MWP

Chapter 06 Biodiversity

Ballinla Wind Farm

Ballinla Wind Farm Ltd.

August 2025

Contents

Tables

Figures

Plates

Appendices

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
23882	6019	A	28/08/2025	OS	HD	HD	Final

MWP, Engineering and Environmental Consultants
Address: Reen Point, Blennerville, Tralee, Co. Kerry, V92 X2TK
www.mwp.ie

6. Biodiversity

6.1 Introduction

This chapter considers the potential effects on biodiversity arising from the Proposed Development. Potential effects to birds is assessed separately in Chapter 7 – Ornithology. A full description of the Proposed Development lands and all associated project elements is provided in Chapter 2 of this EIAR. The nature and probability of effects on biodiversity arising from the overall project has been assessed. The assessment comprises:

- A review of the existing receiving environment.
- Prediction and characterisation of likely impacts.
- Evaluation of effects significance.
- Consideration of mitigation measures, where appropriate.

6.1.1 Competency of Assessor

The assessment was completed by Otto Storan (MSc., BSc., (Hons)), ecologist with MWP. Otto holds an MSc in Applied Environmental Science from University College Dublin and an honours BSc in Applied Freshwater and Marine Biology from Atlantic Technological University. Otto's core professional work to date has focussed on the implementation of European legislation in the context of the Water Framework Directive, the Habitats Directive, Birds Directive and EIA Directive and he has undertaken and prepared assessment reports for a range of coastal, marine, and terrestrial projects.

Surveying and reporting on bats were undertaken by Rob Beer (BSC, MRSB) Senior Ecologist at MWP. Rob is a Senior Ecologist with seven years full-time experience, since graduating in 2017. Before joining MWP in March 2024, Rob had previously been working in the UK. Rob is experienced in a range of standard and complex ecological surveys in accordance with British standards, including, but not limited to, UK habitat classification surveys and JNCC[1] Phase 1 surveys, Biodiversity Net Gain (BNG) metric and reporting, bat surveys (stages 1 & 2), reptile surveys, badger surveys, & great crested newt (GCN) surveys. Rob has also authored ecological reports within an Irish setting including, but not limited to, Screenings for Appropriate Assessment Reports, Natura Impacts Statements and Ecological Impact Assessments. Rob is a holder of a Natural England bat license level 2, a holder of a Natural England GCN license level 1 and has a FISC[2] level 2 certificate. Rob is also a holder of a National Parks and Wildlife Service (NPWS) bat survey license (License Number: DER-BAT-2025-213).

The aquatic report for the Proposed Development has been prepared by Gerard Hayes. Gerard is a Senior aquatic ecologist with over 15 years' experience in environmental consultancy. He is a Member of the Chartered Institute of Ecology and Environmental Management (MCIEEM), a Member of the Freshwater Biological Association (FBA) and has Certified FBA accreditation in Identification of Freshwater Invertebrates to Family Level. Gerard has wide-ranging experience in all aspects of wind farm development relating to aquatic and terrestrial ecology and has authored numerous biodiversity assessments and enhancement plans for wind farm EIAR's.

[1] Joint Nature Conservation Committee (JNCC) - Public body that advises the Government of the United Kingdom on UK-wide and international nature conservation
[2] Field Identification Skills Certificate (FISC) from the Botanical Society of Britain and Ireland (BSBI)

6.1.2 Legislation and Published Guidance

Important legislation underpinning biodiversity and nature conservation in Ireland comprises the:

- EU Habitats Directive (92/43/EEC), as amended.
- EU Birds Directive (2009/147/EC, as amended).
- EU Water Framework Directive (WFD, 2000/60/EC).
- European Communities (Birds and Natural Habitats) Regulations 2011 to 2015 (S.I. 477/2011) and the European Union (Birds and Natural Habitats) (Amendment) Regulations 2021 (S.I. 293/2021).
- Planning and Development Act (2000), as amended.
- Planning and Development Regulations 2001 to 2023, as amended.
- Wildlife Acts 1976 to 2021, as amended.
- Flora (Protection) Order, 2022.

The following other guidance documents and relevant publications were considered:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (Environmental Protection Agency, 2022)
- Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018).
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009).
- Best Practice Guidance for Habitat Survey and Mapping (Smith *et al.*, 2011).
- Guidance document on wind energy developments and EU nature legislation. Guidance document (European Commission, 2020).
- A Guide to Habitats of Ireland (Fossitt, 2000).
- Habitat Survey Guidelines: A Standard Methodology for Habitat Survey and Mapping in Ireland (The Heritage Council, 2011).
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority[3], 2009).
- Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (SNH[4], 2019, 2021).
- Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. (Marnell *et. al*, 2022).
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th Edition). (BCT/Collins, 2023).
- Other information sources and reports footnoted in the course of the report.

Additionally, the Planning and Development (Amendment) (No. 2) Regulations 2023 includes new criteria as for what requires an EIAR. Amendment of Schedule 5, Part 2 of the Principal Regulations states the following.

[3] National Roads Authority, currently known as Transport Infrastructure Ireland (TII). Guidelines available at https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf
[4] NatureScot is the operating name for the body formally called Scottish Natural Heritage (SNH).

"(a) Projects for the restructuring of rural land holdings, undertaken as part of a wider proposed development, and not as an agricultural activity that must comply with the European Communities (Environmental Impact Assessment) (Agriculture) Regulations 2011, where the length of field boundary to be removed is above 4 kilometres, or where re-contouring is above 5 hectares, or where the area of lands to be restructured by removal of field boundaries is above 50 hectares."

6.2 Methodology

6.2.1 Scope of Assessment

This assessment has been prepared for the Proposed Development following a comprehensive desk study, supplemented by ecological walkover surveys undertaken in June 2023, January and February 2024 and aquatic surveying undertaken in August 2023 to establish an ecological baseline of the Proposed Development.

The objectives of the assessment are as follows:

- Establish an ecological baseline of the Proposed Development.
- Identify and evaluate the natural environment and relevant ecological features regarding nature conservation importance in compliance with current methodologies outlined under National and International best practice guidelines.
- Determine, assess and evaluate potential direct, indirect and cumulative impacts and effects on biodiversity.
- Anticipate and prescribe mitigation and avoidance measures to reduce or remove potential impacts of the Proposed Development

6.2.2 Data Requests

A data request for records of rare and protected species records from the hectad N53 was submitted to NPWS on the 20th November 2024. An updated data request was submitted to NPWS on the 1st August 2025 for all relevant hectads (N42, N52, N53 and N62). Data was received from the NPWS on the 25th August 2025.

6.2.3 Consultation

The following statutory and non-statutory bodies were consulted in relation to biodiversity issues from the Proposed Development:

- An Taisce
- Department of Agriculture, Food and the Marine
- Department of Business, Enterprise and Innovation
- Department of Communications, Climate Action and Environment
- Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media
- Department of Housing, Local Government & Heritage,
- Health Service Executive
- Inland Fisheries Ireland (IFI)

- The Commission for Regulation of Utilities (CRU)
- Department of Transport
- Transport Infrastructure Ireland
- Fáilte Ireland
- Heritage Council
- Irish Aviation Authority
- Waterways Ireland
- Birdwatch Ireland
- Friends of the Earth
- Friends of the Irish Environment
- Irish Peatland Conservation Council
- Irish Wildlife Trust

A full list of consultees is available in Volume II Appendix 1-2 of the EIAR.

6.2.4 Study Area

6.2.4.1 Desktop Study

The methodology used for this study included desk-based research of published information and data on sites designated for nature conservation, protected habitats and species, other ecological resources/features occurring or likely to occur, and other sources of information to assemble information on the local receiving environment. The desk study included review of the following:

- Ordnance Survey Mapping and aerial photography to establish existing land use and settlement patterns within the Study Area.
- National Parks and Wildlife Service (NPWS) online mapping and datasets.
- Heritage Council Maps online mapping.
- National Biodiversity Data Centre (NBDC) online mapping and datasets.
- NPWS Article 17 interactive map viewer for Annex I habitats[5].
- EPA online mapping and datasets.
- GSI online mapping.
- Offaly County Development Plan 2021 – 2027 (As Varied).
- Offaly County Development Plan 2021 – 2027: County Wind Energy Strategy
- Offaly Biodiversity Action Plan (as incorporated into Offaly Heritage Plan 2023 – 2027).
- National Biodiversity Action Plan 2017 – 2021.

[5] https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17

- Bat Conservation Ireland – http://www.batconservationireland.org. in order to map Bat Habitat Suitability Index rating to determine an area's landscape suitability for Irish bat species.
- Invasive Species Ireland - http://www.invasivespeciesireland.com/.
- Review of records of plant species protected under the Flora (Protection) Order (2022).
- Ireland Red Lists[6].
- Inland Fisheries Ireland (IFI) fish sampling reports and fish data online.
- Checklists of Protected and Threatened Species in Ireland. *Irish Wildlife Manuals,* No. 116 (Nelson, *et al*., 2019).
- Review of requested records from NPWS Rare and Protected Species database and Bat Conservation Ireland (BCIreland) bat records/roost database.
- All-Ireland Pollinator Plan 2021-2025.
- Other information sources and reports footnoted or referenced.

6.2.4.2 Field Surveys

6.2.4.2.1 Habitats and Flora

Habitat surveys were undertaken on the 14th of June 2023 and on the 26th of January 2024, with a re-examination of the habitats undertaken during non-volant mammal surveying undertaken on the 22nd and 23rd of February 2024. Habitats were mapped according to the classification scheme outlined in the Heritage Council publication 'A Guide to Habitats in Ireland' (Fossitt, 2000) and following the guidelines contained in 'Best Practice Guidance for Habitat Survey and Mapping' (Smith *et al.*, 2011).

Habitat surveys and mapping were considered when identifying ecological constraints during the early design stages of the Proposed Development. Higher value habitats were avoided from the developable area of the Proposed Development where possible.

In conjunction with the habitat surveys, botanical surveys were completed within the Study Area and included a 'look-see' search methodology (NRA, 2009) within habitat features likely to support protected species. This aimed to confirm the presence of plant species considered to be rare in both a national and local context (Scannell and Synnott, 1987), but with particular emphasis on the following:

- The plant species listed in Annex II of the EU Habitats Directive.
- Flora Protection Order species (FPO) (2022).
- Flora species listed in the Irish Red List for Vascular Plants (Wyse Jackson *et al.,* 2016).

Plant nomenclature for vascular plants followed 'Webb's An Irish Flora' (John Parnell and Tom Curtis Eight Edition). Classification of mosses and liverworts followed 'Mosses and Liverworts of Britain and Ireland: a field guide' (Atherton *et al.*, 2010).

During habitat and flora surveys of the Study Area, any invasive plant species were recorded, with a focus on those species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2011). Any infestations encountered were recorded with regard to species, location and extent of infestation, and a photographic record made.

[6] https://www.npws.ie/publications/red-lists

The Study Area refers to a broad geographical area within which habitats and biodiversity have been identified and assessed. This area comprises land and natural features, including areas outside the immediate Proposed Development footprint, and is used to determine baseline data collection and to ensure all ecological aspects are considered.

The Proposed Development boundary refers to the areas within which construction and operational phase activities associated with the proposed wind energy development will take place. This boundary is confined to the immediate Proposed Development footprint and includes turbine hardstands, substation, access tracks and other ancillary infrastructure. The Proposed Development boundary represents the physical limits within which works will take occur and any potential impacts to biodiversity will be assessed with respect to this defined area.

6.2.4.2.2 Non-Volant Mammals

The scope of the non-volant mammal (land-based mammals that cannot fly) surveys were informed by the initial ecological surveys carried out across the Study Area on the 14th of June 2023 and the 26th of January 2024, as well as by species previously recorded in the 10km square N52 and N53 hectads encompassing the Study Area.

Surveys to document non-volant mammals onsite were undertaken on the 22nd and 23rd of February 2024. The surveys targeted species protected under the Wildlife Acts 1976 to 2021, as amended, species listed in Annex II, Annex IV and Annex V of the Habitats Directive, and Irish Red Listed species (Marnell *et al*. 2019). Particular focus was given to protected species such as Badger (*Meles meles*), Irish hare (*Lepus timidus hibernicus*), Pine marten (*Martes martes*), and Otter (*Lutra lutra*) in consideration of the type of habitat features present within the Study Area and the species records listed by the NBDC for hectad N52 and N53.

These surveys involved a comprehensive search for all mammal activity in the form of prints, scat, resting/breeding places, feeding signs, mammal trails and direct observations. These surveys had regard to 'Animal Tracks and Signs' (Bang and Dahlstrom, 2004) and 'Ecological Surveying Techniques for Protected Flora and Fauna' (NRA, 2009). Badger surveys were carried out on the 22nd of February 2024, which confirmed three setts were located in the northwest of the site. The location of these setts are shown in Section 6.3.7.1.2. Surveying for badgers followed methodology in '*Surveying for Badgers: Good Practice Guidelines*' (Scottish Badgers, 2018).

Otter surveys were carried out with a particular focus given to watercourses within the Study Area. Surveys of existing stream crossings were completed as part of the mammal surveys conducted on the 22nd and 23rd of February 2024. Survey methodology had regard to '*Monitoring the Otter Lutra lutra'* (Chanin, 2003a) and '*Ecology of the European Otter'* by Chanin (2003b). Otter signs searched for included spraints, footprints, tracks, couches, and holts.

Pine marten surveys were completed as part of the overall non-volant mammal surveys on the 22nd and 23rd of February, 2024. Surveys for this species primarily focused on the conifer plantation and woodland areas present within the Study Area. Any evidence of pine marten activity in the form of scat, prints and resting/breeding places was recorded.

Two trail cams were deployed within the site on the 22nd of February and were collected on the 9th of March 2024. Trail cams were deployed under licence (licence no. 227/2023).

6.2.4.2.3 Bats

Field surveys were carried out to identify and investigate potential bat roosting features at the Proposed Wind Farm, along the proposed grid route at points of interest, and along the proposed turbine delivery route. All structures with potential to host roosting bats were inspected visually from ground-level. Roosting features' potential is described according to Collins (2023). In addition, bat activity at the proposed wind farm was investigated using a combination of active and passive bat detector surveys.

A number of surveying methodologies were undertaken to inform the assessment of likely effects of the Proposed Development on bats, including:

- Bat foraging and commuting habitat suitability survey.
- Preliminary Roost Assessment (PRA).
- Nighttime Bat Walkover survey (NBW).
- Passive Automated Bat survey (PAB).

Details of the methodologies of these surveys are detailed in Appendix 6-2 Ballinla Bat Survey Report. Preliminary Roost Assessment surveys were undertaken on the 23rd of April, 2024, nighttime bat walkover surveys were conducted on the 23rd of April, 14th of May, 16th of June and 8th of August, the 3rd of September and the 12th of September. The ground-level static surveys were undertaken over the course of the 2023-2024 bat season.

PAB surveys deployed static units for the summer and autumn seasons of 2023 and for the spring, summer, and autumn seasons in 2024 for ten consecutive nights within each season. Initial PAB surveys across the summer and autumn 2023 seasons determined the majority of bat activity across the site is within the northern section which is possibly influenced by the Grand Canal which may be a valuable commuting and foraging resource for bats in the Proposed Development site. The PRA survey was conducted on the 23rd of April 2024, by a licenced MWP bat surveyor to inspect any buildings, structures and trees which could support roosting bats. PAB survey efforts were initially undertaken to capture data on the extent of bat activity within the site. Consequently, static detectors were deployed across areas in an attempt to capture as much habitat representation across the Proposed Development site as possible.

A daytime walkover survey of farmland in the centre-west of the Study Area was undertaken on January 28th, 2025, to determine presence of potential roost features and general habitat suitability of this area.

6.2.4.2.4 Freshwater Aquatic Survey

As part of the aquatic survey report (see Appendix 6-1), biotic indices (Q rating system and Ephemera, Plecoptera, Tricoptera Index (EPT)) were used to assess water quality from ten identified watercourses which comprise EPA registered water bodies and identified field drains (see Figure 6-1). These indices use species richness and relative abundance to determine biological water quality. Results from indices indicate watercourses in the receiving environment are largely degraded due to excessive siltation and enrichment. Unsatisfactory ecological conditions were recorded at all locations.

The Study Area was defined as fluvial habitats (watercourses) potentially affected by the Proposed Development, including within the Proposed Development site, and those downstream, within the receiving environment.

Survey sites were selected on waterbodies within and downstream of the Proposed Development. It is noted that there was once a standing waterbody in a field to the northeast of the site. This waterbody, which appeared to be a semi-natural pond, based on historical aerial imagery has been infilled and is mapped in the habitat map as spoil and bare ground (ED2).

The field surveys comprised an evaluation of aquatic habitats, fish assessments and biotic assessment using aquatic macroinvertebrates, as well as onsite physico-chemical water quality measurements. Water quality affects the viability and quality of salmonid habitat so is useful in assessing habitats for aquatic organisms, including trout (*Salmo trutta*) and salmon (*S. salar*). To this end biological sampling and water quality indices were used to evaluate watercourses at selected locations. This field work was carried out on the 14th and 15th June (biological sampling) and 2nd and 3rd August (electric fishing carried out under licence) during 2023. A survey was also undertaken on 26th January when water levels were higher to determine if any waterbodies within the Proposed Development site drained to the north.

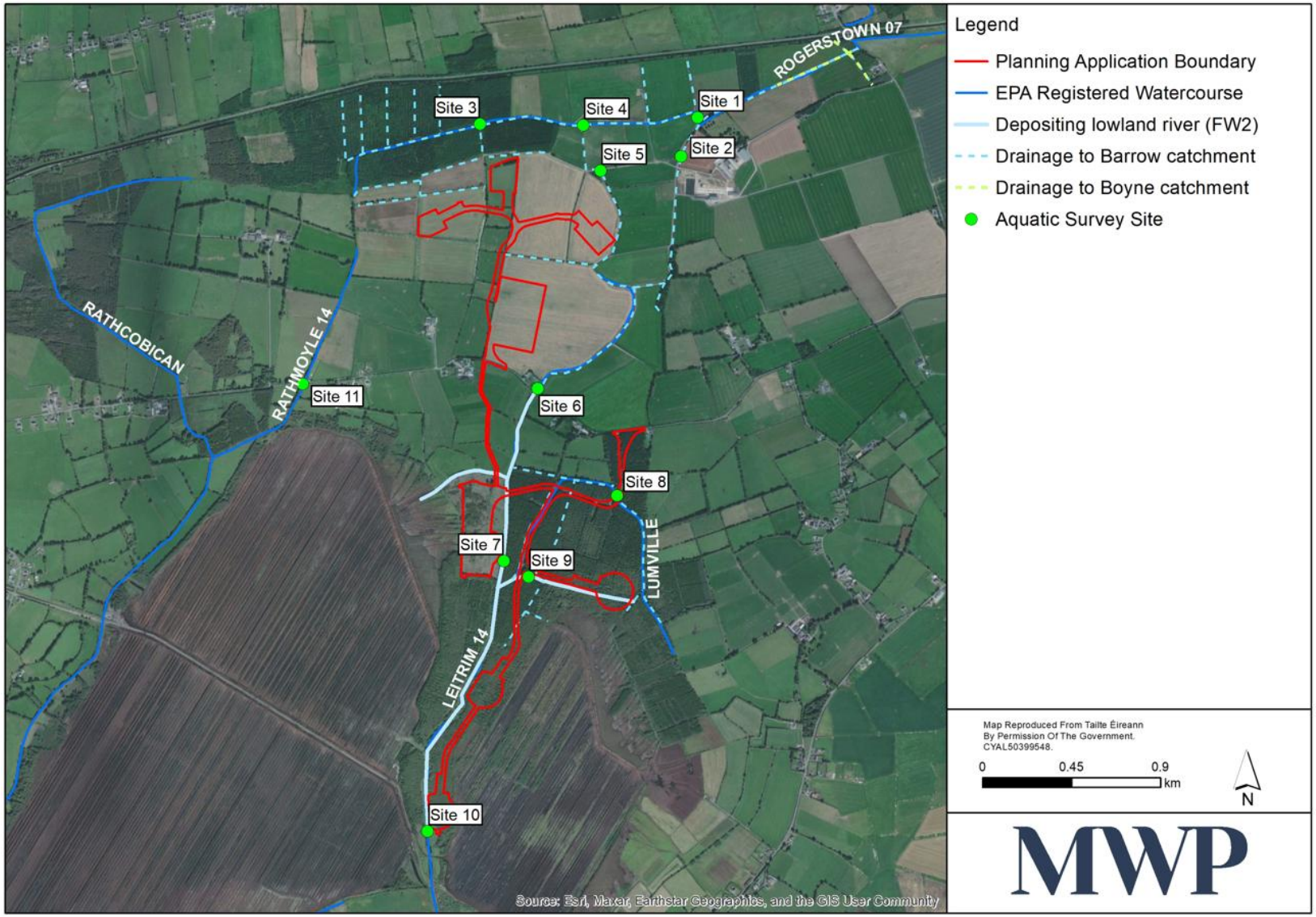

Figure 6-1: Location of Sites Assessed During Aquatic Surveys, see Appendix 6-1

Statement of Limitations and Difficulties Encountered

Limitations to methodologies, procedures, equipment and knowledge can arise during the course of an ecological assessment. Some limitations may be foreseen and can be accounted for while others may not be apparent until the actual assessment has taken place.

The Study Area contains areas of dense conifer mixed forestry plantation in the south of the site. Due to the inaccessibility of these areas, the internal forestry area could not be fully surveyed. However, clearings and the outskirts of the plantations were accessible for surveys.

A trail camera became dislodged after having been deployed outside of a potential badger sett. This location has been identified as a badger sett using the precautionary principle and due to the presence of recent activity by way of latrines and fresh digging in the vicinity of the suspected sett. The necessary protection measures outlined in *Guidelines for the Treatment of Badgers Prior to the Construction of National Roads Schemes* (NRA, 2005. 2009) will be applied in this case.

6.2.5 Ecological Value

The cumulation of desk study and ecological surveys determined the potential Important Ecological Features (IEFs) likely to occur in the zone of influence (ZOI) of the Proposed Development. Potential IEFs include protected habitats and species listed under the following legislation.

- Annexes listed in the EU Habitats Directive (92/43/EEC)
- Qualifying Interest (QI) of Special Protection Areas (SPA)/ Special Areas of Conservation (SAC) within the likely Zone of Influence
- Species Protected under the Wildlife Acts 1976-2021 (as amended)
- Species Protected under the Flora Protection Order (FPO), 2015

The value of the ecological receptors was determined using the ecological evaluation guidance given in the National Roads Authority (NRA) Ecological Assessment Guidelines published in 2009 (NRA, 2009) as well as guidance provided in Guidelines for Assessment of Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018). This evaluation scheme seeks to provide value ratings for ecological receptors, with values ranging from Locally Important to Internationally Important in an Irish context.

The function of this evaluation scheme is primarily to assess the value of a site. In this case, the scheme has been adapted to assess the value of habitats and species. The value of habitats is assessed based on its condition, size, rarity, conservation and legal status. The value of species is assessed on its biodiversity value, legal status and conservation status. Biodiversity value is based on its national distribution, abundance or rarity, and associated trends.

Relevant habitats and associated flora, fauna, conservation sites and other ecological features/resources will be identified in Section 6.3, and then evaluated in terms of their local, national and international conservation importance using the evaluation criteria described in Section 6.3.8. Based on the outcomes of these evaluations, an assessment will then be made as to which of the ecological resources/features are considered to comprise IEFs of the Proposed Development. Only eco receptors evaluated to be of 'local importance (higher value' or higher are considered to be IEFs and subject to impact assessment. Finally, the significance of the potential ecological effects of the Proposed Development on these IEFs will be assessed in Section 6.4.

6.2.6 Assessment

Determination of the significance of an effect will be made in accordance with the terminology outlined in the EPA Guidelines on Information to be contained in Environmental Impact Assessment Reports (2022) (as set out in Table 6-1).

Table 6-1: Impact Assessment Criteria

	Term	Description
Quality of Effects	Positive	A change which improves the quality of the environment
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative /Adverse	A change which reduces the quality of the environment
Significance of Effects	Imperceptible	An effect capable of measurement but without significant consequence
	Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
	Significant	An effect which, by its character, magnitude duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude duration or intensity alters most of a sensitive aspect of the environment
	Profound	An impact which obliterates sensitive characteristics
Duration of Effect	Momentary	Effects lasting from seconds to minutes
	Brief	Effects lasting less than a day
	Temporary	Effects lasting less than a year
	Short-term	Effects lasting one to seven years
	Medium-term	Effects lasting seven to fifteen years
	Long-term	Effects lasting fifteen to sixty years
	Permanent	Effects lasting over sixty years
	Reversible	Effects than can be undone e.g. through remediation or restoration
	Frequency	How often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Probability of Effects	Likely	The effects that can be reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
	Unlikely	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Types of Effects	Indirect	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative	The addition of many minor or significant effects, including effects of other projects, to create a larger, more significant effect.
	'Do Nothing'	The environment as it would be in the future should the subject project not be carried out.
	'Worst case'	The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable	When the full consequences of a change in the environment cannot be described.

	Term	Description
	Irreversible	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic	Where the resultant effect is of greater significance than the sum of its constituents, (e.g. combination of SOx and NOx to produce smog).

Source: EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022)

6.3 Baseline Environment

6.3.1 Site Location and Description

The Proposed Development is located in east Co. Offaly, approximately 4km west of Edenderry town and 24km east of Tullamore (Figure 6-2). Lands within the site are managed for agriculture under varying levels of farming practice intensity, with areas of conifer plantation in the south of the site. Coillte-owned forestry plantations make up a considerable portion of the south part of the site. Access to both the north and south of the Proposed Development site will be via track connected to the L5010 local road.

Electrical energy generated by the proposed windfarm is currently proposed to connect to this substation via an underground grid connection 8km in length along the public roads to the existing Philipstown 110kV substation south east of the Proposed Wind Farm. A TDR is proposed with temporary works along sections of the road corridor including within private lands along the TDR, these private lands are comprised of agricultural fields.

Lands surrounding the site are predominantly in agricultural use, interspersed with conifer plantations and single residential dwellings. There are areas of ecological importance present in the wider landscape, including the Grand Canal proposed Natural Heritage Area (pNHA) (002104), located north of the Proposed Development.

