailed assessment. While not identified as present on the Site, the presence of protected species of fish downstream means that these populations need to be considered for detailed assessment.

Table 9.7: Summary of Key Ecological Receptors

Key Ecological Receptor	Scale of Importance	Comments on Legal Status and/or Importance	Brought Forward for Detailed Assessment
Water Quality	Site	Whilst significant differences in water quality were recorded between the surveyed sites (issues included high levels of Nitrogen and Nitrates, low DO levels and phosphorus/ phosphate related water quality issues) no consistent pollution patterns were observed and the water quality results correlated with the	No

Key Ecological Receptor	Scale of Importance	Comments on Legal Status and/or Importance	Brought Forward for Detailed Assessment
		macroinvertebrate Q-value results. Based on this degraded status, and thus likely absence of significant negative impact from the wind farm project, further detailed assessment is not considered necessary.	
Macro-invertebrate	Site	The Q-value results indicate that all sites sampled are moderately polluted. No sites were found to contain notable numbers of any sensitive taxa and overall the Wind Farm Study Area displays a degraded ecological quality. Based on this degraded status, and thus likely absence of significant negative impact from the wind farm project, further detailed assessment is not considered necessary.	No
Fish and Fish Habitat	National	Historical records of protected species including lamprey, European eel and salmon have been found 5-8.5 km downstream of the project in Hammondstown Stream. These species are protected under Annex II and under Annex II and Annex V of the Habitats Directive respectively. Lamprey are listed as having a near threatened IUCN Conservation Status, while salmon are listed as vulnerable.	Yes

9.4 SITE CONSTRUCTION

9.4.1 Project

The project will consist of five wind turbines and their associated crane hardstand areas and foundations. To access the site, new access tracks and upgrades to existing site roads will be completed as well as two new permanent site entrances. Three temporary construction compounds will be built with associated site offices, parking areas, and security fences. A meteorological 36m mast will be built, as well as an electrical substation, battery energy storage system (BESS), and underground electrical and communications cabling. Ancillary forestry felling will be completed to facilitate construction and operation. Further information on the project construction is available in the CEMP.

9.4.2 Phasing of Works

The phasing of works for the project is envisaged to follow the sequence of construction:

1. Site Preparation including felling and drainage;
2. Site Access Roads;
3. Contractors Compound and Welfare Facilities;
4. Crane hardstandings;

5. Turbine Foundations;
6. Internal cable ducting;
7. Installation of the Grid Connection;
8. Erection of wind turbines;
9. Commissioning and Energisation.

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9.5 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

9.5.1 The Likely Evolution of the Baseline

If the development does not proceed, lands at and in the vicinity of the Site will continue to be used for as they currently are. This Likely Evolution of the Baseline (Do-Nothing scenario) would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices. It should be noted that current agricultural activities are having some effects on water quality within the catchment, as evidenced by the results of the surveys undertaken, and the area as a whole displays a degraded ecological quality, which would not be expected to change.

9.5.2 Potential Effects During the Construction Phase

9.5.2.1 Construction activities

Legislation (Directive 2014/52/EU) states that environmental assessments should consider impacts from both direct and indirect events, such as fuel spills from heavy machinery, that may arise due to a lack of appropriate procedures and mitigation strategies resulting from the construction and operation of a project. However, it is important to note that many of these events, including unplanned events, are accounted for within the CEMP where suitable mitigation measures are proposed. The construction activities associated with the project are detailed in **Error! Reference source not found.** and their mitigation measures are detailed further in section 9.6.

The project may result in emission to water and/ or disturbance to aquatic habitats downstream of the Site, which is important given the presence of lamprey and salmon in historical records downstream of the Site. Although the surveys did not record suitable salmonid or lamprey habitats within the site boundary, there is the potential for species to be present within the site and given the presence of lamprey and salmon in historical records downstream of the Site, indirect effects on these species are possible but unlikely. Protected species may also be present on Site, and direct impacts to these species such are possible.

