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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED SHANCLOON WIND FARM, CO. GALWAY

Volume 2 - EIAR

Chapter 9 - Biodiversity

Prepared for:

RWE Renewables Ireland Ltd

RWE

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9. BIODIVERSITY

9.1 Introduction

This chapter presents a Biodiversity Impact Assessment of the Proposed Development and describes the existing ecological environment of the Proposed Development and examines the potential effects that the Proposed Development (described in Chapter 2) is predicted to have on biodiversity, flora and fauna (excluding ornithology, see Chapter 10). Appropriate mitigation measures are described to avoid, reduce or offset potential significant effect(s) on biodiversity.

This Chapter of the EIAR is supported by Figures in Volume IV, Planning Drawings accompanying the planning application and the following Appendix documents provided in Volume III:

- Appendix 2.1: Construction Environmental Management Plan (CEMP)
- Appendix 9.1: Biodiversity Enhancement and Management Plan (BEMP)
- Appendix 9.2: Aquatic Survey report
- Appendix 9.3: Bat Survey Report

Common terms and acronyms used throughout this EIAR can be found in Chapter 1 - Introduction.

The Proposed Development assessed in this EIAR comprises the following elements:

- The wind farm site (referred to in this EIAR as the 'Site') which includes the turbine array and associated civil and electrical infrastructure and the on-site 110 kV substation and loop-in connection to the existing Cashla-Dalton overhead line;
- The turbine delivery route (referred to in this EIAR as the 'TDR').

An overview of the location of the Proposed Development is shown in Figure 2.1. The general layouts of the Site are presented in Figures 2.2a Figure 2.2b and Figure 2.2c, and the TDR is presented in Figure 2.3.

Ornithological impact assessment is described under separate chapter (Chapter 10 - Ornithology). Any discussion in relation to SPA / RAMSAR Sites within this chapter is in relation to the assessment of effects on the structure and function of habitats within such designated areas. The assessment of effects on bird species as might be associated with such sites is presented in the Chapter 10 - Ornithology.

A Natura Impact Statement has been prepared in support of the consent application for the Proposed Development. As per the EPA Guidance (2022), "*a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European Sites contained in a Natura Impact Statement" but should "incorporate their key findings as available and appropriate*". As such the potential for the Proposed Development to have adverse effects on the integrity of any European (Natura 2000) site has been assessed within a Natura Impact Statement (NIS) and summarised herein.

9.2 Statement of Authority

An ecological appraisal of the proposed project was undertaken by Fehily Timoney and Company (FT) to inform this chapter. The lead author of this chapter is Daniel Weldon (FT Ecologist, BSc. Environmental Science). The chapter was reviewed by Rita Mansfield (FT Principal Ecologist, BSc (Hons) Applied Ecology; H.Dip Environmental Protection and Pollution Control.

Ecological walkover surveys, habitat / botanical surveys (including invasive species surveys), and non-volant mammal surveys were carried out by Principal Ecologist Andrew Torsney.

Baseline aquatic ecology assessment was conducted by Jason Nash (BSc, MIFM) of Flynn Furney Environmental Consultants.

Bat surveys were conducted between 2020 and 2023 by staff from Woodrow Sustainable Solutions Ltd (Woodrow), including: Rachel Irwin, Aoife Moroney, Nicole Fleming, Philip Doddy, Sara Fissolo, Julie Kohlstruck, Patrick Devereux, Ajay Cheruthan, Louise Gannon, Radek Dlugosz, and Oisín O'Sullivan. Manual verification of bat spectrograms, data analysis using Ecobat, and reporting were undertaken by Oisín O'Sullivan, Louise Gannon, Aoife Moroney and Rachel Irwin; with input and supervision from Will Woodrow.

Table 9-1: Contributors to Biodiversity Impact Assessment

Surveyor	Contribution	Biography
Andrew Torsney	Habitat surveys, botanical surveys, invasive species surveys and mammal surveys	Andrew holds a PhD in Ecotourism and visitor Behaviour Analysis, a MRes in Biodiversity and Conservation (Hons.) and a BSc in Zoology. He is a principal ecologist responsible for the preparation and co-ordination of EcIAs, EIARs and AA for large scale plans and projects in Ireland, including for wind energy developments. Andrew has authored the NBDC Identification Guide to Irelands Bats and the Identification Guide to Regulated Invasive Plants. Andrew is an experienced botanical specialist with a focus on Annex I grassland habitats.
Rita Mansfield	Habitat surveys, invertebrate and herpetofauna surveys EIAR Biodiversity Chapter Reviewer	Rita holds a BSc.(Hons) in Applied Ecology and a H. Dip Environmental Protection and Pollution Control. Rita is experienced as a technical ecology lead within the environmental and planning services sector. She is a qualified ecologist with responsibility for environmental impact assessment, planning applications (conventional and strategic infrastructure development), Appropriate Assessment, foreshore licensing, and stakeholder engagement for large scale plans and projects in Ireland, including for wind energy developments. Rita has undertaken and managed a wide range of ecological field assessments including mammal, herpetofauna, bird, fishery, invertebrate and habitat assessments. Rita has held numerous licences under the Wildlife Act and Habitats Directive for disturbance to species which included mitigation (e.g. construction of artificial otter holt, bat exclusion). Rita has provided advice on ecological / environmental design to various private and public sector clients.

Surveyor	Contribution	Biography
		Rita is an experienced Project Manager and Associate Director at FT. With 20 years' experience specialising in statutory consent and environmental assessment for large scale public infrastructure projects in the energy, water (including flood relief schemes) and transport sectors. Rita provides technical advisory services through all stages of project delivery from feasibility assessment, impact assessment, CPO, design, contract administration and construction.
Jason Nash	Aquatic Surveys	Jason holds a Diploma in Fisheries Management and a Certificate in Electric Fishing from the Institute of Fisheries Management (IFM), as well as a BSc in Zoology from UCC. He conducts a broad range of environmental surveys to produce various environmental reports, from pre-construction surveys to Appropriate Assessments. Jason performs fish rescue and fish stock surveys using various electro fishing and netting methodologies. He also designs and implements fisheries habitat and ecological rehabilitation plans and devises site specific plans for riverbank revetment works using modern, nature-based solutions. Jason has extensive experience with invasive plant species and designing programmes for their control and eradication. Jason is a full member of the Institute of Fisheries Management and a Committee Member of its Irish Branch.
Frederico Hintze	Bat Surveys	Fredrico is an ecologist at Woodrow and holds a B.Sc. in Biology-Geology and an M.Sc. in Ecology from the University of Minho (Portugal), as well as a PhD in Animal Biology from the Federal University of Pernambuco (Brazil). Throughout his career, FH has actively participated in more than 10 Environmental Impact Assessment (EIA) projects in Portugal, covering various topics such as dams, wind farms, roads, and transmission lines. As an ecologist with Woodrow, Frederico's work focuses on bat data analysis, including bat call identification, bat roost/habitat suitability surveys, and report writing and review. He possesses a high level of proficiency and experience with various analysis software used to assess bat calls and activity
Jason Guile	Bat Surveys	Jason is a Principal ecologist with APEM Ireland and has over 11 years' experience in ecological assessment and holds a BSc in Marine Biology/Oceanography from the University of Wales, Bangor and a HND in Coastal Conservation with Marine Biology from Blackpool and Fylde College. Jason has a wide range of experience in the preparation of Environmental Impact Assessment Reports, Appropriate Assessment Screening reports and Natura Impact Statements. Jason was the lead ecologist on a range of projects in the UK, including large scale infrastructural schemes. Since moving to Ireland, he has been lead ecologist / author (EIAR, EcIA, AA Screening reports and NIS's) for a number of projects including historic landfill remediation works, urban planning applications and commercial regeneration sites.

Surveyor	Contribution	Biography
Rachel Irwin	Bat Surveys	Rachel (BSc.) is a graduate ecologist at Woodrow and has spent two seasons coordinating the company's bat surveys. Over this time, she has developed considerable experience in PRF surveys for bats, emergence/re-entry roost surveys, activity transects, and deployment of static bat detectors for numerous large wind farms sites in both the Republic of Ireland and Northern Ireland; as well as other developments including quarries and smaller residential projects. Rachel was also developing expertise in conducting roost searches of buildings, bridges, and trees. During her time at Woodrow, Rachel has become accomplished at manually identification of bat sonograms utilising Kaleidoscope and BatExplorer. Towards the end of each active bat season, she was responsible for compiling bat reports. She is a Qualifying member of the CIEEM.
Oisín O'Sullivan	Bat Surveys	Oisín is a graduate ecologist with Woodrow. Oisín has completed a B.Sc. in Ecology and Environmental Biology at University College Cork. His work as a graduate ecologist with Woodrow is focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Oisín has developed a high level of proficiency with Kaleidoscope, Ecobat, and BatExplorer. Since joining Woodrow, Oisín has contributed to the writing of multiple bat activity reports. Oisín is a Qualifying member of CIEEM.
Daniel Weldon	Report author	This report and was authored by ecologist Daniel Weldon (BEnvSc.) who has 5 years' professional experience in EIA, with two years focussing on renewable energy developments. He is experienced in bird and mammal identification and behaviour and has carried out both breeding and wintering bird surveys, mammal surveys and habitat assessments. Daniel has also acted as ecological clerk of works.

9.3 Legislation and Policy

All species and habitats likely to be significantly impacted by this development, including those provided with National and International protection under the following legislative and policy documents have been considered in this Impact Assessment.

European Legislation

The EU Habitats Directive (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) (as amended) (the 'Habitats Directive') together with the Birds Directive (Council Directive 2009/147/EC on the Conservation of Wild Birds) (as amended) (the 'Birds Directive') are the main legislative instrument for the protection and conservation of biodiversity within the European Union (EU).

The Habitats Directive lists habitats and species that must be protected within Special Areas of Conservation (SAC) within Annexes I and II, respectively. The Habitats Directive also identifies plant and animal species within Annex IV which are subject to strict protection anywhere they occur.

The Birds Directive provides for the identification of a network of Sites in all member states to protect birds at their breeding, feeding, or roosting areas. The Birds Directive identifies in Annex I, species that are rare, in danger of extinction, or vulnerable to changes in habitat and which require special protection and areas for their conservation: Special Protection Areas (SPA).

The Habitats Directive and Birds Directive have been transposed into Irish law, by Part XAB of the Planning and Development Act 2000 (as amended) and by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

The EU Water Framework Directive (2000/60/EC) (as amended) requires all Member States to protect and improve water quality in all waters to achieve good ecological status under prescribed deadlines. This was transposed into Irish Law by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) and by the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended) and European Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2009 (as amended) and the European Communities Environmental Objectives (Groundwater) Regulations 2010 (as amended). The Directive applies to rivers, lakes, groundwater, and transitional coastal waters. The Directive requires management plans to be prepared on a river basin basis and specifies a structured method for developing these plans. Ireland's third cycle River Basin Management Plan 2022-2027 ('The Water Action Plan 2024: A River Basin Management Plan for Ireland') was published on 03rd September 2024.

National Legislation

The primary domestic statute providing for wildlife protection in Ireland is the Wildlife Act of 1976 (as amended) (the 'Wildlife Act') and associated Statutory Instruments.

Currently all bird species are protected under the Wildlife Acts from offences including intentional killing or injury and disturbance during the breeding season (to include eggs, young, and nests which are also protected), although there is a provision under the Third Schedule of the Act to provide exemption to protection. The Act also provides protection to a range of terrestrial and aquatic mammal species including bats, three amphibian species (newt, frog and toad) and one reptile species (lizard) and these are all similarly protected from intentional killing or injury, whilst the breeding or resting sites of these species are also protected. The amendment to the Act in 2000 broadens its scope to allow the Minister to prescribe protection for fish and aquatic invertebrate species through statute, however none has been made to date. The Act also provides a mechanism to give statutory protection to Natural Heritage Areas (NHAs). The Act also requires that public bodies, in the performance of their functions, have regard to the National Biodiversity Action Plan.

A number of vascular (i.e. flowering) and non-vascular plant species (i.e. non-flowering) are afforded legal protection under the Flora (Protection) Order, 2022 enacted under Section 21 of the Wildlife Act, 1976. It is an offence to cut, pick, collect, uproot, or otherwise take, injure, damage, or destroy any specimens of the species listed under the Flora Protection Order.

The Third Schedule to the European Communities (Birds and Natural Habitats) Regulations 2011, as amended lists invasive alien plant species. These regulations make it an offence to plant, disperse, allow or cause to disperse, spread, or otherwise cause to grow any of the scheduled species. The more recently published European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374 of 2024) complements the Third Schedule of the European Union (Birds and Natural Habitats) Regulations 2011 by providing a legal framework for managing invasive alien species, particularly those of Union and National concern.

Beyond the national statutes which transpose the Water Framework Directive into national law, there are several older national Acts which are intended for the protection of fisheries and the aquatic environment as follows:

- Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.
- Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters.

National Policy

Ireland's fourth National Biodiversity Action Plan (NBAP) was launched in January 2024 and sets the national biodiversity agenda for the period 2023-2030. The Plan includes five strategic objectives as follows:

- Objective 1 Adopt a Whole-of-Government, Whole-of-Society Approach to Biodiversity
- Objective 2 Meet Urgent Conservation and Restoration Needs
- Objective 3 Secure Nature's Contribution to People
- Objective 4 Enhance the Evidence Base for Action on Biodiversity
- Objective 5 Strengthen Ireland's Contribution to International Biodiversity Initiatives

This plan includes targeted actions for public authorities in relation to their obligations for biodiversity. One particularly important policy change in the plan (Objective 1) relates to the mainstreaming of biodiversity into decision-making across all sectors. Specifically, there is an obligation on all Public Authorities to "move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting, and/or investment in Blue-Green infrastructure". This and other relevant policies in the plan have informed the valuation of ecological features, assessment of potential effects, and development of mitigation in this EIAR.

The Wildlife (Amendment) Act 2023 introduced a new public sector duty on biodiversity. The legislation provides that every public body, as listed in the Act, is obliged to have regard to the objectives and targets in the National Biodiversity Action Plan.

9.4 Consultation

The full list of the bodies consulted as part of the environmental assessment are presented in Chapter 5 - EIA Scoping and Consultation. Specific to biodiversity, the following responses were received:

- The Development Application Unit (DAU)/ National Parks and Wildlife Service (NPWS) (consultation reference G Pre00069/2023) - An informal meeting was held with Eoin Connolly and Tim Rodrick of NPWS on 10th October 2023 the aim of which was to present the findings of ecological field surveys to date and to focus on the road crossing of the Cloonbar Bog (raised bog habitat). NPWS advised that where feasible, as part of wind farm design, opportunity should be taken to block bog drains at Cloonbar bog. NPWS noted the proposed alignment of the road along the periphery of the bog, which will take a path through bog habitat which is subject to scrub encroachment and will be a floated road design. NPWS also advised that they anticipate a Natura Impact Statement would be required for the Proposed Development.

The above NPWS observations have been addressed in the BEMP which accompanies the EIAR.

- Inland Fisheries Ireland (IFI) - provided an EIA scoping consultation response in August 2023, noting that the site of the Proposed Development falls within the Lough Corrib catchment which supports salmonid species. IFI emphasised the need to ensure that the Proposed Development does not have an effect on water quality or on hydromorphology of the watercourses in the catchment and that natural flow paths on site are maintained. IFI recommended retention and maintenance of settlement ponds for the operational phase. IFI raised concerns about possible effects of soil instability on watercourses and recommended specialist geotechnical assessment. They also noted the need to manage and mitigate against impacts from peat and spoil management on site. IFI requested that the use of sedimentary rocks, such as shale, in road construction should be avoided. This type of material has poor tensile strength and is liable to be crushed by heavy vehicles thereby releasing fine sediment materials into the drainage system which are difficult to precipitate. IFI noted that clear-span bridges are the preferred option for all watercourse crossings. Instream works (and works adjacent to waters) should be confined to the open season which is from 1st July to 30th of September. The EIA should include proposals for monitoring all watercourses within the development.