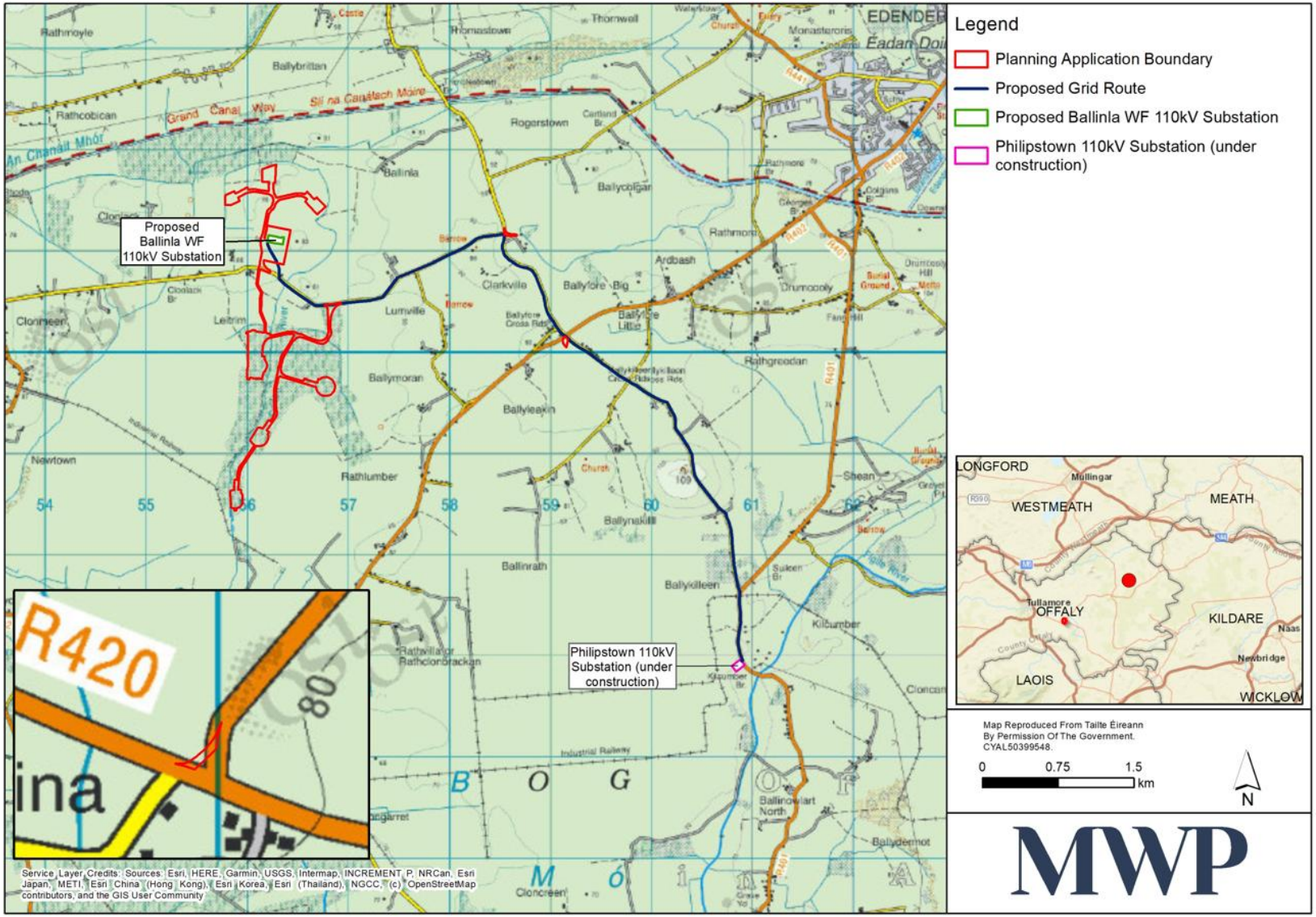

Figure 6-2: Proposed Development Location

6.3.2 Local Hydrology

The Proposed Wind Farm is located within two catchment areas, the Boyne catchment (Boyne_SC_010 sub-catchment) to the north and the Barrow catchment (Figile_SC_020 sub-catchment) to the south. There are two EPA registered watercourses[7] within the Study Area which drain lands within the site and which are fed by several local tributaries.

The southern section of the Study Area is within the Esker (Esker Stream_020) sub-basin and is drained by a second order stream that flows into the Esker River to the south of the site *c*. 1km from the Study Area boundary. Watercourses within the Study Area are detailed in the Aquatic Ecology and Fish Report which can be found in Appendix 6-1.

The northern section of the Study Area is within the Boyne_020 River sub-basin and is drained by a 1st order stream that joins a 2nd order stream before discharging into the Boyne River *c*. 4.2km from the site, a designated Salmonid Water under the first Schedule of the European Communities (Quality of Salmonid Waters) Regulations, 1988 (SI 293 of 1988) and part of the River Boyne and River Blackwater SAC [002299] and the River Boyne and River Blackwater SPA [004232].

The underground cabling associated with both the Proposed Wind Farm and the Proposed Grid Connection will cross the Leitrim stream within the Proposed Development area.

As part of the monitoring requirements for compliance with the Water Frameworks Directive (Directive 2000/60/EC), the EPA carries out biological monitoring at stations within the Boyne_020 sub-basin which comprises the northern part of the site and the Esker Stream_020 subbasin, which includes the southern part of the Proposed Development site. The current WFD River Waterbody Status (2016 – 2021) of the streams draining the site within the Boyne_020 sub-basin are 'Poor' and have been assigned a WFD Risk category of 'At risk'. The WFD River Waterbody Status (2016 – 2021) of the watercourses draining the site within the Esker Stream_020 subbasin are currently 'moderate' and have been assigned a risk category of 'At risk'[8]. Therefore, the watercourses that drain the site do no not meet surface water environmental objectives.

A review of the 'Barrow_SC_040 Sub-catchment Assessment WFD Cycle 2' report[9] determined that the following pressures have been identified with regard to this waterbody. channelisation, diffuse agriculture and peat. The Transitional Waterbody WFD latest status (2013 – 2018) of the 'Waterford Harbour' into which the 'Barrow' River drains is 'at risk' and the ecological status of the waterbody is 'moderate'. A review of the 'Boyne_SC_010 Sub-catchment Assessment WFD Cycle 2' report[10] determined that the following pressures have been identified with regard to this waterbody. domestic wastewater, hydromorphology and peat drainage and extraction. The Transitional Waterbody WFD latest status (2013 – 2018) of the 'Boyne Estuary' into which the 'Boyne' River drains is 'at risk' and the ecological status of the waterbody is 'moderate'.

6.3.3 Designated Sites

All designated sites with hydrological or ecological connection to the Proposed Development have the potential to be impacted by the Proposed Development. In line with the precautionary principle, designated sites that are

[7] https://gis.epa.ie/EPAMaps/
[8] Available at EPA Maps (Accessed 16/12/2021)
[9] Available at Subcatchment Assessment (catchments.ie) (Accessed 16/12/2021)
[10] Available at Subcatchment Assessment (catchments.ie) (Accessed 16/12/2021)

located within a ZoI that have the potential to be significantly impacted by the Proposed Development are considered using the Source-Pathway-Receptor (SPR) model.

Following this, the potential effects associated with the Proposed Development will be identified before an assessment is made of the likely significance of these effects.

6.3.3.1 Sites of International Importance

Natura 2000 sites are sites of international importance for nature conservation and are designated and protected under European legislation. Two types of sites are incorporated within the Natura 2000 network; SACs and SPAs. SACs are protected under the Habitats Directive 92/43/EEC and SPAs are protected under the Birds Directive 2009/147/EC. In Ireland, these European Directives are transposed into Irish legislation under the European Communities (Birds and Natural Habitats) Regulations 2011 to 2023, as amended. Collectively, SACs and SPAs are referred to as Natura 2000 or European sites.

A list of Natura 2000 Sites with the potential to be affected by the Proposed Development was compiled. SACs and SPAs within the ZOI were identified, listed in Table 6-2. In line with the precautionary principle, Natura 2000 sites that lie within a potential ZoI that may be significantly impacted as a result of the proposed development were considered on the basis of the SPR model, particularly those that were within or overlapped with the WFD catchments within which the Proposed Development is located.

The Study Area of the Proposed Development does not lie within the boundary of any designated Natura 2000 site. Hence, the site of the Proposed Development does not overlap with any SPA or SAC.

Table 6-2: European Sites Identified in Stage 1 Appropriate Assessment (MWP, 2024)

Designated Site	Site Code	Qualifying Features of Conservation Interest	Proximity and Connection to the Study Area
The Long Derries, Edenderry SAC	000925	• Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]	The SAC is located 7.6km to the west of the Study Area. There is no hydrological link or plausible impact pathway linking the Proposed Development site to the SAC.
Raheenmore Bog SAC	000582	• Active raised bogs [7110] • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the Rhynchosporion [7150]	The SAC is located 9.8km to the west of the Study Area. There is no hydrological link or plausible impact pathway linking the Proposed Development site to the SAC.
River Boyne and River Blackwater SAC	002299	• Alkaline fens [7230] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)* [91E0] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355]	The SAC is located approximately 17km northwest of the site. Highly tenuous hydrological link between the Proposed Development site and the SAC, located 24 riverkm downstream.
River Boyne and River Blackwater SPA	004232	• Kingfisher (*Alcedo atthis*) [A229]	The SPA is located approximately 17km northwest of the site.

Designated Site	Site Code	Qualifying Features of Conservation Interest	Proximity and Connection to the Study Area
			Highly tenuous hydrological link between the Proposed Development site and the SPA, located 24 riverkm downstream.
River Barrow and River Nore SAC	002162	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] Reefs [1170] • *Salicornia* and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • European dry heaths [4030] • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] • Petrifying springs with tufa formation (*Cratoneurion*) [7220] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0] • *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Alosa fallax fallax* (Twaite Shad) [1103]	The SAC is located 11.2km to the south of the Study Area. There is a highly tenuous hydrological connection (30km) linking the Study Area to this SAC via the watercourses that drain the Study Area and the watercourses crossed by the proposed grid connection route as these watercourses ultimately flow into the River Barrow which is associated with the SAC.

Designated Site	Site Code	Qualifying Features of Conservation Interest	Proximity and Connection to the Study Area
		• *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355] • *Trichomanes speciosum* (Killarney Fern) [1421] • *Margaritifera durrovensis* (Nore Pearl Mussel) [1990]	
Lough Ennell SPA	004044	• *Aythya ferina* (Pochard) [A059] • *Aythya fuligula* (Tufted Duck) [A061] • *Fulica atra* (Coot) [A125] • Wetland and Waterbirds [A999]	The SPA is located 19.8km northwest of the Study Area. It is located outside the core foraging range for QI species for this site. There is no hydrological connection, an intervening distance of 19.8km and absence of a complete source-pathway receptor chain.
Slieve Bloom Mountains SPA	004160	• *Circus cyaneus* (Hen Harrier) [A082]	The SPA is located 25.3km southwest of the Study Area and solely designated for hen harrier. No hydrological connection. The Proposed Development is located beyond the foraging range for hen harrier ((7.5km for females and 11.4km for males) (Arroyo *et al.* 2009. Irwin *et al.* 2012)). No plausible impact pathway linking the Proposed Development site to the SPA.
Charleville Wood SAC	000571	• Alluvial forest • Desmoulin's Whorl Snail	The SAC is located 9.5km west of the Ballina (Geashill By) TDR node. Highly tenuous hydrological link between the Proposed Development site and the SAC, located nearly 10 riverkm downstream.

6.3.3.2 Sites of National Importance

In Ireland, sites of national importance for nature conservation are designated as Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) under the Wildlife Act 1976, as amended. NHAs are areas considered important for the habitats present, or which hold species of plants and animals whose habitat needs protection. A list of pNHAs was published on a non-statutory basis in 1995, but these have not since been statutorily proposed or designated. Prior to statutory designation, pNHAs are subject to limited protection including in the areas of agri-environmental farm planning schemes, certain forest service requirements pertaining to payment of afforestation grants and recognition of the ecological value of pNHAs by Planning and Licencing Authorities.

The Study Area does not lie within the boundary of any NHA or pNHA site. Sites of national importance within the potential ZOI of the Study Area have been identified and listed in **Table 6-3** and **Table 6-4** and those in the immediate environs of the Study Area are shown in **Figure 6-3**.

Table 6-3: NHA Sites within the Potential ZOI of the Proposed Development

Designated Site	Site Code	Features of Interest[11]	Proximity and Connection to Study Area
Black Castle Bog NHA	000570	Black Castle Bog NHA is of considerable conservation importance as it comprises a raised bog, a habitat that is becoming increasingly rare and under threat in Ireland and in the EU.	The NHA is located *c.* 0.7km to the west of the Study Area.

[11] Description of sites taken from NHA Site Synopsises [https://www.npws.ie/protected-sites/nha]

Designated Site	Site Code	Features of Interest[11]	Proximity and Connection to Study Area
			There is no hydrological link connecting the Study Area to the NHA.
Daingean Bog NHA	002033	Daingean Bog NHA is of considerable conservation importance as it comprises a raised bog, a habitat that is becoming increasingly rare and under threat in Ireland and in the EU. There is a population of Irish Hare *Lepus timidus hibernicus,* a species listed on the Red Data Book.	The NHA is located *c.* 9.6km to the west of the Study Area. There is no hydrological link connecting the Study Area to the NHA.
Carbury Bog NHA	001388	Carbury Bog NHA is of considerable conservation importance as it comprises a raised bog, a habitat that is becoming increasingly rare and under threat in Ireland and in the EU. The site comprises several raised bog microhabitats, including scrub, deciduous woodland and hummock/ hollow complexes.	The NHA is located *c.* 10.9km to the east-northeast of the Study Area. There is no hydrological link connecting the Study Area to the NHA.
Milltownpass Bog NHA	002323	Milltownpass Bog NHA is of considerable conservation importance as it comprises a raised bog, a habitat that is becoming increasingly rare and under threat in Ireland and in the EU. The site comprises several raised bog microhabitats, including pools and hummock/ hollow complexes.	The NHA is located *c.* 13km to the north-northwest of the Study Area. There is no hydrological link connecting the Study Area to the NHA.
Cloncrow Bog (New Forest) NHA	000677	Cloncrow Bog (New Forest) NHA is of considerable conservation importance as it comprises a raised bog, a habitat that is becoming increasingly rare and under threat in Ireland and in the EU. The site comprises several raised bog microhabitats, including quaking areas, pools, hummock/ hollow complexes, a small flush and a swallow hole.	The NHA is located *c.* 14.9km to the north of the Study Area. There is no hydrological link connecting the Study Area to the NHA.

Table 6-4: pNHA Sites within Potential ZOI of the Proposed Development

Designated Site	Site Code	Features of Interest[12]	Proximity and Connection to Study Area
Grand Canal pNHA	002104	The Grand Canal pNHA is of ecological significance due to the diversity of species it supports. Opposite-leaved Pondweed *Groenlandia densa,* (Flora Protection Order 1987) is present in the Eastern section of the Main Line and European Otter *Lutra lutra* (EU Habitats Directive >> Annex II) have been recorded using the site.	The pNHA borders the Study Area to the north. Site surveys indicate there is no hydrological link with the grand canal. All land drains and watercourses within the development boundary flow south to the Leitrim 14 (EPA code: 14L21) watercourse.
Ballina Bog pNHA	001012	Ballina Bog pNHA is one of the most easterly raised bogs which remains intact. It is of scientific importance due to the condition of the vegetation and surface.	The pNHA is located *c.* 16km to the northeast of the Study Area. There is no hydrological link connecting the Study Area to the pNHA.

[12] Description of sites taken from pNHA Site Synopsises [https://www.npws.ie/sites/default/files/general/pNHA_Site_Synopsis_Portfolio.pdf]

Designated Site	Site Code	Features of Interest[12]	Proximity and Connection to Study Area
The Long Derries, Edenderry pNHA	00925	The Long Derries, Edenderry pNHA is of significant conservation importance for the priority habitat: Orchid-rich Calcareous Grassland*[6210]. Several rare species occur including 'IUCN Red Listed' Basil Thyme *Acinos arvensis,* and Red Data Book species Green-winged Orchid *Orchis morio* and Blue Fleabane *Erigeron acer.*	The pNHA is located *c.* 7.6km to the east-southeast of the Study Area. There is no hydrological link connecting the Study Area to the NHA.
Raheenmore Bog pNHA	000582	Raheenmore Bog pNHA is of considerable conservation importance as it comprises a Raised Bog (Active)* [7110], Degraded Raised Bog [7120], *Rhynchosporion* Vegetation [7150]. Raised bogs are becoming increasingly rare and under threat in Ireland and in the EU.	The pNHA is located c. 9.8km to the west of the Study Area. There is no hydrological link connecting the Study Area to the NHA.
Raheen Lough pNHA	000917	Raheen Lough pNHA is of significant conservation interest due to the variety and numbers of wildfowl and waders that it attracts. Records from the site include Whooper Swan, Goldeneye, Purple Sandpiper, Jack Snipe, and Kingfisher.	The pNHA is located *c.* 13.4km to the southwest of the Study Area. There is no hydrological link connecting the Study Area to the NHA.
Rahugh Ridge (Kiltober Esker)	000918	Rahugh Ridge pNHA is a particularly fine esker ridge covered for almost its entire length in woodland. The woodland is dominated by Ash (*Fraxinus excelsior*) and Hazel (*Corylus avellana*). Species of particular conservation interest include Dogwood (*Cornus sanguinea*), Columbine (*Aquilegia vulgaris*), Buckthorn (*Rhamnus catharticus*), Stone Bramble (*Rubus saxatilis*), Whitebeam (*Sorbus hibernica*) and Wood Melic (*Melica uniflora*).	The pNHA is located *c.* 14.1km to the west of the Study Area. There is no hydrological link connecting the Study Area to the NHA.

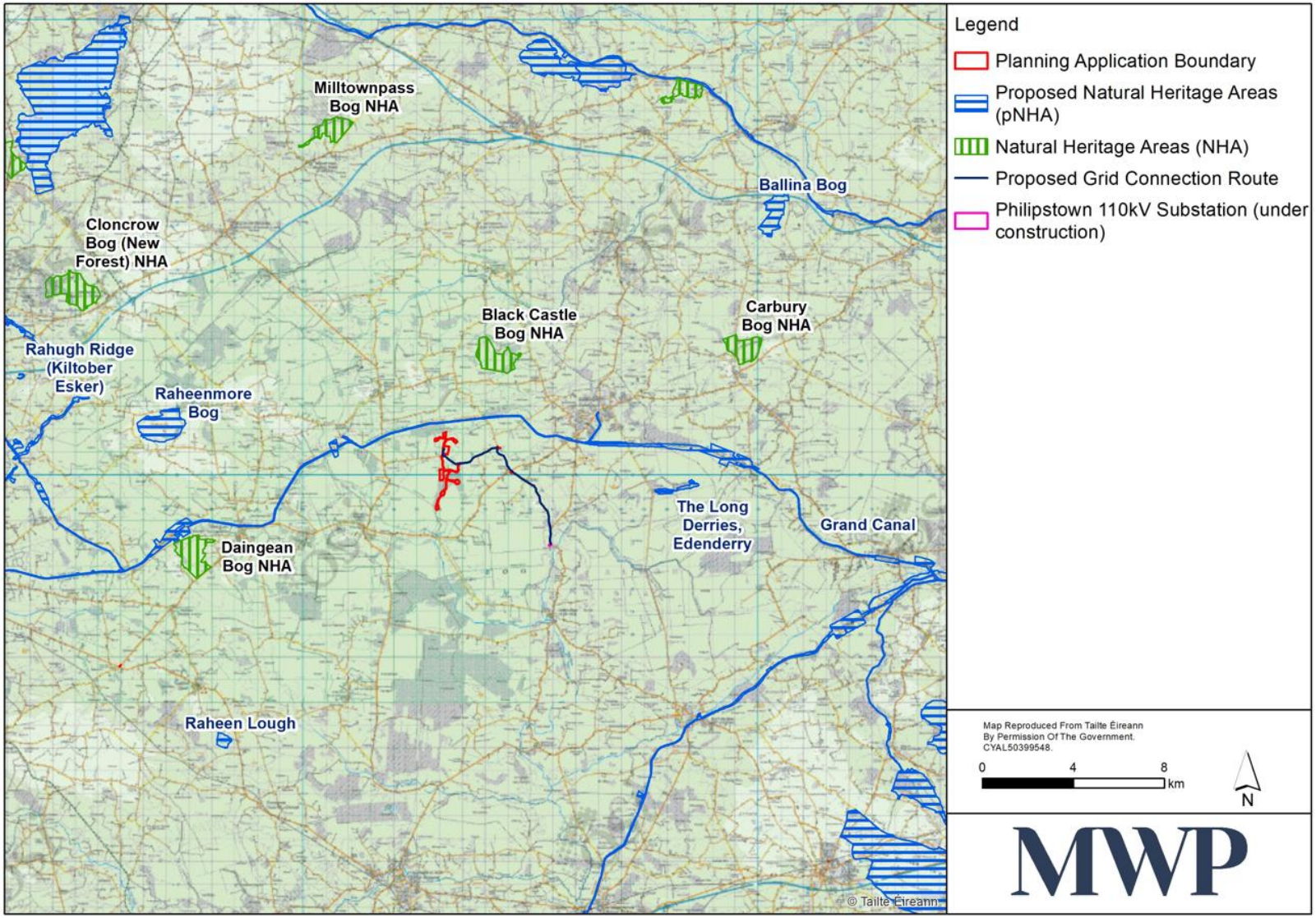

Figure 6-3: NHAs and pNHAs within the Environs of the Study Area

6.3.3.3 Additional Sites

6.3.3.3.1 Ramsar Sites

The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat, is an international treaty that was established for the conservation and sustainable use of wetlands. The Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. A key commitment of Ramsar Contracting Parties is to identify and place suitable wetlands onto the List of Wetlands of International Importance. Ireland presently has 45 sites designated as Wetlands of International Importance.

An on-line search was undertaken to search for Ramsar sites potentially located within the ZOI of the Proposed Development. The desktop review concluded that there is one Ramsar site within 15km of the development boundary: 'Raheenmore Bog', approximately 11.4km west of the site. This site provides nesting and foraging habitat for Merlin and forms part of the breeding area of a pair of Merlin (NPWS, 2013). In consideration of species foraging distance during the breeding season and between alternative nest sites, within 5km and up to 1.5km respectively, this Ramsar site is considered to be outside the zone of influence of the Proposed Development.

6.3.3.3.2 Important Bird and Biodiversity Areas (IBAs)

Important Bird and Biodiversity Areas (IBAs) are sites selected as important for bird conservation because they regularly hold significant populations of one or more globally or regionally threatened, endemic or congregator bird species or highly representative bird assemblages. The European IBA programme aims to identify, monitor and protect key sites for birds all over the continent. It aims to ensure that the conservation value of IBAs in Europe (now numbering more than 5,000 sites or about 40% of all IBAs identified globally to date) is maintained, and where possible enhanced. The programme aims to guide the implementation of national conservation strategies, through the promotion and development of national protected-area programmes.

An on-line search was undertaken to search for IBA sites potentially located within the ZOI of the Proposed Development. The desk-top review concluded that there are no IBA sites within a 15km radius of the Study Area.

6.3.3.3.3 Salmonid Rivers

Water channels in Ireland may be designated as a Salmonid River as per the European Communities (Quality of Salmonid Waters) Regulations, 1988. The Boyne River, *c.* 4.7km northeast of the development boundary, is a designated Salmonid Water under the first Schedule of the European Communities (Quality of Salmonid Waters) Regulations, 1988 (SI 293 of 1988). All watercourses within the Proposed Development drain to the south and consequently there is no hydrological connection to the River Boyne.

6.3.3.3.4 Nature Reserves

Areas of importance to wildlife may be designated as Nature reserves, which are protected under Ministerial order. Raheenmore Bog, located c. 10km west of the development boundary, is a designated Nature Reserve of conservation significance, as it is a deep midland raised bog. This site located outside the Proposed Development boundary and there is no hydrological connection to this site. Consequently, the site is considered outside the ZoI.

6.3.4 Habitats

6.3.4.1 Desk Study

The NPWS Article 17 interactive map viewer for Annex I habitats was accessed from the NPWS website and reviewed for the presence of Annex I habitats. The assessment of mapping found no presence of any Annex I habitats within the Study Area.

Heritage maps, maintained by the Heritage Council, were assessed to review existing habitat data recorded within and connected to the Study Area[13]. These maps recorded no habitats of high ecological value with the landscape of the Study Area.

6.3.4.2 Field Surveys

No Annex I habitats listed under the Habitats Directive were noted within the site and there is no overlap between the extent of development footprint and any European sites. No botanical species protected under the Flora (Protection) Order 2022, listed in Annex IV of the EU Habitats Directive (92/43/EEC) were recorded. Habitats within the Study Area (as shown in **Figure 6-4**) are described in the following subsections using Fossit (2000) characterisation. A detailed habitat map is provided in **Figure 6-5** and photographs of habitats identified are presented in **Plate 1** to **Plate 12**.