Table 9-8: Construction activities and potential pathways and effects for the project.

Construction activity	Source and pathway	Impact	Type of impact	Mitigation required?
Refuelling	Cranes and heavy machinery will be required to move infrastructure on site. Unplanned events may include the spill of hydrocarbons (fuel/oil) into the environment during the refuelling process.	Hydrocarbons are toxic to flora and fauna, including fish, and these chemicals tend to be persistent in the environment. The release of hydrocarbons has the potential to impact on fish and fish habitat as hydrocarbons are known to bioaccumulate in salmonids (e.g. McCain et al. 1990). Atlantic salmon are known to be physically affected by short term exposure, leading to loss of condition, and also known to avoid areas containing hydrocarbons (e.g. Maynard and Weber 1981), leading to an effective loss of habitat or migration routes for the species.	Direct	Yes
Concrete	Concrete will be used as part of the turbine foundation construction process. It will be poured into the foundation excavation areas and cured.	The release of concrete and other cement-based products to an aquatic environment can have the effect of altering the levels of pH, nitrate, phosphate, total solids, total suspended solids, total dissolved solids, turbidity and BOD in the water. Cement products are particularly harmful to aquatic life due to the associated change in alkalinity in the water, which can cause burns to fish skin. Increased nutrient supply can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.	Direct	Yes
Dust release	During periods of dry and windy weather, there is potential for dust to become friable during drilling or other construction activities, where it could enter drainage channels.	Dust can cause nuisance to nearby residences and users of the local road network and could increase the amount of suspended solids entering watercourses on site. More information on the impacts of suspended solids can be found in the ground disturbance activity line.	Direct & indirect	Yes
Ground disturbance	Ground disturbance activities include:	Ground disturbance can lead to the release of suspended solids into watercourses either directly	Direct & indirect	Yes

	<ul style="list-style-type: none"> • Drilling/construction of access tracks/ excavations) • Vegetation/forestry clearance • Drainage activities • Dewatering activities <p>These activities could cause suspended solids to enter the watercourse via rainfall runoff pathways and drainage channels.</p>	<p>(spillage of contaminant into watercourses, or siltation of watercourses through disturbance, vegetation clearance and/or drainage activities) or indirectly (seepage of pollutants into groundwater or dewatering activities). Salmonid species require very high levels of water quality in order to complete their life cycles. High levels of sediment and suspended solid concentrations in waterbodies can affect the feeding and health of individual species through increased turbidity (inhibiting respiration through gills) and increased siltation affecting composition of riverbed substrate (reducing fry survival) and affecting spawning beds. Suspended solids often hold nutrients such as phosphorus or hydrocarbons that can result in eutrophication and reduced oxygen levels (with high oxygen levels being important for all life stages of Atlantic salmon, for example). Small amounts of debris entering a section of river important for vulnerable life stages of salmon and lamprey can have deleterious impacts, even in the short-term, on juvenile survival and habitat utility.</p>		
Construction of watercourse crossings	<p>The construction of watercourse crossings for cable installation could cause direct disturbance to the watercourse.</p>	<p>Potential for disturbance to aquatic habitat especially in times of high rainfall and flow, including accidental damage or siltation of spawning beds could occur if the construction is completed between October and June. It could also alter the in-stream hydromorphology.</p>	Direct	Yes
Noise	<p>Noise generated through construction work and drilling</p>	<p>Disturbance via noise or vibration during construction in the terrestrial areas of the Site could result in reduced habitat suitability for juvenile and spawning lamprey. There is very little information available for lamprey of any species with respect to hearing, that would provide an indication as to their sensitivity to noise or if they are able to detect any sound (Popper, 2005). Therefore, behavioural, or physiological effects</p>	Indirect	Unlikely