The above IFI observations have been addressed through mitigation prescribed in this Biodiversity Chapter and also within the Hydrology chapter of this EIAR.

9.5 Methodology

9.5.1 Relevant Guidance

The methodology for this appraisal has been devised in compliance with the following guidance:

- ‘Guidelines on the information to be contained in Environmental Impact Statements' (EPA, 2022);
- ‘Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment’ (DoHPLG, 2018);
- 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' Rev 2 (NRA, 2009)

- 'Guidance document on wind energy developments and EU nature legislation'. Commission Notice C(2020) 7730 final, Brussels 18.11.2020
- 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' (European Commission, 2013)

In addition, the following guidelines were consulted in the preparation of this document to provide the scope, structure and content of ecological assessment:

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Version 1.2) published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2018; last updated September 2024).

NRA Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna on National Road Schemes (NRA, 2009).

9.5.2 Study Area and Zone of Influence

As per CIEEM guidelines (2018), the study area for the Proposed Development has been defined having regard to the spatial and temporal scale of potential biophysical changes in the environment which might occur as a result of the development and throughout its lifetime. Consideration is given to the following:

- the characteristics, size and location of the Proposed Development,
- whether there could be landscape[1] or ecological connectivity[2] to any ecological receptor which includes examination of the full extent of surface water catchments and potential for hydrologically connectivity.
-

As such the study area extends beyond the footprint of the works and associated red line boundary and considers potential for direct and indirect links to ecological receptors and associated ecological structure and function. From this, the key ecological receptors (KER)[3] are identified and are considered further in terms of their Zones of Influence (ZoI) i.e. the pathway for an effect on the KER (as determined through source-pathway-receptor/target model[4]) and the sensitivity of the KER to the effect as informed by best available guidance / data.

Further information on the study area for individual KERs is provided in Section 9.5.3 and Section 9.5.4.

[1] Landscape connectivity is a combined product of structural and functional connectivity, i.e. the effect of physical landscape structure and the actual species use of the landscape.
[2] Ecological connectivity is defined as a measure of the functional availability of the habitats needed for a particular species to move through a given area. Examples include the flight lines used by bats to travel between roosts and foraging areas or the corridors of appropriate habitat needed by some slow colonising species if they are to spread.
[3] According to the National Roads Authority guidelines (NRA 2009), key ecological receptors will be features of sufficient value to be material in the decision-making process for which potential effects are likely. According to the NRA Guidelines, key ecological receptors are therefore defined as features of Local (Higher Value), County, National, or International Importance.
[4] Based on the guidance provided in the Office of the Planning Regulator practice notes (OPR, 2021a and 2021b).

9.5.3 Desktop Study

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the natural environment in which the Proposed Development is situated.

9.5.3.1 Designated Nature Conservation Sites

Special Areas of Conservation (SACs) and Special Protection Areas for Birds (SPAs) are designated under the EU Habitats Directive and EU Birds Directive, respectively and are collectively known as 'European Sites'.

In relation to European Sites, a Natura Impact Statement has been prepared to provide the Competent Authority with the information necessary to complete an Appropriate Assessment of the Proposed Development in compliance with Article 6(3) of the Habitats Directive. The potential for significant effects on European Sites and adverse impacts on the integrity of European Sites is fully assessed within the AA Screening Report (AASR) and Natura Impact Statement (NIS), respectively, that accompanies this application.

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated, notwithstanding, this EIAR addresses them as if they had the same designation as NHAs. Nationally designated sites that are also designated as European Sites have been assessed as those designations within the Appropriate Assessment Screening Report and NIS, with the relevant conclusions recorded and referenced in this chapter.

The following data sources, accessed in October 2024, were used to identify designated sites: NPWS Protected Sites map-viewer[5], National Parks and Nature Reserves mapping[6] and Wildfowl sanctuaries[7].

9.5.3.2 Habitats and Flora

Records of rare/sensitive species within the 10km grid squares which contain the Site (M25 and M35) and for lands within and adjacent to the proposed accommodation works associated with the turbine delivery were reviewed as available on the National Parks and Wildlife Services (NPWS) and the National Biodiversity Data Centre (NBDC) websites (last accessed May, 2025).

Other data referenced included:

- Aerial imagery of the Site and surrounding lands (captured in 2022)
- Tailte Éireann National Land Cover Map
- OSI Aerial photography and 1:50000 mapping
- Geological Survey Ireland (GSI) maps and data
- OPW drainage and flood maps
- Baseline flood model prepared for the Proposed Development
- Flora (Protection) Order Map Viewer – Vascular Plants, Charophytes and Lichen
- Flora Protection Order Map Viewer – Bryophytes

[5] https://experience.arcgis.com/experience/edf34d92e28040fd87d3d14f55d8d95f
[6] https://www.npws.ie/national-parks and https://www.npws.ie/nature-reserves
[7] https://www.npws.ie/protected-sites/wildfowl-sanctuaries

- Article 17 GIS and Metadata - Terrestrial Habitats Storymap
- Article 17 GIS and Metadata - Terrestrial Species Storymap
- EPA website datasets (land, soil and water)
- Wetland survey Ireland wetland maps:
    - North East Galway Wetland Field Survey 2022
    - North East Galway Wetland Audit 2021
- Inland Fisheries Ireland open data portal[8]

The Botanical Society of Britain and Ireland (BSBI) does not hold any botanical data for 10km grid (M35) in which the Site is located.

9.5.4 Field Study

The field study surveys were designed following the consideration of the findings of the desk study and scoping consultation.

9.5.4.1 Habitats and Flora

Detailed botanical surveys and habitat classification was undertaken by skilled and appropriately experienced ecologists on the following dates: 06th,07th and 08th October 2021, 19th and 20th January 2022, 26th September 2022, 22nd June 2023 and from 01st to 03rd May 2024. All habitats within the proposed development boundary and 500m thereof were classified based on desktop assessment and detailed aerial imagery. All lands within the development boundary were subject to detailed botanical assessment.

The methodology used during botanical survey was based on the Heritage Council's Best Practice Guidance for Habitat Survey and Mapping (2011) and CIEEM 'Good Practice Guidance for Habitats and Species' Version 3 May 2021.

The classification of habitats recorded during the field survey is based on the A Guide to Habitats in Ireland (Fossitt, 2000). The Guide to Habitats in Ireland classifies habitats according to a hierarchical framework with Level 1 habitats representing broad habitat groups, Level 2 representing habitat subgroups and Level 3 representing individual habitat types. The Field Survey focused on identifying habitats to Level 3 of the Guide to Habitats in Ireland. Any other records of interest (e.g., invasive plant species) were also marked on ArcGIS Field Maps. The DAFOR scale was used to record species abundance within relevés: Dominant, Abundant, Frequent, Occasional and Rare (DAFOR). All species were readily identifiable during the survey. Plant nomenclature for vascular plants follows 'New Flora of the British Isles' (Stace, 2019), while mosses and liverworts nomenclature follow 'Mosses and Liverworts of Britain and Ireland - a field guide' (British Bryological Society, 2010).

Vegetation was sampled by taking botanical quadrats/relevés which were undertaken to analyse potential links with Annex I habitat types. The Interpretation Manual of European Union Habitats [EUR28] and Article 17 reports were used to evaluate whether links with Annex I habitats exist.

[8] https://opendata-ifigeo.hub.arcgis.com/

In addition to habitat identification, each habitat was assessed for its ecological significance, based on the NRA Guidelines for Ecological Impact Assessment of National Road Projects (NRA, 2009).

During habitat surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended).

Habitat boundaries and associated attribute data were mapped using ArcGIS Field Maps and ArcGIS Pro, which was also used to calculate habitat areas and lengths.

Additionally, the habitats within the Proposed Development boundary were evaluated to determine their suitability to support protected species.

9.5.4.2 Non-Volant Mammals

Mammal surveys of the Proposed Development were undertaken on 26th September 2022 and 1st June 2024. The mammal survey covered the entire development footprint and surrounding suitable habitats within 150m[9] of the development footprint and were undertaken to determine the presence or absence protected mammal species and habitat suitability to support protected mammal species and any change in habitat features during the survey period.

Sightings, tracks or signs of mammals were recorded using ArcGIS Field Maps.

Based on the findings of desktop assessment, dedicated survey for the following species was carried out in accordance with best practice methods (in addition to general mammal walkover as per the NRA's (2009) '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes*' and the JNCC's (2004) '*Common Standards Monitoring Guidance for Mammals*':

- Badger survey in accordance with Harris S, Cresswell P and Jefferies D (1989) Surveying Badgers, Mammal Society and Surveying for Badgers: Good Practice Guidelines. Version 1 (Scottish Badgers, 2018).
- Pine marten scat survey O'Mahony D, O'Reilly C and Turner P (2006). National Pine Marten Survey of Ireland 2005.
- Red squirrel drey search in accordance with Gurnell J and Pepper H (1994) Red squirrel conservation: Field study methods. Research Information Note 255. Forestry Commission, Edinburgh.
- Survey for signs of hare in accordance with Reid N, Harrison AT and Robb GN (2009) Northern Ireland Irish hare survey 2009. Northern Ireland Environment Agency Research and Development Series No. 09/04.
- Survey for signs of hedgehog in accordance with Morris PA (2006) The New Hedgehog Book. Whittet Book, Stowmarket.

[9] Study area for mammals was based on NRA (2008) (Guidelines For The Treatment Of Otters Prior To The Construction Of National Road Schemes and NRA (2009) Guidelines For The Treatment Of Badgers Prior To The Construction Of National Road Schemes

- Survey for otter in accordance with Chanin P (2003) Monitoring the Otter *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No 10. English Nature, Peterborough, and National Otter Survey of Ireland 2010/12. Irish Wildlife Manuals No. 76 (Reid, et al., 2013). Focus was on crossing points of drains and watercourses by Proposed Development Infrastructure and locations where infrastructure is proposed within 150m of any drain or watercourse, with survey extending 200m upstream and downstream of these locations. Additionally, observations of Otter activity were also recorded as part of the aquatic ecology surveys carried out in 2022 as described in Section 9.5.6.1.

9.5.4.3 Bats

Bat surveys were conducted over the 2020, 2021 and 2023 bat activity seasons at the proposed development site by Woodrow Environmental Consultants, with an additional daytime roost assessment conducted in 2024. The study area for bats included the lands within the proposed development boundary, the proposed wind turbines development infrastructure (including temporary construction compounds and the 110 kV infrastructure) plus a 300m buffer. All habitats within the footprint of the works were examined for potential to support bats and significant habitat features located within 100m plus one rotor radius of turbines were assessed.

The surveys encompassed preliminary roost assessments, summer and winter roost inspections, activity surveys (transects and emergence surveys) and static detector surveys.

The following guidelines in relation to bats were adhered to:

- Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London.
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition)'. Collins, J. (ed) (2023). Bat Conservation trust (updated 27th March 2024)
- Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments – Version 1.1 NIEA, Natural Environment Division, (2021, Updated April 2024)
- Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (NatureScot 2021)
- Wind Turbine/Wind Farm Development Bat Survey Guidelines (Bat Conservation Ireland, 2012);
- Bat Survey Guidelines: Traditional Farm Buildings Scheme (Aughney et al., 2008)
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA, 2006);

Further details on bat survey methodology are available in Appendix 9.2 – Bat Survey Report, Volume III of this EIAR.

Roost Assessment surveys

Woodrow utilised the assessment criteria described in Collins (2016) which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats. This allows surveyors to assign features, a 'negligible', 'low', 'moderate' or 'high' status in terms of their potential for bats, i.e., the presence of Potential Roost Features (PRFs).

Potential roost feature locations which were identified for activity survey are presented in Appendix 9.2 – Bat Survey Report, Volume III of this EIAR and included in Image 9-1 hereunder for ease of reference. Features deemed to be of moderate or high potential were subject to activity (emergence and re-entry survey) between 01st September 2020 and 29th September 2021. Three features were subject to activity survey:

- F1: Derelict house and cattle shed in the western section of the site.
- F2: Abandoned cottage to the east of the western section of the site.
- F3: Derelict house in field south of the eastern section of the site

Dusk bat emergence surveys commenced 30 minutes prior to sunset and concluded 1.5 hours thereafter, whereas dawn re-entry surveys began 1.5 hours before sunrise and concluded 30 minutes later. Trained observers recorded the occurrence of dusk emergencies and dawn re-entries near potential roosting sites, using the ESRI Survey123 mobile app and hand-held Elekon Batlogger M bat detectors, which enabled the collection of geo-referenced records of bat activity. Subsequently, the captured acoustic recordings were subjected to analysis using the BatExplorer software.

Winter Roost Inspections

The survey was conducted on the 25th February 2021, within the timeframe in which bats would still be hibernating. Surveys involved searching for and collecting bat faecal samples, closer examination of roost potential, and the use of a thermal imaging camera. The following structures of high roost potential and likely structures for winter roost occupation were examined:

- F1: Derelict house and cattle shed in the western section of the site [53.529249, -9.025090]
- F2: Abandoned cottage to the east of the western section of the site [53.541603, -9.003607]
- F3: Derelict house in field south of the eastern section of the site [53.536216, -9.004166]

While the following structures of low roost potential were also examined:

- F4: Lambing shed in the eastern section of the site [53.537196, -8.996103]
- F5: Corrugate shed to the north of the eastern section of the site [53.551000, -8.997493]
- F6: Concrete stable to the north of the eastern section of the site [53.551624, -9.000209]
- F7: Tree with fluting and pruning cut [53.536897, -8.996695]
- F8 Tree with canker and peeling bark [53.535339, -8.993584]

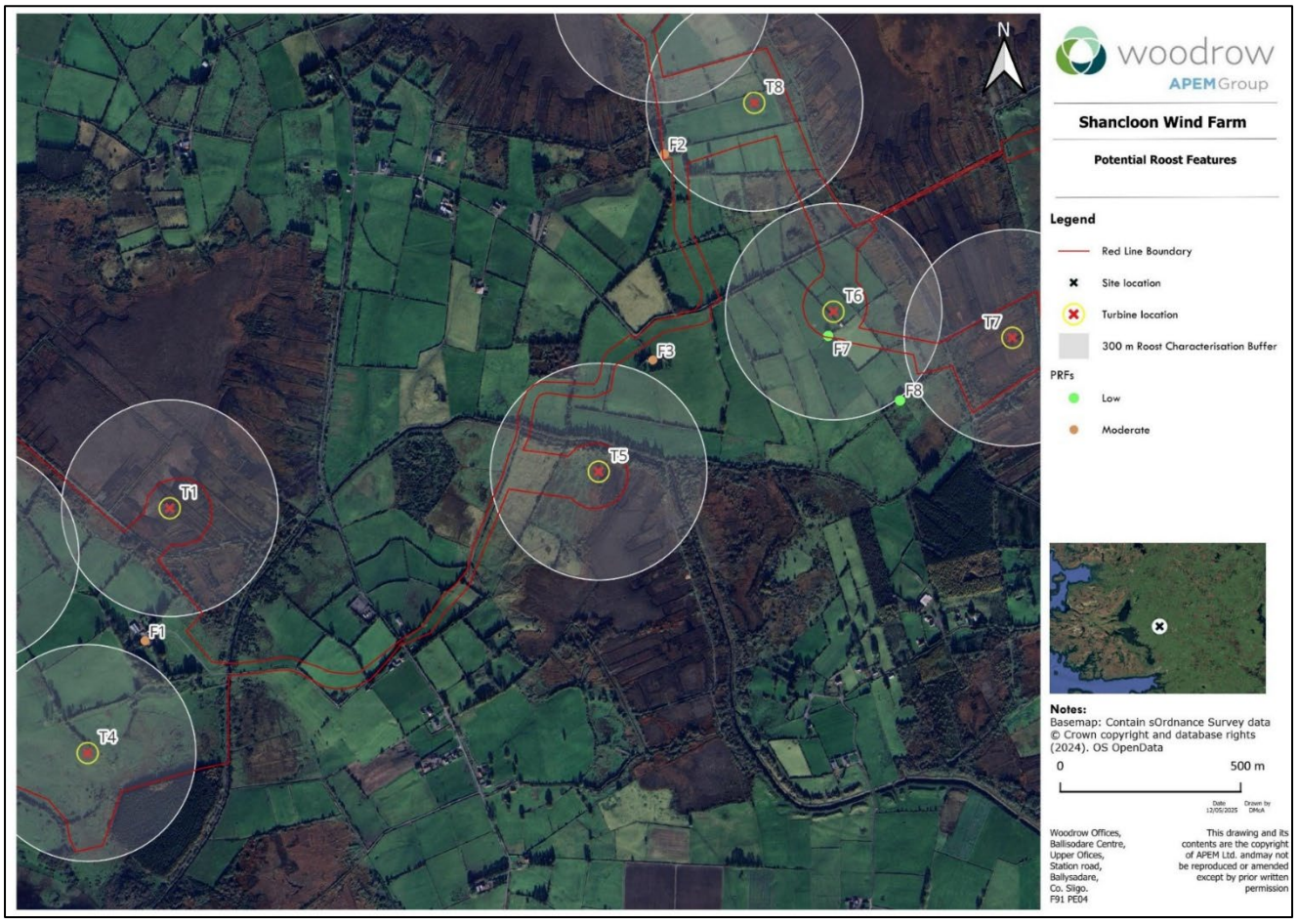


Image 9-1: Potential roost feature locations (extract from Appendix 9.2)

Bat activity surveys - walked/driven transects

Under the NatureScot guidance (NatureScot *et al*. (2021)), the application of transect surveys is discretionary, with survey requirements designed on a site-by-site basis. Transects are complementary to data collected from static bat detectors; and are important for identifying flight lines and for gaining understanding of bat abundance within the survey area. Driven transects can provide useful information on the wider landscape in the vicinity of the proposed development site. Point counts (of a fixed duration) can be incorporated into transects to survey specific features to provide information on comparative density of use.