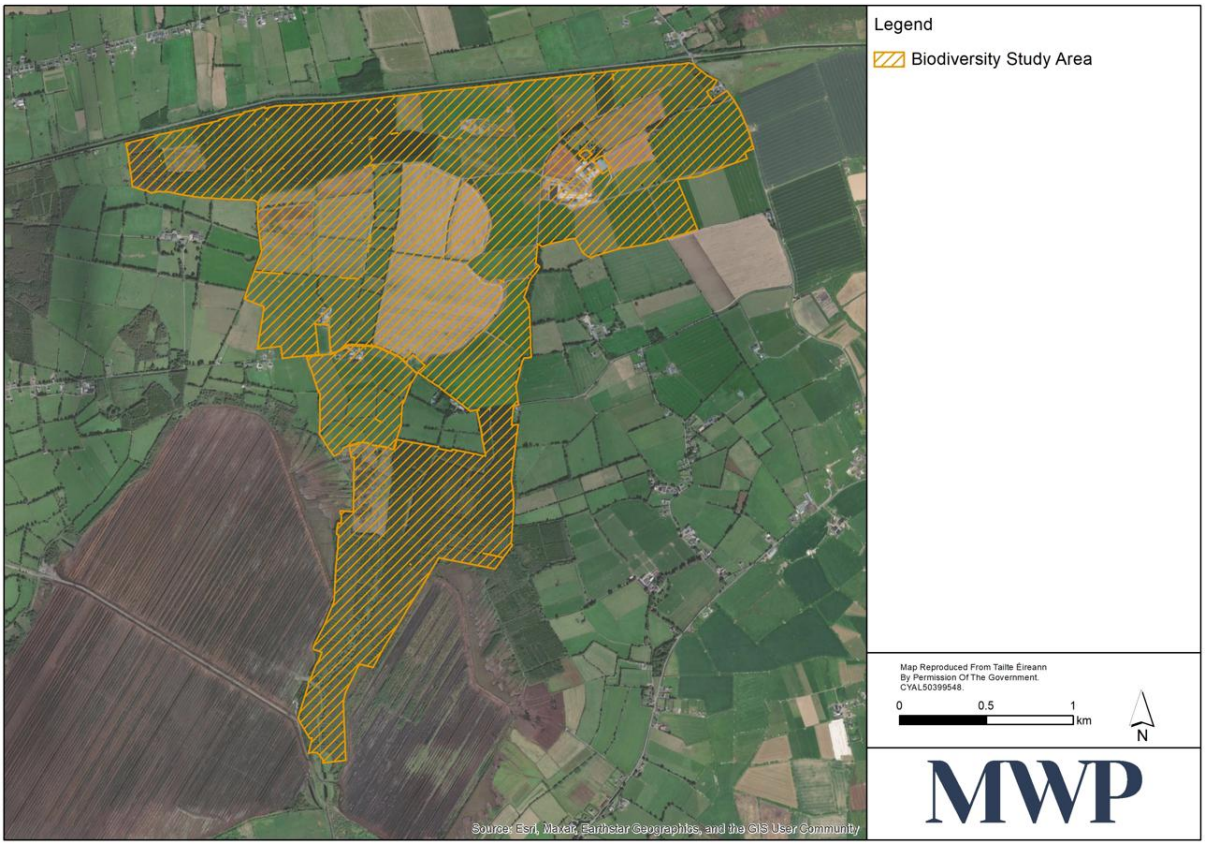

Figure 6-4: Biodiversity Study Area

[13] https://www.heritagemaps.ie/WebApps/HeritageMaps/index.html

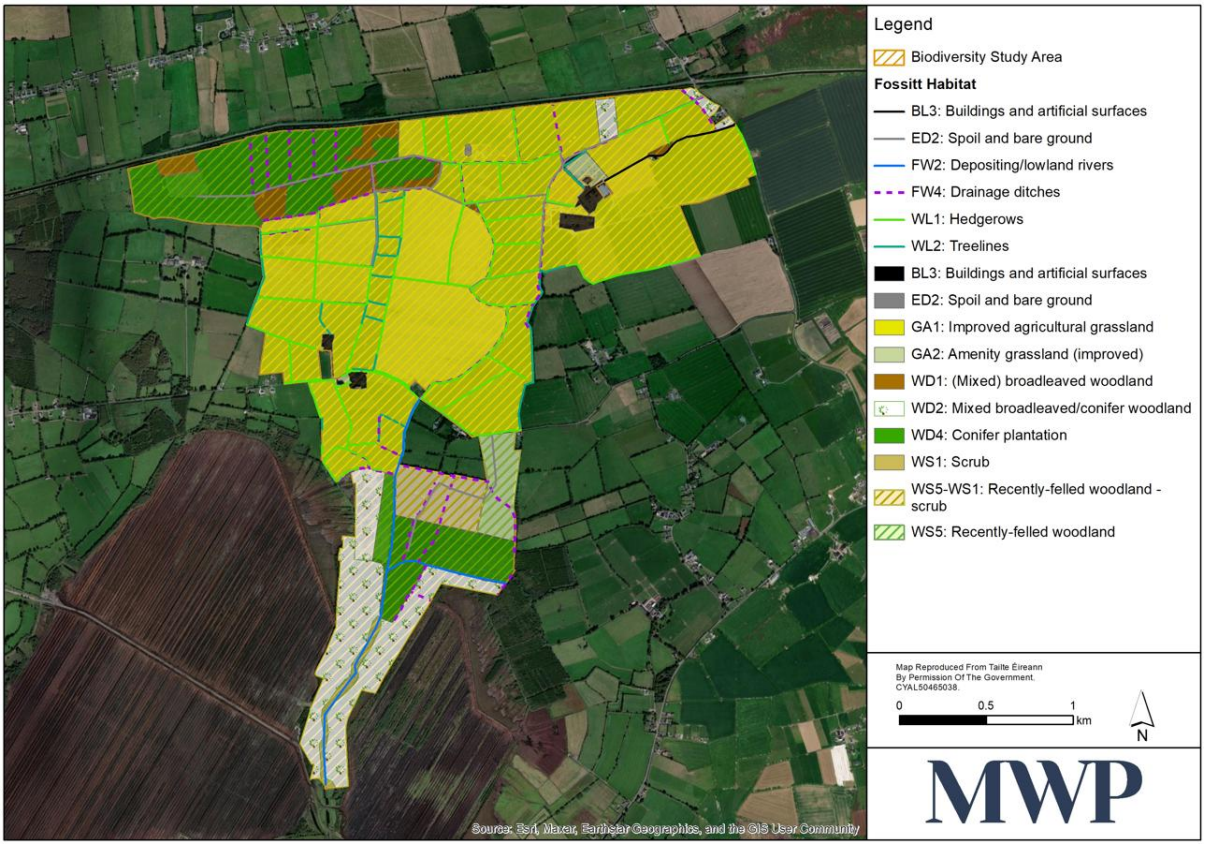

Figure 6-5: Biodiversity Study Area Habitat Map

6.3.4.2.1 Improved Agricultural Grassland (GA1)

Some areas of this habitat will be removed to facilitate the Proposed Development. This habitat type is the dominant habitat throughout the site. This habitat type is particularly species-poor and dominated by grasses (*Lolium* spp.) due to intensive management of pasture. Species recorded in this habitat included docks (*Rumex* spp.), white clover (*Trifolium repens*) and dandelions (*Taraxacum* spp.). Farmland in the centre-west of the site, on farmland north of the proposed location of T4, supported rushes *Juncus effusus* due to poor drainage in this area. This habitat type does not correspond to any EU Habitats Directive Annex I Habitat.

Plate 1: Improved Agricultural Grassland Habitat (GA1) Throughout Northern Section of Proposed Development Site

6.3.4.2.2 Broadleaved Woodland (WD1)

This habitat type occurs in the north of the Study Area where it occurs in large sections amongst conifer plantation. Areas of this woodland habitat in the north comprise mainly ash (*Fraxinus excelsior*) and oak trees (*Quercus* spp.) in varying concentrations and are often bordered by fencing and internal tracks where they occur. Other species occurring in these habitats include buttercup (*Ranunculus repens*), herb robert (*Geranium robertanium*), bluebell (*Hyacinthoides non-scripta*), and ivy (*Hedera hibernica*) with bramble (*Rubus* spp.) also being common. This habitat does not correspond to any EU Annex I habitat.

Plate 2: Broadleaved Woodland (WD1) Located in Northwest of the Proposed Development Site

6.3.4.2.3 Mixed Broadleaved-Conifer Woodland (WD2)

This habitat type occurs within the Proposed Development site either as small woodland areas in the north of the Study Area or as larger assemblages in the south. In the north, small areas of birch (*Betula* spp.) occur in tandem with conifers which have been managed. In the south of the site, this habitat is the dominant habitat where conifer species such as sitka spruce (*Picea sitchensis*) occur alongside beech (*Fagus* spp.), willow (*Salix* spp.) and hawthorn (*Crataegus* monogyna) and field maple (*Acer campestre*) trees. The understorey is species-poor with bramble (*Rubus*) dominating. Consequently, most of the area in the south of the Study Area is particularly dense, which limits access, particularly in areas east of the Leitrim watercourse. These areas are relatively managed and are considered to be of relatively low ecological value.

Plate 3: Mixed Broadleaved-Conifer Woodland (WD2) in South of the Proposed Development Site

6.3.4.2.4 Conifer Plantation (WD4)

This habitat is one of the dominant habitat types within the Study Area. Conifer plantation within the Study Area is limited to two main areas, one in the northwest of the Study Area with the second located in the south of the Proposed Development area. These areas are planted with Norway spruce (*Picea abies*) and sitka spruce (*Picea sichensis*). This habitat has been planted for commercial forestry and diverse flora is absent. Rows of deciduous trees are often planted along the edges of the habitat type to increase biodiversity such as beech (*Fagus sylvatica*).

Areas of conifer plantation in the north of the Study Area contain three active badger setts (see Section 6.3.6.2), however these setts are located outside the Proposed Development site and have been actively avoided to ensure their protection from the Proposed Development. This habitat does not correspond to any EU Annex I habitats.

Plate 4: Conifer Plantation (WD4) in South (left) and Northwest (right) of Study Area with Drainage Ditch (FW4)

6.3.4.2.5 Scrub (WS1)

This habitat occurs in the south of the Study Area, along the lower reaches of the Leitrim River, and includes the immediate bankside area which has graded from grassland to the immediately located fringing Mixed Broadleaved-Conifer Woodland (WD2). This area is dense, particularly for the length of the eastern bank, and is composed of hawthorn (*Crataegus monogyna*), willow (*Salix* spp.), birch (*Betula* spp.), and bramble (*Rubus fruticosus*). The areas to the immediate east and west of the bankside are particularly dense forming a narrow corridor of habitat along the river's banks. mammal trails were found along the eastern bank indicating mammals may use this habitat as a corridor for commuting between areas.

Plate 5: Scrub (WS1) Habitat (Note density in background, along bank of Leitrim river in the south of the Proposed Development Site)

6.3.4.2.6 Recently Felled Woodland (WS5)

Recently felled woodland occurs in the southeast of the Study Area. This area was previously planted with sitka spruce and Norway spruce and has been recently felled. The ground was highly disturbed when surveyed in February 2024. The ecological value of both mature and recently felled commercial woodland are both considered to be of low ecological value.

Plate 6: Recently Felled Woodland (W55) in the Centre of the Proposed Development Site

6.3.4.2.7 Recently-Felled Woodland – Scrub (WS5/WS1)

Areas which have been felled and are undergoing recolonisation by early coloniser plant species occur in the centre of the Proposed Development site. Vegetation height in this area is very low though quick to grow. Species occurring in this area includes bindweed, fireweed, common hogweed, grey willow (*Salix cinerea*) and goat willow (*Salix caprea*), stinging nettle (*Urtica* spp.), watercress (*Nasturtium* spp.), common reed (*Phragmites australis*), plantain species (*Plantago major, P. minor*), milkweed, (*Sonchus oleraceus*), bittercress (*Cardamine hirsuta*), dandelion (*Taxacum officinale*), oat grass (*Arrhenatherum elatius*), creeping buttercup (*Ranunculus repens*), and mullein (*Verbasum thapsus*).

Plate 7: Recently-felled Woodland - Scrub (WS5/WS1) in Centre of the Study Area

6.3.4.2.8 Spoil and Bare Ground (ED2)

This habitat comprises a spoil area in the north of the Study Area and unpaved roadways which demarcate field boundaries in areas. This habitat is disturbed and represents no ecological value within the Study Area.

Plate 8: Spoil and Bare Ground (ED2) Habitats in North of Study Area, Bare Track (Left) & Infilled Area (Right)

6.3.4.2.9 Buildings and Artificial Surfaces (BL3)

This habitat type is limited to farm holdings (farmyards) which are located together in the northeast of the Study Area. These structures are highly modified and have little capacity to support floral vegetation due to their

continued use. None of the structures listed above will be removed to facilitate the development of the wind farm. The area of this habitat within the Proposed Development boundary is limited to paved road which constitutes a driveway connecting the farm to the local road network. No demolition or change of use of these buildings is considered to occur as a result of the Proposed Development.

6.3.4.2.10 Depositing Lowland River (FW2)

The Leitrim River is classified as a depositing/lowland river in the southern extent of the Study Area and drains watercourses to the south of the site. A naturalised land drain runs east to west in the southern area of the Study Area, bisecting conifer and mixed broadleaved-conifer woodland habitats. The channel width ranges from approximately 1.5m to 4.7m.

An additional length of this habitat type was identified during surveying in the southwest of the Study Area on the 28th of January, 2025. This habitat was slow flowing and in-water conditions were noted to be degraded at this location when compared with other examples in the Study Area. The length of this first order stream is approximately 360m to the river head where it originates in extracted bogland and is fed by at least two drainage ditches along its north bank. Flow in this watercourse was notably very slow along its length. This watercourse runs west to east where it joins the Leitrim stream in the south of the Study Area. This channel width ranges from approximately 1 m – 1.5 m in width. The physical characteristics of these watercourses are further outlined in the 'Aquatic Ecology and Fish Survey Report', included in Appendix 6-1.

Watercourses draining the site collectively support fool's watercress (*Apium nodiflorum*), brooklime (*Veronica beccabunga*), watercress (*Rorippa nasturtium-aquaticum*), lesser water-parsnip (*Berula erecta*), water starwort (*Callitriche sp.*), reed canary grass (*Phalaris arundinacea*) and great willowherb (*Epilobium hirsutum*).

Plate 9: Depositing Lowland River (FW2) along Leitrim River in South of Study Area (left) and in Woodland in Centre of Study Area (right)

Plate 10: Depositing Lowland River (FW2) in the Southwest of the Study Area Looking Upstream (left) Showing Indications of Enrichment at Points Along its Length (right)

6.3.4.2.11 Drainage Ditch (FW4)

Drainage ditches are located extensively throughout the northern extent of the Study Area which have been created historically for land drainage purposes. These habitats occur often at the edge of field boundaries but also within conifer plantation habitats. Flows in drainage ditches in the site were often imperceptible as the low gradient of the surrounding area provides little natural flow by way of gravity. Slow flows allow duckweed (*Lemna* sp.) to proliferate where conditions are particularly still.

This habitat has low ecological value for aquatic species such as fish and limited value for frog as spawning habitat. Tadpoles were identified at one drainage ditch in June 2023, though no successful frog spawning was recorded at the site when surveyed in February 2024.

Plate 11: Drainage ditch (FW4) in Centre of Study Area

6.3.4.2.12 Hedgerow (WL1) and Treeline (WL2)

Hedgerows and treelines are located exclusively in the northern section of the Study Area, delineating field boundaries and bordering access tracks and local roads, and adjoining ditches. These habitats also occur along the Proposed Grid Connection and at the Proposed TDR nodes along the L-5006. These habitat types generally link up, sometimes transitioning from one to the other along the same linear feature.

Treeline habitat mainly comprises single rows of ash (*Fraxinus excelsior*) pitched as field boundaries in the northwest of the Study Area. Treelines are focused in the northwest of the Study Area where most mature trees are present. Hedgerows are typically comprised of willow (*Salix* spp.), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*) with ivy (*Hedera helix*) and an understory of bramble (*Rubus fructicosus*) and nettle (*Urtica dioica*). The species richness of hedgerows within the site were relatively species poor and were typically highly managed. This habitat type does not correspond to any EU Annex I habitats.

Plate 12: Hedgerow (WL1) (left) and Treeline (WL2) (right) in the North of the Study Area

6.3.4.2.13 Roadside Grass Verge (GS2)

This habitat type occurs along the margins of public roads and access tracks within the study area of the Proposed Development, most notable within the Proposed Grid Connection and Proposed TDR node at the junction of the R-402 and R-420. It typically comprises a narrow strip of semi-natural grassland maintained by regular mowing or disturbance. Dominant species include perennial ryegrass (*Lolium perenne*), cocksfoot (*Dactylis glomerata*), and creeping bent (*Agrostis stolonifera*), with frequent occurrences of daisy (*Bellis perennis*), dandelion (*Taraxacum officinale*), and clover (*Trifolium repens*). Occasional ruderal species such as broad-leaved plantain (*Plantago major*) and nettle (*Urtica dioica*) may also be present, particularly in more disturbed areas. This habitat is classified under Fossitt as GS2 – Dry meadows and grassy verges and does not correspond to any EU Annex I habitat.

6.3.5 Invasive Alien Species

6.3.5.1 Desk Study

A search for invasive plant species recorded in the NBDC database N52 and N53 hectads encompassing the Study Area was carried out, with a focus on non-native plant species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015).

Documented records of high-impact invasive species listed on the Third Schedule include Canadian Waterweed (*Elodea canadensis*) in hectad N52 and Japanese knotweed (*Fallopia japonica*) and Rhododendron*(Rhododendron*

ponticum) in N53. Documented records of medium-impact invasive species listed on the Third Schedule include Butterfly-bush (*Buddleja davidii*) in N52 and Traveller's-joy (*Clematis vitalba*) in N53. The only invasive species recorded in the NBDC database that is not listed on the Third Schedule is sycamore (*Acer pseudoplatanus)*, present in both hectads.

A search for invasive faunal species recorded in the NBDC database for the N52 and N53 hectads with a focus on non-native animal species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was undertaken. High impact animal species documented in the hectads include eastern grey squirrel (*Sciurus carolinensis*), most recently recorded in N52 in 1981 and in N53 in 2009, zebra mussel (*Dreissena polymorpha*), most recently recorded in 2003 in N53, brown rat (*Rattus norvegivus*) in N52, fallow deer (*Dama dama*) in both hectads, and American mink (*Mustela vison*) also having been recorded in both the N52 and N53 hectads. There were no documented records of medium-impact invasive faunal species listed on the Third Schedule from N52 or N53. The remaining invasive species were limited to snail species and European rabbit (*Oryctolagus cuninculus*).

6.3.5.2 Field Study

During ecological field surveys, no invasive plant species were positively identified within the Study Area. A field camera was deployed in the north of the site near the entrance to a suspected mustelid den entrance on the 3rd of February, 2024. This camera picked up images albeit unclearly of a large mustelid. The images obtained indicate American mink (*Neovison vison*), due to a lack of any obvious bib of pale cream fur colour in images and tail indicating a species other than pine marten. Due to records of the species within the site, it is considered the species recorded on cameras is American mink an invasive animal species designated under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015).

Plate 13: American Mink (*Neovison vison*) Captured on Cameras Deployed Onsite 3 Feb 2024

Plate 14: American Mink (Neovison vison) Captured on Cameras Deployed Onsite 3 Feb 2024

6.3.6 Rare and Protected Flora within the Study Area

6.3.6.1 Desk Study

The desktop study included a review of data held by the NBDC for the hectads N52 and N53. The search targeted plant species listed under the EU Habitats Directive, Flora Protection Order species (FPO) (2022), and species listed in the Irish Red List (Wyse Jackson, et al. 2016) within the hectads N52 and N53 which encompasses the Study Area. Species records are listed in Table 6-5.

Table 6-5: Documented Records of Protected Flora Species within Hectads N52 and N53

Name	Record Date	Designations and Status	Habitat Requirements (Curtis and McGough, 1988)[14],[15]
Alder Buckthorn (*Frangula alnus*)	2010	Red List: Vulnerable	Wet soils, heaths, open woodland, river banks and bogs.
Basil Thyme (*Clinopodium acinos*)	1921	Red List: Endangered	Exposed esker ridges, in arable fields, on gravel, and on sandy soils.
Blue Fleabane (*Erigeron acer*)	2022	Red List: Endangered	Eskers, in dry grassland, sandy pastures and on walls - especially on calcium-rich substrates.
Fir Clubmoss (Huperzia selago)	2022	Habitats Directive [92/42/EEC] Annex V	Acidic, nutrient-poor upland heaths, moorlands, bogs, rocks.
Pyrola rotundifolia subsp. rotundifolia	2022	Red List: Endangered	Wet bogs, damp hollows in dunes, in fens, woods and on damp rock ledges.
Round-leaved Wintergreen (*Pyrola rotundifolia*)	2019	Red List: Endangered	Wet bogs, damp hollows in dunes, in fens, woods and on damp rock ledges.
Slender Tufted-sedge (*Carex acuta*)	2001	Red List: Near threatened	Ponds, lakes and marshes on mostly basic or weakly acid substrates.

[14] https://www.npws.ie/sites/default/files/publications/pdf/Curtis_1988_PlantsRedBook.pdf
[15] https://www.irishwildflowers.ie/habitats.html

6.3.6.2 Field Survey

The Study Area is dominated by conifer plantation and intensively managed agricultural grasslands in the north, with the southern area of the site being characterised by mixed conifer broadleaved woodlands and recently clearfelled areas. No rare or protected flora species, including any of those listed in Table 6-5 above, were recorded during ecological surveys undertaken in the Study Area. While the lack of evidence of a protected species does not necessarily preclude its presence at the site either at this current time or in the future, the highly altered habitats in the area within the Study Area considered in combination with the species' habitat requirements as described by Curtis and McGough, 1988, indicate a lack of suitable habitat within the Study Area for any of the species to occur.

6.3.7 Protected Fauna within the Study Area

6.3.7.1 Non-volant mammals

6.3.7.1.1 Desk study

Records of protected fauna were retrieved from the NBDC database for hectads N52 and N53 which encompasses the Study Area and information received from the NPWS data request for rare and protected species were reviewed. These records are listed in Table 6-7.

Table 6-6: Records of Protected Non-Volant Mammals from Hectads N52 and N53

Common Name	Species Name	Level of Protection	Hectad	Record Origin
Badger	*Meles meles*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N52/ N53	NBDC
Eurasian Pygmy Shrew	*Sorex minutus*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N52/ N53	NBDC
Eurasian Red Squirrel	*Sciurus vulgaris*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N52/ N53	NBDC
European Otter	*Lutra lutra*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). EU Habitats Directive (92/43/EEC) Annex II, Annex IV	N52/ N53	NBDC
Hedgehog	*Erinaceus europaeus*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N52/ N53	NBDC
Pine marten	*Martes martes*	EU Habitats Directive (92/43/EEC) Annex V	N52/ N53	NBDC
Irish Hare	*Lepus timidus* subsp. *hibernicus*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). EU Habitats Directive (92/43/EEC) Annex V	N52/N53	NBDC
Stoat	*Mustela erminea*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N53	NBDC

6.3.7.1.2 Field Surveys

No visual observation of badger was made within the Study Area however; signs of badger activity were frequently recorded throughout the Study Area during site visits. Evidence of badger activity in the form of scats and latrines were recorded throughout the Study Area, predominantly in the northwestern area comprised of conifer woodland and broadleaved woodland in areas located outside the Proposed Development boundary.

Badger setts, three in total, were recorded in the vicinity of the Proposed Development site and were again focussed in the northwest of the Study Area within conifer forestry (Figure 6-6). These setts comprised a main sett in the northeast of the conifer woodland habitat with an annex sett located approximately 120m directly to the south of this. A third sett, a subsidiary sett, was identified approximately 1km west of these two setts in the far northwest of the Study Area. These sites displayed varying levels of badger activity when visited in February and September 2024. None of these setts are within 30m or 50m of any proposed turbine location or access track. The closest turbine (T2) is located *c.* 152.2m south of the nearest sett.

The setts were revisited on the 12th of September 2024, which found badger setts at location 1 and 2, refer to Figure 6-6, were both recently in use by badgers, whilst the subsidiary sett in the far northwest at location 3, was determined to not be actively in use due to infilling of the sett entrance, no evidence of entrance having been in recent use, as well as a lack of prints or latrines located close by. During the daytime bat walkover undertaken on 28th of January 2025, an attempted sett was observed at the western extent of the Study Area in the centre of the site. The attempted sett was shallow and infilled with debris and measured approximately 35cm x 35m (length x height). This attempted sett is located approximately 380m from the nearest proposed infrastructure footprint and will not be removed as part of the Proposed Development.

Trail cams deployed to monitor a sett failed to capture active badger activity on video, however photographic stills were captured of a small mammal believed to be American mink (*Neovison vison*), an invasive mammal species and not protected under legislation.

No evidence of otter was found on the site, though there was instance of likely otter scat recorded along the banks of the Leitrim river in the south of the Study Area. No otter holts, couches or slides were found along this watercourse, though species may likely be using aquatic corridor for foraging purposes.

Irish hare were present in vegetated areas and were noted in the northeast of the Study Area on the fringes of mixed woodland and in the centre of the site amongst the clear felled conifer plantation.

No additional non-volant mammal species were identified during surveying of the site.

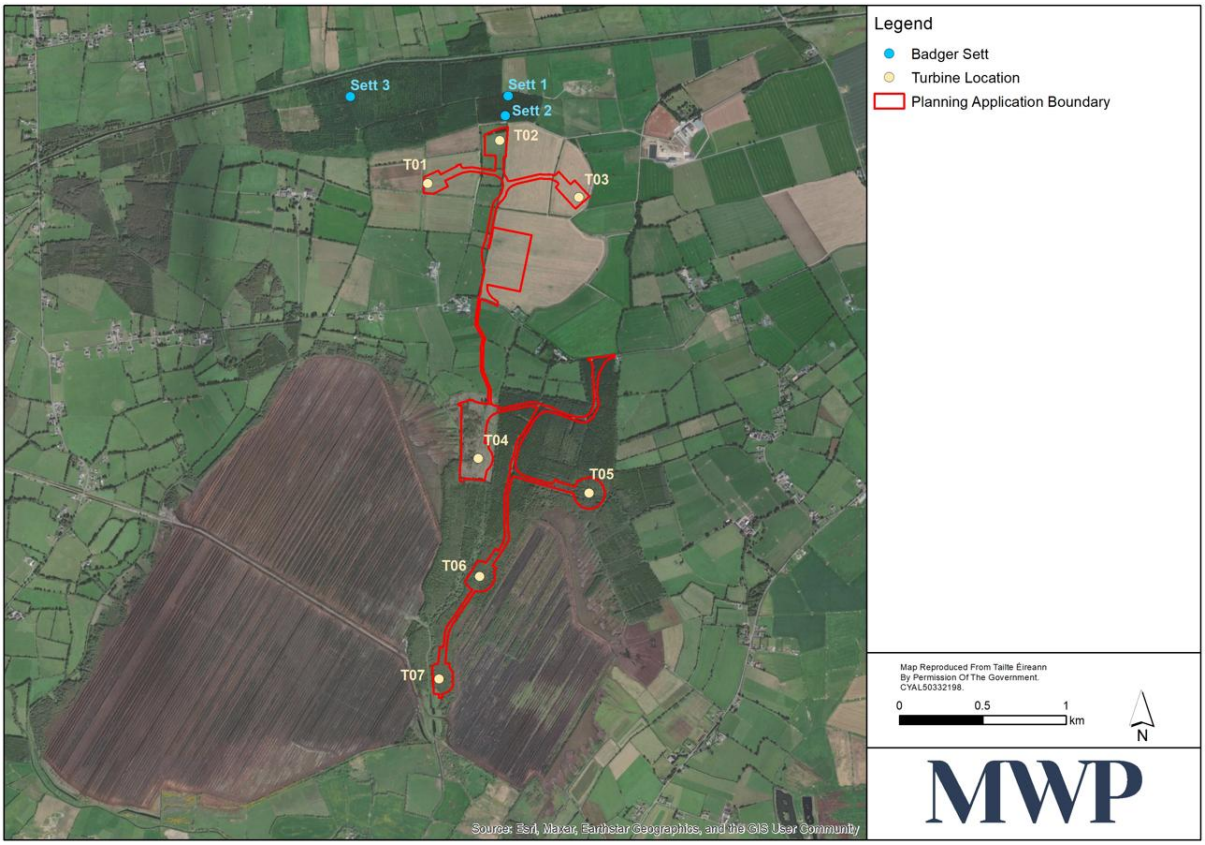

Figure 6-6: Active Badger Setts within the Study Area

Plate 15: Badger Site 1, Refer to Figure 6-6, Located in the North of the Study Area, 22 Feb 2024

Plate 16: Badger Site 2, Refer to Figure 6-6, Located in the North of the Study Area, 22 Feb 2024 [16]

[16] Note snuffle holes in centre and left foreground of photo

Plate 17: Badger Site 3, Refer to Figure 6-6, Located in the North of the Study Area, 22 Feb 2024[17]

Plate 18: Badger Site 1, Refer to Figure 6-6, Located in the North of the Study Area, 12 Sep 2024[18]

[17] Snuffle holes and latrines found in environs
[18] Note fresh scat located to the left of the sett entrance

Plate 19: Badger site 2, refer to Figure 6-6, located in the north of the Study Area, 12th Sept, 2024[19].