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		<p>on lamprey are usually considered likely to occur only when the organism is very close to a powerful noise source (Popper, 2005). However, this assumption is based on the use of very limited morphological data. As a result, no significant effects are predicted to result from construction noise or vibration.</p>		
<p>Site hydrology alterations</p>	<p>The installation of new permanent features such as drainage channels and hardstands will alter the hydrology of the site</p>	<p>A change in site hydrology may cause reduced flow of water during drought periods and/ or increased flood events. It also poses a risk of reduced habitat suitability for protected fish species that may use the Site. Hydrological impacts are considered in Chapter 11 of the EIAR.</p>	<p>Indirect</p>	<p>Yes</p>

9.5.2.2 TDR Routes

For the TDR route all river crossings are on straight sections of road where no alterations are anticipated. Therefore, no impacts are anticipated, so long as the appropriate mitigations measures/ conditions are met (Section 9.6).

TDR route option 3 requires construction of a temporary road to enable passage at the L6274/R132 road junction. This construction will be close to the Hammondstown 06 river crossing, requiring appropriate mitigation to avoid runoff into the river.

9.5.2.3 GCR Routes

No impacts along the GCR are anticipated. Therefore, no impacts are anticipated, so long as the appropriate mitigations/ conditions are met (Section 9.6).

Table 9.9: GCR Construction Requirements and Potential Effects.

Route option number	Construction requirement	Linked construction activity	Type of impact	Mitigation required
Option 1 and option 2	Road excavation	<ul style="list-style-type: none"> • Ground disturbance • Suspended solids • Dust release • Construction of watercourse crossings (via existing bridges and culverts) 	Direct	No, as long as conditions are met*
	Horizontal directional drilling works at one location under the M1 motorway (see Section 2.6.13.4 in Chapter 2 of the EIAR).		Indirect	Yes
	Construction of Joint bays and Communication chambers		Indirect	Yes

Overall, direct effects upon fish and fish habitat during the construction phase are considered to have the potential to be **Significant Negative** and **Temporary** (less than 1 year)⁸ at **County** scale in the **absence of mitigation measures**. The frequency of potential effects are limited to the construction phase and effects are predicted to be reversible.

Overall, indirect effects upon juvenile and spawning lamprey species during the construction phase are considered to have the potential to be **Slight Negative** and **Temporary** (less than

⁸ https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf

1 years) at a **Townland / Local Lower** scale in the **absence of mitigation measures**. Potential Indirect effects upon salmonid species and habitats is considered to be **Not Significant** and **Temporary** (less than 1 years) at a **Townland / Local Lower** scale in the **absence of mitigation measures**.

The frequency of potential effects are limited to the construction phase and effects are assessed as reversible.

9.5.3 Potential Effects During the Operational Phase

9.5.3.1 Direct Effects

There is limited potential for direct effects on watercourses within the project during the operational phase as no instream works or loss of natural watercourse features are planned as part of the operational phase. However operational maintenance for the windfarm may impact on watercourses if streams are crossed or instream works occur during the operational phase.

There is potential for runoff if any cable maintenance is required along the GCR.

As the TDR will no longer be active during this phase, there will be no TDR effects.

Overall, potential direct effects upon fish and fish habitat during the operational phase are considered to be **Imperceptible** in the **Long-term** (15 to 60 years) at a **Local Lower** scale in the **absence of mitigation measures**. The frequency of potential effects is limited to the duration of the operational phase and effects are assessed as reversible.

9.5.3.2 Indirect Effects

There is potential for indirect effects on watercourses within the project during the operational phase due to the permanent Site drainage changes, as covered under Construction Indirect effects.

Taking this into account, the potential for indirect effects on watercourses resulting from the operational phase is considered **Imperceptible** in the **Long-term (35 years)** at a **Local Lower** scale in the **absence of mitigation measures**. The frequency of potential effects is limited to the duration of the operational phase and effects may be fully reversible if the hardstandings are removed during decommissioning, or imperceptible due to the small footprint of the hardstanding, if they are retained following the operational period.