Multiple transects were completed in between 02nd July 2020 and 11th October 2021. Survey routes, dates and weather conditions for transects are provided in Appendix 9.2 – Bat Survey Report.

Field records were made of bat species encountered, number of bat passes, activity (where known e.g. foraging, commuting, advertising), travelling direction and approximate height (where known). Temperature and wind speed were measured at intervals throughout the survey. Batloggers recorded temperature throughout the surveys.

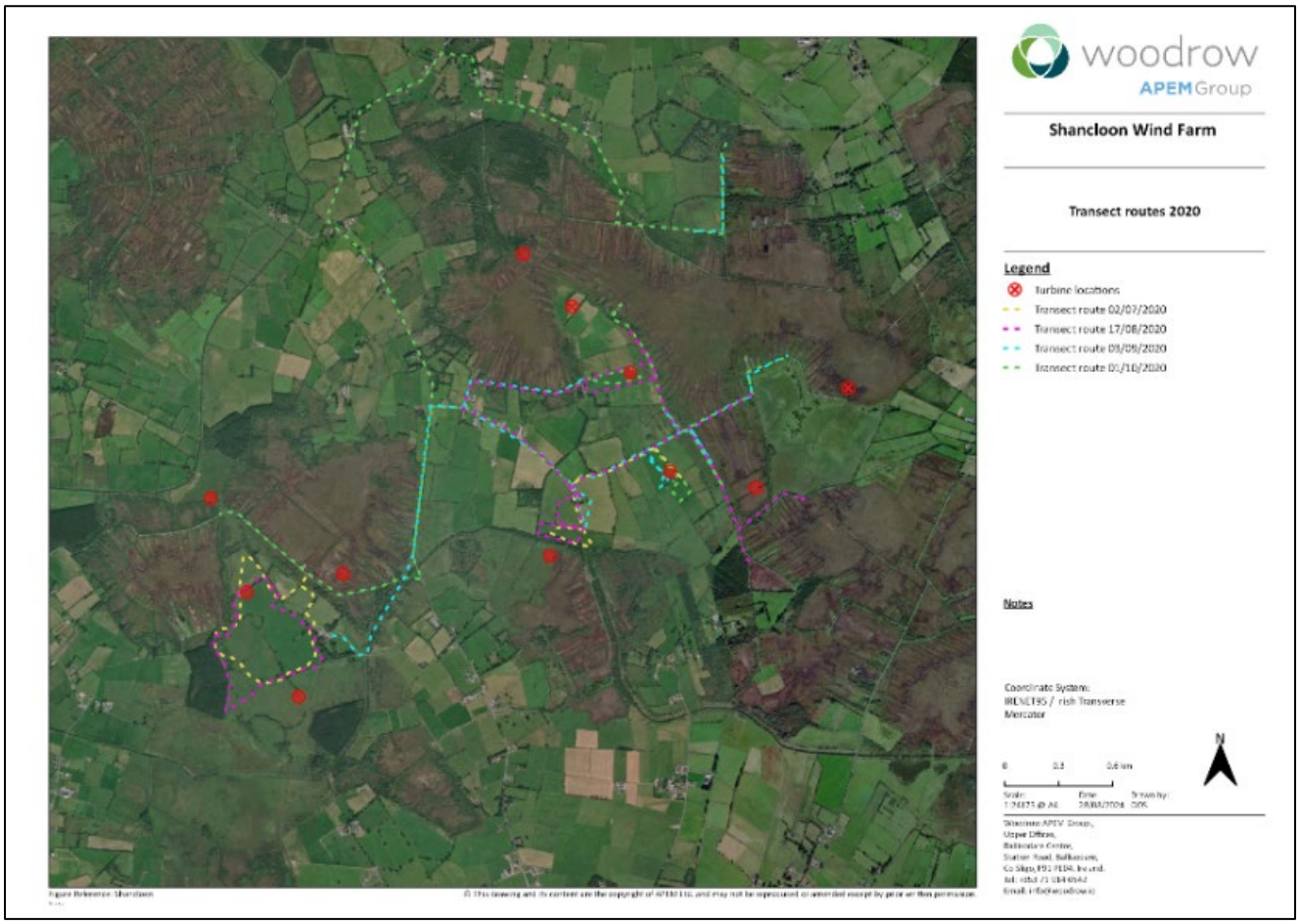


Image 9-2: Transect routes 2020 (extract from Appendix 9.2)

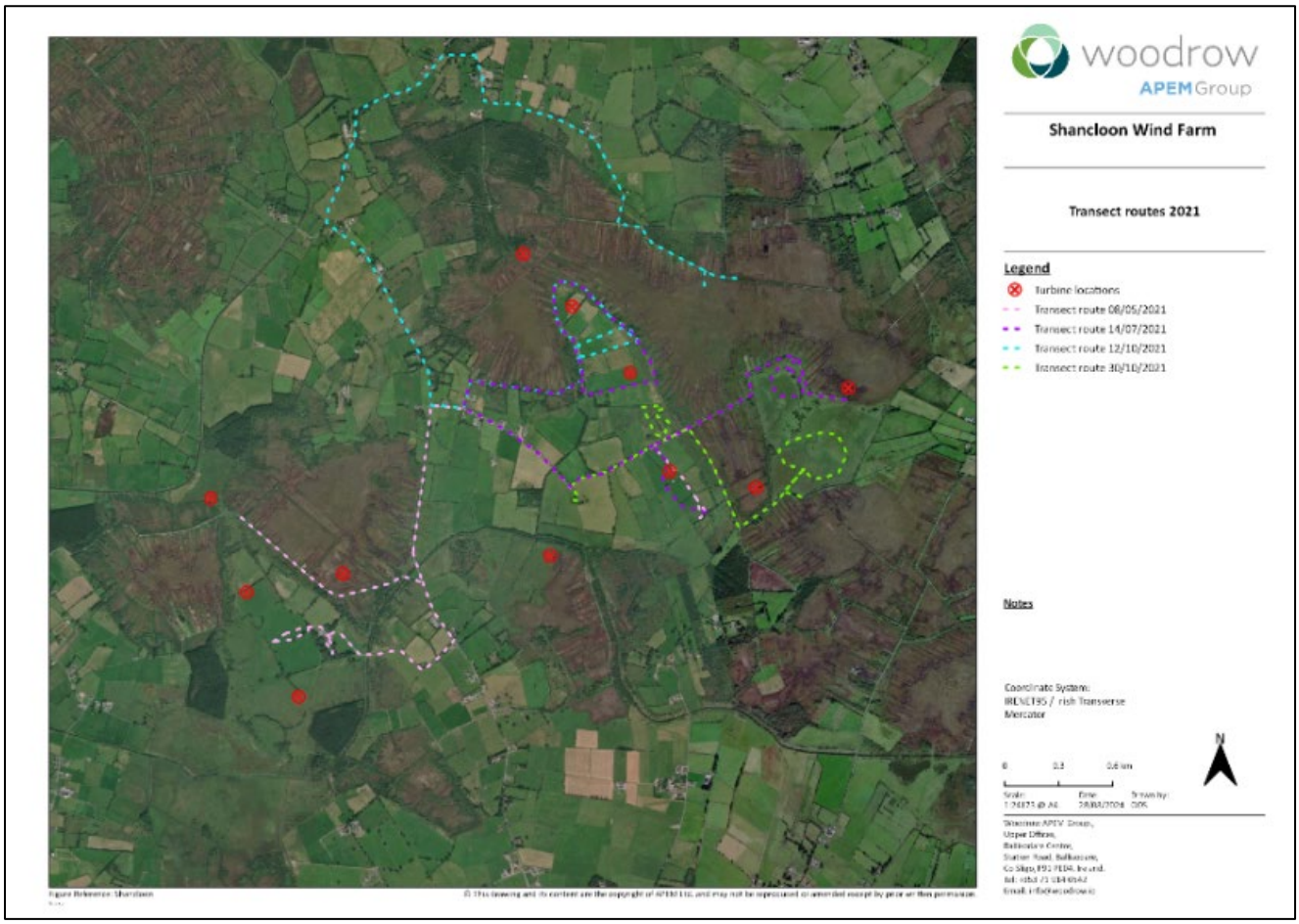


Image 9-3: Transect routes 2021 (extract from Appendix 9.2)

Static bat detector surveys

Static detector surveys for 2020 were undertaken using Wildlife Acoustics Song Meters (Song Meter 2 Bat Plus (SM2BAT+) using the SMX-U1 microphones and Song Meter 4 Bat-Full Spectrum (SM4BATFS) using SMM-U2 microphones) on three occasions covering spring, summer, and autumn. Static detector surveys for 2021 were undertaken again using Wildlife Acoustic Song Meters (SM4BAT-FSs and SM Mini Bat) and were deployed on four occasions, spring, summer, and autumn with a supplementary deployment between spring and summer for additional data. Static detector surveys for 2023 were undertaken using Wildlife Acoustics Song Meters (SM4Bat-FS and SM Mini Bat) on three occasions covering spring, summer and autumn. Refer to Image 9-4**.** to Image 9-7**.** (extract from Appendix 9.2) for locations of static detector deployments.

A 384 kHz sampling rate was set for all detectors, and recording was scheduled to be continuous from 30 minutes before sunset until 30 minutes after sunrise, for at least 10 weather-compliant nights. Static bat detectors were deployed to record the bat species present and to provide an overview of how bat activity is distributed over the site.