Plate 20: Badger Site 3, refer to Figure 6-6, Located in the North of the Study Area, 12 Sep 2024, Inactive Sett

6.3.7.2 Bats

6.3.7.2.1 Desk Study

With regard to the Study Area, the Bat Habitat Suitability Index (BHSI) rating was determined for all Irish bat species. Bat habitat suitability for all bat species within the Study Area is 29.11 for hectad N53 and 23.78 for hectad N52, respectively, ratings which are considered very low. The highest rating value for any individual species was 48.

Table 6-7: Bat Habitat Suitability Index (BHSI) for the Study Area and surrounds (NBDC, 2024)

Species		Suitability Index Rating (N52/N53)	
		N52	N53
All Bats		23.78	29.11
Lesser Horseshoe bat	*Rhinolophus hipposideros*		
Nathusius' pipistrelle	*Pipistrellus nathusii*	2	5
Daubenton's bat	*Myotis daubentonii*	31	35
Natterer's bat	*Myotis nattereri*	25	34
Whiskered bat	*Myotis mystacinus*	13	16
Common pipistrelle	*Pipistrellus pipistrellus*	40	48
Leisler's bat	*Nyctalus leisleri*	36	45
Soprano pipistrelle	*Pipistrellus pygmaeus*	38	44
Brown long-eared bat	*Plecotus auritus*	29	35

6.3.7.2.2 Field Study

Overall, the PRA undertaken on the Study Area determined the area was considered to be of 'negligible' value to bats. In the north of the Study Area, the PAB surveys indicated activity was predominantly focussed on the Grand Canal flowing west to east, located outside the planning boundary for the Proposed Development. Nighttime walkover surveys in the south of the Study Area, indicated activity in the south was focussed along the watercourse which exits the Study Area to the south.

PAB surveys determined that soprano pipistrelle had the highest number of passes recorded at 46.91% across both years. Common pipistrelle was the second most frequently recorded species at 34.53%. Overall bat activity in the south was relatively low and limited to common pipistrelle, soprano pipistrelle, Leisler's bats and Myotis spp. More details on these PRA and PAB bat surveys can be found in Appendix 6-2 – Ballinla Bat Report.

Separately from surveying undertaken as part of the bat report, a daytime walkover survey was undertaken on the 28th of February 2025. This survey identified three potential roost features between three trees along a mature treeline of approximately twelve ash trees (*Fraxinus excelsior*) in the centre-west of the Study Area. At the time of surveying, livestock consisting of bullocks were located in the area where the ash treeline occurs, with the ground at the treeline showing disturbance from trampling highlighting their activity in this area of farmland. These trees were considered to be in relatively poor condition with dead branches and tree material present on the ground at time of surveying. The first potential roost feature (PRF) consisted of lifting bark on the trunk of the tree located at a height of c. 1.8 m, whilst the remaining two features consisted of fluting and/or wounding at approximately 1 m height. All trees were approximately 1.4 m in diameter and all PRFs faced north with the latter two being susceptible to water infiltration which indicated they may not be suitable as shelter for bats. Where the lifting bark PRF occurred, this feature was notably small and whilst it could be used by individual bats, in consideration of the isolated nature of the ash trees and their poor health, all the PRFs were considered to be of

[19] Active latrines and snuffle holes found throughout this area.

'Low' habitat suitability. Therefore, in accordance with Collins (2023) guidance, no further survey for these trees was considered necessary.

6.3.7.3 Invertebrates

6.3.7.3.1 Desk Study

NBDC records from the hectads N52 and N53 overlapping the Study Area indicate documented records for butterflies, and moths (Lepidoptera), beetles (Coleoptera) and bees (Hymenoptera). Species of note, including the legislative protection and/or conservation status of these species, are listed in Table 6-8.

Table 6-8: Documented Records of Terrestrial Macro-Invertebrate within N52 and N53 Encompassing the Study Area

Common Name	Species Name	Hectad	Level of Protection/Conservation Status[20]
Dark Green Fritillary	*Argynnis aglaja*	N52	None/'Vulnerable'
Dingy Skipper	*Erynnis tages*	N52/ N53	None/'Near Threatened'
Large Red-Tailed Bumble Bee	*Bombus (Melanobombus) lapidarius*	N52/ N53	None/'Near Threatened'
Marsh Fritillary	*Euphydryas aurinia*	N52/ N53	Annex II/'Vulnerable'
Small Heath	*Coenonympha pamphilus*	N52/ N53	None/'Near Threatened'
Wall butterfly	*Lasiommata megera*	N52/ N53	None/'Endangered'
Large Red-Tailed Bumble Bee	*Bombus (Melanobombus) lapidarius*	N52/ N53	None/'Near Threatened'

6.3.7.3.2 Field Study

No protected and/or threatened species, including those listed in Table 6-8, were recorded during ecological surveys completed in the Study Area. A number of other species of butterfly and bee were noted during surveys, including the small tortoiseshell butterfly, the peacock butterfly, speckled wood, meadow brown, ringlet, silver-washed fritillary, orange tip, painted lady, small heath, green-veined white, common carder bee, and white tailed bee species. None of these species are considered threatened or vulnerable and are not afforded legal protection in Ireland.

Regarding Q values: Site 1, Site 7 and Site 12 were rated Q3-4 'Moderate' status, Site 6 was rated 'Poor' status whilst the remaining sites were unsuitable for Q-rating due to unsuitable habitat present for surveying. With regard to EPT index, water quality varied between 0 at site 1 to 7 at Sites 1, 3, 4, 8, 9, and 11. Results of the EPT index indicated degraded water quality. Biological water quality results and interpretations at study sites on watercourses potentially affected by the Proposed Development are detailed in Table 6-9. Water quality was Unsatisfactory (Moderate or Poor status) across the Study Area which may be due to the substrate siltation causing reduced biological diversity and thus reduced biological water quality across the Study Area. High and

[20] https://www.npws.ie/sites/default/files/publications/pdf/RL_2010_Butterflies.pdf.
https://www.npws.ie/sites/default/files/publications/pdf/Fitzpatrick_et_al_2006_Bee_Red_List.pdf

persistent sediment loads may affect invertebrate assemblages and abundances, with Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa exhibiting the greatest negative response to increased sediment[21].

Table 6-9: Q Values

Site	Watercourse	Q-rating	Quality Status	Corresponding WFD Status	EPT
1*	Not registered	n/a	n/a	n/a	0
2*	Not registered	n/a	n/a	n/a	1
3*	Not registered	n/a	n/a	n/a	0
4*	Not registered	n/a	n/a	n/a	0
5*	Leitrim	n/a	n/a	n/a	1
6	Leitrim	3	Moderately Polluted	Poor	2
7[1]	Leitrim	3-4	Slightly Polluted	Moderate	4
8	Lumville	n/a	n/a	n/a	0
9	Lumville	n/a	n/a	n/a	0
10	Leitrim	3-4	Slightly Polluted	Moderate	3
11[1]	Rathmoyle	n/a	n/a	n/a	0
12	Esker (Stream) [Offaly]	3-4	Slightly Polluted	Moderate	7

6.3.7.4 Freshwater Aquatic species

6.3.7.4.1 Desk Study

In order to collate information on aquatic species and to identify features of aquatic ecological importance within the Study Area, a desk-top study was undertaken. Details of records of aquatic macroinvertebrates, fish, and amphibians are detailed in the Aquatic Ecology and Fish report, which can be found in Appendix 6-1.

Aquatic species recorded in the N52 and N53 hectads are listed in the table below. The influence of the Boyne catchment to the north of the Proposed Development site is likely driving the presence of lamprey and salmon in N53. Though white-clawed crayfish has been recorded in N52 and N53, EPA biological sampling did not return records for the species in 2022.

Table 6-10: Documented records of freshwater aquatic species within N52 and N53 encompassing the Study Area

Common Name	Species Name	Level of Protection	Hectad	Record Origin
Brook lamprey	*Meles meles*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N52/ N53	NBDC
Atlantic salmon	*Salmo salar*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). EU Habitats Directive (92/43/EEC) Annex II, Annex IV	N52/N53	NBDC

[21] https://www.salmon-trout.org/wp-content/uploads/2017/09/STC-The-impact-of-excess-fine-sediment-on-invertebrates-and-fish-in-riverine-systems.pdf

Common Name	Species Name	Level of Protection	Hectad	Record Origin
White-clawed crayfish	*Austropotamobius pallipes*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). EU Habitats Directive (92/43/EEC) Annex II, Annex V	N52/N53	NBDC

6.3.7.4.2 Field Study

As part of the aquatic baseline surveys, extensive surveying of the watercourses within the site was undertaken. Surveying found that the Leitrim River within the site is not utilised by spawning salmonids due to its small size and slow flowing watercourse. Despite brown trout being found in the Leitrim River itself, those found were deemed to have spawned in the Esker River located downstream. Other species found in the watercourses draining the Study Area included three-spined stickleback (36), brown trout (15), minnow (41), pike (2), dace (4), perch (1), and brook lamprey (1). Salmonids were absent from all sites with the exception of Site 10 (Leitrim River) and 12 (Esker stream) due to a lack of habitat suitability but also partly due to water quality, with these two features being interrelated in small channels draining the site. Overall, the biological water quality is considered to be largely compromised within the Study Area which suggests an unstable aquatic ecosystem in smaller channels within the site attributed to loss of soils to streams and associated enrichment relating to agriculture and coniferous forestry, albeit to a lesser degree.

Though a single brook lamprey was recorded during electrofishing efforts on the Leitrim River, the aquatic report concluded that migratory lamprey species such as sea and river lamprey are highly unlikely to occur in watercourses within the Study Area.

6.3.7.5 Reptiles & Amphibians

6.3.7.5.1 Desk Study

Common frog (*Rana temporaria*) has been recorded previously in hectads N52 and N53, encompassing the Study Area. Smooth newt (*Lissotriton vulgaris*) has been recorded previously in hectad N53. Both species are protected under the Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000) and Common frog is also listed under Annex V of the EU Habitats Directive.

Table 6-11: Records of Protected Reptile/Amphibian Species Recorded in N52 and N53

Common Name	Species Name	Level of Protection	Hectad	Record Origin
Common frog	*Rana temporaria*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). EU Habitats Directive (92/43/EEC) Annex V	N52/ N53	NBDC
Smooth newt	*Lissotriton vulgaris*	Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000)	N52	NBDC

6.3.7.5.2 Field Study

Some suitable breeding habitat for frog was identified within the Study Area. tadpoles were identified at one location in a drainage ditch in the northern extent of the site in June 2023. However, there was evidence of failed frog spawning at the site when surveyed in February 2024.

No Smooth newt nor its habitat was identified during any site surveys.

6.3.8 Ecological Valuation

6.3.8.1 Designated Sites

6.3.8.1.1 Sites of International Importance

With regard to European sites, a Screening for Appropriate Assessment report (MWP, 2024) was prepared to determine whether the Proposed Development, alone or in-combination with other plans or projects, is likely to have significant effects on the European sites listed in Table 6-2, Section 6.3.3.1, in view of the conservation objectives of those sites.

The Screening for Appropriate Assessment report objectively concluded that the Proposed Development will not result in any likely significant effects on any European sites and consequently, all QI habitats and species and impact mechanism combinations were screened out for further assessment.

6.3.8.1.2 Sites of National Importance

Due to an absence of ecological/hydrological connection and thus impact pathways, all NHAs and pNHAs identified in the vicinity of the Study Area are located outside of the zone of influence and therefore effects on these sites as a result of the Proposed Development are not envisaged to occur. Therefore, these sites will not be considered further in this evaluation.

6.3.8.2 Selection of Key Habitats as Important Ecological Features

The habitat types within the Study Area are evaluated in Table 6-12 for their conservation importance. Those identified as being of 'Local importance (higher value)' are selected as Important Ecological Features.

Table 6-12: Evaluation of the Habitats within the Study Area Identified as IEFs

Ecological receptor	Extent/Location	Ecological value	Rationale	Important Ecological Feature
Spoil and Bare Ground (ED2)	Very localized to a small pocket in the north of site. Linear examples are limited to unpaved natural tracks in north and central Study Area.	Local importance (lower value)	No intrinsic ecological value	No
Cutover Bog (PB4)	Approx. 0.7ha of cutover bog pocket within southeastern limit of Study Area.	Local importance (lower value)	No intrinsic ecological value	No
Improved Agricultural Grassland (GA1)	Dominant habitat in northern section of the Study Area, Proposed Development site,	Local importance (lower value)	Highly managed habitat with no ecological function	No
Conifer Plantation (WD4)	Found throughout Study Area primarily in the northwest and southern areas.	Local importance (lower value)	No significant intrinsic ecological value	No
Broadleaved Woodland (WD1)	Occurs as patchy isolated pockets in the northwest of the Study Area	Local importance (higher value)	Represents native broadleaf tree species albeit in isolated areas.	**Yes**
Mixed Broadleaved-conifer woodland (WD2)	Occurs throughout southern extent of Study Area,	Local importance (lower value)	These areas are highly modified and are considered to be of low importance for wildlife.	No
Recently-felled woodland (WS5)	Located in the centre of the Study Area	Local importance (lower value)	No intrinsic ecological value	No
Recently-felled woodland – Scrub (WS1 - WS5)	Mosaic habitat in the centre-west of the Study Area	Local importance (lower value)	Limited intrinsic ecological value	No

Ecological receptor	Extent/Location	Ecological value	Rationale	Important Ecological Feature
Scrub (WS1)	Located on the banks of the watercourse in the south of the Study Area	Local importance (higher value)	Provides pathway for commuting mammals in south of site along watercourse for foraging, access to watercourse. Potential nesting habitat for birds.	**Yes**
Hedgerow (WL1)	Extensive in the north of the Study Area. Delineates field boundaries of improved agricultural grassland (GA1)	Local importance (higher value)	Potentially important foraging, commuting, breeding and resting linear habitat for fauna	**Yes**
Treeline (WL2)	Found throughout the Study Area delineating field boundaries.	Local importance (higher value)	Potentially important foraging, commuting linear feature, intrinsic biodiversity value and links/ecological corridors between linear habitats in the northwest	**Yes**
Drainage Ditch (FW4)	Low gradient features located throughout the site	Local importance (higher value)	Used by breeding frog in the northern extent of site	**Yes**
Depositing Lowland River (FW2)	One main watercourse draining the southern half of the Study Area to the south	Local importance (higher value)	Provide habitat for a variety of fauna and hydrological connections with catchment	**Yes**
Amenity Grassland (improved) (GA2)	Small area in the northeast of the site which is focused on the gardens of a house	Local importance (lower value)	Highly managed grassland habitat on private land and outside the infrastructure of the PDS	No
Buildings and Artificial Surfaces (BL3)	Farm buildings and outhouses	Local importance (lower value)	Not ecologically important due to active use in farming and limited potential	No
Roadside Grass Verge (GS2)	Proposed Grid Connection and Proposed TDR node at the junction of the R-402 and R-420	Local importance (lower value)	Not ecologically important due to traffic disturbance and proximity to road.	No

6.3.8.3 Selection of Key Fauna and Flora as Important Ecological Features

Table 6-13 presents an evaluation of the ecological value of the floral and faunal species, excluding birds, identified within the receiving environment of the Proposed Development and rationale for inclusion, or, exclusion as IEFs.

Table 6-13: Evaluation of Fauna and Flora (Excluding Birds) within the Study Area as IEFs

Ecological Receptor	Legislative Protection	Ecological Value	Rationale	Important Ecological Receptor
Non-volant mammals				
Badger (*Meles meles*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (higher value)	Species is protected under national legislation. Badger activity, including 3 setts, recorded within the Study Area located entirely in the conifer plantation habitat in the northwest of the Study Area. All setts are located outside footprint of Proposed Development.	**Yes**

Ecological Receptor	Legislative Protection	Ecological Value	Rationale	Important Ecological Receptor
Eurasian Pygmy Shrew (*Sorex minutus*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (higher value)	The species is protected under national legislation. Not recorded during ecological surveys but suitable habitat occurs. Precautionary principal.	**Yes**
Eurasian Red Squirrel (*Sciurus vulgaris*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (higher value)	The species is protected under national legislation. Not recorded during ecological surveys but suitable habitat occurs. Precautionary principal.	**Yes**
European Otter (*Lutra lutra*)	Wildlife Acts, 1976 to 2021, as amended. Annex II, Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher value)	The species is protected under national and European legislation. Evidence of the species (scat) found near watercourse on site during surveying. No evidence of holt on watercourse. may use area for commuting	**Yes**
Hedgehog (*Erinaceus europaeus*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (higher value)	This species was not recorded on site during ecological surveying. however, suitable habitat exists and there are desktop records in the greater area. This species is protected under national legislation.	**Yes**
Pine marten (*Martes martes*)	Annex V Habitats Directive, Wildlife Acts, 1976 to 2021, as amended	Local importance (higher level)	Species not identified during surveying though area contains suitable resting and breeding habitat for the species	**Yes**
Irish Hare (*Lepus timidus hibernicus*)	Annex V Habitats Directive, Wildlife Acts, 1976 to 2021, as amended	Local importance (higher value)	National legal protection, observed during surveying, particularly in the northern areas of the Study Area. Consequently, site was considered to contain suitable resting and breeding habitat for the species.	**Yes**
Irish stoat (*Mustela erminea hibernica*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (higher level)	The species is protected under national legislation. Suitable resting and breeding habitat occurs.	**Yes**
Bats				
Lesser Horseshoe bat (*Rhinolophus hipposideros*)	Wildlife Acts, 1976 to 2021, as amended. Annex II and Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (lower level)	None detected during survey efforts across 2023 and 2024 survey seasons. No records within 10km of the site and the BHSI rating for this species is 0 throughout the site	No
Nathusius' pipistrelle (*Pipistrellus nathusii*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species identified during surveying	**Yes**
Daubenton's bat (*Myotis daubentonii*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species potentially identified during surveying	**Yes**

Ecological Receptor	Legislative Protection	Ecological Value	Rationale	Important Ecological Receptor
Natterer's bat (*Myotis nattereri*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species potentially identified during surveying	**Yes**
Whiskered bat (*Myotis mystacinus*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species potentially identified during surveying	**Yes**
Common pipistrelle (*Pipistrellus pipistrellus*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species identified during surveying	**Yes**
Leisler's bat (*Nyctalus leisleri*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species identified during surveying	**Yes**
Soprano pipistrelle (*Pipistrellus pygamaeus*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species identified during surveying	**Yes**
Brown long-eared bat (*Plecotus auritus*)	Wildlife Acts, 1976 to 2021, as amended. Annex IV of the EU Habitats Directive (92/43/EEC)	Local importance (higher level)	Species identified during surveying	**Yes**
Terrestrial Macro-Invertebrates				
Marsh Fritillary (*Euphydras aurinia*)	Annex II of the Habitats Directive (92/43/EEC)	Local importance (lower value)	No suitable habitat composed of devil's bit scabious (*Succisa pratensis*) was identified during field surveys. Unlikely to occur	No
Other terrestrial macro-invertebrates (bees, butterflies etc.,)	N/a	Local importance (higher value)	The terrestrial insect population in semi-natural terrestrial habitats is important at the lower level of ecosystem food chains, for example, essential for sustenance of bats.	**Yes**
Aquatic Species				
White-clawed crayfish (*Austropotamobius pallipes*)	Wildlife Acts, 1976 to 2021, as amended. Annex II and Annex V of the Habitats Directive (92/43/EEC)	Local importance (lower value)	Though NBDC reports records of the species in the River Deel once supported crayfish but was decimated in 2017, likely due to the introduction of crayfish plague. Not recorded during EPA sampling in 2020.	No
Brook Lamprey (*Lampetra planeri*)	Annex II of the Habitats Directive (92/43/EEC)	Local importance (higher value)	Common species in most fluvial habitats with suitable spawning and nursery habitats. One brook lamprey identified during surveying, however unlikely to be spawning in area	**Yes**
Atlantic Salmon (*Salmo salar*)	Annex II, Annex V of the Habitats Directive (92/43/EEC)	Local importance (lower value)	Overall evaluation of the salmon habitat at aquatic survey sites was considered unsuitable and	No

Ecological Receptor	Legislative Protection	Ecological Value	Rationale	Important Ecological Receptor
			marginal for all sites (1-11) other than site 12. Site 12 (Leitrim River) was considered to be suboptimal for early life stages and spawning adult salmon. Due to the morphological characteristics of the Leitrim River.	
Freshwater Pearl Mussel (*Margaritifera Margaritifera*)	Wildlife Acts, 1976 to 2021, as amended. Annex II, Annex IV of the Habitats Directive (92/43/EEC)	Local importance (lower value)	No habitat for the species exists within the site. Aquatic surveys found no evidence of the suitable habitat or presence of species in watercourses.	No
Other fish species (e.g., Brown trout (*Salmo trutta*), minnow (*Phoxinus phoxinus*), three spined stickleback, stone loach (*Barbatula barbatula*), dace (*Leuciscus leuciscus*), perch (*Perca fluviatilis*), and pike (*Esox lucius*)	N/a	Local importance (higher value)	These species were recorded during electrical fishing in watercourses draining the Study Area	**Yes**
Reptiles & Amphibians				
Common Frog (*Rana temporaria*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (higher value)	Drainage ditches located throughout the site provide spawning habitat for frog. Tadpoles were identified at one drainage ditch location in June 2023, though no evidence of successful spawning in February 2024. It is considered likely that frogs spawn in other drainage ditches within the Study Area.	**Yes**
Smooth Newt (*Lissotriton vulgaris*)	Wildlife Acts, 1976 to 2021, as amended	Local importance (lower value)	Neither species nor pond habitat were identified within the Study Area.	No

6.3.9 Do-Nothing Scenario

The Proposed Development is situated in a locality with a well-established pattern of mixed land use pertaining to both within the application boundary and its surrounds. These comprise predominantly commercial forestry and agriculture in the immediate environs, with areas of the conifer forest areas having been recently felled. The lands encompassed within the development site are not subject to any form of formal nature designation. If the proposed wind farm development does not progress beyond the planning application stage it is likely that the current land-use practices, mainly comprising agriculture in the north of the Study Area and forestry in the south, will continue at the Proposed Development site.

6.4 Assessment of Impacts and Effects

Wind farm developments are projects that may potentially impact on the natural environment (habitats, flora, fauna, water quality, and aquatic ecology). For wind farm projects, the construction phase has the potential to have the most significant effect on biodiversity. This section will identify in detail the potential ecological impacts of the construction, operational, and decommissioning phases of the Proposed Development on the receiving natural environment. The potential impacts of the Proposed Development were considered and assessed to ensure that all effects on IEFs are adequately addressed, and no significant residual effects are likely to remain following the implementation of mitigation measures.

6.4.1 Construction Phase

The main potential effects associated with the construction phase of the Proposed Development are identified in the points below:

- Habitat loss and alteration effects associated with forestry felling, vegetation clearance, site access tracks, and excavations for turbine foundations and deposition areas, site substation, as well as the temporary construction compound within the development boundary.
- Temporary habitat loss, barriers to animal movements and disturbance as a result of side-casting, and/or stockpiling of material.
- Temporary disturbance and/or displacement of species, potential for injury/mortality as a result of increased activity and physical presence.
- Potential pollution of drains and streams draining the site and of downstream watercourses lower in the catchment, without appropriate mitigation.
- Potential spread of invasive species.

The construction phase of the Proposed Development will require excavation and construction within the site, which will bring about habitat loss. It will have a potential impact on flora and fauna. A potential impact during construction is disturbance of sheltering or foraging species of fauna by the operation of machinery and other human activity.

This section identifies the impact of the construction phase of the Proposed Development on the local natural environment.

6.4.1.1 Habitats and Flora

Habitat loss will result from the construction of turbine bases and hardstands for wind turbines, the construction of the electrical substation, construction of new access tracks and widening of existing tracks, permanent site operations compound as part of the substation layout, and underground electrical and communications cabling connecting the turbines to the proposed onsite substation. To facilitate the delivery of the turbine, the removal of hedgerow will be undertaken at two locations along the route. The network of existing access tracks will be upgraded and widened, together with new access tracks would be used to access each of the turbines and substation compound. Figure 6-7 illustrates the habitat within the Study Area.

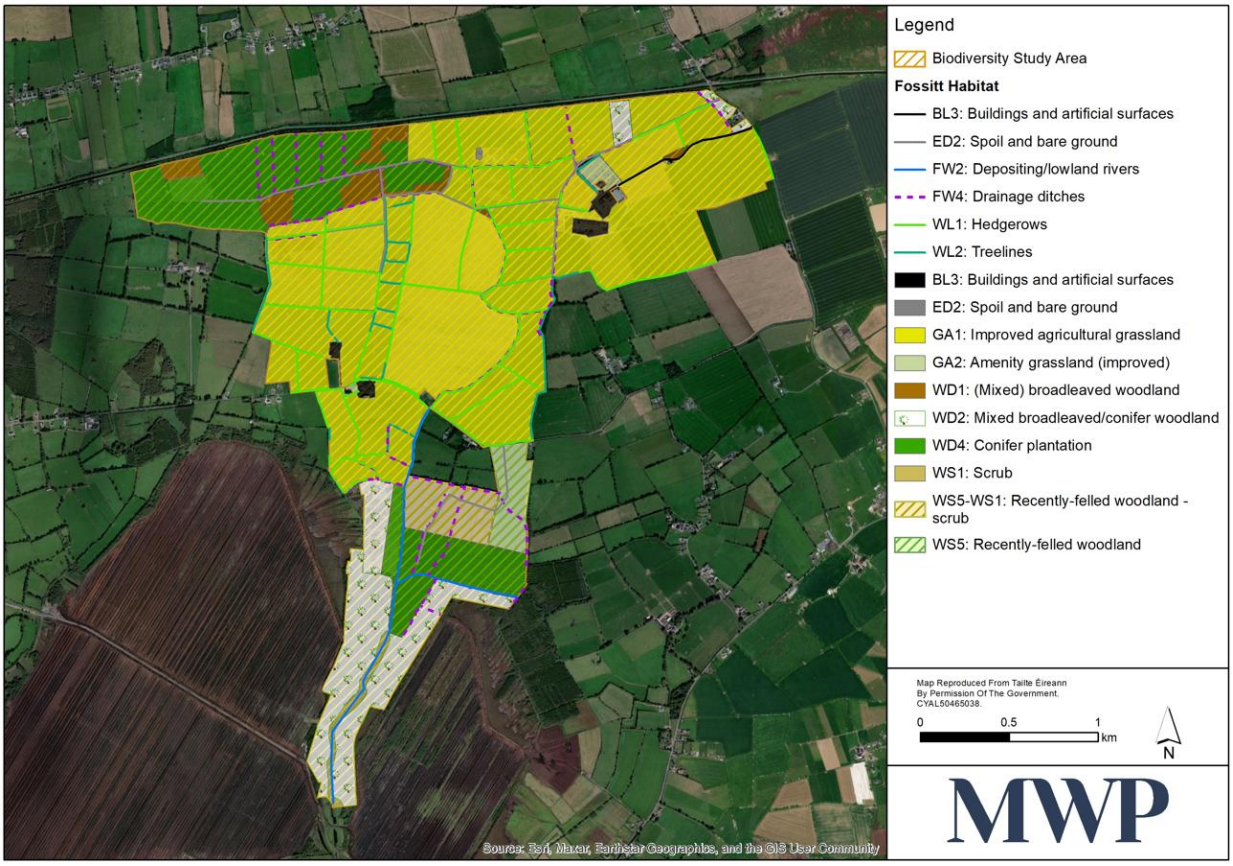

Figure 6-7: Habitats Identified within the Study Area for the Proposed Development

The area of a single hardstand is approximately 80m long by 30m wide. Internal access tracks will have a running width of generally 5m along straight sections, with localised wider areas at bends to accommodate the efficient transport of the wind turbine components. The habitats recorded and their areas of loss, or, in the case of linear habitats, the length of habitat which will be lost to facilitate construction of the Proposed Development, are provided in Table 6-14. Most infrastructure is situated in Improved Agricultural Grassland (GA1) and Mixed broadleaved – Conifer woodland (WD2).