9.5.4 Potential Effects during the Decommissioning Phase

9.5.4.1 Direct Effects

Potential Direct effects during the decommissioning phase will be similar to the potential Direct effects during Construction e.g., emissions to water from all hydrocarbons (fuel, oil), hydraulic fluids, silt material (sands, gravels and nutrients) and concrete/ cement-based products. This includes removing the turbines and any GCR cabling.

Potential direct impacts also include the release of suspended solids into watercourses within and surrounding the Site, either directly (spillage of contaminant into watercourses, or siltation of watercourses through disturbance, vegetation clearance and/ or drainage activities).

These sources and pathways have the potential to impact aquatic environments, including fish and fish habitats.

The potential effects of the decommissioning phase on watercourses resulting from the emissions to water is considered to be **Significant Negative** and **Temporary** (less than 1 years) at the **Local Lower** scale in the **absence of mitigation measures**. The frequency of potential effects is limited to the duration of the decommissioning phase and effects are assessed as reversible.

9.5.4.2 Indirect Effects

Potential Indirect effects during the decommissioning phase will be similar to the potential Indirect effects during Construction e.g., Disturbance via noise or vibration in the terrestrial areas of the Site.

Overall, potential indirect effects are considered to have the potential to be **Imperceptible** and **Temporary** (less than 1 years) at a **Townland/ Local Lower** scale in the **absence of mitigation measures** and effects are assessed as reversible.

9.6 MITIGATION MEASURES

The following mitigation measures will be put in place to protect aquatic ecology during all stages of works. The Operational phase of the project is not considered to pose a significant impact on the aquatic ecology in the immediate and wider area.

Within the design of the project good practice environmental and pollution control measures will be employed in accordance with current best practice guidance such as, but not limited to, the following:

- CIRIA C532, 'Control of water pollution from construction sites: guidance for consultants and contractors' (2001).
- CIRIA C741, 'Environmental good practice on site guide' (Kwan et al., 2023).
- IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.

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9.6.1 Embedded Mitigation

The project incorporates embedded mitigation aimed at minimising the potential impacts during the design phase. This includes the design principle of maintaining set-backs of 50 m for turbines and associated infrastructure from watercourses and utilising existing forestry access tracks where feasible.

9.6.2 Construction Phase Mitigation

Construction phase mitigation for hydrology and water quality should follow that outlined in Section 2.6.15 of Chapter 2 of the EIAR, and the mitigation measures outlined should be adhered to in conjunction with those outlined in this section. Construction phase mitigation measures for aquatic ecology predominantly involve the preservation of water quality.

All measures for the protection of water quality within the project Site, as detailed in the CEMP (see **Appendix 2.1**), will also protect the aquatic ecology and fisheries value of downstream watercourses. The measures adopted within the CEMP (including recommendations from IFI) will ensure effective protection of aquatic ecological interests downstream of the project, particularly the habitats supporting sensitive aquatic species and/or with hydrological connectivity to any designated sites.

9.6.2.1 Mitigation by Avoidance

A key mitigation measure during the construction phase is the avoidance of hydrological features, by the implementation of buffer zones (i.e. 50 m to main watercourses, and 10 m to main drains) except for the watercourse crossings, road development and drainage measures as detailed on the Water Quality Management Plan. The proposed buffer zone will avoid physical damage to watercourses and associated release of sediment; and also avoid the entry of suspended sediment from earthworks into watercourses. The site compound and any temporary soil storage areas will also be located at a minimum distance of 50 m from any watercourse. No crossing of rivers or streams by machinery will be permitted, all machinery must stay within the designated routes. In addition, roadside drains will not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on

design drawings. Work in or near water is expected to be limited to construction of drainage outfalls and pre-construction felling.