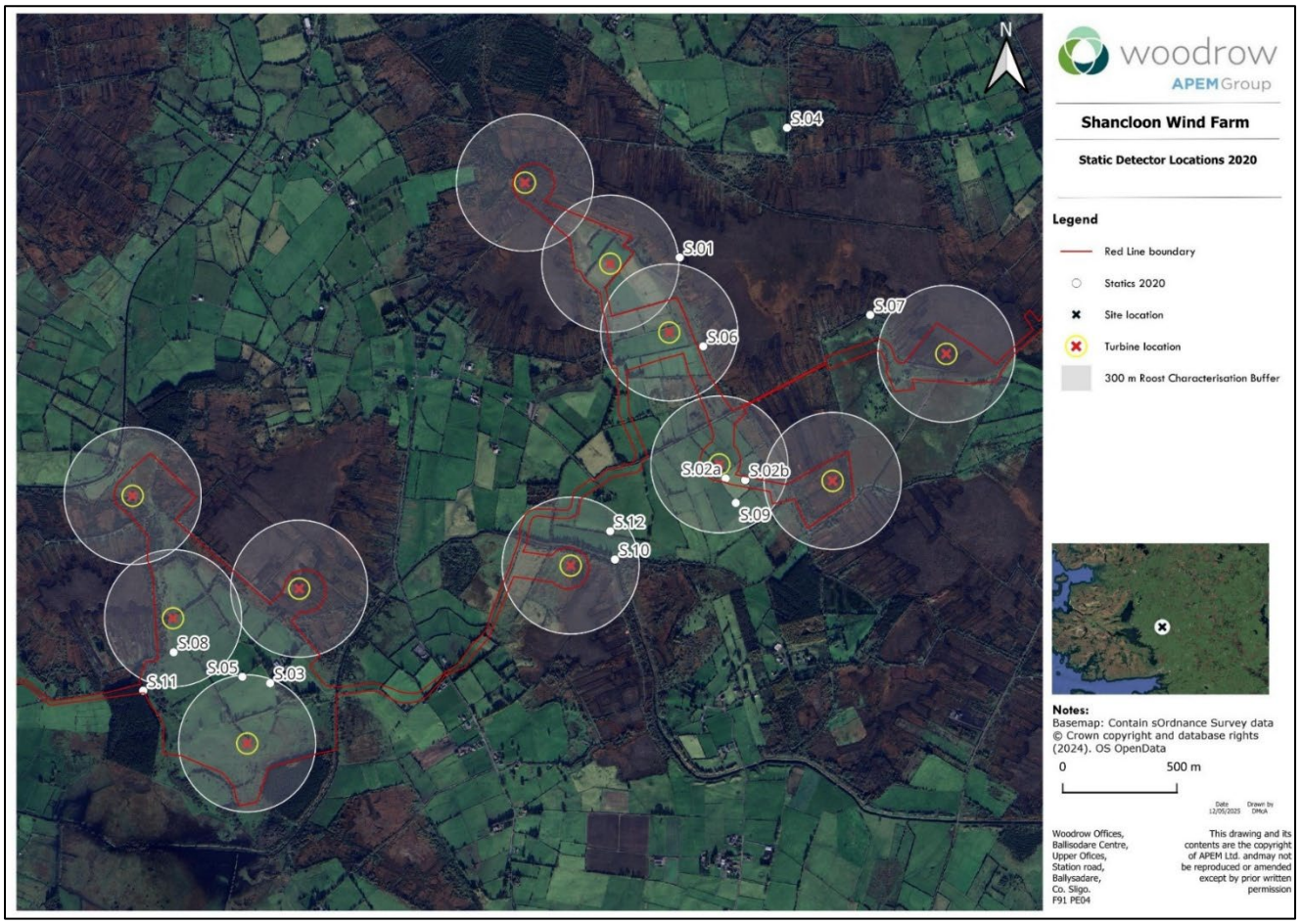


Image 9-4: Static Detector Locations 2020

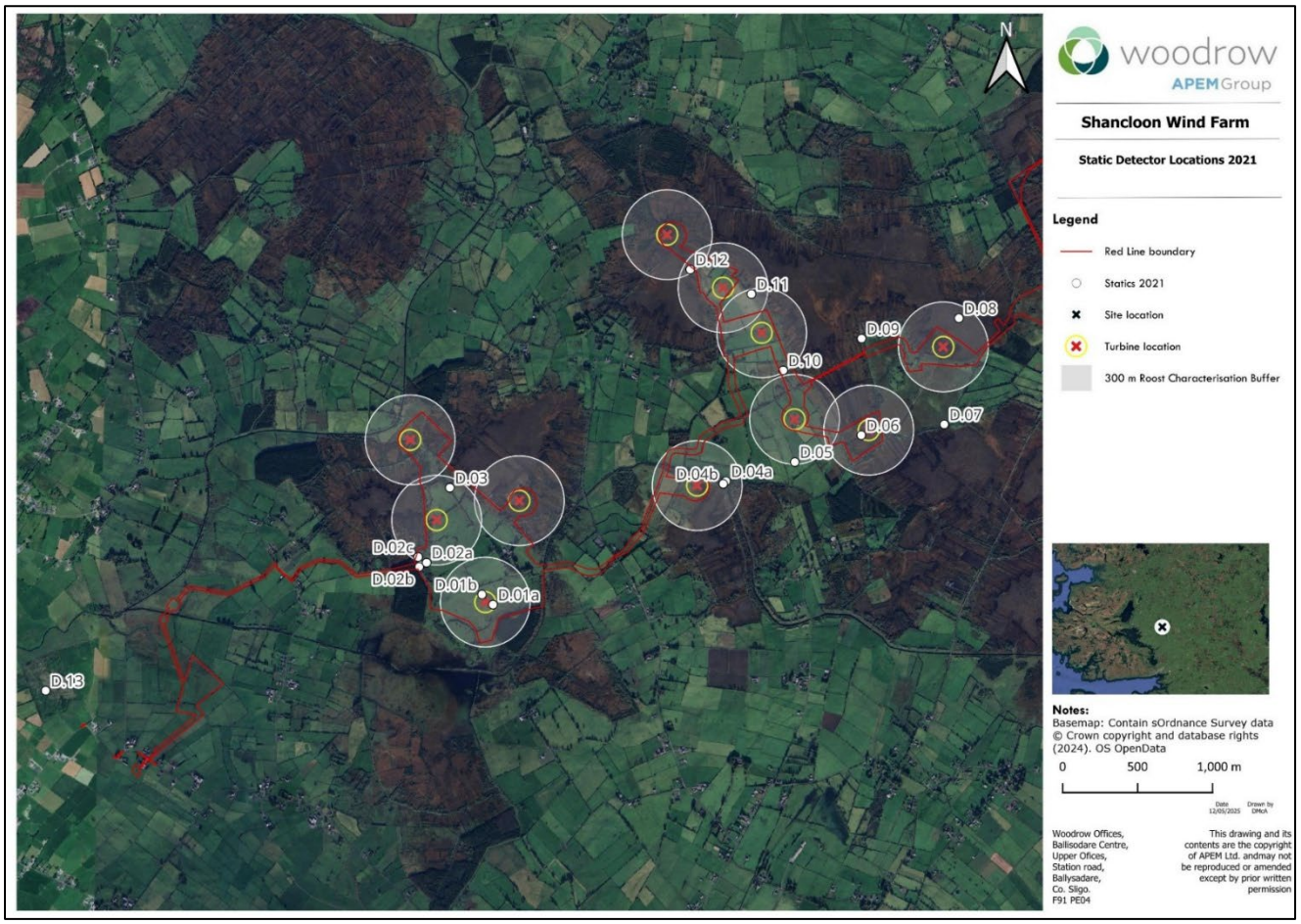


Image 9-5: Static Detector Locations 2021

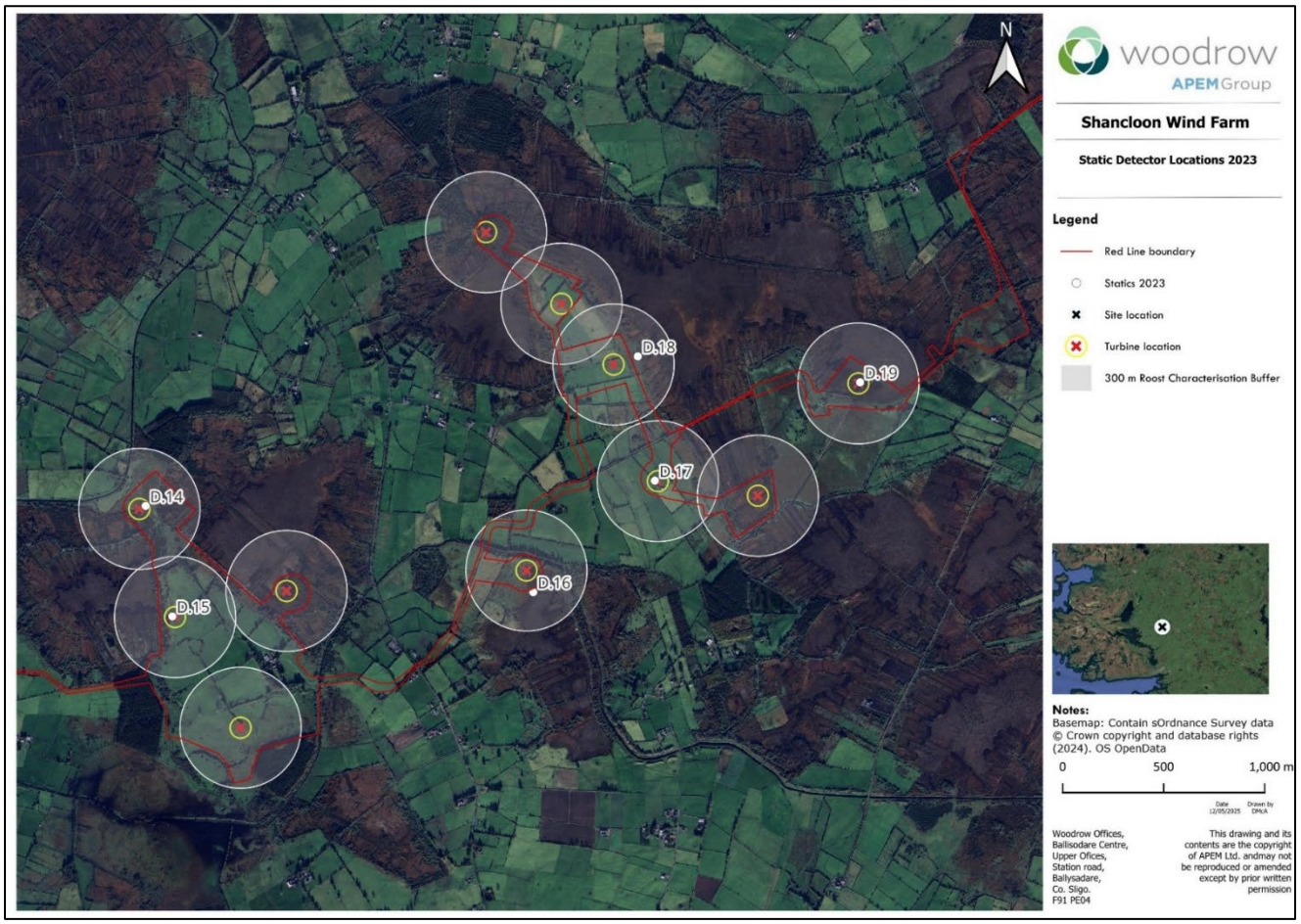


Image 9-6: Static Detector Locations 2023

Monitoring climatic of conditions

Monitoring climatic conditions was undertaken through the deployment of an on-site fully automated weather station with 3G connectivity.

Calibration and testing of recording equipment

Calibration and testing of recording equipment is required by the NatureScot *et al*. (2021)guidelines, and as a standard operating procedure Woodrow have a stringent schedule of testing all bat recording equipment prior to and during deployment in the field.

Analysis

Bat data analysis was carried out using Kaleidoscope software (Version 5.6.3) and BatExplorer software coupled with manual verification (see Appendix 9.2 for further details). This analysis aimed to confirm species (or genus for Myotis species) and bat activity (exact number of bat passes) for each deployment and transect survey.

Geographical and temporal context for activity levels was then examined through internal comparative analysis. Woodrow have developed an in-house analysis script for data collected. Mean and median bat passes per hour were generated using statistical software R. In order to provide an appropriate test of activity within the Site, Woodrow analysis compares activity levels with other wind farm developments from its own database to provide comparative activity levels.

Activity levels are assessed using the criteria applied by Matthews et al. (2016). This study examines the risk of European bat species to wind energy developments in the UK. Woodrow have adapted the Matthews et al. (2016) scale of activity per night to a scale of bat passes per hour. This adaptation uses an average of 10 hours per night across the active bat season to determine the cut-off of high activity. Table 2.3 shows the adapted activity levels. The output is then converted to show the mean and median activity levels that can then be used to determine a risk assessment in relation to bat activity (It should be noted that presenting mean activity levels can be highly misleading where the data are highly skewed, as is frequently the case with bat activity at wind turbines (Lintott & Mathews, 2018)). A judgement can then be made on which is the most relevant.

The results are presented at both local level (per detector) and site scale to allow assessment of activity across the proposed development

9.5.5 Terrestrial Invertebrates

9.5.5.1 Marsh Fritillary Surveys

Marsh fritillary (*Euphydryas aurinia*) is Ireland's only legally protected insect species. It is afforded protection under Annex II of the EU Habitats Directive. As part of ecological walkover assessments for the Proposed Development, the habitats within the Site were assessed for suitability to support Marsh Fritillary having regard to the National Biodiversity Data Centre Marsh Fritillary Habitat Condition Form: i.e. sites with the presence of the butterfly's foodplant, devil's-bit scabious *Succisa pratensis* (see Figure 9.6 for Marsh Fritillary survey areas) Habitats which were determined to be potentially suitable or habitats in good condition to support Marsh Fritillary (as per the habitat condition form) were subjected to dedicated Marsh Fritillary larval web searches on 31st August 2022. The surveys were undertaken within the optimal period for undertaking larval web surveys, i.e. August – September, on dry days, with no rain and little wind. The survey methodology followed that described in the NBDC Marsh Fritillary Larval Web Recording Form and surveys were carried out under dry weather conditions.

Additionally, on the basis of the findings of desktop assessment, habitats were assessed for their suitability to support the following species:

- Dark Green Fritillary (*Argynnis aglaja*) – Red Listed (vulnerable) associated with habitats with *Viola sp.*
- Small heath (*Coenonympha pamphilus*) - Red Listed (threatened) associated with grassland habitats with fine grasses, especially fescues (Festuca spp.), meadow-grasses (Poa spp.), and bents (Agrostis spp.)

9.5.5.2 Whorl Snail Surveys

Historic records for the 10km^2 grid in which the Site is located, dating to the 1970's, include records for Common Whorl Snail (Vertigo (Vertigo) pygmaea) and Marsh Whorl Snail (Vertigo (Vertigo) antivertigo). As part of ecological walkover assessments for the Proposed Development, the habitats within the Site were assessed for suitability to support these whorl snail species. Common Whorl Snail is associated with damp pastures and the margins of wetlands while Marsh Whorl Snail is associated with floodplains: where *Iris pseudacorus* flourishes, or on marshy streambanks and lakeshores. Following habitat walkover survey, a decision was made to conduct a targeted whorl snail survey (based on habitat suitability). The number of monitoring stops within suitable habitat and survey method was in accordance with Long, M.P. & Brophy, J.T. (2013). Surveys were conducted on 08th October 2021, and 27th September 2022. Materials used included a light-coloured tray (onto which to beat vegetation, and onto which snails fall), hand lens (x10) and tablet (Field Maps software). Identification was aided through Mollusc Ireland: https://www.habitas.org.uk/molluscireland/index.html.

9.5.6 Amphibians and Reptiles

As per the National Biodiversity Data Centre, there are 6 species of amphibian and reptile species in Ireland. Five of which are native, Common Frog (*Rana temporaria*), Natterjack Toad (*Epidalea calamita*), Smooth Newt *(Lissotriton vulgaris*), Common Lizard (*Zootoca vivipara*), Leathery Turtle (*Dermochelys coriacea*) and one non-native species, the Slow-worm (*Anguis fragilis*). Natterjack Toad occurs within only two counties in Ireland: Kerry and Wexford, and as such was not considered further in this impact assessment. Similarly there are no records for slow-worm within County Galway. Leathery Turtle is a marine species and as such was not considered further in this EIAR. While there are no records for frog, newt or lizard within the Site, the NBDC[10] holds records for these species within 10km^2 grid M25 in which the Proposed Development is located. Herpetofauna survey was carried out for these three species within the Site with particular focus on the locations of drain crossings for newt and frog and on scrubby bog / heath habitat for lizard having regard to Gent T and Gibson S (2003) and the Herpetological Society of Ireland[11].

In order to determine the presence of frog and newt in the locality of the Proposed Development, frog spawn survey and newt egg searches were conducted between mid-February and early March 2023 and comprised three survey visits during the spawning season: the first survey took place between 17th and 19th February, the second visit between 25th and 27th February and the third on 02nd and 03rd March. The survey was focussed upon on-site drains/ditches which are proposed to be crossed by site infrastructure. Surveys were carried out having regard to Griffiths et al. (1996), NRA (2008) and Reid et al. (2013).

Common lizard survey comprised morning walkover surveys (between 9am and 11am) of the proposed infrastructure footprint over four survey periods in 2023: 27th and 28th March, 01st 02nd May, 22nd and 23rd June and 28th and 29th August. The proposed infrastructure footprint was slowly walked and searched for basking lizards in order to confirm presence / absence from the area.

9.5.6.1 Aquatic Ecology

Flynn Furney Environmental Consultants conducted aquatic ecology surveys at 12 locations within the Black (Shrule) river and its tributaries (located within the following waterbody catchments: WE_Corrib_Togher_BeaghMore, WE_Corrib_Black_CloghansBeg and WE_Corrib_Black_Cloghmoyne) between July 26th and July 28th 2022. The aims of the surveys were to:

- characterise the habitat quality of the watercourses through biological analysis (Q-value), fishery habitat appraisal and hydromorphology assessment (RHAT),
- identify any habitats that correlate to Annex I habitat 'Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation'
- Identify the presence of aquatic invasive alien species
- Identify the presence or potential presence of other protected aquatic species, such as otter and kingfisher.

[10] Irish Wildlife Trust, Newt Survey 2010-2014, National Biodiversity Data Centre, Ireland, accessed 18 October 2024, https://maps.biodiversityireland.ie/Dataset/169
Irish Peatland Conservation Council, Irish National Frog Database, National Biodiversity Data Centre, Ireland, accessed 18 October 2024, <https://maps.biodiversityireland.ie/Dataset/33>
[11] https://thehsi.org/native-reptiles-and-amphibians/common-lizard/

Survey methodology included a walkover of the watercourses to characterise the river habitats plus assessment by wading with a bathyscope where appropriate.

The surveys conformed to the following standards:

- River habitat assessment and hydromorphology assessment (RHAT) in accordance with BS EN 14614:2004 & RHS Manual 2003 Version 1 (2018)
- Assessment of correlation to Annex I habitat 'Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' mas made against The Interpretation Manual of European Union Habitats - EUR28 (European Commission, 2013) and https://eunis.eea.europa.eu/habitats/10077
- Visual assessment for the presence of aquatic invasive alien species listed on the Third Schedule of the European Communities (Birds & Natural Habitats) Regulations 2011 as amended (S.I. No. 477 of 2011)
- Fishery habitat appraisal, specifically focusing on Salmonids, Salmo spp., (Hendry& Cragg-Hine, 2003); Lamprey Lampetra spp., (Maitland, 2003); White-Clawed, Crayfish, Austropotamobius pallipes, (Holdich, 2003 & Peay, 2003) and Freshwater Pearl Mussel, Margaritifera margaritifera, (Skinner et al., 2003).
- Water quality biological analysis (Toner et al., 2005)

An additional confirmatory aquatic ecology walkover survey was conducted by Fehily Timoney Ecologists between 12th and 14th August 2024 to assess the validity of the aquatic ecology surveys given passage of time, based on and assessment of any change in the baseline aquatic environment. Confirmatory walkovers determined that there had been change from the initial baseline determined in 2022 and as such no additional surveys were recommended. The results of the Flynn Furney aquatic ecology surveys remain valid and are representative of the current baseline environment.