Electrical cabling will be required between turbines and the onsite substation. The underground cabling between the proposed substation and turbines will be installed along internal access tracks connecting to the substation compound. There will be no overhead power lines constructed as part of the Proposed Development.

There are some small lowland watercourses draining the Proposed Development site which have been classified per Fossitt (2000) as depositing/lowland rivers (FW2) and drainage ditches (FW4). The crossing points of underground cabling within the Proposed Development will coincide with the crossing points of the proposed access tracks. New bottomless culverts will be installed to carry both the track and the cable over the crossings within the northern section of the wind farm. A clear span bridge will be used on the Leitrim Stream crossing in the southern section of the wind farm to T4. All other land drains/watercourses in the southern section of the Proposed Development site, which are considered to be of low ecological value, will be crossed using culverts. Details of the crossing methodologies for the access tracks and cables within the wind farms are provided in Chapter 3 Civil Engineering.

Construction operations taking place onsite, such as the movement of materials, can disturb local ecosystems. There is potential to generate dust from extraction of raw material, loading and haulage as well as vehicle

movement. This can travel into waterways and can impact upon sensitive habitats thus disrupting wildlife, without appropriate mitigation.

Table 6-14: Areas of IEF Habitat Loss Associated with the Proposed Development

Habitat Type	Area of Habitat Loss (Ha)	IEF (Y/N)
Woodland and Scrub habitats and mosaics		
Mixed Broadleaved-Conifer Woodland (WD2)	13	N
Conifer Plantation (WD4)	6.2	N
Scrub (WS1)	0.006	Y

Habitat Type	Length of Habitat Loss (m)	IEF (Y/N)
Hedgerows (WL1)	143	Y
Treeline (WL2)	192	Y
Depositing/lowland river (FW2)	5	Y
Drainage ditches (FW4)	126	Y

Table 6-15: Construction Stage Potential Effects on IEF Habitats Without Mitigation

Important Ecological Feature	In-situ Impact	In-situ/Ex-situ effect	Description of Unmitigated Impact	Significance of Unmitigated effects (NRA, 2009 & EPA, 2022)
Woodland and Scrub Habitats and Mosaics				
Broadleaved Woodland (WD1)	None	Habitat loss, loss of habitat connectivity, alteration	Habitat Loss The proposal will require no loss of this habitat type. This habitat will be avoided and no habitat loss will occur. Habitat Alteration/Disturbance Habitat disturbance may occur due to encroachment from works areas, side-casting of materials or spread of invasive species.	Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**
Scrub (WS1)	Unlikely	Loss of broader connectivity within site	Habitat Loss There will be 0.006ha of loss of this habitat as a result of the Proposed Development. This constitutes a small area of overlap with this habitat at the southernmost point of the Study Area, within the footprint of hardstand structure of T7. The majority of this habitat type is located outside the infrastructure footprint of the Proposed Development. Habitat Alteration/Disturbance Habitat disturbance may occur due to encroachment from works areas, side-casting of materials or spread of invasive species.	Habitat loss effects are assessed as **Permanent, Likely Slight Negative Effects.** Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**
Hedgerow WL1)	Habitat Loss	Habitat loss and loss of habitat connectivity	Habitat Loss The proposal will require 143m loss of this habitat type. Separately, along the turbine delivery route, hedgerow will be removed at two pinch points along the route where they delineate heavily managed agricultural grasslands. Hedgerows at these locations are considered to have relatively low value with regard their value to local biodiversity. Habitat Alteration/Disturbance Habitat disturbance may occur due to encroachment from works areas, side-casting of materials or spread of invasive species.	Direct habitat loss effects are assessed as **Permanent, Likely Significant, Negative Effects**. Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**
Treeline (WL2)	Habitat Loss	Habitat loss and loss of habitat connectivity	Habitat Loss The proposal will require 192m loss of this habitat type. This loss is nearly entirely limited to a single stand of ash trees located within the buffer felling area at T2. Habitat Alteration/Disturbance Habitat disturbance may occur due to encroachment from works areas, side-casting of materials or spread of invasive species.	Direct habitat loss effects are assessed as **Permanent, Likely Moderate, Negative Effects**. Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**

Important Ecological Feature	In-situ Impact	In-situ/Ex-situ effect	Description of Unmitigated Impact	Significance of Unmitigated effects (NRA, 2009 & EPA, 2022)
Freshwater Aquatic Habitats				
Depositing/lowland river (FW2)	Habitat loss Impairment of water quality	Impairment of downstream water quality	Habitat Loss There will be limited loss of depositing lowland river habitat within the site. One pipe culvert is proposed in this habitat for the collector cable just north of T4. Approximately 5 m of substrate of this habitat will be lost as a result of culvert/installation. The watercourse on which the culvert is proposed is of notably poor quality, nearly akin to the existing drainage ditches throughout the Study Area, and drains extracted peatland immediately upstream at its head and adjacent agricultural lands. Flows were observed to be slow in this watercourse with enrichment and encroachment from cattle occurring in areas. This watercourse does not contain suitable habitat utilised for any important ecological feature species. Standard operating procedure wherein upstream and downstream of the culvert area will be dammed and side channel or overpiping will be installed to prevent loss of flow downstream. This method allows work to be done in the effective dry of the channel and limits disturbance of immediate sediments release downstream. Habitat Alteration Potential indirect effects due to deterioration of water and stream habitat quality as a result of potential run of silt/sediment, ingress of cementitious material, fuel or oil and /or impacts on flow regime and in-stream vegetation. There will be some loss of primary instream production due to a reduction in light.	Direct effects relating to loss of substrate habitats area assessed as **Permanent, Likely Slight, Negative Effects..** Direct macroinvertebrate habitat loss effects are assessed as **Permanent, Likely Slight**, **Negative Effects**. Habitat alteration effects are assessed as **Permanent, Likely Moderate Negative Effects.** **Moderate Negative Effects** with regards to aquatic ecology and water quality.
Drainage ditch (FW4)	Habitat loss	Impairment of water quality	Habitat Loss There will be loss of c. 5 m of this habitat where one pipe culvert is proposed. Standard operating procedure will be utilised wherein upstream and downstream of the culvert area will be dammed and side channel or overpiping will be installed to prevent loss of flow downstream. This method allows works to be done in the effective dry and limits release of sediments downstream. Where culverts are to occur, they occur in biodiversity-low watercourses. Proposed Development Habitat Alteration There will be approximately 126 m of this habitat type altered within the Proposed Development site covered due to access tracks. Potential indirect effects due to deterioration of water and stream habitat quality as a result of potential run of silt/sediment, ingress of cementitious material, fuel or oil and /or impacts on flow regime and in-stream vegetation.	Direct habitat loss effects are assessed as **Permanent, Likely Slight, Negative Effects.** Habitat alteration effects are assessed as **Short-term, Likely Slight, Negative Effects.**

6.4.1.2 Non-Volant Mammals

Table 6-15 describes the potential construction phase effects on non-volant mammal species identified as Important Ecological Features (IEFs) (excluding bats) Proposed Development within the Proposed Development boundary, as well as the significance of the effect, without the implementation of appropriate mitigation measures.

In terms of potentially significant disturbance/displacement of species, it is considered that increased activity at the site during the construction phase are likely to occur. However, these activities will be restricted to daylight, it can be considered that the potential disturbance or displacement effects are likely to not be significant.

Table 6-16: Construction Stage Potential Effects on IEF Non-Volant Terrestrial Mammal Species Without Mitigation

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
Otter	Not identified during surveying. Watercourses within Study Area identified as being suitable for otter. Spraint also identified during walkover surveys on watercourse bank along Leitrim River in the south of the Study Area. Evaluated as Local Importance (Higher Value)	Habitat Loss None expected. Habitats which will be lost as a result of the proposal are not considered to be of particular ecological value to otter. No evidence of breeding and resting places within the site. Disturbance and/or Displacement On a precautionary basis, direct disturbance and/or displacement effects on otter could potentially ensue as a result of increased noise, lighting and human activity if otters were to occur within the vicinity of construction works. It is noted that agricultural, and forestry activities comprise the majority of on-going land-use at the development site and in immediate environs. Indirect disturbance and/or displacement effects on otter could potentially ensue due to water quality impacts which could impact on otter foraging/commuting habitat and/or prey biomass in rivers. Watercourses onsite identified as being sub-optimal for otter. however, extensive suitable habitat for foraging is located downstream of the Proposed Development site. As the development incudes a minimum 10m buffer from all main river watercourses, it is considered that this setback will reduce risk of direct disturbance and/or displacement effects on otters. As direct disturbance is thus reduced, there is an even lesser likelihood of indirect disturbance and/or displacement impacts to otter during construction of the Proposed Development.	No habitat loss effects on otter predicted. Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term, Slight Negative Effects.** Indirect disturbance and/or displacement effects during the construction phase are assessed as **Likely Temporary to Short-term, Slight Negative Effects.**
Badger	The habitats occurring within the Study Area provide foraging and breeding/resting habitat for badger. Ecological surveys determined that badger use the Study Area for foraging, resting, and likely breeding. Presence of badger confirmed within the Study Area, albeit outside the Proposed Development boundary. Evaluated as Local Importance (Higher Value).	Habitat Loss Linear habitat such as hedgerows that will be lost provide foraging habitat for badger. These habitats are relatively focussed within the Proposed Development site in the northwest in proximity to badger setts, however are located throughout the broader landscape where they delineate field boundaries of agricultural grasslands. No loss or disturbance of badger setts identified during field surveys is proposed as part of the works. Existing badger setts will be retained.	Habitat loss effects on badger (loss of potential foraging habitat) assessed as a **Likely Short-term Slight Negative Effect.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
		Disturbance and/or Displacement Three badger setts were confirmed present outside the Proposed Development area with the closest badger sett located approximately 152.2 m from the nearest point of any proposed infrastructure. Considering the scale of the proposed works, there is potential for disturbance and/or displacement effects as a result of increased noise and human activity at the site during the construction phase. It is noted that agricultural and forestry activities comprise on-going land-use at the development site.	
Pine marten	Species not observed during walkover surveys. Some suitable foraging habitat occurs within the Proposed Development site in the northwest of the site where broadleaved and conifer woodlands occur. Evaluated as Local Importance (Higher Value).	Habitat Loss The treeline and hedgerow habitat which will be lost provides potential foraging and breeding/resting habitat for pine marten. This habitat type is widespread within the overall site. Disturbance and/or Displacement Direct disturbance and/or displacement effects could arise as a result of increased noise, lighting and human activity at the site during the construction phase.	Habitat loss effects on pine marten are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**
Irish Hare	Observed in the northwest and western areas of Study Area during surveys. suitable foraging and breeding/resting habitat was considered to occur in throughout much of the Study Area. Evaluated as Local Importance (Higher Value).	Habitat Loss The grassland and scrub habitats which will be lost provide potential foraging and breeding/resting habitat for Irish hare. These habitats are common and widespread within the overall site. Disturbance and/or Displacement Direct disturbance and/or displacement effects could arise as a result of increased noise and human activity at the site during the construction phase.	Habitat loss effects on Irish hare are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**
Irish Stoat	Some suitable foraging and breeding/resting habitat occurs at the subject site. Evaluated as Local Importance (Higher Value).	Habitat Loss Within the Proposed Development boundary, woodland/scrub/hedgerow/treeline habitats which will be impacted provide potential foraging and breeding/resting habitat for Irish stoat. Woodland habitat occurs throughout the site. Disturbance and/or Displacement	Habitat loss effects on stoat are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
		Direct disturbance and/or displacement effects could arise as a result of increased noise and human activity at the site during the construction phase.	
European Hedgehog	Not recorded during surveys but suitable foraging and breeding/resting habitat occurs at the subject site. Evaluated as Local Importance (Higher Value).	<u>Habitat Loss</u> Habitats which will be lost provide potential foraging and breeding/resting habitat for hedgehog. These habitat types are common and widespread in the greater area. <u>Disturbance and/or Displacement</u> Direct disturbance and/or displacement effects could arise as a result of increased noise and human activity at the site during the construction phase.	Habitat loss effects on hedgehog are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**
Pygmy shrew	Not recorded during surveys but suitable foraging and breeding/resting habitat occurs at the subject site. Evaluated as Local Importance (Higher Value).	<u>Habitat Loss</u> The habitats which will be lost provide potential foraging and breeding/resting habitat for pygmy shrew. These habitat types are common and widespread in the greater area. <u>Disturbance and/or Displacement</u> Direct disturbance and/or displacement effects could arise as a result of increased noise and human activity at the site during the construction phase.	Habitat loss effects on pygmy shrew are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**
Red Squirrel	Not recorded during surveys but suitable habitat for foraging and breeding/resting available within the subject site. Evaluated as Local Importance (Higher Value)	<u>Habitat Loss</u> The habitats which will be lost provide potential foraging and breeding/resting habitat for red squirrel. These habitat types are common and widespread in the greater area. <u>Disturbance and/or Displacement</u> Direct disturbance and/or displacement effects could arise as a result of increased noise and human activity at the site during the construction phase.	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**

6.4.1.3 Bats

Wind turbines and associated infrastructure present four main potential construction phase impacts to bats, namely:

- Collision mortality, barotrauma and other injuries.
- Loss or damage to commuting and foraging habitat.
- Loss of, or damage to, roosts.
- Displacement of individuals or populations.

Whilst the Study Area is predominantly composed of intensive agricultural grasslands and dense conifer plantations with a general lack of roosting opportunities, the foraging and commuting habitat is suitable with good connectivity to the surrounding habitats. Pasture-based agriculture will continue in undeveloped areas in the Study Area post-construction and the impact of foraging habitat loss to bats is likely to be not significant.

Whilst linear habitat features such as hedgerows and treelines are common features in the wider landscape, the loss of these commuting habitats will potentially displace some bats in the immediate environs of the Proposed Development and marginally reduce habitat connectivity. It should be noted that, in the context of wind farm development, it is preferrable to reduce habitat connectivity in the immediate locality of turbines to reduce the potential for collision and barotrauma to occur.

No bat roosts were confirmed within the Proposed Development area with the assessments as outlined in the bat report (see **Appendix 6-2 – Ballinla Bat Survey Report**) determining the site was of 'negligible' potential for roosting bats. Bat activity surveys across the site determined that the majority of activity was found to be within the northern section of the Proposed Development Study Area, likely driven by the Grand Canal which borders the site to the north, as well as the presence of relatively higher number of linear habitats in the north of the site such as hedgerows and treelines. Comparatively, the southern section of the Study Area is dominated by relatively dense conifer plantation-mixed broadleaf woodland which is not conducive to favourable bat habitat. Most bat activity in the south, albeit low activity, was recorded in areas relatively clear of trees such as along the river watercourse and in areas of scrub.

No significant potential tree roost locations suitable to support roosting bats were noted along the grid route. Trees proposed for removal within the wind farm site are considered to be of low suitability. Trees located along the proposed turbine delivery route are also considered to be of low suitability for bat roosts.

Construction phase lighting has the potential to attract certain bat species and displace others, however this will be temporary in nature, relatively localised around the site compound, and limited to standard construction hours which are mostly during daylight hours.

Overall, the potential effects on bats during the construction phase of the Proposed Development are considered to be slight negative. Details of the construction phase impacts can be found in **Appendix 6-2 - Ballinla Bat Survey Report**, the results of which are summarised in Table 6-17.

Table 6-17: Construction Stage Potential Effect on Important Ecological Feature Bat Species Without Mitigation

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (EPA 2022)
All Bat Species, excluding Lesser Horseshoe Bat (Common pipistrelle, soprano pipistrelle, brown long-eared bat, Leisler's bat, *Myotis* spp., Nathusius' bat, Daubenton's bat)	Higher bat activity recorded in northern section of the Study Area, likely due to Grand Canal and presence of linear features such as hedgerows and treelines.	Habitat Loss Linear feature habitat loss of hedgerows and treelines provide foraging and commuting habitat for bats. Similar habitat of equivalent ecological value is abundantly available within and adjacent to the Proposed Development Study Area. Disturbance/Displacement Surveys determined a variety of bat species to be using the site for foraging and commuting. Direct/indirect disturbance and/or displacement effects on foraging/commuting bats could arise as a result of construction-related disturbances and increased lighting at the site during the construction phase.	Habitat loss/vegetation removal (potential foraging/ commuting habitat) effects on bat species are assessed as **Likely Permanent, Slight, Negative Effects**. Disturbance and/or displacement effects on bat species during the construction phase are assessed as **Likely Short-term, Slight Negative, Effects.**

6.4.1.4 Terrestrial Macro-Invertebrates

Table 6-18 describes the potential construction phase effects on terrestrial macro-invertebrates identified as Important Ecological Features at the Proposed Development site, as well as the significance of the effect, without the implementation of appropriate mitigation.

Table 6-18: Construction Stage Potential Effect on Important Ecological Feature Terrestrial Macro-Invertebrates Without Mitigation

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
Terrestrial macro-invertebrates	Habitats within the Proposed Development site support a wide variety of terrestrial macro-invertebrate species.	Habitat Loss/alteration Habitat loss will result in the loss of terrestrial macroinvertebrate habitat and therefore reduce the abundance and potentially the diversity of this group. The impact of the Proposed Development is at a local scale.	Habitat loss/alteration effects on other terrestrial macro-invertebrate species are assessed as **Likely, Temporary to Permanent, Slight to Moderate Negative Effects.**

6.4.1.5 Freshwater Aquatic Species

Table 6-19 describes the potential construction phase effects on freshwater aquatic species (freshwater fish and invertebrate species) identified as IEF at the Proposed Development site, as well as the significance of the effect, without the implementation of appropriate mitigation measures.

Table 6-19: Construction Stage Potential Effect on Important Ecological Feature Freshwater Aquatic Species Without Mitigation

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
Brook Lamprey	Fish habitat evaluation determined that low densities of brook lamprey are likely to occur within the watercourses draining the site. Records current range and distribution of the species in hectad N53 is due to the Boyne catchment, considered to be beyond the zone of influence to the north of the Proposed Development site.	<u>Disturbance and/or Displacement</u> The Proposed Development has limited culvert works to drainage ditches/watercourses in the south of the Study Area with low ecological value for brook lamprey. Potential water quality impacts as a result of the proposal could result in indirect disturbance/ displacement impacts on brook lamprey in watercourses within the Proposed Development site. Potential indirect impacts may include deterioration of water quality and river habitat, which could also impact on prey biomass for the species. Watercourses on which culverts are proposed are located draining forestry and immediate agricultural lands and do not contain habitat which could support brook lamprey. Lamprey had the potential to occur in watercourses downstream of the Study Area, however where culverts are proposed, the works area will be dammed with overpiping or side channel installed to maintain flow. The works are brief (1 – 2 days) and any sedimentation will likely settle immediately due to the low flows experienced on these courses. No increased sedimentation is likely to occur as a result of the proposed culverts.	Disturbance/displacement effects on brook lamprey are assessed as **Temporary to Short-term, Likely Slight to Moderate Negative effects.**
Other fish species	Brown trout (*Salmo trutta*) was recorded during the survey of watercourses draining the Proposed Development area. Watercourses in the aquatic report's Study Area have determined that the 1st order streams draining the Proposed Development area are generally too small to be of importance to trout. Larger trout recorded indicate spawning probably occurs in the Esker Stream, though is less	<u>Disturbance and/or Displacement</u> The Proposed Development has limited culvert works to drainage ditches/watercourses in the south of the Study Area with low ecological value. Proposed Development Potential water quality impacts as a result of the proposal could result in indirect disturbance/ displacement impacts on other fish species, namely brown trout, downstream of the site. Potential indirect impacts	Disturbance/displacement effects on brook lamprey are assessed as **Temporary to Short-term, Likely Slight Negative effects.**

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
	likely in the Leitrim River, corresponding with habitat characteristics.	may include deterioration of water quality and river habitat, which could also impact on prey biomass for the species	
Aquatic Macro-invertebrates (excluding FWPM and white-clawed crayfish)	Aquatic surveying of watercourses draining the Proposed Development area generally rated habitat for aquatic macroinvertebrates as being marginal regarding suitability. Species recorded were common and largely pollution tolerant species with the communities recorded showing reduced diversity. Local land management and activities including agricultural practices were identified as having an adverse effect on water quality within the Proposed Development area.	<u>Disturbance and/or Displacement</u> The Proposed Development has limited culvert works to drainage ditches/watercourses in the south of the Study Area with low ecological value. Proposed Development Potential water quality impacts as a result of the proposal could result in indirect disturbance to aquatic macroinvertebrate species downstream of the site. Potential indirect impacts may include deterioration of water quality and alteration of habitat. Two locations are proposed for pipe culverts in the south of the site. These locations will be dammed upstream and downstream, as per standard methods for these works, with flows being maintained using side channel or overpiping. These works are very brief (*c.* 1 -2 days) with sedimentation being limited due to works being done in the dammed area. Upon removal of damming, some sedimentation may occur, however, this is considered to settle locally due to low flows, and in consideration of pollution-tolerant species, any effects are likely not significant.	Indirect disturbance and/or displacement effects are assessed as T**emporary to Short-term, Likely Slight Negative effects.**

6.4.1.6 Reptiles & Amphibians

Common frog was the only species of amphibian selected as an IEF. No reptiles (common lizard) were selected as an IEF as no suitable habitat was present within the Study Area nor were they found during surveying. Table 6-20 details potential effects to common frog at the construction stage of the proposed wind farm development, without implementation of appropriate mitigation measures.

Table 6-20: Construction Stage Potential Effect on Important Ecological Feature Reptile & Amphibian Species Without Mitigation

Important Ecological Feature	Extent/Location	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
Common Frog	Proposed Development area has suitable foraging and breeding/resting habitat for all life stages of frog. The drainage ditches located in the north of the Proposed Development Study Area are used by breeding frogs whilst the southern extent of the site is likely used by foraging frogs.	<u>Disturbance and/or Displacement</u> Direct disturbance and/or displacement effects on common frog could potentially ensue as a result of increased noise and human activity. Indirect disturbance and/or displacement effects on common frog could potentially ensue as a result of water quality impacts to frog foraging/breeding/resting habitat. The installation of pipe culverts at two locations in the south of the site is not foreseen to affect frogs which may forage in these slow-flowing watercourses. As is standard for these works, the immediate upstream and downstream area of the proposed culvert locations will be dammed and flows will be maintained using a side channel or overpiping. Works will effectively be done in the effective dry of the channel and will take approximately 1 – 2 days to complete. Any sedimentation from these works are likely to settle immediately due to the generally low flow conditions in the courses.	Direct disturbance and/or displacement effects during the construction phase are assessed as **Short-term Slight Negative Effects**. Indirect disturbance and/or displacement effects during the construction phase are assessed as **Temporary to Short-term, Slight Negative Effects**.

6.4.1.7 Water Quality

Watercourses potentially affected by the development primarily the EPA mapped Leitrim River drains the majority of the Study Area. The Leitrim River flows south through the site and is fed by smaller watercourses and drainage ditches. The river exits the Study Area to the south where it joins the third order Esker stream which in turn is a tributary of the Daingean stream.

Water quality effects from wind farm development can arise during the construction phase due to the potential for increases in sediment load to local watercourses. There is potential for earthworks associated with the construction phase to cause impacts to water quality owing to entrainment of suspended solids and nutrient release to surface watercourses via surface water runoff. There is also the potential for the release of pollutants such as fuels and oils containing hydrocarbons, etc., used during the construction phase and where incorrect practices in land use and improper management during the construction phase can lead to excessive siltation,

nutrient enrichment, and organic matter during heavy rainfall. Pathways for fine sediments to enter watercourses are primarily via overland flows during periods of high rainfall.

High levels of suspended solids in waters draining the construction areas can result in transport of these highly laden waters to receiving watercourses. These sediments may also act as vectors for other contaminants to downstream environments such as nitrogen, phosphorous, and other organic pollutants and heavy metals.

Consequently, any construction within the Proposed Development site in proximity to watercourses may affect water quality for which mitigation will be implemented. Drains and watercourses within in the Proposed Development will be crossed using either a bridge, bottomless culvert or piped culvert. Where a pipe culvert is to be installed on watercourses, specifically at two locations in the south the Study Area, standard operating procedures will be implemented whereby upstream and downstream of the proposed culvert area will be dammed and either side channel or overpiping of water will occur, allowing continued flow downstream. Consequently, works will be done in the effective dry and water quality effects are unlikely to occur as a result. Installation of box culverts is estimated to take 1 to 2 days and any increased sedimentation which may occur will likely settle immediately due to low flows experienced in these watercourses. Aquatic biodiversity across watercourses within the Proposed Development reflect a community of relatively low-diversity, pollution-tolerant species, and as such impacts to biodiversity are considered unlikely to occur which any effects being highly localised, brief, and imperceptible.

The construction phase poses potential significant effects to water quality directly via increased siltation from excessive runoff of silt, as well as increased nutrient s and organic matter during heavy rainfall. Consequently, any construction onsite may affect water quality for which mitigation will be implemented.

The potential effect of the construction phase to water quality without implementation of appropriate mitigation measures is determined to be a potentially **likely, short-term, significant negative effect** due to the potential for increased sediment load to occur in local watercourses as a result of the proposed wind farm development. However, it is considered that water can be protected with appropriate mitigation.

6.4.2 Operational Phase

6.4.2.1 Habitats and Flora

During the operational phase of the Proposed Development, significant effects on habitats and flora are not anticipated. No additional habitat loss is required as part of the operational phase.