No plant maintenance will be completed on-site, with any broken-down plant removed from site to be fixed. All machinery will be serviced before being mobilised to site and will be fully maintained and routinely checked during operation to ensure no leakage of oils or lubricants occurs. All fueling of machinery will be undertaken at a discrete "fuel station" designated for the purpose of safe fuel storage and fuel transfer to vehicles (see Section 2.7.3 in Chapter 2 of the EIAR). Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water; and, where necessary, fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores procedures. Contingency plans will be set up to deal with emergency accidents or spills; an emergency spill kit with oil boom and absorbers will be kept on site in the event of an accidental spill.

Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall to minimise contact with water.

Ready-mix concrete will be delivered to the Site with no concrete batching on the Site and a dedicated, bunded area will be created to cater for concrete wash-out from chutes (see Section 2.7.4 in Chapter 2 of the EIAR). The concrete wash water will be discharged to a lined basin in order that it be disposed of at a licensed facility as outlined in the CEMP – Management Plan 5 - Waste Management Plan (**Appendix 2.1**). Any waste which is not recyclable or compostable will be properly disposed to landfill.

9.6.2.2 Mitigation by Design

The proposed surface water management system, including existing and proposed infrastructure, will be inspected and confirmed to be of sufficient capacity to prevent any potential emissions to water entering the watercourses on Site. This will include adopting SuDS principles, catering for a 1 in 100-year rainfall event, and maintaining existing natural flow paths where possible to avoid significant hydrological changes on site.

All site drainage, as described in the surface water management plan and shown on associated drawings, will be directed through either sediment traps, settlement ponds and/ or buffered drainage outfalls (NRA, 2006) to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25 mg/l (IFI, 2016). To address sediment on

site, a spoil management plan has been developed which details the location and positioning of spoil heaps on site and the requirement for silt fencing near watercourses. Additionally, in periods of dry weather, damping down dust may be required on site and the covering of Heavy Goods Vehicles (HGVs) may be required to prevent dust generation. Chemical, silt and other suspended pollutant transport will be reduced by providing a "treatment train" of two to three stages of pollutant removal to all surface water runoff prior to discharge. Daily monitoring of all sediment traps and settlement ponds will be undertaken by the Environmental Manager or Ecological Clerk of Works to ensure satisfactory operation and/ or maintenance requirements. Re-seeding/ re-vegetation of all areas of bare ground or the placement of Geojute (or similar) matting will take place prior to the operational phase to prevent silt-laden runoff.

Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, away from any watercourse or drainage ditches and will adhere to best practice. Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution, with further equipment available (such as absorbent booms) if required. If a hydrocarbon contamination incident were to occur, it will be dealt with immediately. Hydrocarbon spill kits will be prepared and kept in vehicles associated with the construction phase of the project. Spill kits will also be established at proposed construction areas, for example, a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Spill kits will also be available in designated areas throughout the Site. Suitable receptacles for hydrocarbon contaminated materials will also be at hand. Escalation can include measures such as the installation of temporary sumps, drains or dykes to control the flow or migration of hydrocarbons, excavation and disposal of contaminated material. On site training and toolbox talks will ensure any response to any potential incident is mobilised quickly and efficiently.

Mess and welfare facilities will be required during the construction phase and will be located at the construction compounds. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e., there shall be no emission of treated or untreated foul effluent on the Site).

Depending on the timing of the proposed works, different life stages of migratory fish species may be impacted by factors such as noise and disturbance associated with the installation of hardstands, or by increased sediment ingress into the watercourse during works involving excavation. Spawning and egg incubation for salmon occurs from October to February and for lamprey species from March to May. As a result, the construction of

watercourse crossings will be undertaken during the period July to September as set out in Inland Fisheries Ireland Guidance (2016) to avoid accidental damage or siltation of spawning beds, unless otherwise specified by Inland Fisheries Ireland during consultations in advance of works. Work in or near water is expected to be limited to construction of drainage outfalls and pre-construction felling.