Note on Electrofishing: Electrofishing is a survey method used to sample fish populations to determine abundance, density and species composition. The method works by imposing a physiological effect of an electric field in water on fish's nervous system. Electrofishing was not employed as a survey method for the purpose of this EIAR because, although electrofishing is an efficient method for catching fish, it can injure them, with spinal injury noted in Pottier, G., et al (2020). The data as might be gathered on fish population through electrofishing was not warranted given that IFI has a robust monitoring programme in place for the Black (Shrule) catchment, with monitoring locations NRSP09R_30B020100A, NRSP20R_30_593_107A and NRSP20R_30_2806_129A being closest to the Proposed development. This data, coupled with Q-value and RHAT assessment allowed a thorough characterisation of the baseline environment without the need for injury to fish.

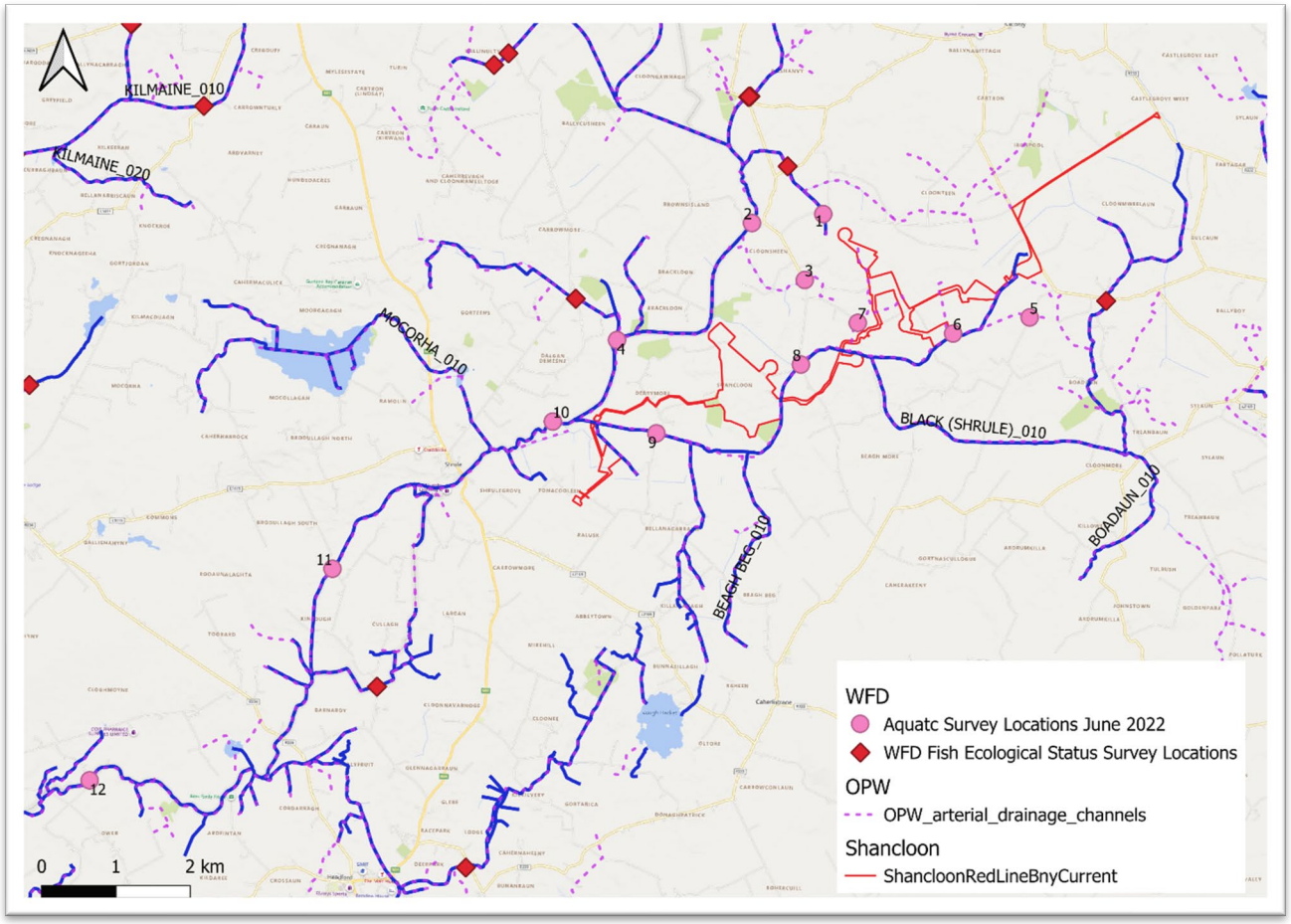


Image 9-7: Aquatic Survey Locations

9.5.7 Survey Limitations

General

No limitations in the scope, scale or context of botanical and habitat surveys, mammal, invertebrate and herpetofauna surveys was encountered.

The habitats and species on the site were readily identifiable and comprehensive assessments were made during the field visit which spanned several years.

Surveys were undertaken by competent ecologists in accordance with the best practice guidelines as per CIEEM's technical guidance series on Competencies for Species Survey in Britain and Ireland. Seasonal factors that affect distribution patterns and habits of species were taken into account when scoping and conducting the surveys such that surveys were conducted over several years over varying seasonality thereby allowing an understanding of site usage / occurrence within the site by these protected species. Notwithstanding whether a protected species (or signs thereof) was observed during field survey, the potential of the Site to support species of conservation importance was assessed given that species can be absent due to their seasonal usage of an area or cryptic habits.

Bat Survey and Analysis Limitations

Prior to the bat surveys, a desktop study is carried out. One limitation of this study is the use of Lundy *et al*. (2011) for the habitat suitability index, given that these results only use records up to 2009 to provide suitability for bats. However, while there are no new roost data available for the metric, there have been no major developments in the area surrounding the Site therefore, the habitat suitability metric is still feasible for the Site.

While detectors S.05, S.07 and S.11 failed to record for the compliant 10 nights during autumn 2020 (refer to Appendix 2), the data collected shows activity as soon as weather conditions were compliant. Therefore, even with the shortage of weather compliant nights, all data (including zero count data) from these detectors are considered to be relevant and have been used in the assessment.

During the 2021 spring deployment, detectors D.01 and D.02 suffered interference from livestock (recording 1 and 7 nights respectively), and D.08 had a faulty memory card resulting in corrupted data. Due to these detector failures, three detectors were re-deployed covering 22 nights between the spring and summer deployments (refer to Appendix 2 of EIAR Appendix 9.2).

In cases where redeployment in the exact original location was not feasible, the new deployment was ensured to be within a 100-meter radius of the original location. This approach allowed us to compensate for any potential limitations and gather supplementary data and provided clear identification and distinction between the locations.

During the 2023 spring static deployment, there was a technical issue with D.19, which did not record during spring (refer to Appendix 2 of EIAR Appendix 9.2). However, as this survey was to show activity levels were still the same around the Site, and there had been no development or indication that activity would have changed during the planning process, the data collected for the duration of deployment was appropriate for the assessment update.

9.6 Ecological Resource Evaluation

The value of the ecological resources/receptors was evaluated using the ecological evaluation guidance given in the NRA guidance on assessment of ecological impacts of National Road Schemes (NRA, 2009a).

This guidance provides ratings for resources based primarily on geographic context and allows for resources at International, National, County and Local (higher and lower value) levels. Key ecological receptors (for assessment) are those deemed to be above the 'Local Importance (lower value) evaluation.

9.6.1 Receptor Evaluation

Ecological features are assessed on a scale ranging from international-national-county-local. The local scale is approximately equivalent to one 10 km square but can be operationally defined to reflect the character of the area of interest.

Habitats and species were evaluated following the NRA (2009a) criteria on the basis of a number of characteristics and features defined as follows:

- The fisheries value of a watercourse refers to its suitability for fish, primarily Salmonids (Salmon and Trout), and to the associated value for recreational angling purposes.
- Annex II species are those that are listed under the EU Habitats Directive (92/43/EEC).
- Annex I habitats are those that are listed under the EU Habitats Directive, including Priority Habitats.

- Species protected under the Wildlife Acts 1976-2022 and associated orders.
- The evaluation of water quality uses a five-point biotic index (Q-value) based on the presence and relative abundance of various invertebrates using the Environmental Protection Agency's (EPA) standard technique.

9.6.1 Assessing Effect Significance

Once the value of the identified ecological receptors (features and resources) was determined, the next step was to assess the potential effect or impact of the project on the identified key ecological receptors, following the EPA evaluation criteria utilised in this appraisal of the Environmental Factor, Biodiversity. The criteria is included in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA 2022).

Assessment of Effect Type and Magnitude

Assessment of effects considers construction, operational and decommissioning effects with reference to the potential for direct, indirect and cumulative effects. The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design.

The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects considers the magnitude of effects affecting populations.

This EIAR uses the EPA (2022) classification of effects in order to describe the quality, significance, duration and type of effect. The magnitude of effect is based on probability of the likely effect occurring, its spatial scale and duration.

The ecological significance of the effects is determined following the precautionary principle and in accordance with the methodology set out in Section 5 of CIEEM (2018), whereby an ecologically significant effect is an effect that either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general through impacts on the ecological structure and function. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local (CIEEM, 2018).

When determining significance, consideration is given to whether:

- Any processes or key characteristics of key ecological receptors will be removed or changed
- There will be an effect on the nature, extent, structure and function of important ecological features
- There is an effect on the average population size and viability of ecologically important species.
- There is an effect on the conservation status of important ecological habitats and species.

Assessment of Cumulative Effects

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period or concentrated in a location (CIEEM, 2018). Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as:

- Additive/incremental – in which multiple activities/projects (each with potentially insignificant effects) add together to contribute to a significant effect due to their proximity in time and space (CIEEM, 2018); and,
- Associated/connected – a development activity 'enables' another development activity e.g. phased development as part of separate planning applications. Associated developments may include different aspects of the project which may be authorised under different consent processes.

9.7 Description of Baseline Environment

The following sections describe the results of the assessment of available published material that was carried out as part of the desk study coupled with the findings of ecological field surveys which were conducted to establish the current state of the environment (baseline scenario) and the likely evolution thereof through natural changes.

Note the proposed construction materials haul route is located within existing road infrastructure and will not have an interaction with habitats or species and as such is not discussed further.

The turbine delivery route will require habitat removal at two locations PoI 16 (removal of mixed conifer forestry) and PoI18 (removal of scrub habitat). All other accommodation works along the TDR involve road verge, roundabouts, or street furniture/lighting and as such are of negligible ecological value.

9.7.1 Designated Sites

In establishing the study area to assess the baseline scenario for designated sites regard was had to OPR (2021a) guidelines. In this regard a Source-Pathway-Receptor (S-P-R) model was adopted to identify potential pathways for designated sites and was informed by the following best practice publications:

- Scottish Natural Heritage (2016) 'Guidance on Assessing Connectivity with Special Protection Areas (SPAs)'
- SEPA Land Use Planning System (2017) 'Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems', Guidance Note 31
- BCT (2020) Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats. Bat Conservation Trust, London.
- Collins J. (ed.) (2023) Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition). The Bat Conservation Trust, London
- NRA (2009a). Guideline for the Assessment of Ecological Impacts of National Road Schemes, National Roads Authority

The S-P-R model minimises the risk of overlooking distant or obscure effect pathways, while also avoiding an over reliance on buffer zones (e.g. 15 km), within which all designated sites should be considered. This approach follows the DEHLG (2010) guidance which states that:

"For projects, the distance could be much less than 15 km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects".

9.7.1.1 Sites of International and National Importance

An Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have been completed to appraise the likely significant effects of the Proposed Development either alone or in combination with other plans or projects on European Sites; these accompany this planning application. Figure 9.1 and Figure 9.2, Volume IV shows the locations of the protected sites relative to the location of the Proposed Development. The full list of European sites subjected to S-P-R assessment are included in the screening for Appropriate Assessment which accompanies the planning application.

Special Areas of Conservation (SACs)

SACs are protected under the European Union (EU) 'Habitats Directive' (92/43/EEC), as implemented in Ireland by S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) and Part XAB of the Planning and Development Act 2000 (as amended).

There is one SAC with potential Source-Pathway-Receptor (S-P-R) connectivity to the Proposed Development: Lough Corrib SAC (000297). The Proposed Development is located within the Corrib-Togher-BeaghMore, Corrib-Togher-Bellanagarraun and Corrib-Black-CloghansBeg waterbody catchments. The drains and watercourses within these catchments flow to the BLACK (SHRULE)_020 river which is part of the Lough Corrib SAC designated for bog habitats and associated woodland, grasslands, lake habitats, springs and fens, limestone pavement, old oak woodland, freshwater species including salmon, otter and lamprey, freshwater pearl mussel and crayfish, lesser horseshoe bat and flora species: Slender Naiad and Slender Green Feather-moss.

The turbine delivery route uses the road network which crosses the CLARE (GALWAY)_060 river and its tributaries (part of the Lough Corrib SAC), However there are no accommodation works proposed at or near any of the water crossings in the is catchment, and as such there is no tangible hydrological connection between the SAC and the turbine delivery associated with the Proposed Development.

Haulage of construction materials to and from the site will be along the road network and does not require any accommodation works and as such will not interact with any European site.

Having regard to BCT (2020) in relation to Lesser Horseshoe Bat (LHB) core foraging range, it was assessed that the Proposed Development is not within a distance of any SAC designated to protect habitat which supports the structure and function of LHB. Additionally, field surveys and desktop assessment identified that there are no summer or winter roosts for LHB within the core foraging range for LHB nor within 5-10km of the Proposed development, having regard to Collins, 2023 which states that summer and winter roost sites are generally no more than 5-10km apart. The nearest Special Area of Conservation for lesser horseshoe bats is Kildun Souterrain [002320] and lies approximately 13.5 km west of the site. This lies beyond the foraging range of lesser horseshoe bats (2 km) and the estimated maximum range for which they can travel between summer and winter roosts (10 km) (Collins 2023).

The Shrule Turlough SAC (000525) hydrologically connected to the Lough Corrib SAC via arterial drainage channels which connect to Lough Lee and then to the BLACK (SHRULE)_020 river upstream of Shrule village. This turlough does not however share a waterbody catchment with the Proposed Development and the arterial drainage channel tributary which forms the hydrological connection between the turlough and the BLACK (SHRULE)_020 is downstream of the Proposed Development. As such there is no tangible hydrological connection between the Shrule Turlough SAC and the Proposed Development.

The Shrule Turlough is a Groundwater Dependent Terrestrial Ecosystems (GWDTE). Consideration it therefore also given to potential hydrogeological connection from the Proposed Development. Excavation of peat and soil during the construction phase of the Proposed Development has the potential to cause localised disruption and interruption to groundwater flow. The potential for interruption of groundwater flow to alter the hydrology of the turlough is assessed as negligible having regard to SEPA Land Use Planning System (2017) i.e. the Turlough is beyond the S-P-R zone of influence for hydrological change due to the Proposed Development.

Similarly, other SACs designated for the protection of turlough or fen habitats (i.e. GWDTEs) have no hydrogeological, ecological or hydrological S-P-R connectivity with the Proposed Development having regard to distance from the development, the absence of potential for hydrogeological interaction (ref. the SEPA Land Use Planning System, 2017) and lack of surface water connectivity with the Proposed Development.

There are no other SACs with potential Source-Pathway-Receptor (S-P-R) connectivity to the Proposed Development.

The full NPWS Site synopses for designated areas are available on www.NPWS.ie.

Special Protection Areas (SPA's)

SPAs are designated under the EU Birds Directive (2009/147/EC) ('The Birds Directive').

Having regard to SNH, 2016 'Guidance on Assessing Connectivity with Special Protection Areas (SPAs)', an initial study area of 20km was adopted (based on the largest documented core foraging range for certain SPA bird species). Within this study area are Lough Corrib SPA (004042), Lough Carra SPA (004051) and Lough Mask SPA (004062) protected for wetland and waterbirds and their associated habitats.