Fuel and/or oil spills are unlikely to occur due to the limited use of plant and machinery that will be required during the operational phase. In the unlikely event that a spill was to occur the significance of any potential effects will be ameliorated by the inherent limiting effects of the small volumes and the fact that any dispersal plume will not percolate through the soil beyond the immediate footprint of the spill area. During reinstatement, bare areas at the site, including felled areas around turbines will be re-vegetated, reducing the potential for encroachment of invasive and ruderal species, and also reducing any potential for increased run off from the site.

During the operation of a wind farm, any medium and long-term impacts are typically associated with the permanent site infrastructure such as access tracks, turbine bases, and hard stands (Natural England, 2010) which, in the case of the Proposed Development, are sited primarily in agricultural grassland and forestry plantation habitats.

While impacts during the operational phase may be lower in magnitude, the Proposed Development is likely to operate for up to 35 years. Impacts associated with the operational phase include sediment release and chemical pollution, alteration of surface water flows by new drainage systems as well as localised disruption of flow paths

near turbine stands and water table lowering near drainage ditches. Alteration of flow pathways can alter erosion potential downstream due to changes in runoff patterns and/or changes in sediment supply.

Regarding habitats with potential to support mammals, the area of conifer plantation with pockets of broadleaved woodland in the northern section of the Study Area has been avoided by design due to the presence of badger of setts in this area. Other habitats with lower relative ecological value and higher proportional representation within the Proposed Development site were chosen as alternative.

Consequently, the potential effects on terrestrial habitats and flora, identified as IEFs in **Table 6-13** above, during the operation phase of the Proposed Development, in the absence of mitigation, are assessed as **long-term, imperceptible, negative effects**.

The potential effects on aquatic habitats, comprising 'Depositing/lowland rivers (FW2)' and 'Drainage ditches (FW4)' during the operational phase of the Proposed Development, in the absence of mitigation, are assessed as **long-term, slight negative effects**.

6.4.2.2 Non-Volant Mammals

No significant disturbance and/or displacement impacts are expected to affect protected mammals selected as IEFs, detailed in **Section 6.4.1.2**, **Table 6-13** above. Once the construction phase of the Proposed Development has been completed, any individuals of protected non-volant mammal species (badger, otter, pine marten, Irish hare, Irish stoat, hedgehog, pygmy shrew or red squirrel) that may have been temporarily displaced owing to construction activity are expected to utilise the habitats within and adjacent to the Proposed Development site within a short period of time.

During the operational phase, there may be some slight disturbance owing to noise and human activity arising from periodic maintenance. however, it is considered that the level of operational traffic, human presence and ongoing maintenance will not significantly exceed existing noise levels at the site, given the level of agricultural and other activity within/surrounding the Study Area.

There is some potential for minor excavations associated with drainage, access track and cable maintenance. however, these will be small in scale and infrequent in comparison to the construction phase. Maintenance works on turbines will be carried out from the tracks and hardstands. Some erosion of soil will continue into the operation phase, however, as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to pre-construction levels, lowering the risk of effects on species such as otter.

Operational phase effects which may arise as a result of potential disturbance/displacement impacts on non-volant mammals identified as IEFs (badger, otter, hedgehog, pygmy shrew, red squirrel, Irish hare, Irish stoat, pine marten), in the absence of mitigation, are assessed as **long term, slight to imperceptible negative effects**.

6.4.2.3 Bats

The primary impact to bats associated with the operational phase of the Proposed Development is considered to be injury/mortality caused by potential collision with operational turbine blades and/or barotrauma (damage to internal tissues caused by rapid changes in air pressure as a result of moving turbine blades) (Mathews *et al*., 2016). Several operational phase impacts are presented by wind turbines and associated infrastructure namely injury and/or mortality due to collision with turbine blades and/or barotrauma, and from the displacement and/or disturbance of foraging, commuting, or roosting bats.

The susceptibility of bat species likely to be at risk of impacts from wind turbines is partly associated with the likelihood of different species flying at rotor blade height. Bat activity at the site was considered to be low across all seasons for all species. Though there is little published evidence regarding bat fatalities at wind farms in an Irish context, species of bats which may be considered to be at greater risk include Leisler's bat which are relatively

larger, higher flying, and forage independently of linear habitat features such as treelines and hedgerows. However, decreased connectivity to proposed turbine locations is considered desirable to reduce risk of injury and/or fatality as a result of collision with wind turbines and/or their blades.

A licenced senior bat ecologist from MWP carried out an assessment of collision risk scheme provided in NatureScot (2021) and the assessment is considered to represent the best available information for use in an Irish context. Species are categorised into 'Low', 'Medium', and 'High' risk based on flight characteristics and foraging behaviour as well as fatality rates in the UK, whilst relative abundance was determined according to a scheme for rarity of bat species in Wray *et al.,* 2010, using best available population data from recent Article 17 reports (NPWS, 2019). The estimation is presented in Table 6-21.

Table 6-21: Estimation of Irish bat species' Population Vulnerability to Wind Energy Development

Relative Abundance	Collision-Risk		
	Low	Medium	High
Common (100,000 plus)			Common Pipistrelle Soprano Pipistrelle
Rarer (10,000 – 100,000)	Daubenton's Bat Brown Long-eared Bat Lesser Horse-shoe Bat		Leisler's Bat
Rarest (under 10,000)	Natterer's Bat Whiskered Bat		Nathusius Pipistrelle

Population vulnerability: yellow = low, orange = medium, red = high.

NatureScot (2021) recommends a two-stage process in determining risks to bats from wind farms projects. The first stage assesses risk based on habitats present and development related features including the number of proposed turbines and size, as well as proximity to other wind farm developments. The second stage assesses risk for high-collision species (see **Table 6-22**) considering species vulnerability and results of bat activity.

In relation to stage one, a habitat site risk of 'Low' was considered appropriate due to a lack of roost features within the site, low-quality foraging habitat and the site being relatively isolated. In consideration of development-related features, the Proposed Development is considered to be in the 'Medium' category considering the seven turbines proposed, with other wind farms located within 10km. This category uses the number of turbines, turbine height and proximity to other wind developments as the descriptors to define project size. Although the 185m blade tip height of the turbines indicates their classification as a 'Large' project, the number of turbines proposed (7) and proximity to other wind developments also requires consideration and as a result the category of 'Medium' was considered by the assessor to be a more appropriate project size category. Based on the initial risk assessment the Proposed Development is considered to be 'Medium Risk' to bats and a site risk score of 3 is applicable.

In relation to stage two, 'high collision-risk' species are assessed with regards to their activity level within the site in each monitoring period and in doing so identifies projects of greatest concern in terms of collision risk. The 'high collision-risk' species are Leisler's bat, Common pipistrelle, Soprano pipistrelle and Nathusius' bat.

Leisler's bat is a common species in Ireland and is considered high-risk due to their foraging behaviour and flight characteristics. Their minimum population range in Ireland is estimated at between 63,000 to 113,000 and they were recorded across all seasons during activity surveys. In the context of the proposed wind farm, their activity levels are considered 'Low' across the surveying seasons.

Soprano pipistrelle is also considered a 'high collision risk' species due to their foraging ecology and flight characteristics. Activity levels for this species is considered to be 'Low' across all survey seasons.

Common pipistrelle is another widespread species in Ireland and is considered high-risk due to their foraging behaviour and flight characteristics. Activity levels for this species was considered to be 'Low' across all survey seasons.

The fourth 'high collision risk' species Nathusius' pipistrelle is a slightly less agile, albeit fast, flyer compared to other pipistrelle species. Like the other species considered, Nathusius' pipistrelle is of high collision risk due to their foraging behaviour and flight characteristics. This bat species was only recorded during 2024 surveying efforts with low numbers of registrations, thus yielding a 'Low' activity category for this species.

Table 6-22 gives the result of the assessment, with scoring being a product of multiplying site risk and the activity category for high collision species. The overall assessment results are categorised as follows: Low (green): 0 – 4, Medium (amber): 5 – 12, High (red): 15 – 25.

Table 6-22: Overall Collision Risk Assessment of Relevant (High-Risk) Bat Species

	Species	Site Risk Level	Activity Category	Overall Assessment
Summer 2023	Leisler's Bat	3	Low (1)	3
	Common Pipistrelle	3	Low (1)	3
	Soprano Pipistrelle	3	Low (1)	3
Spring 2023	Leisler's Bat	3	Low (1)	3
	Common Pipistrelle	3	Low (1)	3
	Soprano Pipistrelle	3	Low (1)	3
Spring 2024	Leisler's Bat	3	Low (1)	3
	Common Pipistrelle	3	Low (1)	3
	Soprano Pipistrelle	3	Low (1)	3
	Nathusius' Pipistrelle	3	Low (1)	3
Summer 2024	Leisler's Bat	3	Low (1)	3
	Common Pipistrelle	3	Low (1)	3
	Soprano Pipistrelle	3	Low (1)	3
	Nathusius' Pipistrelle	3	Low (1)	3
Autumn 2024	Leisler's Bat	3	Low (1)	3
	Common Pipistrelle	3	Low (1)	3
	Soprano Pipistrelle	3	Low (1)	3
	Nathusius' Pipistrelle	3	Low (1)	3

Overall collision risk assessment: Low (green), medium (amber), high (red) (following SNH, 2019).

The overall risk assessment pertains to high-risk species, and per NatureScot (2021), there is no requirement to assess for low-risk species (see Table 6-21). Low-risk species recorded at the site included Brown Long-eared bat, Natterer's bat, Whiskered bat, and Daubenton's bat. Overall, activity levels for these species were 'Low' and no significant related risk is likely in consideration of their low potential vulnerability to wind energy developments. Lesser horseshoe bat was not recorded during any of the surveys.

The effect of potential impacts to bats during the operational phase of the proposed wind farm development is considered to be slight negative at a local level in the absence of mitigation. For more details refer to **Appendix 6-2 – Ballinla Bat Survey Report**. The results of the assessment of operational effects are detailed in **Table 6-23**.

Table 6-23: Operational Stage Potential Effects to Important Ecological Feature Bat Species Without Mitigation

Important Ecological Feature	Description of Unmitigated Impact	Significance of Unmitigated Effects (NRA 2009 & EPA 2022)
Common pipistrelle (*Pipistrellus pipistrellus*) Soprano pipistrelle (*Pipistrellus pygmaeus*) Leisler's bat (*Nyctalus leisleri*) Nathusius' bat (*Pipistrellus nathusii*)	Injury/mortality due to collision/barotrauma associated with rotating turbine blades. Disturbance/displacement of foraging/commuting bats due to loss of relevant habitat, increased lighting.	Injury/mortality due to collision/barotrauma during the operational phase is assessed as **long-term, slight negative effects**. Disturbance/displacement during the operational phase is assessed as **long-term, slight negative effects.**
Daubenton's bat (*Myotis daubentoniid*) Brown long-eared bat (*Plecotus auritus*) Whiskered bat (*Myotis mystacinus*) *Myotis* spp.	In consideration of these species' flight characteristics and foraging behaviour, they are considered to be at low risk of injury/mortality due to collision with turbine and/or its blades. Disturbance/displacement of foraging/commuting bats due to loss of relevant habitat, increased lighting.	Injury/mortality due to collision/barotrauma during the operational phase is assessed as **long-term, insignificant negative effects**. Disturbance/displacement during the operational phase is assessed as **long-term, slight negative effects.**

6.4.2.4 Terrestrial Macro-Invertebrates

With regard to other macro-invertebrates, once the construction phase has been completed, other than those initially displaced by the construction of the development would utilise the habitats within and adjacent to the Proposed Development boundary Proposed Development within a short period of time. Disturbance and/or displacement effect on terrestrial macro-invertebrates during the operational phase are assessed as **long-term, insignificant, negative effects**.

6.4.2.5 Freshwater Aquatic Species

Once the construction phase is completed the source element of the source-pathway-receptor pathway will be significantly reduced. Whilst there is some potential for minor excavations associated with drainage, access track and cable maintenance, however these will be small in scale and infrequent in comparison to the construction phase.

Maintenance works on turbines will be carried out from the tracks and hardstands. Some erosion will continue into the initial operational phase, however as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to pre-construction levels, with the risk of water quality impacts and related effects returning to pre-construction conditions.

The effects on fish species during the operational phase are assessed as **long-term, insignificant negative effects**.

With regard to aquatic macro-invertebrates. the majority of species recorded on site during aquatic surveying were pollution tolerant species with low diversity between communities. Low diversity reflects the current fluvial condition within the onsite waterbodies, some of which are degraded from anthropogenic pressures such as agriculture and forestry.

Any disturbance and/or displacement effects on aquatic macroinvertebrates during the operational phased are assessed as **long-term, neutral effects.**

6.4.2.6 Reptiles & Amphibians

Though common frog (*Rana temporaria*) utilises the site for breeding and foraging, it is expected that any frogs that may have been temporarily affected due to the construction activity would utilise aquatic habitats within and downstream of the Proposed Development site within a short period of time.

The disturbance and/or displacement effects on common frog during the operational phase are assessed as **long-term, neutral effect**.

6.4.2.7 Water Quality

Biological water quality results are suggestive of an unstable ecosystem in some channels with the most likely influencer of water quality being enrichment from soil loss to streams. The Q-values scored the biological water quality as Moderate or Poor at all sites whilst downstream EPA monitoring sites were also rated as Moderate in 2020 with improvements at Clonbulloge, downstream of the confluence with the River Figile located approximately 10km downstream of the Study Area.

Based on the results of aquatic surveys, it is concluded that the main water quality problems in the study are related to agriculture and to a lesser degree coniferous forestry, with some albeit reducing legacy effects of peat harvesting practices in the past.

The operational phase does not pose potential significant effects to water quality directly, however indirect effects may arise as a result of the operational phase which may affect water quality. In general, drainage and changes to morphology could comprise a potential risk to water quality during the operational phase of a wind farm development in the absence of appropriate design and mitigation. Consequently, any impact likely to occur as a result of the operational phase to water quality is assessed as being **likely short-term**, **imperceptible negative** effect at a local level.

6.4.3 Decommissioning Phase

At the end of the estimated 35-year lifespan of the wind farm element of the Proposed Development, it will be decommissioned and reinstated with all seven wind turbines and towers removed. Hardstand and turbine foundation areas will be left in situ and covered with soil to match the existing landscape. Access tracks will be left for use by the landowners. At present it is anticipated that underground cables connecting the turbines to the substation will be cut back and left underground. The cables will not be removed if an environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them in situ. The substation and Proposed Grid Connection will remain a permanent part of the national grid and therefore decommissioning is not foreseen. In the event of decommissioning, it will involve removing above ground structures and equipment while leaving underground infrastructure in place.

Proposed Development will be decommissioned with all seven wind turbines and towers removed. Removal of infrastructure will be undertaken in line with landowner and regulatory requirements and best practice applicable

at the time. The information below outlines the likely decommissioning tasks based on current requirements and best practice.

Prior to wind turbine removal, due consideration would be given to any potential impacts arising from these operations. Some of the aspects to be considered and agreed with the Local Authority prior to decommissioning may include:

- Potential disturbance by the presence of cranes, heavy goods vehicles and personnel onsite.
- Onsite temporary compound would need to be located appropriately.
- Time of year and timescale (to be outside sensitive periods).
- Prior to the decommissioning work, a comprehensive plan will be drawn up to ensure the safety of the public and workforce and the use of best available techniques at the time.
- Prior to the decommissioning work, a comprehensive reinstatement proposal, including the implementation of a programme that details the removal of structures and landscaping, will be submitted to the Planning Authority.

Any disturbance associated with the removal and disposal of the material may likely be more deleterious than leaving them in place. In the event of decommissioning being progressed, full engagement with the Local Authority and relevant departments including planning, environment and roads would take place to agree and ensure that any potential effects are minimised and controlled. A decommissioning plan will be agreed, and this would guide the process and control any potential effects.

Overall, the impacts of decommissioning a wind farm are potentially similar to construction impacts and will comprise temporary disturbance such as noise associated with decommissioning of turbines and onsite machinery. Ecological impacts of the decommissioning phase are assessed as **likely, temporary, moderate negative** effects in the absence of mitigation measures. Therefore, mitigation measures for the construction phase will also be applied to the decommissioning phase.

6.4.4 Cumulative Effects

A cumulative effect arises from incremental changes caused by other past, present, or reasonably foreseeable activities interacting synergistically with the impacts generated by the Proposed Development in a manner that has the potential to cause effects on the receiving environment. The activities, pressures and projects identified as plausible sources of impacts to be assessed for their potential to generate cumulative effects are listed in **Table 6-24**, as are the characterisations of cumulative effects. The assessment and rationales supporting the individual characterisations of other ongoing activities in the broader environs are provided in **Sections 6.4.4.2.1** to **6.4.4.2.4**, inclusive, below. In each case the Confidence Level of the Prediction is Near certain.

Table 6-24: Characteristics of Cumulative Effects for Proposed Development

Other Activities	Characterisation of Effect			Confidence level
	Quality	Significance	Duration	
Agriculture	Negative	Moderate	Short term	Near certain
Peat Extraction	Neutral	Imperceptible	Short term	Near certain
Forestry	Negative	Slight	Short term	Near certain
Wind Farm Development	Neutral	Slight	Long-term	Near certain
Solar Farm Development	Neutral	Imperceptible	Long-term	Near certain
Plans (minor)	Neutral	Imperceptible	Long-term	Near certain

6.4.4.1 Plans

The Proposed Grid Connection for the Proposed Development and Proposed TDR has also been assessed as part of this EIA and is therefore not considered cumulatively.

The Proposed Development was considered in combination with other plans and projects that could result in cumulative effects including:

- Offaly County Wind Energy Strategy (2021 - 2027).
- Offaly County Development Plan 2021-2027.

Any development under these plans will firstly have to be consented under planning and development legislation. Significant cumulative impacts are not predicted with the plans listed above, as each plan has a range of environmental and natural heritage policy safeguards in place. Furthermore, this Proposed Development has been developed in view of achieving the objectives of these plans. Therefore, development of the Proposed Development in combination with the scope of works required to achieve the objectives of these plans will not result in cumulative effects. In terms of the Proposed Development, the zoning in the development plans relates to wind energy development and there is no other contradictory zoning for other project types or infrastructure. In terms of the Offaly County WES, the area where the Proposed Development is to be located is deemed 'Open for consideration for Wind Energy development' in principle.

The material for the cumulative assessment was gathered through a search of relevant County Councils' Online Planning Registers, the ABPs website and the EIA Portal. A review of applications for the preceding 5 years was carried out during the EIA process. The search focused on the townlands common to the development area. All other wind farm developments were considered within 15km of the site for cumulative impact on biodiversity. Finally, recent planning applications that are pending a decision from the planning authority, which were accompanied by an EIAR, were also considered. The projects in the surrounding areas mostly relate to small scale development including agricultural sheds and shed extensions, dwelling houses, and extensions to dwelling houses, attic conversions, domestic wastewater treatment systems, installation of photovoltaic for domestic purposes, garages, demolitions, and retention permission applications etc.

Such minor domestic and agricultural development will not introduce cumulative effects. These minor projects are either under the threshold for EIA or excluded from the list of projects requiring EIA and due to the nature and scale of these applications would not introduce complex or significant issues. Therefore, they are not considered in the cumulative assessment. The most relevant applications relate to the expansion of Ballinla Farm within the subject site. The remaining developments are ancillary applications for the nearby wind farms or Edenderry Power Station.

6.4.4.2 Ongoing Activities

6.4.4.2.1 Forestry

Poorly managed and inappropriately sited forest operations can negatively impact on water quality and aquatic habitats and species. The most common water quality problems arising from forestry relate to the release of sediment and nutrients and the impacts from acidification. Forestry may also give rise to changes in stream flow regimes caused by associated land drainage[22].

In terms of the replacement forestry lands, there is no potential for significant cumulative effects associated with the site and forestry operations. The Applicant commits that the location of any replanting (alternative afforestation) associated with the Proposed Development will be at a distance so as to not create any potential

[22] https://www.catchments.ie/significant-pressures-forestry/

cumulative effect and also outside any potential pathways of connectivity with the Proposed Development. This will ensure that there is no potential cumulative effect associated with this replanting. In addition, the Applicant commits to not commencing the Proposed Development until both felling and afforestation licenses are in place and this ensures the afforested lands are identified, assessed and licensed appropriately by the relevant consenting authority. Forestry operations within the planning boundary (apart from the operations required for the development) will also cease and will resume again post commissioning of the wind farm.

There is potential for the Proposed Development to contribute to a cumulative effect on water quality in local watercourses without the implementation of appropriate mitigations, within the site via increased sedimentation entering watercourses as a result of felling to accommodate new access tracks and construction activities in addition to ongoing forestry operations, and where they occur in proximity to watercourses. The Proposed Development is assessed as potentially having a **likely, short-term, slight negative cumulative** effect on water quality in relation to forestry without the implementation of appropriate mitigation measures.

6.4.4.2.2 Agriculture

Land management practices in the wider area which are considered in combination with the effects of the Proposed Development are agriculture and forestry. It is proposed that all agricultural activities within the planning boundary will cease for the duration of the construction and commissioning phase. Agricultural activities within the wider Study Area will continue and will be separated from construction activities by appropriate stock proof fencing.

Agriculture has been identified as a pressure for waterbodies in the Figile sub-catchment, including those located downstream of the Proposed Development. Agriculture in this subcatchment can produce elevated levels of sediment as well as diffuse phosphorus entering freshwater waterbodies.

Excess phosphorus is a key concern to surface waterbodies. Diffuse phosphorus losses from agriculture are particularly difficult to manage as the sources do not occur uniformly in the landscape, but from 'hot spots', or critical source areas where runoff pathways connect phosphorus sources to rivers and streams. It takes only very small amounts of phosphorus to be lost, relative to the amounts used in agriculture, to cause a water quality problem. Cattle in the area may use watercourses as a source of water for drinking or as a crossing point during drier conditions. Unrestricted access of cattle to watercourses can potentially result in increases in the levels of organic nutrients found in surface waters and can alter habitats as a result of access and impact water quality by way of faecal contamination.

The Proposed Development is assessed as having **likely, short-term, moderate negative cumulative** effect on water quality in combination with the surrounding agriculture in the environs, without mitigation measures. In the absence of suitable mitigation measures with regards to protection of water quality during the lifetime of the Proposed Development, but in particular during the construction phase, there is potential for significant cumulative water quality effects as a result of the proposal in-combination with agricultural activity in the surrounding area. However, the implementation of water quality mitigation measures and other measures designed to protect surface waters as detailed in **Section 6.5.2** will prevent significant effects arising as a result of the proposal and therefore, significant cumulative effects in-combination with agriculture are not likely to occur.

6.4.4.2.3 Other Wind Farm Development

The potential cumulative impact of the Proposed Development has been assessed in accordance with Annex IV of the EIA Directive as amended which provides that the EIAR must contain a description of the likely significant effects of the Proposed Development on the environment resulting from the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources.

The Proposed Development would positively cumulate with other wind farm developments in the region to advance in delivering local, regional, and national Green Energy targets. Wind turbines identified within 15km of the proposed Ballinla development are listed below and illustrated in **Figure 6-7**.

- Cushaling Wind Farm (9 - turbine) (Permitted and under construction). located approximately 5km southeast of the Proposed Development at Ballinla,
- Cloncreen Wind Farm (21 - turbine) (existing). approximately 2km south of the Proposed Development,
- Mountlucas Wind Farm (28 - turbine) (existing). located approximately 6km southwest of the Proposed Development,
- Yellow River Wind Farm (29 - turbine) (Permitted and under construction). Located approximately 3.5km northwest of the Proposed Development.

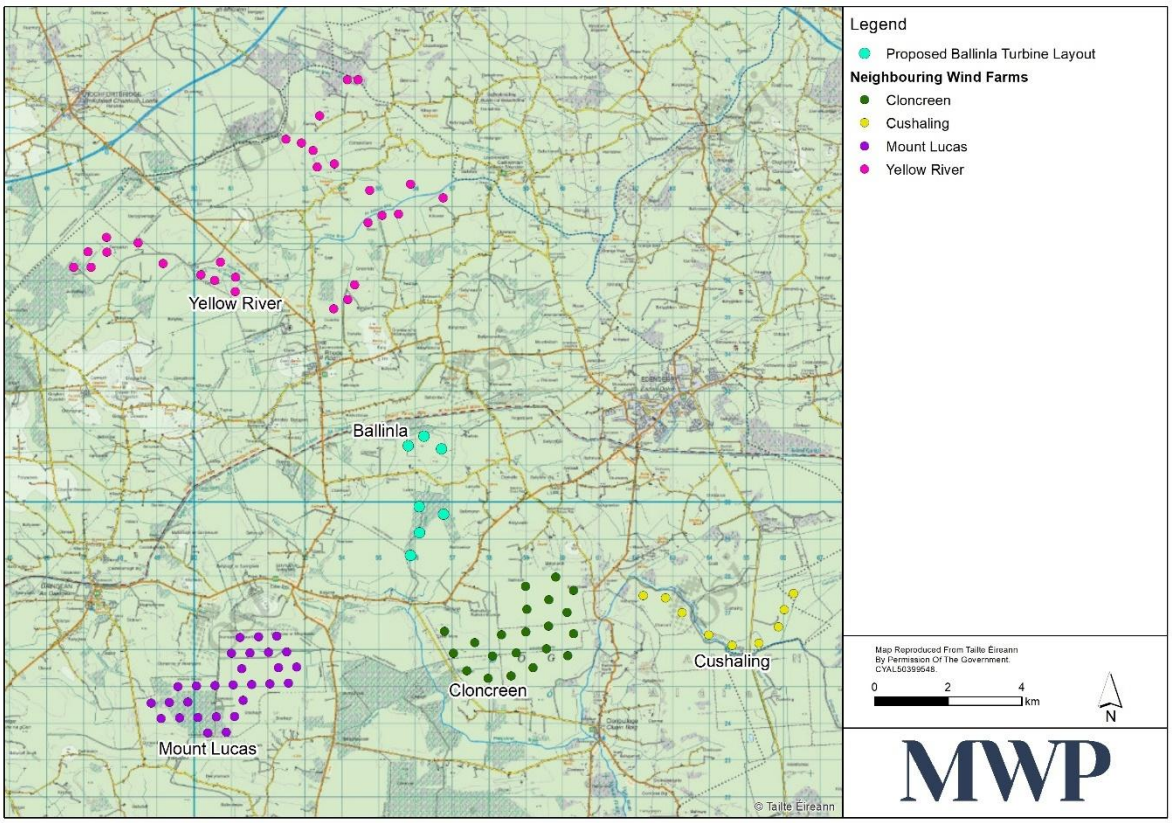

Figure 6-7: Wind Farm Developments within 15km of the Proposed Development

The Study Area has experienced extensive changes from naturalness in its current state, with the north of the site comprising intensive agricultural land use, the southern area comprising non-native conifer plantation and recently felled woodland, whilst the remaining limited habitats within the site comprise of areas with relatively low ecological importance. Strategic design and the location of the wind farm layout to avoid habitats with relatively higher ecological value such as woodlands containing badger setts in the northwest has been a focus of the Proposed Development and in considering the relatively unnatural state of much of the site's features and relatively low terrestrial ecological interest throughout the site, it is concluded that there will be no likely significant effect as a result of the Proposed Development. This also takes into account the proposed grid connection and turbine delivery route. Consequently, the effect is considered to be a **long-term**, **imperceptible**, **negative cumulative effect.**

6.4.4.2.4 Proposed Solar Farm Development

The nearest proposed solar farms to the Proposed Development are listed as follows:

- Kilcush Solar Farm (21/598) – c. 117.47 hectares to include PV panels mounted on metal frames, 22 No. MV power stations (Permitted by OCC but not yet constructed).
- Obton Limited Oldcourt Solar Farm (22/327) – c. 121.55 hectares of solar panels on ground mounted frames and other ancillary works (Permitted by Kildare County Council)

Kilcush Solar farm is located approximately 7km south of the Proposed Development while Oldcourt is located approximately 10km east. Due to location of these sites in relation to the Proposed Development site the cumulative effect is considered to be long-term, imperceptible, negative cumulative effect.