The Proposed Development will result in the loss of a limited amount of habitat of significant ecological importance in a local context, for example, small areas of wet grassland will be lost by a section of track leading southwards from Turbine T04 (estimated at 150 m²). A Biodiversity Enhancement and Management Plan (BEMP) will be created to offset these losses by looking at the enhancement of certain habitats on site.

An Ecological Clerk of Works (ECoW) will be employed to monitor the Site and review the emissions to water control measures and working practices during construction (see Section 2.7.12 in Chapter 2 of the EIAR). The ECoW will be educated to degree or diploma in ecology or a related field, with experience and knowledge gained in similar roles, ideally on large civil engineering projects, of environmental legislation, wildlife legislation, and the ecology of the site. The ECoW will check for fish activity before any works adjacent to watercourses and advise on whether the work should be rescheduled. A full specification for the water quality monitoring is presented in the Water Quality Management Plan.

9.6.3 Operational Phase Mitigation

On completion of the construction stage, any areas not required for operation will be reinstated. Drainage will be reinstated, if required, to minimise future erosion of the soils and restore the pre-development state of the environment. To verify the efficacy of pollution prevention and mitigation works (during construction), Water Quality Monitoring is required to be undertaken by a suitably qualified Environmental Consultant(s) (qualified to minimum of degree level with a minimum of 5 years' relevant experience), prior to, during and post completion of construction works. A Biodiversity Enhancement and Management Plan (BEMP) will be developed to further mitigate against changes to landscape, for example, that could otherwise lead to increased drought or flushing events.

The temporary works areas will be reinstated using the original spoil material removed and stockpiled close to the location from where it was excavated. Silt traps erected (during the construction phase) within roadside and artificial drainage will be replaced with stone check dams for the operational lifespan of the project. These stone check dams will only be placed

within artificial drainage systems such as roadside drains and not in natural streams or drainage lines. A full review of construction stage temporary drainage will be undertaken by the Developer (in conjunction with the Project Hydrologist/ Site Engineer and the Project Ecologist) following the completion of construction, and drainage removed or appropriately blocked where this will not interfere with infrastructure. ECoW will monitor and review the emissions to water control measures and working practices. Mitigation against emissions to water will also be applied during maintenance visits.

9.6.4 Decommissioning Phase Mitigation

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

9.7 CUMULATIVE EFFECTS

Following the incorporation of mitigation measures for the potential effects of the project, a review of proposed and active developments which may have sources and pathways effecting the same receptors (under consideration for the project) was completed and the following developments were taken forward for potential cumulative effects consideration.

9.7.1 Kilsaran Quarry

Kilsaran Quarry, operated by Kilsaran Concrete, is situated immediately adjacent to the Site, with three turbines to its south, one to its south west and one to its south east, and access routes extend the redline boundary to almost completely encircle the quarry. It is a large (84.5 ha) quarry with a licence (granted on 27 November 2023) to operate for 25 years following which there will be a two year restoration period. The quarry sits mainly in the catchment of the Slieveboy Stream (EPA Slieveboy_010), draining the north, but a small part of the south west is in the catchment of the Hammondstown Stream (White (Louth)_010) and part of the south east is in the catchment of the Drumshallon Lough Stream (Termonfeckin_010), both of which rise in the area encompassed by the project. The quarry, whilst operational, is considered due the expansion of the extraction area and the planned restoration of the lake, following its operational lifespan.

9.7.1.1 Extraction area extension

The 2023 licence granted permission to extend the size of the extraction area from 37.5 ha to 47.5 ha.

Slieveboy Stream is to be crossed north of the quarry by an access track from Local Road L6274. As the majority of the water in this stream derives from the quarry, and will originate in due course from the restored lake, there is a potential cumulative impact. Water samples taken from downstream of the quarry discharge in 2021 showed low concentrations of nutrients, with orthophosphate as P within the Water Framework Directive (WFD) threshold for High status, and similar results for organic pollution indicators ammonia and BOD (Tom Phillips Associates, 2022). These results are in line with data collected from this stream in 2023 (see the Technical Appendix – APEM, 2023). As surface water and groundwater seepage from the quarry passes via a settlement canal and hydrocarbon interceptor prior to discharge, no changes to quality of water being discharged are anticipated following the expansion. Therefore, there is no cumulative effect on the river drainage to Slieveboy_010 catchment during quarry operation.