Having examined the species for which the SPAs are designated, their core foraging ranges and their typical foraging, roosting, breeding and wintering habitat associations, it was determined that a landscape/ecological connectivity could exist for all of the SPAs within 20km of the Proposed Development:

- Lough Carra SPA is designated for the protection of Common Gull (*Larus canus*),
- Lough Mask SPA is designated for Tufted Duck (*Aythya fuligula*), Common Tern (*Sterna hirundo*), Greenland White-fronted Goose (*Anser albifrons flavirostris*) and various gull species.
- Lough Corrib SPA is designated for various duck species, gull species and tern species as well as Greenland White-fronted Goose and Hen Harrier.

The turbine delivery roue includes some minor accommodation works (removal of street furniture at PoI 1 to PoI 4) near at Galway Harbour, which is designated as part of Inner Galway Bay SPA (004031), designated for various wetland and waterbirds. Given the minor nature of the works and the location within an urban context, there is no landscape/ecological connectivity to the SPA.

The full NPWS Site synopses for designated areas are available on www.NPWS.ie.

The consideration of potential for significant effects on bird species associated with these SPAs from the Proposed Development is considered in Chapter 10 – Ornithology.

Sites of National Importance

Sites of National Importance in Ireland are termed NHA and pNHA.

An initial assessment was made to identify all sites of National importance within 15km of the Proposed Development (based on Scott Wilson et al., 2006)[12]. No NHAs and seventeen pNHAs are present within 15 km of the Proposed Development Site: Rathbaun Turlough (000215), Altore Lake (000224), Belclare Turlough (000234), Drumbulcaun Bog (000263), Killower Turlough (000282), Knockavanny Turlough (000289), Lough Corrib (000297), Turlough O'Gall (000331), Rostaff Turlough (000385), Ardkill Turlough (000461), Carrowkeel Turlough (000475), Cloughmoyne (000479), Clyard Kettle-Holes (000480), Greaghans Turlough (000503), Kilglassan/Caheravoostia Turlough (000504), Shrule Turlough (000525) and Skealoghan Turlough (000541).

The locations of these sites relative to the Proposed Development is shown on Figure 9.2, Volume IV. The majority of the sites are identified as important turlough habitats, while there are some proposed for protection for lowland wet grassland, freshwater marsh, reed-beds, raised bog and fen and limestone pavements.

These sites were examined for potential Source-Pathway-Receptor (S-P-R) connectivity with the Proposed Development. No potential hydrological, ecological or landscape connectivity was determined for any NHA. Two pNHAs have a potential S-P-R connectivity with the Proposed Development: Rostaff Turlough pNHA and Lough Corrib pNAH. Rostaff Turlough is located downstream of the Proposed Development and the BLACK (SHRULE)_030 is hydrologically connected to this turlough whereby during flood conditions the turlough and river spill into eachother. Similarly, the BLACK (SHRULE)_030 flows in to the Lough Corrib pNAH

Summary of Sites of International and National Importance within S-P-R connectivity

Lough Corrib SAC (000297), Lough Corrib SPA (004042), Lough Carra SPA (004051) and Lough Mask SPA assessed as ***International Importance***.

Rostaff Turlough pNHA (000385) and Lough Corrib pNHA (000297) are assessed as ***National Importance***.

9.7.1.2 Other Protected Sites

Lough Corrib, which is designated an SAC and SPA, is also designated as a RAMSAR site (846). The lake is located 10.4km southwest of the Proposed Development and the Black (Shrule) river flows into the lake. The lake provides critical nesting and foraging habitat for common scoter (*Melanitta nigra*) and for breeding terns and gulls which nest on the lake's islands. The lake supports white-clawed crayfish (*Austropotamobius pallipes*) (although unfortunately, an outbreak of Crayfish Plague was confirmed in the Clare River within the lough Corrib catchment mid-2019 which is affecting the population) and Atlantic Salmon (*Salmo salar)* amongst other protected species. Further details are available through https://rsis.ramsar.org/ris/846.

The Moyne Wildfowl Sanctuary (WFS-6), which is associated with Rostaff Turlough in Co. Mayo, is located 5.3km south-west of the Proposed Development. The turlough and surrounding lands supports many wetland bird species including duck, geese and swan species as well as other wetland species such as snipe (*Gallinago gallinago)*, lapwing (*Vanellus vanellus*) and curlew (*Numenius Arquata)*. Wildfowl Sanctuaries are areas that have been excluded from the 'Open Season Order' so that game birds can rest and feed undisturbed.

The nearest nature reserve to the Proposed Development is Richmond Esker Nature Reserve which is located 23.3km to the east of the Proposed Development, near the village of Moylough, County Galway. The reserve is protected for native woodland associated with esker ridge.

[12] Scott Wilson, Levett-Therivel Sustainability Consultants, Treweek Environmental Consultants and Land Use Consultants. 2006. Appropriate Assessment of plans. http://www.landuse.co.uk/Downloads/AppropriateAG.pdf

9.7.1.3 Other Habitats of Interest

Under Article 11 of the Habitats Directive, each Member State is obliged to undertake surveillance of the conservation status of the natural habitats and species listed in the Annexes of the Directive and under Article 17, to report to the European Commission every six years on their status and on the implementation of the measures taken under the Directive. Ireland most recently submitted our Article 17 reporting to the Commission in April 2019. The spatial data used to derive the distributions of protected habitats and species are from many sources.

Relative to the Proposed Development, the Article 17 reporting has mapped the following Annex I type habitats (see Figure 9.5):

- Cloonbar Bog (Active Raised Bog - Annex I habitat type code 7110) – the Article 17 mapping for this habitat is based upon an assessment of aerial photography carried out in 2013. The mapped extent of the bog is 1.04km^2 with the extent of active raised bog being mapped as 0.25ha (given as a minimum, based on Aerial Photographs). The proposed access track for the wind farm will traverse the periphery of the bog, in parallel with the Black (Shrule) river. Cloonbar Bog is mapped in the Map of Irish Wetlands[13] (site code: WMI_GA559), however the site was not surveyed as part of the development of mapping but was instead determined based on aerial imagery dating from 2016. Habitat characterisation of the lands to be traversed by the Proposed Development has been carried out as part of this EIAR. The peatland is heavily encroached by scrub at this location and does not correlate to active raised bog habitat.
- Commonage Area / Cloonbar East Wetland (Dry Heath - Annex I habitat type code 4030) – the data used to inform the Article 17 mapping came from multiple sources and ranges in age from the years 1998 to 2010. The Commonage area is located south of T11 and will be traversed by the turbine access track. The commonage area was surveyed in 2021/22 and mapped as part of the Map of Irish Wetlands (site code: WMI_GA560) and is given a 'C Rating: Local conservation value (high value)'. The Map of Irish Wetlands describes the lands as follows: "Sward height particularly in the grassland is low due to grazing. Heath dominates in the south but grades into grassland throughout. It also has bog characteristics with abundant *Calluna vulgaris, Eriophorum angustifolium* and *Narthecium ossifragum*". The habitat characterisation of the lands to be traversed by the Proposed Development, as carried out as part of this EIAR similarly reflects the findings of the Map of Irish Wetlands studies, in that the heath habitat is present only to the south of the mapped extent of the Article 17 mapping.
- Lands west of the proposed new bridge crossing and adjacent to T5 at Beagh More North Cutover (Dry Heath - Annex I habitat type code 4030) – these lands are mapped in Article 17 mapping as dry heath. However, Article 17 mapping here is inaccurate as reflected in the Map of Irish Wetlands (WMI_GA566), and habitat survey carried out for the purpose of this EIAR (as informed by aerial survey in 2022) which shows the habitat to the west of the bridge crossing as agricultural grassland and at Beagh More North Cutover as a mosaic of cutover bog and raised bog habitat.
- Lands at Cloonsheen-Shancloon bog and cutover complex (Dry Heath - Annex I habitat type code 4030) – these lands are included in the Map of Irish Wetlands (WMI_GA562) as a mosaic of wet grassland, raised bog, scrub, fen and cutover bog. There are no works proposed within the lands mapped as Annex 1 type habitat dry heath.

[13] https://www.wetlandsurveys.ie/miw-intro

Other habitats of note include the Cloonmweelaun-Cloonaglasha cutover complex (WMI_GA558) which bounds the L6483 local road to the north and south. This road will be used to access the Proposed Development and will include passing bays, and accommodation works for turbine delivery. The passing bays are located within the road verge, outside of the wetland habitats associated with the Cloonmweelaun-Cloonaglasha cutover complex. The turbine accommodation works PoI ref. 16 will oversail and overrun into third party land where a load bearing surface will be laid, and a drainage ditch temporarily culverted. Trees and vegetation will be cleared, and one utility pole removed. These lands comprise planted mixed conifer woodland dominated by Sitka Spruce (*Picea sitchensis*) with scattered Ash (*Fraxinus excelsior*) and Beech (*Fagus sylvatica*). The turbine accommodation works PoI ref. 18 will oversail and overrun into third party land where a load bearing surface will be laid. Two road signs will be removed. Trees and vegetation will be cleared. These lands comprise cutover bog with peripheral growth of willow (*Salix sp*.) and gorse (*Ulex europaeus*) scrub. None of these habitats correlate to Annex I type habitats.

9.7.2 Habitats and Flora within the Proposed Development Site

The habitats at the application site were the subject of a detailed survey and assessment by Fehily Timoney and Company ecologists between October 2021 and May 2024. A habitat map of the Proposed Development lands is provided in Figure 9.3a, Figure 9.3b Figure 4.3c and Figure 9.3d, Volume IV. All habitats described below have been classified in accordance with Fossitt (2000).

The Proposed Development is predominantly located within improved agricultural grassland habitat (GA1) (often in mosaic with wet grassland (GS4)) and within cutover bog (PB4), areas of willow scrub (WS1), conifer plantation (WD4), raised bog (PB1) and calcareous and neutral grassland (GS1) in mosaic with dry calcareous heath (HH2). There is also a large area of dry-humid acid grassland (GS3) associated with Cloonbar East Wetland. Waterbodies within the Site include a network of drainage ditches, small streams/watercourses classified as lowland depositing rivers, many of which are the subject of arterial drainage. The hedgerows and treelines within the Site are mainly associated with the agricultural lands and waterbody riparian areas. The habitat type(s) at each turbine location is presented in Table 9-2 and are more generally described thereafter, with habitat types at all other areas of infrastructure also described in the following sections.

Table 9-2: Habitat at Each Turbine Location

Turbine	Habitat Type	Relevé at Turbine Foundation Location		
		Latin name	Common name	Percentage cover (%)
T1	Cutover Bog (PB4)	*N/A*	Bare ground	60
		Eriophorum angustifolium	Common cottongrass	35
		Molinia caerulea	Purple moorgrass	5
T2	Mosaic of wet grassland (GS4) and gorse/willow scrub (WS1) colonising cutover bog (PB4)	*Festuca pratensis*	Meadow fescue	20
		Lolium perenne	Perennial ryegrass	20
		Agrostis capillaris	Common bent grass	15
		Centaurea nigra	Common knapweed	10

Turbine	Habitat Type	Relevé at Turbine Foundation Location		
		Latin name	Common name	Percentage cover (%)
		Plantago lanceolata	Ribwort plantain	10
		Succisa pratensis	Devils-bit scabious	5
		Argentina anserina	Silverweed	5
		Cirsium vulgare	Spear thistle	3
		Mentha aquatica	Water mint	3
		Filipendula ulmaria	Meadowsweet	3
		Angelica sylvestris	Angelica	2
		Ranunculus repens	Creeping buttercup	2
		Potentilla erecta	Common tormentil	1
		Rumex obtusifolius	Broad-leaved dock	1
T3	Improved agricultural grassland (GA1) in mosaic with wet grassland (GS4)	*Lolium perenne*	Perennial ryegrass	75
		Trifolium repens	White clover	8
		Bellis perennis	Daisy	7
		Taraxacum vulgaria	Dandelion	5
		Ranunculus repens	Creeping buttercup	3
		Rumex obtusifolius	Broadleaved dock	1
		Plantago lanceolata	Ribwort plantain	1
T4	Improved agricultural grassland (GA1) in mosaic with wet grassland (GS4)	*Lolium perenne*	Perennial ryegrass	40
		Agrostis capillaris	Common bent	15
		Anthoxanthum odoratum	Sweet vernal grass	15
		Juncus effusus	Soft rush	10
		Bellis perennis	Daisy	10
		Cirsium vulgare	Spear thistle	5
		Trifolium repens	White clover	3
		Taraxacum vulgaria	Dandelion	2

Turbine	Habitat Type	Relevé at Turbine Foundation Location		
		Latin name	Common name	Percentage cover (%)
T5	Dry neutral grassland (GS1) and cutover bog (PB4)	Cutover Bog		
		N/A	Bare ground	65
		Eriophorum angustifolium	Common cottongrass	20
		Juncus acutiflorus	Sharp-flowered rush	5
		Erica tetralix	Cross leaved heath	5
		Molinia caerulea	Purple moorgrass	2
		Calluna vulgaris	Ling	2
		Campylopus introflexus	Heath star moss	1
		Dry neutral grassland		
		Agrostis capillaris	Common Bent	15
		Anthoxanthum odoratum	Sweet Vernal-grass	15
		Brachythecium rutabulum	Moss	5
		Calliergonella cuspidate	Moss	3
		Carex divulsa	Grey Sedge	1
		Festuca rubra	Red Fescue	10
		Holcus lanatus	Yorkshire-fog	10
		Leontodon spp	Hawkbit spp	1
		Lolium perenne	Perennial Rye-grass	15
		Lotus corniculatus	Common Bird's-foot-trefoil	5
		Luzula campestris	Field Wood-rush	1
		Ranunculus repens	Creeping Buttercup	10
		Trifolium dubium	Lesser Trefoil	1
		Trifolium pratense	Red Clover	5
		Veronica filiformis	Slender Speedwell	3

Turbine	Habitat Type	Relevé at Turbine Foundation Location		
		Latin name	Common name	Percentage cover (%)
T6	Improved agricultural grassland (GA1)	*Poa annua*	Annual meadowgrass	30
		Anthoxanthum odoratum	Sweet vernal grass	20
		Lolium perenne	Perennial ryegrass	15
		Trifolium repens	White clover	12
		Holcus lanatus	Yorkshire fog	10
		Stellaria media	Common chickweed	5
		Juncus effusus	Soft rush	5
		Ranunculus repens	Creeping buttercup	3
T7	Cutover bog (PB4)	*Eriophorum angustifolium*	Common cottongrass	40
		Molinia caerulea	Purple moorgrass	30
		Calluna vulgaris	Ling	10
		Sphagnum denticulatum	Cow-horn bog-moss	8
		Potentilla erectacro	Common tormentil	4
		Erica tetralix	Cross leaved heath	3
		Cladonia portentosa	Cladonia	3
		Osmunda regalis	Royal fern	1
		Pteridium aquilinum	Bracken	1
T8	Improved agricultural grassland (GA1)	*Lolium perenne*	Perennial ryegrass	50
		Poa annua	Annual meadow grass	30
		Trifolium repens	White clover	12
		Juncus effusus	Soft rush	5
		Ranunculus repens	Creeping buttercup	3
T9	Improved agricultural grassland (GA1)	*Lolium perenne*	Perennial ryegrass	30
		Poa annua	Annual meadow grass	25

Turbine	Habitat Type	Relevé at Turbine Foundation Location		
		Latin name	Common name	Percentage cover (%)
		Trifolium repens	White clover	20
		Ranunculus repens	Creeping buttercup	15
		Bellis perennis	Daisy	5
		Taraxacum vulgaria	Dandelion	3
		Stellaria media	Common chickweed	2
T10	Cutover bog (PB4)	*Eriophorum angustifolium*	Common cottongrass	45
		N/A	Bare ground	35
		Campylopus introflexus	Heath star moss	10
		Juncus acutiflorus	Sharp-flowered rush	5
		Carex flacca	Glaucous sedge	3
		Arrhenatherum elatius	False-oat grass	2
T11	Cutover bog (PB4)	*Eriophorum angustifolium*	Common cottongrass	40
		N/A	Bare ground	30
		Juncus effusus	Soft rush	15
		Molinia caerulea	Purple moorgrass	5
		Agrostis capillaris	Common bent	3
		Narthecium ossifragum	Bog asphodel	3
		Carex flacca	Glaucous sedge	2
		Drosera rotundifolia	Round-leaved sundew	2

Improved Agricultural Grassland GA1

As per Table 9-2, most of the turbines are located within agricultural lands. The turbines in the central parcel of the Site (T6, T8 and T9) and their associated hardstandings and access tracks are located within intensively managed agricultural grassland and sparsely vegetated treelines and hedgerows. Similarly, the 110 kV infrastructure (substation and loop-in) are located within intensively managed grasslands. The uniform sward is dominated by perennial rye-grass *Lolium perenne*, with Yorkshire-fog *Holcus lanatus*, and white clover *Trifolium repens*. The forbs component was species poor and consisted of species such as creeping buttercup (*Ranunculus repens)*, dandelion (*Taraxacum officinale* agg.), and ribwort plantain (*Plantago lanceolata)*. It is likely that regular reseeding and fertilisation of the grassland occurs. Soft rush (*Juncus effusus*) and thistles (*Cirsium* spp.) were present in damper areas of the grassland. Self-seeded herbs listed above increase the diversity of this habitat somewhat and the presence of clover is beneficial to pollinators. However, it is predominantly an intensive monoculture crop managed for grazing and as such is of limited biodiversity value.