6.5 Mitigation and Monitoring Measures

6.5.1 Mitigation by Design

Site design was carried out with cognisance to ecological features to minimise the impact of the Proposed Development on biodiversity and other environmental receptors. Consultation between the design team (project manager, project engineers, and project ecologists) and the Applicant was conducted on a regular basis during the design phase in order to formulate a project design which would avoid, prevent, and/or minimise any significant adverse environmental effects, in so much as was practicably possible. A considerable effort was spent by the project ecologists and engineers on avoiding or minimising ecological effects and this has been constraint led throughout the design process.

The Proposed Development has been designed wherein the footprint avoids relatively ecologically valuable habitats. This has been achieved in collaboration with engineering constraints, for example by taking account of habitat value, the location of badger setts, and areas potentially impacted by the Proposed Development.

During the construction phase, there is potential for increased sedimentation to surface waters via runoff which may lead to potential contamination of immediate and downstream watercourses without the implementation of appropriate mitigation. Consequently, the need to keep clean water clean (i.e., runoff from adjacent ground upslope of the permitted development footprint) and manage all other runoff and water for construction is fundamental. In consideration of these requirements and in order to safeguard water quality from any potential increased sediment as a result of the wind-farm development, a specific drainage system has been designed. The system is designed to ensure it will largely mimic the existing drainage regime across the site and will not deteriorate water quality. A Water Quality Management System has been prepared to control erosion and prevent sediment runoff during the construction phase of the Proposed Development. The implementation of sediment and erosion control measures will ensure the construction and early-post construction phases of the Proposed Development will not create adverse effects on the aquatic environment including effects to water quality. Furthermore, a site-specific Surface Water Management Plan (SWMP) has been designed for the Proposed Development to avoid impacts to water quality both in immediate and downstream surface waters.

In the north of the Proposed Development site, within the areas to be managed for bats as per the SNH guidance at T1, T2, and T3, linear hedgerow habitats within the zones will be retained with hedgerows being kept short, *c.* 1m to 1.5m in height, as opposed to being lost entirely. This was considered a better option when considering the relative openness of the surrounding landscape. Retaining these linear features at these turbines should limit bats being drawn towards turbines. The retention of these linear features should create a shield effect and draw incoming bats away from the turbine hardstand. The length of these retained habitats is approximately 700m in length.

Where there will be unavoidable removal of hedgerow and treeline habitat, these areas of losses will be reinstated within the proposed site. A linear length of approximately 1km for hedgerow has been designed alongside the Proposed Development with a further minimum 0.76ha of additional potential enhancement and/or creation area provided (see **Figure 6-8 and drawing number 23882-MWP-00-00-DR-C-5426 landscaping plan**). These areas will be rewilded or fully reinstated with native trees and shrub species and will be composed of at least 75% whitethorn and 25% of other native species in keeping with ideal hedgerow creation (NBDC, 2009). Some of the habitat creation area will be managed with shallow routing species as collector cable and grid connection cable will require a 3m buffer zone from trees.

South of T5 a forested area bordering a naturalised land drain classed as a lowland depositing river will be removed in order to accommodate the bat buffer felling zone around the turbine. Where conifer trees will be removed from the bank of the watercourse due to overlap with felling zone, these areas will not be replanted with improved species in order to minimise drawing in of bats towards the turbines during the operational phase.

The riparian zone along the Leitrim stream will be preserved even if it does occur within the bat buffer zone. This is specific to T6 and T7 in the south. The keeping of the riparian zone on the Leitrim Stream is seen as beneficial in preserving a potential bat corridor on the stream.

Habitat reinstatement will commence at the construction stage. The success of any habitat reinstatement measures will be monitored by the project ecologist/ECoW throughout the construction phase and continue into the operational phase. Existing internal treelines and hedgerows within the Proposed Development site, where possible and appropriate, will be retained and improved comprising the planting up of large gaps and openings with native shrubs and tree species. Reinforcing these linear features vegetatively will also deter livestock from breaking though features which can reduced connectivity.

Figure 6-8: Proposed Biodiversity Creation Areas at the Proposed Development

As part of the Proposed Development, an initial objective was to achieve an overall gain in habitats by creating and enhancing biodiversity across the site. However, it was considered that in light of the current condition of the site, the creation and enhancement of habitats within the site may in fact lead to deleterious effects to species such as bats. Risks to bats arise where they may be drawn into turbines. This may occur via habitat creation which create linear pathways bats could follow towards turbines or where wildflower meadow creation encourages insect biodiversity which could attract bats into the Proposed Development site towards the turbines. In consideration of ecological constraints within the site, such as the dominance of biodiversity-low habitats such as conifer plantation and intensive agricultural grassland which provide a weak jumping off point for a cohesive and meaningful biodiversity gain within the site, a 'No Net Loss' approach was considered. This approach would ensure that the overall value of biodiversity within the site is maintained at the baseline level where mitigation can reinstate IEF habitats proposed to be lost as part of the Proposed Development.

'No Net Loss' is referenced in several national biodiversity plans and policies in Ireland including in Objective 3 of the 4th National Biodiversity Action Plan wherein Action number 3C1 details the goal of all public authorities and private sector bodies moving towards a no net loss of biodiversity through strategies, planning and mitigation measures (DHLGH, 2023). Additionally, a report by the Business for Biodiversity Ireland platform, whose formation was an objective under the 3rd National Biodiversity Action Plan discusses the implementation of the 4th National Biodiversity Action Plan in relation to its aims to halt biodiversity loss and achieve no net loss by 2030.

Through the reinstatement of habitats within the Proposed Development site, as well as the implementation of mitigation measures and habitat management and monitoring, the Proposed Development will ensure biodiversity on the site is maintained and no net loss occurs.

Hedgerow and potential woodland areas will take time to establish, grow, and mature and will become more ecologically significant in proportion to age. Table 6-25 gives the areas and lengths of IEF habitats to be removed and reinstated within the Proposed Development.

Overall, it can be seen that there will be an overall gain for linear habitats where the total loss of linear habitats is 335m and reinstatement is 913m. This equates to an overall gain of 578m additional linear habitat within the site and with the implementation of mitigation measures, it is likely that there will be no net loss to important ecological feature linear habitats as a result of the Proposed Development.

Table 6-25: Areas and lengths of IEF habitats being removed and gained with the Proposed Development

Habitat Type	Area Of Habitat Removed (Ha/M)	Habitat Gain /Benefit (Ha/M)	Net Gain (Ha/M)	Description/Rationale
Scrub (WS1)	0.006ha	See habitat creation	-0.006ha	Scrub already occurs along the watercourse to the west of T6 and T7. The overall area of this habitat is 4.2ha, and this loss represents approximately 0.1% of the habitat's total area. This loss represents very little, in realistic terms, to the health of this habitat and this degree of loss would be realistically neutral when considering it in relation to its extent throughout the Study Area.
Depositing lowland river (FW2)	5m	None, though similar habitat as drainage ditch as proposed location	-	5m of this habitat will be lost due to the installation of a pipe culvert in the southwest of the Study Area. The proposed culvert is located on a first-order stream (1 – 1.5 m in width) which joins the Leitrim stream approximately 50m to the east of the proposed culvert location. The stream shows evidence of enrichment and drains upstream extracted bog at its head and immediate agricultural grasslands. The watercourse is slow flowing and there are no likely instream habitats for fish species either at or upstream of the culvert location. This stream is the only watercourse on this distributary before joining the Leitrim stream.
Drainage ditch (Settlement Ponds)	N/a	Approx 39 ponds measuring 24m^2 (12m x 2m), thus an overall area of 936m^2 (0.09ha),	936m^2/ 0.09ha	Drainage ditch habitat will not be lost, but there will be a net gain for similar habitat via settlement ponds within the site. Drainage ditch habitat has links to ponds, as both are potential habitats for frogs, aquatic plants, insects and mammals. Using the settling ponds for this purpose will greatly benefit aquatic and other wildlife throughout the site.
Hedgerows (WL1)	143m	964m	821m	Hedgerows of a length of 964m will be planted along access track and other infrastructure. This reinstatement yields an overall net gain of 821m, over 6.5 times the amount of hedgerow being removed. In time, these hedgerows may grade to treeline habitat and therefore this reinstatement also affords itself towards reinstatement of treeline. In consideration of linear habitat loss including treeline (WL2), the combined gain to linear habitats within the site is nearly three times the number of that lost between both hedgerow and treeline (964m gained compared to 335m lost). Overall, in consideration of the reinstatement of hedgerows it can be considered that there will be no net loss of linear habitats.

Habitat Type	Area Of Habitat Removed (Ha/M)	Habitat Gain /Benefit (Ha/M)	Net Gain (Ha/M)	Description/Rationale
				Separately to the above figures, though in keeping with the ethos of a no net loss approach - where hedgerow is lost along the turbine delivery route, this will be reinstated and will be composed of at least 75% whitethorn and 25% of other native species in keeping with ideal hedgerow creation (NBDC, 2009).
Treelines (WL2)	192 m	Will benefit from instatement of hedgerow habitat above, thus 964m	See Hedgerow above, potential	The removal of this habitat is largely required to remove bat foraging habitat within a distance from the proposed turbines in order to reduce risk to bats. 192m of treeline will be removed and due the relatively low activity level of bats within the Study Area, the replanting of this habitat was considered to have the potential to encourage bats into the site and thus towards turbines which may result in injuries and/or fatalities. To discourage bats into the site, habitat reinstatement was limited to hedgerow, however the possibility for these to mature into treeline may occur over time.
Habitat creation area for rewilding	N/a	0.53ha	0.53ha	This area includes three parcels of agricultural grassland to the west of the proposed substation. If allowed to regenerate naturally this area may propagate to scrub and due to its width (15m and 25m at its most narrow and widest points, respectfully) it may eventually succeed to smaller woodland where hedgerow is retained and allowed to expand.
Habitat creation area managed / landscaped	N/a	0.23ha	0.23ha	This area includes three parcels of agricultural grassland to the west and north of the proposed substation. Adjacent to the rewilded area and the 110kV substation, it will need to be managed as native small scrub as there are underground cables in these areas and deep routed species need to be removed.

6.5.2 Mitigation by Management

6.5.2.1 Construction Phase

6.5.2.1.1 Project Ecologist/Ecological Clerk of Works (ECoW)

A suitably qualified and experienced Project Ecologist/ECoW will be employed during the construction phase of the Proposed Development. Duties will include the delivery of toolbox talks, undertaking of all required pre-construction surveys, clearance works, and monitoring of works throughout the construction phase to ensure all EIAR mitigation measures are implemented in full. As part of toolbox talks, contractor staff and site personnel will be made aware of the procedure to follow if a protected species and/or their resting and/or breeding site, i.e., badger sett, is encountered.

6.5.2.1.2 Protection of Fauna

A number of badger setts were identified during baseline ecology surveys, at least three of which were confirmed active at the time of surveying. These setts will be retained. None of the identified setts are located within 30m or 50m of a proposed turbine location or access track.

No otter holts were identified within the development site, however evidence of otter including spraint were found during ecology surveys. Pre-construction surveys for badger and otter will be undertaken prior to the commencement of any construction activity to identify any changes within the site with regard to protected mammals. Pre-construction surveys will be undertaken no more than 10 to 12 months prior to site works commencing.

Where areas of dense vegetation are to be removed, the Project Ecologist/ECoW will be present to oversee removal of vegetation and ensure any necessary mitigation measures are in place in the event that a previously unknown breeding or resting site of any protected mammal species e.g., badger sett, are encountered during the works.

If any new badger setts are discovered during the pre-construction surveys within or in proximity to the construction corridor, then all works within a 30m buffer (50 m buffer during the breeding season) will cease. NPWS will be contacted, and the necessary mitigation implemented further to consultation.

Surveys and implementation of best-practice guidelines for badger and otter will be overseen by the ECoW and in accordance with NRA/TII Guidelines 'Guidelines for the Treatment of otters prior to the Construction of National Road Schemes' (NRA 2008) and 'Guidelines for the Treatment of badgers prior to the Construction of National Road Schemes' (NRA, 2008). Where relevant, mitigation for badger and otter will be carried out in full accordance with NRA/TII Guidelines.

Where possible, felling of forestry will be limited to periods outside of when red squirrel and pine marten are likely to have young in dreys/dens (peak period January to March for red squirrel, March and April for pine marten). If felling of forestry during these time periods is unavoidable, then the area to be cleared will be surveyed by a suitably-qualified ecologist to search for the presence of breeding sites. The general avoidance of removal of vegetation during the bird-nesting period (March to August, inclusive) will avoid disturbance to stoat during their peak breeding season.

Where any breeding sites will be disturbed, mitigation will be carried out under approval from NPWS as necessary and in full accordance with NRA/TII Guidelines.

Irish hare, hedgehog, and pygmy shrew are mobile species and so are expected to disperse from the area. however, young are vulnerable to impacts during vegetation clearance and/or during periods of hibernation, such as is the case with hedgehog. Prior to any vegetation clearance, the area to be cleared will be checked by a suitably-qualified ecologist to check for the presence of young mammals, or hibernating hedgehog, as appropriate.

NatureScot (2021) recommends a minimum 50 m buffer from the blade tip to the nearest key habitat features (e.g. woodland, hedgerow etc.) to be implemented to avoid encouraging bat activity within the 'blade-swept' area. These areas will be cleared of tall vegetation during the operational life of the development whilst existing hedgerow found within these buffer areas will be intensively managed to ensure the height is kept as low as possible (1m – 1.5m) whilst still retaining their function as filed boundaries for livestock.

A methodology for determining the recommended clearance area at ground level is presented in NatureScot (2021). This buffer creates a clearance setback of 50 m between the arc of the blade's sweep and the forest edge which reduces risk of collision with the turbine blades.

To calculate the necessary buffer distance required between the edge of the woodland (feature) and the centre of the tower to achieve the recommended 50m clearance setback, as above, the following formula (adapted from NatureScot, 2021) is used to calculate (D), the distance.

$$D = [(50 + bl)^2 – (hh – fh)^2]^{½}$$

Where: **bl** = blade length, **hh** = hub height, **fh** = feature height (all in metres).

Based on this formula and proposed turbine dimensions, the following felling distances were calculated for each of the turbines: T1 = 77m, T2 = 89m, T3 = 77m, T4 = 83m, T5 = 91m.

A modified buffer around turbines T6 and T7 will be required to ensure the stream and bordering tree lines, found in the southwest of the site, are retained. This feature was found to be used at a low activity level and by low numbers of individual species of bats. This approach is to ensure there is no net habitat change in this area. If the full SNH (2021) felling buffer area were to be applied at these turbine locations, this would create an opening within the current treeline along the stream corridor which could potentially encourage bat species to forage within this newly created open habitat and increase risk of collisions with turbine blades.

Control of regrowth of trees/encroachment of scrub will be managed and controlled within turbine felling buffer areas for the lifetime of the wind farm to maintain vegetation at low-height and thus retain recommended clearance setbacks around relevant turbines. Vegetation will be managed by appropriate mechanical means.

Any proposed lighting shall adhere to the following guidelines, taken from the Bat Conservation Trust 2023 ‘Guidance Note 08/23’, to ensure that any unnecessary light spill from the Proposed Development and its potential impacts to any roosting, foraging and commuting bats are minimized. Lighting will only occur at substation during operations and will be motion sensor lights. Lights on turbines will be limited to those required for safe aviation, used to enhance the visibility of the turbines by aircraft.

- LED luminaires to be used due to the fact that they are highly directional, and have a sharp cut-off, lower intensity, good colour rendition and dimming capability.
- All luminaires should lack UV elements to reduce impact. Metal halide, compact fluorescent sources should not be used.
- A warm white light source (<2700 Kelvins) is to be adopted to reduce the blue light component).
- Light sources should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Internal luminaires can be recessed (as opposed to using a pendant fitting) where they are installed in proximity to windows to reduce glare and light spill.
- Waymarking inground markers (low output with cowls or similar to minimise upward light spill) to delineate path edges.
- Column heights will be carefully considered to minimise light spill and glare visibility. This should be balanced with the potential for increased numbers of columns and upward light reflectance as with bollards. The shortest column height allowed will be used where possible.
- Only luminaires with a negligible or zero upward light ratio and with good optical control will be used.
- Luminaires should always be mounted horizontally with no light output above 90° and/or no upward tilt.

- Where appropriate, external security lighting should be set on motion sensors and set to as short a possible a timer as the risk assessment will allow. For most general residential purposes, a 1- or 2-minute timer is likely to be appropriate.
- Use of a Central Management System (CMS) with additional web-enabled devices to light on demand.
- Use of motion sensors for local authority street lighting may not be feasible unless the authority has the potential for smart metering through a CMS.
- The use of bollard or low-level downward-directional luminaires is strongly discouraged. This is due to a considerable range of issues, such as unacceptable glare, poor illumination efficiency, unacceptable upward light output and increased upward light scatter from surfaces. Therefore, they should only be considered in specific cases where these issues can be resolved.
- Only if all other options have been explored, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed. However, due to the lensing and fine cut-off control of the beam inherent in modern Light-Emitting Diode (LED) luminaires, the mitigating effect of cowls and baffles is often far less than anticipated and so should not be relied upon solely.

6.5.2.1.3 Protection of Habitats

The area of proposed works will be kept to the minimum necessary to minimise disturbance to habitats and flora. The footprint of the development area and construction area will be clearly marked prior to commencement of construction with secure posts and high visibility tape. These areas will be marked out with reference to design drawings, under the supervision of the project engineer and ECoW. There will be no removal of habitat, movement/storage of construction machinery or any other construction related activities permitted outside the Proposed Development area.

6.5.2.1.4 Removal of Vegetation (Excluding Conifer Plantation)

In accordance with Section 40 of the Wildlife Acts, vegetation removal, including hedgerow and tree removal, will be conducted outside of the restricted bird nesting period (March 1st to 31st August). The provisions of Section 40 of the Acts do not relate exclusively to birds, but to broader biodiversity, the protection of which will contribute to local food chains and ecosystem functioning.

6.5.2.1.5 Forestry Felling

Overall, felling of appropriately 18ha of commercial forestry will be required. All tree felling will be undertaken in accordance with the conditions attached to the tree felling licence and in accordance with Forest Service Guidelines. Harvesting is the main of two forest operations that can cause nutrient runoff to water bodies and contribute to their eutrophication unless mitigating measures are taken. The *Forestry and Water Quality Guidelines*[23] (DMNR, 2000) and *Standards for Felling & Reforestation*[24] (DAFM, 2019) describe best practice that must be adopted if carrying out felling. A harvesting plan and associated mapping will be prepared and will include a review of the felling areas, environmental receptors – water features (including aquatic zones, relevant watercourses, hotspots, water abstraction points and crossing points), biodiversity (including hedgerows and other habitats), selection of felling and extraction system and machinery, silt and sediment control, timing, and extraction management.

6.5.2.1.6 Water Quality

The main potential for impacts is during the construction phase. Runoff of silt and pollution by accidental concrete/fuel/oil spill will comprise the main sources of potential water quality impacts during the construction stage.

Construction phase mitigation for hydrology will follow that outlined in the CEMP and that in Chapter 8 Water.

A programme for water monitoring will be prepared to best practice guidance prior to the commencement of the construction of the wind farm. The plan will include monitoring of water during the pre-construction, throughout construction and in the immediate post construction phases.

Further baseline water quality monitoring of all streams near the development site will be undertaken prior to construction to confirm existing conditions at the time of construction. This baseline data will include the main components of a full hydrograph for the streams including both high spate flow and base flow where possible.

Silt control will be a primary concern during the construction stage, as silt has been identified as a sediment source to downstream areas. Silt ponds will be required as mitigation at access tracks and swales within the Proposed Development site as these are considered an effective method of retaining silt. The design of these features will be in accordance with best practice, oversized and retained post construction.

During the construction phase of the Proposed Development, water quality in the streams and outflow from the drainage and attenuation system will be monitored, field-tested and laboratory tested on a regular basis during different weather conditions. This monitoring together with the visual monitoring will help to ensure that the mitigation measures that are in place to protect water quality are working effectively.

During the construction phase of the Proposed Development, the development areas will be monitored regularly for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system to ensure it does not become blocked, eroded, or damaged during the construction process.

Prior to any construction activity being carried out, the subject part(s) of the Proposed Development site will be inspected for areas that may be prone to siltation of nearby rivers/streams and drains as appropriate. Where necessary, check dams, sandbags and/or silt fences will be installed in adjacent trackside drainage ditches to ensure an optimum standard of water running into adjacent streams from the trackside drainage. During periods of heavy precipitation and runoff, works will be halted if posing a risk to the water environment or working surfaces/pads will be provided to minimise soil disturbance. Any requirement for temporary fills or stockpiles will be covered with polyethylene sheeting of suitable grade/gauge to avoid sediment release during periods of heavy rainfall.

Additional infrastructure and measures used to control water quality will include:

- Settling out as far as reasonably practicable any silty water generated on site through drainage mitigation measures (silt traps, etc.) and channelled into suitable vegetation (as defined by ECoW) at least 50 m from watercourses.
- Establishing vegetation on exposed areas by using top sod or reseeding with a suitable seed mix.
- Regular road cleaning.
- Use of wheel washes.
- Use of check dams on drains to slow water velocity.
- Use of silt fences on drains to reduce sediment loading.
- Daily and weekly weather forecast monitoring.

- Programme of daily, weekly, and monthly water quality monitoring.

All design and works in proximity to watercourses will follow the best practice guidance outlined in the following documents:

- Draft Revised Wind Energy Development Guidelines (DHPLG, 2019).
- 'Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters' (IFI, 2016).
- 'Control of water pollution from linear construction projects' (Murnane et al. 2006).
- 'Guidelines for the crossing of Watercourses during Construction of National Road Schemes'(NRA, 2008).

6.5.2.1.7 Dewatering

All ground water/surface water that may enter turbine foundations or cable trenches/joint bays will be removed, treated and disposed of appropriately, in accordance with best practice. Any dewatering (if/where required) will adhere to the following measures:

- Ground water/surface water will not be pumped directly into trackside drains/watercourses.
- Ground water/surface water which has become silted within the turbine foundations will be pumped to the surface water drainage system to settle out.
- Ground water/surface water which has become silted within the trenches/joint bays will be pumped and allowed to infiltrate to a designated percolation area (area designated by the ECoW). Dedicated settlement ponds will be provided adjacent to the site tracks, proposed borrow pit location, hard stands, substation. The design and locations of the ponds are outlined in Chapter 3 Civil Engineering. Where necessary, sediment ponds will be partly filled with stone so that they will not present a long-term safety risk. The remaining ponds will be left to fill in and re-vegetate naturally or retained as ponds.

6.5.2.1.8 Cement Bound Granular Mixtures (CBGM)

For the cable trench construction, temporary storage of Cement Bound Granular Mixtures (CBGM) will be on hardstand areas, or areas that are not prone to run off. These areas will be located where there is no direct drainage to surface waters and where the area has been appropriately bunded. Bunding will be in the form of sandbags, geotextile sheeting, or silt fencing. This method will prevent any solid runoff. Concrete truck chutes will be washed out at a dedicated, bunded area.

6.5.2.1.9 Fuel Management

All plant will be refuelled on site e.g. excavators, dumpers etc, while rigid and articulated vehicles will be fuelled off site as will all site vehicles (jeeps, cars and vans). At construction stage, a Fuel Management Plan will be developed specific to the site and the particular plant and equipment required for construction.

The plan outlined will have regard to the following elements:

- Mobile bowsers, tanks and drums will be stored in a secure, impermeable storage area, away from drains and open water.
- Fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores.
- Ancillary equipment such as hoses, pipes will be contained within the bund.
- Taps, nozzles or valves will be fitted with a lock system.
- Fuel and oil stores, including tanks and drums, will be regularly inspected for leaks and signs of damage.
- Only designated trained operators will be authorised to refuel plant on site.
- Procedures and 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.

6.5.2.1.10 Refuelling of Construction Plant Onsite

The following measures will be undertaken to avoid or minimise negative effects to water quality as a result of the use of hydrocarbons:

- Refuelling will be carried out using 110% capacity double bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained in using.
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water.
- To reduce the potential for oil leaks, only mechanically sound vehicles and machinery will be allowed onto the site. An up-to-date service record will be required from the main contractor.
- Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits. the nearby dirty water drain outlet will be blocked with an oil absorbent boom until the fuel/oil spill has been cleaned up and all oil and any contaminated material removed from the area. This contaminated material will be properly disposed of in a licensed facility.
- Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and also in site vehicles and machinery.
- In the event of a major oil spill, a company who provide a rapid response emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill kits kept in site vehicles and machinery.

6.5.2.1.11 Construction Wheel Wash

A construction wheel wash will be used for vehicle wheels and undersides entering and leaving the construction site. Water residue from the wheel wash will be fed through a settlement pond for settling out of suspended solids. The wheel wash area will be cleaned regularly so as to avoid the buildup of residue. While these measures pertain to hydrology, and are included in the CEMP, they also relate to aquatic biodiversity, so are included here.

6.5.2.1.12 Temporary Construction Compound

The following measures will be undertaken to avoid or minimise negative effects to water quality as a result of the erection of the temporary compound:

- Drainage within the temporary site compound will be directed to an oil interceptor to prevent pollution if any spillage occur.
- A bunded containment area will be provided within the compound for the storage of fuels, lubricants, oils etc.
- The compound will be in place for the duration of the construction phase and will be removed once commissioning is complete.

6.5.2.1.13 Storage

The storage of materials, containers, stockpiles, and waste, however temporary, will follow best practice at all times and be stored at designated areas. Storage will be located as follows:

- Away from drains and sensitive habitats (IEFs).
- On an impermeable base.
- Under cover to prevent damage from the elements.
- In secure areas.
- Well away from moving plant, machinery and vehicles.

All containers will be stored upright and clearly labelled. Sufficient storage will be supplied near to all working areas.