9.7.1.2 *Lake restoration*

Following the operational lifespan of the quarry, the restoration of the site is to include flooding of the excavated area to create a c. 45 ha lake up to 35 m deep.

Within the quarry, all surface water runoff from site hardstanding/ yards and pumped discharges from the quarry void sump (comprising mainly rainfall and surface water runoff) are discharged to Slieveboy Stream via a licensed discharge point. Due to the void created by the quarry excavation there is no surface water drainage from the site to the south west or south east. When the lake is created following restoration, there are no plans to alter this flow direction. Therefore, there is no cumulative effect on the river drainage to the White (Louth)_010 or Termonfeckin_010 catchments.

The effect on water quality of the lake restoration will be determined by such factors as the methods used to carry out the restoration (causing short-term impacts) and any recreational or other uses to which the lake is put after restoration (causing long-term impacts). No details are available for these so it is premature to assess this impact at this time. It is assumed that the lake restoration will be subject to a planning application in due course. .

9.7.2 *Other developments*

There are five wind farms, to the west and north, within 20 km of the Site (Table 2.1), the closest being approximately 11.4 km away. All are operational and none are situated within the river catchments affected by the Site. Therefore, there is no cumulative effect on the river drainage.

No other significant developments have been identified that may have a cumulative effect on aquatic ecology.

9.8 SUMMARY OF EFFECTS

9.8.1 Assessment of Significant Residual Effects

The project may result in the degradation of water quality in aquatic habitats within and downstream of the Site, however the likelihood of emissions to water occurring is significantly reduced due the proposed mitigation measures. **Residual effects** on fish and fish habitat are **not predicted to be Significant** (Table 9.10 - Table 9-12).

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Table 9.10: Summary of Construction impacts, mitigation measures, residual effects

Project element	Pre-mitigation Impacts	Effects (Pre-Mitigation)	Mitigation Measures	Residual Effects following Mitigation
Construction activities	Direct: <ul style="list-style-type: none"> • Refuelling • Concrete • Dust release • Ground disturbance • Watercourse crossings 	Significant Negative and Temporary at County scale	<ul style="list-style-type: none"> • Buffer zones from watercourses • No permitted crossing of rivers or streams by machinery • Watercourse crossings to be completed July - Sept • Discrete “fuel station” with contingency plans for spills • No concrete batching on-site • Dust suppression bowser 	Not significant
	Indirect: <ul style="list-style-type: none"> • Ground disturbance • Noise • Site hydrology 	Slight Negative and Temporary at a Townland/ Local Lower scale	In addition to above measures: <ul style="list-style-type: none"> • Riparian buffers and sediment traps/ ponds • Revised Surface Water Management Plan • Biodiversity Enhancement and Management Plan 	Not significant
TDR	Direct: <ul style="list-style-type: none"> • Construction of a temporary road • Watercourse crossings • Refuelling 	Significant Negative and Temporary at County scale	<ul style="list-style-type: none"> • Riparian buffers and sediment traps/ ponds • Watercourse buffer for excess spoil location/ removed from site to licenced facility • Revised Surface Water Management Plan • Discrete “fuel station” with contingency plans for spills 	Not significant
	Indirect: <ul style="list-style-type: none"> • Site hydrology from vehicles • Ground disturbance 	Slight Negative and Temporary at a Townland/ Local Lower scale	<ul style="list-style-type: none"> • Riparian buffers and sediment traps/ ponds 	Not significant
GCR	Direct: <ul style="list-style-type: none"> • Road excavation 	Significant Negative and Temporary at County scale	<ul style="list-style-type: none"> • Riparian buffers and sediment traps/ ponds • Dust suppression bowser • Watercourse buffer for excess spoil location/ removed from site to licenced facility 	Not significant
	Indirect: <ul style="list-style-type: none"> • Horizontal directional drilling works 	Slight Negative and Temporary at a Townland/ Local Lower scale	<ul style="list-style-type: none"> • Buffer zones from watercourses • Riparian buffers and sediment traps/ ponds • Dust suppression bowser • Watercourse buffer for excess spoil location/ removed from site to licenced facility 	Not significant