Given the habitat is species poor and common in the area, it is assessed as being ***locally important, lower value***.

Plate 9-1: Lands at T8: Improved grassland (GA1) with managed hedgerows (WL1)

Plate 9-2: Relevé at T9

Hedgerows WL1

A limited number of hedgerows are present predominantly bounding the improved grassland fields within the Site. The hedgerows are sparse, intensively managed, and frequently grade to stone walls. Species composition was dominated by Hawthorn (*Crataegus monogyna*) and Gorse (*Ulex europaeus*) with Crack-willow (*Salix fragilis*) present in wetter areas. Understory species included Common Nettle (*Urtica dioica*), lesser celandine (Ficaria verna), cleavers (*Galium aparine*), Brambles (*Rubus fruticosus*) and mosses including *Rhytidiadelphus squarrosus*.

The hedgerows may still provide commuting habitat for mammals, bats or birds despite intensive management regimes and were assessed to be of ***locally important, higher value***.

Stone walls BL1

These low features help delineate improved grassland fields. The stonewalls are low and dominated by grasses of the agricultural fields.

The walls have low floristic diversity and limited habitat potential of these walls makes it ***locally important, higher value***. Additionally, as per Section 9.7.3, no evidence of usage by mammals e.g. Pine Marten (*Martes martes*) was observed on site during field surveys.

Treelines WL2

Several treelines are present throughout the Site, with trees ranging from between 5m and 8m in height. Understory vegetation was sparse, and beech *(Fagus sylvatica*) and ash (*Fraxinus excelsior*) were a common component of the habitat. The habitat has the potential to offer roost sites for bats and breeding locations for birds as well as commuting opportunities for species. Therefore, it is ***locally important, higher value***.

Mosaic of Wet Grassland GS4 and Improved Agricultural Grassland GA1

The turbines within the west of the Site (T2, T3 and T4), Construction Compound # 2, and the meteorological mast are located within improved grassland in mosaic with wet grassland. Management of the grassland is less intensive than the improved agricultural grassland towards the centre of the Site. The habitat mosaic is species poor with typical agricultural grassland species in mosaic with Rushes (*Juncus spp.*) and Yorkshire-fog, which dominate the species composition in the wetter areas. Creeping buttercup, marsh thistle (*Cirsium palustre*) and silverweed (*Potentilla anserina*) were also present. Evidence of grazing was apparent at the time of the surveys.

The wet grassland towards T2 has a greater species diversity than the adjacent grasslands in which T3 and T4 are proposed. Additionally, the footplant for Marsh Fritillary butterfly: Devils-bit scabious *(Succisa pratensis)*, occurs in patches within the grassland near T2. However, as per the NBDC Habitat Condition Assessment for March Fritillary and having regard to Table 9-2, the grassland is classified as unsuitable for Marsh Fritillary given the low frequency of *Succisa* per m^2 (~5%) and the level of grazing at this location coupled with scrub encroachment.

The wet grassland fields do not correspond with the Annex 1 habitat '*Molinia meadows [6410]*' as they are species poor and often rank where grazing is lighter. As such they are ***locally important, lower value***.

Plate 9-3: General View of Grassland Habitat from T4 Looking Northwest

Plate 9-4: Habitat at T2

Plate 9-5: Habitat at T3

Cutover Bog PB4

Cutover bog is present at T1, T5, T7, T10 and T11.

This habitat type covers a broad range of conditions from bare peat and dry but vegetated peat. The habitat frequently occurred in a mosaic alongside other habitats including scrub. The cutover varies in its characteristics throughout the site with active turf cutting evident in areas during the Site surveys. The vegetation communities associated with cutover bog are largely dominated by common cottongrass (*Eriophorum angustifolium*) on dry peats with little to no *Sphagnum spp.* present. Other typical species include black-bog-rush (*Schoenus nigricans*), deergrass (*Trichophorum cespitosum*) and ling (*Calluna vulgaris*), glaucous sedge (*Carex flacca)*, bog-myrtle (*Myrica gale*), bog asphodel (*Narthecium ossifragum*) and red dead-nettle (*Lamium purpureum*) were also present. Encroaching willow (*Salix* spp.) scrub and grassland was common in many areas. Where this encroachment dominated, habitats were classified accordingly.

According to Smith and Crowley (2020) the cutover bog vegetation assemblages within the Site equate to 'Eriophorum angustifolium cutover bog type (LS2)', 'Eriophorum angustifolium–bare peat cutover bog (BP2)' and 'Molinia caerulea cutover bog (LS3)' which are defined by Smith and Crowley as habitat types of low conservation importance and generally low species richness (noting that the bare peat type cutover bog habitat has good restoration potential, especially if there is a seasonally high water table).

The vegetation communities associated with the cutover bog habitat within the Site do not conform to Annex I type habitats. As such the habitats are assessed as being of ***locally important, higher value.***

Plate 9-6: Habitat at T1

Plate 9-7: Habitat at T5

Plate 9-8: Habitat at T7

Plate 9-9: Habitat at T11

Plate 9-10: Aerial View of Cutover Bog and Scrub Habitat Near T7, with Black (Shrule) Watercourse

Raised Bog PB1

The Proposed Development includes the construction of a piled and floated road along the periphery of Cloonbar Bog (see Section 9.7.1.3 for baseline information on Cloonbar Bog). The habitat within the footprint of the proposed floated road comprises a linear swath of scrub (WS1) which parallels the Black (Shrule) watercourse/arterial drainage channel. The vegetation is dominated by Gorse, Bog-myrtle *(Myrica gale*), Yorkshire-fog (*Holcus lanatus*) and Common Knapweed (Centaurea nigra). Additionally, the following species are occasional throughout: Sweet Vernal-grass (*Anthoxanthum odoratum*) Creeping Thistle (*Cirsium arvense*), Brambles (*Rubus fruticosus*), Broad-leaved Rush (*Juncus planifolius*), Purple Moorgrass, Daisy (*Bellis perennis*), White Clover, Ribwort Plantain (***Plantago lanceolata),*** Heath Spotted orchid (*Dactylorhiza maculata*), Royal Fern (*Osmunda regalis*), Glaucous Sedge (*Carex flacca*), Rough Hawkbit (*Leontodon hispidus*), Devils-bit Scabious, Tormentil (*Potentilla erecta*) and Marsh Thistle (*Cirsium palustre*). Scattered in low numbers within the scrub habitat are Self-heal (*Prunella vulgaris*), Jointed Rush (*Juncus articulates*) and Alder (*Alnus glutinosa*).

Plate 9-11: Scrub Habitat (WS1) along Access Track Alignment

This scrub habitat gives way to more typical raised bog habitat as one moves further into Cloonbar Bog in a northwestern direction. The bog here is dry with patches of bare peat and is surrounded by facebanks and cutover bare peat to the south. There is no permanent infrastructure proposed within this raised bog habitat as part of the Proposed Development, however this habitat is within the red line boundary. Detailed relevé surveys were conducted as part of botanical surveys carried out by Fehily Timoney in May 2024 along the bog habitat located within the red line boundary for the Proposed Development. These are presented in Table 9-3 and the locations of the relevés is shown on Figure 9.3c, Volume IV.

Beyond the red line boundary, within Cloonbar Bog, the habitat becomes wetter as you move away from the influence of the Black (Shrule) river/arterial drainage channel (Plate 9-12). However, there is a land drain located 6.2m beyond the red line boundary which is influencing adjacent habitat quality by drawing down the water table locally and essentially forms a hydrological break between the main Cloonbar Bog habitat and the proposed development lands.

Table 9-3: Relevé Surveys in Degraded Raised Bog Habitat

Species	Relevé 1 % Cover	Relevé 2 % Cover	Relevé 3 % Cover	Relevé 4 % Cover	Relevé 5 % Cover	Relevé 6 % Cover
						
Sphagnum capillifolium	5	20	14	5	15	20
Bog Asphodel *Narthecium ossifragum*	2	8	17	4	7	4

Species	Relevé 1 % Cover	Relevé 2 % Cover	Relevé 3 % Cover	Relevé 4 % Cover	Relevé 5 % Cover	Relevé 6 % Cover
Common Cottongrass *Eriophorum angustifolium*	4	6	3	2	3	2
White beak-sedge *Ryhnchospora alba*	4	1	1	0	0	0
Reindeer moss *Cladonia portentosa*	40	40	18	6	15	6
Sphagnum magellanicum agg.	0	0	0	0	0	20
Sphagnum subnitens	2	6	1	2	0	0
Cladonia uncialis	0	2	3	1	0	0
Sphagnum fuscum s.l.	0	2	0	0	0	0
Ribbed Bog-moss *Aulacomnium palustre*	0	0	0	4	2	0
Pleurozia purpurea	0	0	0	0	0	5
Black Bog-rush *Schoenus nigricans*	50	45	60	55	50	15
Deergrass *Trichophorum germanicum*	10	15	4	2	15	20
Purple Moor-grass *Molinia caerulea*	2	3	0	0	6	0
Ling *Calluna vulgarus*	42	28	45	30	15	3
Glaucous Sedge *Carex flacca*	5	2	4	4	6	7
Willow spp. *Salix* spp.	4	0	0	0	0	0

Species	Relevé 1 % Cover	Relevé 2 % Cover	Relevé 3 % Cover	Relevé 4 % Cover	Relevé 5 % Cover	Relevé 6 % Cover
Cross leaved-heath *Erica tetralix*	3	1	6	3	2	2
Bog-myrtle *Myrica gale*	1	2	8	5	0	10
Bare Peat	2	12	3	3	2	2
Firmness*	Firm	Firm	Firm	Firm	Firm	Soft
Pools and Hollows**	Pools absent, <10% hollows	Pools absent, <10% hollows	Pools absent, <10% hollows	Pools absent, <10% hollows	Pools dominated by algae <5% cover	Pools dominated by algae <5% cover
Hummocks***	Hummocks are low in height and have a low percentage cover and are mainly associated with Ling and reindeer moss.	Low hummock cover and few hollows	Low hummock cover and few hollows	Low hummock cover and few hollows	Low hummock cover and some hollows	Low hummock cover and some hollows

* Firmness: Firm: ground does not sink under the weight of your body; Soft: ground sinks approximately 1 to 3cm but little amount of water is released by the peat or Sphagnum; Very soft: ground sinks more than 3cm and a considerable amount of water is released by the peat or Sphagnum; Quaking: ground bounces or shakes when the surveyor jumps.

** Pools are depressions on the bog surface where the water table drops below surface level for only very short periods of time. Hollows are shallow depressions on the bog surface where surface water collects, or where the water table reaches ground level or lies just above ground level, depending on seasonal conditions.

*** Hummocks are mounds on the bog surface which can range from a few cm to more than a meter in height. They are usually composed

The relevés were assessed against the following publications to determine the potential correlation with Annex I type habitats '7120 Degraded raised bogs still capable of natural regeneration' and '7110 Active raised bogs':

- The habitats of cutover raised bog - IWM 128 (Smith & Crowley,2020)
- Best practice in raised bog restoration in Ireland (Mackin et al, 2017)
- Raised Bog Monitoring and Assessment Survey 2013 (Fernandez et al, 2014)
- The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. (NPWS, 2019)

Typical species associated with raised bog habitat are set out in these publications and summarised in Table 9-4.

Table 9-4: Typical Raised Bog Species

Vascular Plants	Mosses, Liverworts and Lichens
Andromeda polifolia	*Aulacomnium palustre*
Drosera anglica & *D. intermedia*	*Campylopus atrovirens, Pleurozia purpurea* & *Racomitrium lanuginosum* (Western indicators)
D. rotundifolia	*Cladonia ciliata* & *C. portentosa*
Menyanthes trifoliata	*C. uncialis*
Narthecium ossifragum	*Leucobryum glaucum*
Rhynchospora alba	*Sphagnum austinii,*
Utricularia minor	*S. beothuk/S. fuscum*
Vaccinium oxycoccos	*S. capillifolium*
Eriophorum vaginatum	*S. cuspidatum*
Eriophorum angustifolium	*S. denticulatum*
	S. magellanicum agg.
	S. papillosum
	S. pulchrum
	S. subnitens

Source: (Smith & Crowley,2020)

The high bog habitat within the Site is generally firm underfoot indicating drier conditions. The habitat lacked a diverse or abundant Sphagnum component. The hydrology and species composition are indicative of 'Marginal ecotope and Sub-marginal ecotope' habitats as defined in Fernandez et al (2014) and is classified as degraded raised bog (DRB).

"Sub-marginal Physical characteristics: Surface ranges from hard to soft but not quaking. Wetter vegetation types are absent except for algal mats/Rhynchospora and Narthecium hollows dominant. Sub-marginal Characteristic species: In lawns Sphagnum papillosum dominates, although absent from some areas. S. magellanicum & S. capillifolium are present but not S. cuspidatum. Trichophorum is common, but in less tussocky form than in marginal ecotope. Rhynchospora fusca occurs in hollows and pools. In hummocks Calluna vulgaris, Sphagnum capillifolium, Cladonia portentosa are common".

"Marginal Physical characteristics: Water level low, surface generally hard, soft in spots e.g. Rhynchospora alba hollows. Degraded micro-topography, with very little differentiation between hummocks and hollows, etc. Non-algal pools & tall hummocks absent. Hollows can be frequent & these are dominated by Rhynchospora/Narthecium/Trichophorum in tussock form/Algal mats. Pools area absent except for tear pools. Characteristic species: In lawns Narthecium is most dominant, Sphagnum papillosum & S. capillifolium are present in small amounts (not in lawns, or in big hummocks, but in small patches). Trichophorum common in tussock form".

Of note is the definition of DRB which implies that it must be capable of being restored to active raised bog within a reasonable timeframe. The Interpretation Manual of European Union Habitats - EUR28 specifies that "Sites judged to be still capable of natural regeneration will include those areas where the hydrology can be repaired and where, with appropriate rehabilitation management, there is a reasonable expectation of reestablishing vegetation with peat-forming capability within 30 years". The conditions outlined in the Article 17 report as being suitable for supporting DRB include "a) sites over 30ha of high bog with typical bog vegetation which were part of a larger bog and contain drains which could be blocked and b) smaller sites (< 30 ha) which are part of small basins with drains present which could be blocked…..". As such, the potential for restoration to be successful depends on hydrological conditions, and whether it is feasible for the water table in the peat to be maintained at or close to the ground surface throughout the entire year. Given the prevailing hydrological conditions at this location within the bog, as driven by the presence of the Black (Shrule) river/arterial drainage channel, it is not likely that rehabilitation could be achieved within 30 years. As such this habitat within the red line boundary is assessed as being of ***Local Importance (Higher Value)***.