6.5.2.1.14 Excavation Works

Excavation works relate mainly to trench digging and excavations. Mitigation in soil management as outlined in Chapter 9 Land and Soil will also apply. The following measures will be undertaken to avoid or minimise negative effects to water quality as a result of excavation works:

- Earth movement activities will be suspended during periods of prolonged rainfall events.
- The earthworks material will be placed and compacted in layers to prevent water ingress and degradation of the material.
- Drainage and associated pollution control measures will be implemented on site before the main body of construction activity commences.

6.5.2.1.15 Excavated Materials and Soil Management

All soils generated from excavation works within the wind farm associated with turbines, access track, substation, turbine delivery route, grid connection and internal cable construction will be retained on site and reused in

bunding, landscaping and restoration of the borrow pit and deposition areas. No soils will be removed from the site.

During excavations in the existing tracks, excavated material will be temporarily stockpiled adjacent to the section of trench, with appropriate material used as backfill. Appropriate siltation measures will be put in place prior to excavations. Temporary stockpiles will be stored a minimum of 50m back from rivers/streams on level ground with a silt barrier installed at the base.

6.5.2.2 Operational Phase

The following operational phase (monitoring) mitigation measures are recommended with regard to the Proposed Development.

6.5.2.2.1 Habitat Reinstatement Management

Any hedgerow maintenance will be undertaken on a 3-to-4-year rotational cutting cycle to ensure a continual supply of food for pollinators. Suitable cutting equipment will be used to minimise unnecessary flaying and shredding of hedgerow vegetation to reduce risk of long-term damage and disease.

Where hedgerows are maintained, they will be allowed to flower throughout the year to provide pollen and nectar to pollinators. Hedge cutting will be kept to a minimum for those located outside the buffer felling areas, wherein hedgerows will be kept short at 1m to 1.5 m in height to discourage their use by bats. Any necessary hedgerow maintenance will be undertaken between November and February, in line with the NBDC Data Series Guidance 'Pollinator-friendly management of wind farms'. Hedgerow maintenance will be prohibited during the bird nesting season (March-August, inclusive), which will also have positive effects on other wildlife such as insects.

6.5.2.2.2 Protection of Fauna - Bats

A stringent post-construction monitoring programme shall be performed to assess any changes in bat activity patterns and help inform any potential mitigation in the form of turbine curtailment. Monitoring will be completed annually for three years after construction. During this time period, casualty searches and acoustic monitoring will take place alongside one another.

Acoustic surveys can be used to continue to assess bat activity and behaviour following construction of turbines to assess any significant decrease or indeed increases in bat activity. Passive Automated Bat surveys (PAB) shall be conducted each year for three years over 10 nights in each of spring (April to May), summer (June to mid-August) and autumn (mid-August to October). The methodologies for these surveys are the same as those described in Appendix 6-2 Ballinla Bat Survey Report. The PAB surveys can be accompanied with nighttime bat activity walkover surveys with the use of thermal imaging cameras as necessary to provide more detailed information on bat activity in the vicinity of turbines.

Systematic searches for bat casualties on the ground below wind turbines are currently the only effective means of monitoring bat fatalities. Searches should be undertaken as early as possible in the morning during high-risk periods. Data from the pre-application activity surveys show that the highest level of activity was recorded in the summer, as such it is concluded that this period is deemed to be of the highest risk for bats currently using the site.

Suitably trained dogs with handlers are significantly more efficient and faster than humans in locating carcasses and should preferably be used to achieve more robust results. The number of turbines surveyed should be proportional to the size of the site. As the site is deemed to be large (greater than five turbines), turbines can be selected at random, except where there is evidence to suggest an elevated risk at a particular turbine location (at present there is no evidence to suggest this is the case).

A limitation to conducting carcass searching is lack of access to the land beneath the turbine. As such it is essential that access is secured through liaising with the turbine operator and that land-use is conducive to performing a search. Systematic searches will be conducted within a 100m x 100m grid centred on the turbine, they will be conducted in at least two search periods, which is typically in the summer and autumn periods. Data must be obtained from the turbine operators on whether or not the target turbine(s) were operational on the night prior to the search, with the surveying procedure adjusted as necessary if the turbines were either non-operational or were not rotating because of a lack of wind.

Once all surveys have been conducted across the bat active season (spring, summer and autumn), data shall be compiled into an annual bat monitoring report, outlining the findings and implications for the wind farm operation, including any mitigation measures.

6.5.2.2.3 Water Quality

The measures for control of runoff and sediment relate to the construction phase of the Proposed Development when there is continuous movement of site vehicles and delivery vehicles moving around the wind farm site. Following construction, the amount of onsite traffic will be very low and there will be negligible risk of sediment runoff. Runoff from the access tracks, hard-standings, and other works areas will continue to be directed to settlement ponds and from there to the outfall weirs. Check dams within the drainage channels will also remain in place. The retention of this drainage infrastructure will ensure that runoff continues to be attenuated and dispersed across existing vegetation before reaching the downstream receiving waters. This infrastructure will be inspected regularly by the operational maintenance personnel.

Water monitoring will be updated prior to the commencement of the Proposed Development and will be undertaken monthly for a period of 6 months prior to commencement of construction. During the construction phase of the Proposed Development, weekly field surface water quality chemistry monitoring will be undertaken with reasonable frequency.

Where pipe culverts are proposed, any instream works will be carried out during the period of July – September (IFI, 2016). Appropriate periodic visual inspections of culverts during the operational phase will ensure they are maintained free from blockages, and there is no damage or erosion of the stream crossing wing walls, particularly after storm events. Silt ponds will also be inspected and maintained before the drains and verges have vegetated. Photographic records will also be taken during regular inspections and after major rainfall events. These will be collected and assessed by the ECoW or suitable qualified and competent person delegated by the ECoW. All records will be included in the CEMP and maintained onsite.

It is important to keep ecological disruption of watercourses to a minimum and to maintain the aquatic ecosystem in a healthy, functional condition. Biological water quality monitoring will be undertaken to monitor surface water quality during the operational phase.

Macroinvertebrates will be sampled annually on the first, second and third years at aquatic sites listed in the aquatic report, and in future years if there is instability in the macroinvertebrate communities. Biotic indices corresponding with those used in the aquatic report, as well as Functional Feeding Group Analysis will be carried out in line with the methodology described the aquatic report. A key biotic index in this regard is the Quality Rating System. This biotic index has been shown to be a robust and sensitive measure of riverine water quality and has been linked with both chemical status and land use pressures in catchments (Clabby *et al.*, 1992).

6.5.2.2.4 Decommissioning Phase

If it is decided to decommission the wind farm at the end of its operational life of 35 years, a comprehensive reinstatement proposal, including the implementation of a program that details any removal of structures and landscaping, will be submitted to OCC for approval prior to the decommissioning work.

The potential for impacts during decommissioning are similar in nature, if not in scope, to those assessed for the construction phase. All elements of the decommissioning works will be agreed with OCC beforehand and in accordance with their requirements. The same mitigation for the construction phase of the wind farm will apply to the decommissioning phase. Any mitigation measures will be carried out using appropriate best practice at the time.

6.6 Residual Impacts and Effects

Residual effects are those which are likely to occur even following the implementation of mitigation measures. Mitigation measures are proposed in Section 6.5.1 to provide robust and effective protection to Important Ecological Features likely to be affected by the Proposed Development in the absence of mitigation. As set out in Table 6-29, any residual effects are outlined after taking account of the mitigation proposed. For the likely significant effects assessed, application of the proposed mitigation measures in full will limit residual effects.

Provided that the mitigation measures outlined in Section 6.5.1, above, are implemented in full, it is not likely that significant adverse effects, to the IEF habitats and species identified for appraisal in this chapter, will arise. It is considered that the receiving environment within the Proposed Development site has the capacity to accommodate the Proposed Development without significant effects on habitats and flora and faunal features discussed in this chapter. The watercourses downstream are considered to have assimilation capacity adequate to absorb water quality effects to a level that would not have significant effects on aquatic biota or water quality status.

It is considered that the effects on IEFs from potential construction, operation and decommissioning impacts will be avoided, reduced and mitigated sufficiently to ensure that no likely significant effects remain, provided the ecological mitigation measures are implemented in full.

There will be loss of habitats at the Proposed Development site where hard surfaces will exist for the duration of the operational stage. This unavoidable loss is independently assessed as a likely, permanent, significant negative effect. Elsewhere on site, existing habitats will be preserved, leading to an effect independently assessed as likely, permanent, significant positive effect. The overall effect on habitats is assessed as likely, slight positive taking into account the greater proportion of habitat converted for overall biodiversity net gain beyond that which already exists within the Proposed Development site prior to development and beyond that which would exist in a do-nothing scenario.

There will be an increased human presence in the locality with an expected associated increase in noise and disturbance during construction stage. For fauna, it is considered that the residual effects will be likely, insignificant negative provided the appropriate mitigation measures and best practice methodologies provided in the CEMP are implemented. The effect on aquatic features will be likely, insignificant negative taking account of the CEMP and planned clear spanning of waterways on site. Similarly, with regard to water quality and cognisant of the site drainage design and water quality management systems, the mitigated effect on water quality will be a likely short-term, imperceptible negative effect. A summary of the unmitigated effects of the construction and operational phases, and then including mitigation and residual effects, of the Proposed Development are detailed in Table 6-26. Decommissioning effects are expected to be similar to construction phase effects however reduced in magnitude.

Table 6-26: Summary Table of Effects

IEF	Impact (Pre-mitigation)		Mitigation Measures	Residual Effect (Post-Mitigation)
	Construction	Operational		
Broadleaved Woodland (WD1)	No habitat loss proposed. Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**	Potential effects on terrestrial habitats and flora during the operation phase of the Proposed Development, in the absence of mitigation, are assessed as **Long-term, Likely Imperceptible, Negative Effects.**	None required for either construction or operational phases	**Long-term, Likely Neutral Effect**
Scrub (WS1)	0.006ha of area lost where overlap occurs in south of site. Habitat loss effects are assessed as **Permanent, Likely Imperceptible Negative Effects**. Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**	Potential effects on terrestrial habitats and flora during the operation phase of the Proposed Development, in the absence of mitigation, are assessed as **Long-term, Likely Imperceptible, Negative Effects.**	None required for either construction or operational phases	**Long-term, Likely Neutral Effect**
Hedgerow (WL1)	Direct habitat loss effects are assessed as **Permanent, Likely Significant, Negative Effects**. Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**	Potential effects on terrestrial habitats and flora during the operation phase of the Proposed Development, in the absence of mitigation, are assessed as **Long-term, Likely Imperceptible, Negative Effects.**	Hedgerow and treeline reinstatement	**Likely Permanent, Likely Slight Positive Effect**
Treeline (WL2)	Direct habitat loss effects are assessed as **Permanent, Likely Significant, Negative Effects**. Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**	Potential effects on terrestrial habitats and flora during the operation phase of the Proposed Development, in the absence of mitigation, are assessed as **Long-term, Likely Imperceptible, Negative Effects.**	Hedgerow and treeline reinstatement	**Likely Permanent, Likely Slight Positive Effect**
Drainage Ditch (FW4)	Direct habitat loss effects are assessed as **Permanent, Likely Moderate, Negative Effects**.	Potential operational effects on aquatic habitats are assessed as **Likely, Long-term, Slight, Negative Effects.**	Site-specific drainage design CEMP Best Practice and Site Management Pre-construction checks with regard to presence of frog with possibility for follow-up	**Long-term, Likely Slight Negative Effect**

IEF	Impact (Pre-mitigation)		Mitigation Measures	Residual Effect (Post-Mitigation)
	Construction	**Operational**		
	Habitat disturbance effects are assessed as **Short-term, Likely Slight Negative Effects.**		translocation to nearby suitable aquatic habitat if required	
Depositing Lowland River (FW2)	Direct effects relating to loss of substrates habitats are assessed as **None**. Direct macroinvertebrate habitat loss effects are assessed as **Permanent, Likely Moderate Negative Effects.** Habitat alteration effects are assessed as **Permanent, Likely Moderate Negative Effects, Moderate Negative Effects** with regards to aquatic ecology and water quality.	Potential operational effects on aquatic habitats are assessed as **Likely**, **Long-term, Slight, Negative Effects.**	Site-specific drainage design CEMP Best Practice and Site Management	**Long-term, Likely Slight Negative Effect**
Otter (*Lutra lutra*)	No habitat loss effects on otter predicted. Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term, Slight Negative Effects.** Indirect disturbance and/or displacement effects during the construction phase are assessed as **Likely Temporary to Short-term, Slight Negative Effects.**	Potential operational effects to otter are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	CEMP Best Practices and Site Management Pre-construction surveys	**Short-term, Likely Slight Negative Effect.**
Badger (*Meles meles*)	Habitat loss effects on badger (loss of potential foraging habitat) assessed as a **Likely Short-term Slight Negative Effect.**	Potential operational effects to badger are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Implementation of CEMP, Pre-construction surveys	**Short-term, Likely Slight Negative Effect.**

IEF	Impact (Pre-mitigation)		Mitigation Measures	Residual Effect (Post-Mitigation)
	Construction	**Operational**		
	Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**			
Eurasian Pygmy shrew (*Sorex minutus*)	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**	Potential operational effects to pygmy shrew are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Pre vegetation clearance check	**Short-term, Likely Slight Negative Effect.**
Eurasian red squirrel (*Sciurus vulgaris*)	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**	Potential operational effects to red squirrel are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Any felling of forestry should be limited to avoid the January – March period when young are in dreys	**Short-term, Likely Slight Negative Effect.**
European Hedgehog (*Erinaceus europaeus*)	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**	Potential operational effects to hedgehog are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Pre vegetation clearance check	**Short-term, Likely Slight Negative Effect.**

IEF	Impact (Pre-mitigation)		Mitigation Measures	Residual Effect (Post-Mitigation)
	Construction	**Operational**		
Pine marten (*Martes martes*)	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**	Potential operational effects to pine marten are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Pre-vegetation clearance check Limit felling to avoid March to April period when young may be in dens	**Short-term, Likely Slight Negative Effect.**
Irish hare (*Lepus timidus hibernicus*)	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**	Potential operational effects to Irish hare are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Pre-vegetation clearance check	**Short-term, Likely Slight Negative Effect.**
Irish stoat (*Mustela erminea Hibernica*)	Habitat loss effects on red squirrel are assessed as **Likely Short-term Slight Negative Effects.** Direct disturbance and/or displacement effects during the construction phase are assessed as **Likely Short-term Slight Negative Effects.**	Potential operational effects to Irish stoat are, in the absence of mitigation, assessed as being **Likely, Long term, Slight to Imperceptible, Negative effects**	Pre vegetation clearance check Limit vegetation removal to avoid bird-nesting period (March – August) where possible	**Short-term, Likely Slight Negative Effect.**
Common pipistrelle (*Pipistrellus pipistrellus)* Soprano pipistrelle	Habitat loss/vegetation removal (potential foraging/ commuting habitat) effects on bat species are assessed as **Likely**, **Permanent, Slight, Negative Effects**.	Injury/mortality due to collision/barotrauma during the operational phase is assessed as **long-term, slight negative effects**.	Up to 92 m buffer at all turbines, Turbine lighting Implementation of CEMP, Best Practices and Site Management	**Long-term, Likely Slight Negative Effect.**

IEF	Impact (Pre-mitigation)		Mitigation Measures	Residual Effect (Post-Mitigation)
	Construction	**Operational**		
Leisler's bat Nathusius' bat	Disturbance and/or displacement effects on bat species during the construction phase are assessed as **Likely, Short-term, Slight Negative, Effects.**	Disturbance/displacement during the operational phase is assessed as **long-term, slight negative effects.**		
Daubenton's bat Brown long-eared bat Whiskered bat Myotis spp.	Habitat loss/vegetation removal (potential foraging/ commuting habitat) effects on bat species are assessed as **Likely**, **Permanent, Slight, Negative Effects**. Disturbance and/or displacement effects on bat species during the construction phase are assessed as **Likely, Short-term, Slight Negative, Effects.**	Injury/mortality due to collision/barotrauma during the operational phase is assessed as **long-term, insignificant negative effects**. Disturbance/displacement during the operational phase is assessed as **long-term, slight negative effects.**	Up to 92 m buffer at all turbines, Turbine lighting Implementation of CEMP, Best Practices and Site Management	**Long-term, Likely Slight Negative Effect.**
Terrestrial macro-invertebrates	Habitat loss/alteration effects on other terrestrial macro-invertebrate species are assessed as **Temporary to Permanent, Slight to Moderate Negative effects.**	Disturbance and/or displacement effect on terrestrial macro-invertebrates during the operational phase are assessed as **Long-term, Insignificant, Negative Effects.**	None required	**Long-term, Likely Slight Negative Effect**
Brook lamprey (*Lampetra planeri*)	Disturbance/displacement effects on brook lamprey are assessed as **Temporary to Short-term, Likely Slight to Moderate Negative effects.**	The effects on fish species during the operational phase are assessed as **Long-term, Insignificant Negative effects.**	Implementation of CEMP, Best Practice and Site Management, Site-specific drainage system design	**Long-term, Likely Slight Negative Effect.**
Other fish species	Disturbance/displacement effects on brook lamprey are assessed as **Temporary to Short-term, Likely Slight Negative effects.**	The effects on fish species during the operational phase are assessed as **Long-term, Insignificant Negative effects.**	Implementation of CEMP, Best Practice and Site Management, Site-specific drainage system design	**Long-term, Likely Slight Negative Effect.**
Common frog (*Rana temporaria*)	Direct disturbance and/or displacement effects during the construction phase are assessed	The disturbance and/or displacement effects on common frog during the	Pre-construction checks with the possibility of translocation to nearby suitable aquatic habitat if required	**Long-term, Likely Slight Negative Effect**

IEF	Impact (Pre-mitigation)		Mitigation Measures	Residual Effect (Post-Mitigation)
	Construction	**Operational**		
	as **Short-term Slight Negative Effects.** Indirect disturbance and/or displacement effects during the construction phase are assessed as **Temporary to Short-term, Slight Negative Effects.**	operational phase are assessed as **Long-term, Neutral effect**.		

6.7 Conclusion

Provided that the proposed wind farm development is constructed and operated in accordance with the design, best practice and mitigation measures proposed, significant residual effects on biodiversity are not likely on any Important Ecological Feature (IEF).

The application of mitigation and protection measures throughout the construction and operational phases will ensure that no significant residual effects are likely to arise from the Proposed Development, either alone or in combination with other plans or projects.

The following mitigation measures are considered for the project (see Table 6-27).

Table 6-27: Summary of All Recommended Mitigation Measures

Mitigation Measures
Habitat reinstatement of hedgerow, rewilding area, settlement ponds
Site specific drainage system and adherence to Surface Water Quality System (SWQS), Surface Water Management Plan (SWMP), Construction Environmental Management Plan (CEMP)
Management of site for bats by keeping hedgerow and linear features short (c. 1 – 1.5 m height at T1, T2, and T3) to shield draw-in to turbines by bats when considering the openness of landscape if they were removed.
Project Ecologist/Ecological Clerk of Works (ECoW) on site during construction phase to ensure compliance with EIAR mitigation
Pre-construction surveys including vegetation surveys prior to vegetation clearance
Avoidance of vegetation clearance during the bird-nesting period (March to August, inclusive)
Avoid forestry felling to periods outside young in dreys/dens for red squirrel (January to March) and pine marten (March to April)
Bat buffer zones (tree clearance and/or hedge management) at turbines, standard for T1 – T5, with modified buffers for T6 and T7
Proposed lighting follows Bat Conservation Trust 2023 'Guidance Note 08/23'
Post construction monitoring for bats – PABs shall be conducted each year for three years over 10 nights in spring (April – May), 10 nights in summer (June – mid-August) and 10 nights in autumn (mid-August – October)
Post construction monitoring - nighttime bat activity walkover surveys to accompany the PABs
Post construction monitoring - Casualty searches (to be conducted in at least two search periods, which is typically in the summer and autumn periods)
Footprint of development area to be clearly marked prior to commencement of construction with secure posts and high visibility tape
Programme for water monitoring to be prepared prior to commencement of construction of wind farm
Silt ponds at access tracks
In-stream works, i.e., pipe culverts, carried out during July – September period (IFI, 2016)
Regular checking of dams and culvert to ensure no blockages occur
Dewatering – removal of groundwater or surface water that may enter the turbine foundations or cable trenches, etc., and disposed appropriately.
Correct storage of Cement Bound Granular Mixtures (CBGM) in areas not prone to runoff
Implementation of Fuel Management Plan
Earth movement activities will be suspended during periods of prolonged rainfall events with the earthworks material being placed and compacted in layers to prevent water ingress and degradation of the material
Habitat Reinstatement Management – Any hedgerow and/or shrub species will be composed of at least 75% whitethorn and 25% of other native native species in keeping with ideal hedgerow creation (NBDC, 2009). Any hedgerow maintenance will be on a 3 - 4 year rotational cutting cycle to ensure a continual supply of food for pollinators. Suitable cutting equipment will be used to minimise unnecessary flaying and shredding of hedgerow vegetation to reduce risk of long-term damage and disease

6.8 References

Atherton, I., Bosanquet, S. & Lawley, M. eds (2010). Mosses and liverworts of Britain and Ireland a field guide. British Bryological Society, London.

Bang & Dahlstrom, (2004) Animal tracks and signs.

Bat Conservation Ireland (2010). Bats and Lighting. Guidelines for protecting bats' roosts, foraging and commuting routes from negative effects of street lighting.

Bat Conservation Ireland (2012). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. Bat Conservation Ireland, www.batconservationireland.org.

Chanin, P. 2003a. Monitoring the Otter Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.

Chanin, P. 2003b. Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10, English Nature, Peterborough.

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland. Chartered Institute of Ecology and Environmental Management, Winchester UK.

Collins, J. (ed.) (2023) Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition). The Bat Conservation Trust, London.

Davis, S. J., Ó hUallacháin, D., Mellander, P., Kelly, A., Matthaei, C. D., Piggott, J. J. and Kelly-Quinn, M. (2018) Multiple-stressor effects of sediment, phosphorus and nitrogen on stream macroinvertebrate communities. Science of the Total Environment 637–638 (2018) 577–587.

Department of Housing, Local Government and Heritage (DHLGH) (2023). Fourth National Biodiversity Action Plan 2023 – 2030. National Parks and Wildlife Service.

EPA (2024a).Cycle 3 HA 14 Barrow Catchment Report.

EPA (2024b). Cycle 3 HA 07 Boyne Catchment Report.

EPA (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports.

Fossitt, J. A. (2000). A Guide to Habitats in Ireland. The Heritage Council, Kilkenny.

Horton, R., Yohe, G., Easterling, W., Kates, R., Ruth, M., Sussman, E., Whelchel, A., Wolfe, D. &

Inland Fisheries Ireland. 2016. Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters

Institution of Lighting Professionals (ILP) (2023). Guidance Note 08/23: Bats and Artificial Lighting At Night. Institution of Lighting Professionals, Rugby.

Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals No. 25. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011). Landscape Conservation for Irish bats * Species specific Roosting Characteristics. Bat Conservation Ireland.

Marnell, F., Looney, D. & Lawton, C. (2019) Ireland Red List No. 12: Terrestrial Mammals. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

Marnell, F., Kelleher, C. & Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

Mathews, F.. Richardson, S.. Lintott, P.. Hosken, D. (2016). Understanding the Risk of European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management. Report by University of Exeter. Report for RenewableUK.

McGinnity, Philip & Gargan, Paddy & Roche, William & Mills, Paul & McGarrigle, Martin. (2003). Quantification of the Freshwater Salmon Habitat Asset in Ireland using Data Interpreted in a GIS Platform. Irish Freshwater Fisheries Ecology and Management Series. 3.

Moorkens, E. A.(2000) Conservation Management of the Freshwater Pearl Mussel Margaritifera margaritifera. Part 2: Water Quality Requirements. Irish Wildlife Manuals, No. 9.

NatureScot (2021). Bats and onshore wind turbines – survey, assessment and mitigation. Scotland's Nature Agency. Version: August 2021 (updated with minor revisions).

NBDC (2009). Pollinator-friendly Management of Wind Farms, Guidelines 12. National Biodiversity Data Series No. 25.

Nelson, B., Cummins, Fay, L., Jeffrey, R., Kelly, S., Kingston, N., Lockhart, N., Marnell, F., Tierney, D., Wyse Jackson, M. (2019) 'Checklists Protected and Threatened Species in Ireland', [report], National Parks and Wildlife Service. Department of Culture, Heritage and the Gaeltacht, 2019-12, Irish Wildlife Manuals, No.116.

Nature Scot (2019) Good practice during Wind Farm construction. A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and AEECoW. 4th Edition.

NPWS (2009). Threat Response Plan: Otter (2009-2011). National Parks & Wildlife Service, Department of the Environment, Heritage & Local Government, Dublin.

NRA (undated). Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Roads Authority (Ireland).

NRA (undated). Guidelines for the Treatment of Bats During the Construction of National Road Schemes. National Roads Authority (Ireland).

NRA (2008). Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes. National Roads Authority (Ireland).

NRA (2008). Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes. National Roads Authority (Ireland).

NRA (2008). Guidelines for the Treatment of Otters Prior to the Construction of National Road. National Roads Authority (Ireland).

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Roads Schemes. Revision 2, 1st June 2009. National Roads Authority.

NRA (undated). Best Practice Guidelines for the Conservation of Bats in the Panning of National Road Schemes. National Roads Authority.

Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., & Wilson, C.J. (2010) Ireland Red List No. 4 – Butterflies. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

Roche, N., Aughney, T., Marnell, F., & Lundy, M. G., (2014). Irish Bats in the 21st century. Bat Conservation Ireland.

Scannell, M.J.P. & Synnott, D.M. (1987). Census catalogue of the flora of Ireland. A list of Pteridophyta, Gymnospermae and Angiospermae including all the native plants and established aliens known to occur in Ireland with the distribution of each species, and recommended Irish and English names. pp. [i]-xxvii, 1-171, map. Dublin: Stationery Office.

Scottish Badgers (2018). Surveying for Badgers: Good Practice Guidelines. Version 1.

Settele, Josef & Scholes, Robert & Betts, R.A. & Bunn, Stuart & Leadley, Paul & Nepstad, D. & Overpeck, J. & Taboada, M.. (2014). Terrestrial and Inland Water Systems.

Smith, G. F., O'Donoghue, P., O'Hara, K., Delaney, E (2011). Best Practice and Guidance for Habitat Surveying and Mapping. Heritage Council.

SNH (2019). Bats and onshore wind turbines – survey, assessment and mitigation.

SNH (2021). Bats and onshore wind turbines – survey, assessment and mitigation (updated with minor revisions).

Strahler, A. N., (1957). Quantitative analysis of watershed geomorphology, Trans. Am. Geophys. Union, 38, No. 6, 913–920.

Wray, S., Wells, D., Long, E. and Mitchell-Jones, T. December (2010). Valuing Bats in Ecological Impact Assessment, CIEEM In-Practice.

Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. & Wright, M. (2016) Ireland Red List No. 10: Vascular Plants. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.