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Project element	Pre-mitigation Impacts	Effects (Pre-Mitigation)	Mitigation Measures	Residual Effects following Mitigation
	<ul style="list-style-type: none"> • Construction of Joint bays; Communication chambers 			

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Table 9-11: Summary of Operational impacts, mitigation measures, residual effects

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Project element	Pre-mitigation Impacts	Effects (Pre-Mitigation)	Mitigation Measures	Residual Effects following Mitigation
Windfarm	Direct: • Watercourse crossing for operational maintenance	Imperceptible in the Long-term (15 to 60 years) at a Local Lower scale	<ul style="list-style-type: none"> • No permitted crossing of rivers or streams by machinery • Watercourse crossings to be completed July - Sept 	Not significant
	Indirect: • Site hydrology	Imperceptible in the Long-term (15 to 60 years) at a Local Lower scale	<ul style="list-style-type: none"> • Biodiversity Enhancement and Management Plan • Review of temporary drainage 	Not significant
TDR	This element is not applicable to the operational phase.			
GCR	Direct: • Runoff from cable maintenance	Imperceptible in the Long-term (15 to 60 years) at a Local Lower scale	<ul style="list-style-type: none"> • Riparian buffers and sediment traps/ ponds • Revised Surface Water management plan • Reinstatement of drainage where necessary • Water quality monitoring 	Not significant

Table 9-12: Summary of Decommissioning impacts, mitigation measures, residual effects

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Project element	Pre-mitigation Impacts	Effects (Pre-Mitigation)	Mitigation Measures	Residual Effects following Mitigation
Decommissioning activities	Direct: <ul style="list-style-type: none"> • Refuelling • Concrete • Dust release • Ground disturbance • Watercourse crossings 	Significant Negative and Temporary at the Local Lower scale	Information will be contained within the site Decommissioning Plan which will manage and control the component removal and ground reinstatement.	Not significant
	Indirect: <ul style="list-style-type: none"> • Dust release • Ground disturbance • Noise • Site hydrology 	Imperceptible and Temporary at a Townland/ Local Lower scale		Not significant
TDR	Direct: <ul style="list-style-type: none"> • Decommissioning of temporary road • Watercourse crossings • Refuelling 	Significant Negative and Temporary at the Local Lower scale		Not significant
	Indirect: <ul style="list-style-type: none"> • Site hydrology from vehicles • Ground disturbance 	Imperceptible and Temporary at a Townland/ Local Lower scale		Not significant
GCR	Direct: <ul style="list-style-type: none"> • Ground disturbance 	Significant Negative and Temporary at the Local Lower scale		Not significant

9.9 STATEMENT OF SIGNIFICANCE

With the proposed mitigation successfully implemented, **No Significant Residual Effects** are predicted upon aquatic ecological features within the zone of influence, from the project.

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9.10 REFERENCES

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9.11 PLATES

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Plate 1. Drumshallon Lough, water quality location



Plate 2. Site 2 water quality and kick sample location, photo facing upstream



Plate 3. Site 3 water quality and kick sample location, facing downstream



Plate 4. Site 4 unsuitable for water quality or kick sampling



Plate 5. Site 5 water quality location, unsuitable for kick sampling



Plate 6. Site 6 water quality and kick sample location, facing downstream



Plate 7. Site 7 water quality and kick sample location, facing downstream



Plate 8. Site 8 water quality location, unsuitable for kick sampling

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