The intact degraded and active raised bog habitat within Cloonbar Bog is located beyond the footprint of the Proposed Development (Plate 9-12) and is assessed as being of ***National Importance***.

Plate 9-12: Cloonbar Bog: High Bog Habitat Beyond the Red Line Boundary

Dry neutral grassland GS1

Dry neutral grassland occurs at T5 and at the proposed location of the access track to T6. These grasslands are not subject to the same intensive agricultural improvement as the surrounding grasslands. They are lightly grazed with frequent rush (*Juncus spp*.) present throughout. A range of typical species were present including bents (*Agrostis* spp.), meadow-grasses (*Poa* spp.) and Yorkshire-fog. A range of common boradleaved herbs were also present including clovers (*Trifolium* spp.), Common Knapweed (*Centaurea nigra*), Common Bird's-foot Trefoil (*Lotus corniculatus*) and Cat's-ear (*Hypochoeris radicata*).

The main construction compound for the Proposed Development (Construction Compound 1), is located at the east of the Site within dry heath habitat (HH2) grading to dry calcareous and neutral grassland (GS1) with a high level of scrub encroachment by Crack-willow (*Salix fragilis*), Birch, (*Betula pubescens*), Hawthorn and Gorse (*Ulex europaeus*). Small areas of wet flushes containing bog cotton (less than 2-3 m) are sparsely dispersed within the heath habitat, with Bell Heather (*Erica cinerea*) comprising 35-40% of groundcover. Purple Moor-grass (*Molinia caerulea*) dominates.

The above grasslands do not correlate to Annex I type habitat 'semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (*important orchid sites) (6210)', and the heath is not Dry Heath - Annex I habitat type code 4030, given the level of scrub encroachment. However, the grassland/heath offer value to pollinators and ground nesting bird species and as such is assessed to be of ***local importance, higher value***.

Dry humid-acid grassland GS3

The habitat within the Cloonbar East Wetland comprises dry-humid acid grassland (GS3). The grassland was heavily grazed (horses and sheep, but also signs of hare and rabbits) with a very short sward and mosses evident in all areas. Species composition was dominated by red fescue (*Festuca rubra*), Yorkshire-fog and glaucous sedge. Other grasses present in abundance within the habitat included sweet-vernal grass (*Anthoxanthum odoratum*) and rough meadow grass (*Poa trivialis*) while field wood-rush (*Luzula campestris*) was also occasional. Forbs present consisted of cat's ear, daisy (*Bellis perennis*), red dead-nettle, ribwort plantain, common milkwort (*Polygala vulgaris*), and creeping thistle (*Cirsium arvense*).

While there are no turbines proposed within this habitat, a floated access road and turning head associated with T11 will be located within this habitat.

The heavily grazed nature of the habitat means it's of limited use to pollinators and ground nesting birds (albeit Skylark, Golden Plover, Curlew and Snipe have been recorded in this habitat during field survey - see Chapter 10 - Ornithology for further details). Proper management / grazing regime of these grasslands could allow a future evolution into a more species rich grassland.

This is a non-Annex type habitat with no links to '*species-rich Nardus grasslands on siliceous substrates in mountain areas (6230)' given the paucity of positive indicator species as per O'Neill et al. (2013). Therefore, the habitat was assessed as being ***locally important, lowervalue***

Plate 9-13: Dry-humid Acid Grassland (GS3) at Cloonbar East Wetland

Scrub WS1

The Scrub habitat within the Site is predominantly a mosaic habitat of gorse/willow scrub that is relatively open in nature with patches of scilaceous heath and is associated with recolonised cutover peat with no sphagnum cover. Species assemblages tend to be dominated by gorse (*Ulex europaeus*) monoculture with willow, hawthorn (*Crataegus monogyna*) and birch (*Betula pubescens*) also present in patches. Hawthorn hedges which have grown outwards were also classified as scrub. The understory was comprised of bramble (*Rubus fruticosus* agg.), nettle (*Urtica dioica*), timothy (*Phleum pratense*), rough meadow-grass (*Poa trivialis*), Broad-leaved Rush (Juncus planifolius), Common Knapweed (Centaurea nigra), Wild Privet (Ligustrum vulgare), Common Nettle (Urtica dioica), and purple moor-grass. Willow and gorse were also present on recolonised areas of cutover peat with no *sphagnum* cover. Patches which were more open in nature showed characteristics more consistent with siliceous heath. Areas which had been grazed formed a mosaic with wet grassland.

At T1 a small patch of habitat within a linear section of scrub has graded beyond the characteristics of scrub and aligns more towards Bog woodland (WN7). It comprises semi mature trees with birch and willow species abundant. However, it does not align to Annex I type habitat, '*bog woodland (91D0)', as refers to woodland of intact raised bog, and this habitat is located on cutover peat.

The semi-natural character of scrub habitat makes it ***locally important, higher value***.

Plate 9-14: Gorse scrub (WS1)/Wet grassland (GS4) mosaic

Broadleaved woodland WD1

The broadleaved woodland on site surrounds the farmyard buildings within the western land parcel (derelict house and cattle shed adjacent to occupied farmhouse – Location F1 in Bat survey report). The understory is largely bare and species poor. Tree species include beech, ash, cypress spp. and sycamore (*Acer pseudoplatanus*). The derelict building is a confirmed bat roost and as such the trees surrounding the building provide foraging habitat and potentially opportunistic roosting habitat. These mature trees may also provide nesting habitat for birds. The majority of these trees (and farm buildings) will be retained as part of the Proposed Development. The habitat is assessed as being of ***locally importance, higher value*** given that it is known to support bats.

Conifer Plantation WD4 and (Mixed) Conifer Woodland WD3

The turbine accommodation works PoI ref. 16 will oversail and overrun into third party land where trees and vegetation will be cleared (1,355 m^2 in area out of a planted area of 23,752 m^2). These lands comprise mixed conifer woodland (WD3) dominated by Sitka Spruce (*Picea sitchensis*) with scattered Ash (*Fraxinus excelsior*) and Beech (*Fagus sylvatica*). A potential bat roost (mature ash tree – see Plate 9-24) located 10m outside of the red line boundary within this habitat and will not be affected by the Proposed Development.

The 33 kV cable for the turbines will be routed through planted conifer forestry which comprises Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine (*Pinus contorta*). An area of 4,085 m^2 will be felled (out of a total planted area of 71,745 m^2).

At T10, an area of 7,450m^2 of an immature Douglas Fir (*Pseudotsuga menziesii*) forestry, with some intermittent Sitka Spruce will be removed to create a bat buffer around the turbine.

Ground flora in these habitats is underdeveloped and species poor (with ivy dominating) as is typical due to the lack of light able to penetrate the canopy. Monocultures offer little in the way value to biodiversity.

These habitat types are assessed as ***locally important, lower value***.

Buildings and Artificial Surfaces BL3

Buildings and artificial surfaces within the Proposed Development include local road crossings and existing farm tracks and turbary roads which are adopted into the footprint of the Proposed Development, as set out in Chapter 2 - Development Description. These tracks and roads are assessed as ***local importance, lower value***.

An existing bridge crossing of the BLACK (SHRULE)_010 river (EPA name Togher River), EU waterbody section code: IE_WE_30B020200) will be incorporated into the internal Site access. This bridge was constructed as part of the Corrib Headford arterial drainage scheme in the 1960's (structure ref. 9664 B2 on channel C4/13) and comprises bridge deck, parapets, parapet retaining walls and abutments all constructed of reinforced concrete. The bridge has low suitability to support any protected species or habitats. This bridge is assessed as ***local importance, lower value***.

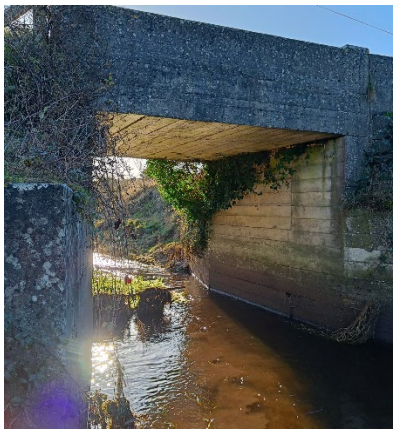


Plate 9-15: Existing bridge structure ref. 9664 B2 on channel C4/13

Additionally, there is one property (Eircode H54 KH73) located within the Proposed Development red line boundary. This property is under the control of the Developer and will be taken out of use as a residential property and will not be occupied for the operational period of the development should the Proposed Development be granted planning permission. The derelict building located adjacent to this residential property is a confirmed bat roost. As such this building is assessed as being of ***local importance, higher value***.

Plate 9-16: Derelict Buildings at Eircode H54 KH73

Depositing/lowland rivers FW2

The Proposed Development is in the Corrib catchment and is drained by Black (Shrule) river and the Togher River and its' associated tributaries. The Black (Shrule) River flows into Lough Corrib SPA and SAC. A full description of the watercourses at the Site and adjacent to the red line boundary is contained within Chapter 12 – Hydrology and Water Quality.

The Proposed Development includes three infrastructure crossings of the BLACK (SHRULE)_010 (Togher River, IE_WE_30B020200):

- Culvert crossing near the source of the river (Culvert No CV14, ITM 535417.3152, 755371.7636): the river at this location has been historically drained and straightened. Flows are sluggish and river substrate comprises soft mud. Riparian vegetation comprises scrubby Willow, Alder and Gorse. Instream vegetation comprises Water Starwort (*Callitiche stagnalis*), Water Mint, Water Horsetail (*Equisetum fluviatile*), Yellow Marsh Marigold (*Caltha palustris*), Bulrush (*Typha latifolia*) and Broad-leaved Pondweed (*Potamogeton natans*).
- New bridge crossing (ITM 533089.53, 754307.53) on Togher River: This river has been historically drained, straightened and deepened. River substrate is soft peaty mud. Riparian vegetation comprises Willow and Alder, while instream vegetation comprises Water Mint, Watercress, Varigated Yellow Pond-Lily, European Bur-Reed, Common Reedgrass (*Phragmites australis*), Broadleaved Pondweed, Mare's-Tail.
- HDD crossing (ITM 529758.48,753338.06) on Togher River: This river has been historically drained, straightened and deepened. River substrate is dominated by cobbles which are heavily silted. Riparian vegetation included Ash, Hawthorn, Blackthorn, Willow and Alder. Instream vegetation includes Water Mint, Watercress, Water Starwort, Mare's-Tail (*Hippuris vulgaris*), Marsh Marigold, Long-Leaf Pondweed (*Potamogeton nodosus*), Varigated Yellow Pond-Lily, Common Water-Plantain (Alisma plantago-aquatica), Filamentous Green Algae, Water Forget-Me-Not, Water Dropwort, Water Horsetail (*Equisetum fluviatile*), Star Duckweed, European Bur-Reed, Common Clubrush (*Schoenoplectus lacustris*) The Third Schedule invasive species Water Fern (*Azolla filiculoides*) and Canadian Pondweed (*Elodea canadensis*) occur in this stretch of the river (noting that E. canadensis is not listed in the European Union (Invasive Alien Species) Regulations 2024).

Additionally, the existing OPW bridge crossing structure ref. 9664 B2 on channel C4/13 (Togher River) will be used to access lands in which turbines T1 to T4 will be constructed.

The BLACK (SHRULE) River (Togher River) does not support habitats that match the criteria set out for 'Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation'

The watercourses within the Site were identified as Lowland/depositing rivers. Historic dredging and straightening were evident throughout. Flows varied from moderate to low at the time of surveying. In-stream habitat consisted predominantly of pool and glide. Substrates comprised of soft sediment with occasional hard substrates also present. Abundant growth of aquatic macrophytes were present at sections. The Togher River was assessed as suitable to support salmonid species and being of high fishery value (See Section 9.7.4 for further details) while the upper sections of the Black (Shrule) river had low fishery value and the lower reaches being of high fishery value. Riparian vegetation varied from sparse to dense in areas. The watercourses are of suitability to otter (*Lutra lutra*) as signs (spraints & slide) were found during the site surveys. Additionally, Kingfisher (*Alcedo atthis*) was recorded on the Togher River.

The watercourses within the Site have been assessed as ***County Importance***.

Plate 9-17: Togher River near HDD Crossing

Plate 9-18: Watercourse Near Culvert Crossing on Black (Shrule)

Drainage ditches FW4

The Proposed Development lands are extensively drained with drainage channels, many of which are part of the Corrib Headford Arterial Drainage Scheme, which others are associated with land drainage for turbary and agriculture. Where the Proposed Development interacts with these drains, they will be culverted, the locations of which are shown in the 100 series planning drawings.

The drains vary in character and scale, ranging from small swales/bog drains, some holding water and with low fishery potential through to larger arterial ditches with in-stream habitat suitable to provide moderate fishery value.

No significant areas of permanent open water are present within the Proposed Development Site.

The drainage ditches in the study area are ***locally important, higher value*** due to their potential to host breeding amphibians and to have some fishery value.

Plate 9-19: Example of Drains within the Study Area

9.7.2.1 Rare and Protected Flora

The NBDC and NPWS holds records for four rare or protected flora species within the 10km grid square M25 and M35 which overlaps the Proposed Development:

- large white-moss *(Leucobryum glaucum)* - occurs in wet and dry acid woodlands, as well as bogs, heaths and poor fen (source: NBDC[14]). The NBDC records relate to Fartagar Bulcan cutover bog complex, located along the R332 road, 1km southeast of turbine accommodation works PoI 16. The habitats within the Proposed Development lands include bogs (raised and cutover) and as such are suitable habitat for this species. Botanical survey included targeted searches for this species within bog habitats within the Proposed Development red line boundary.
- limestone fern (*Gymnocarpium robertianum*) – is associated with cracks, fissures and scree in limestone rock (source: BSBI[15]). The records relate to limestone pavement at and Cloughmoyne, Co. Mayo. The habitats within the Proposed Development lands do not include limestone rock and as such there is not suitable habitat to support this species.
- wood bitter-vetch (*Vicia orobus*) - found on sloping, free draining neutral to mildly-acid soils across a range of habitats, including low fertility pastures and hay meadows, mires, stream banks, ravines, sea cliffs, limestone heath and woodland margins (Source: BSBI[16]). The records relate to Bunnafollistraun, Headford, Co. Mayo. The soils within the Proposed Development are typically not free draining and the pasture lands are heavily managed. As such there is not suitable habitat to support this species.
- wood small-reed (*Calamagrostis epigejos*) – associated with damp woods, ditches, fens, ungrazed or lightly grazed grasslands, and on sheltered sea-cliffs and sand dunes (Source: BSBI [17]). The NPWS/NBDC records relate to Cloughmoyne, Co. Mayo. The lands and drains within the Proposed Development are heavily managed and as such are unlikely to support this species. Notwithstanding, botanical survey included targeted searches for this species at all drain crossings associated with the Proposed Development.

None of the above species were observed during the botanical surveys carried out between October 2021 and May 2024.

Flora Protection Order Species Pennyroyal (*Mentha pulegium*) was recorded within riparian habitat near aquatic survey Site 1 during ecological field survey. This site is located 390m northwest of proposed turbine T10, outside of the red line boundary. Survey within the Proposed Development boundary site did not identify this FPO species to be present.

[14] https://species.biodiversityireland.ie/profile.php?taxonId=126552#:~:text=It%20occurs%20in%20wet%20and,Dry%20siliceous%20heath%20(HH1)
[15] https://plantatlas2020.org/atlas/2cd4p9h.ya5
[16] https://bsbi.org/wp-content/uploads/dlm_uploads/Vicia_orobus_species_account.pdf
[17] https://plantatlas2020.org/atlas/2cd4p9h.f30

Plate 9-20: Pennyroyal

9.7.2.2 Invasive / Non-native Flora

Unless specified otherwise, the term "invasive species" in this EIAR refers to Third schedule species to the European Communities (Bird and Natural Habitat) Regulations 2011 (as amended). The Regulations make it an offence to plant, disperse, allow or cause to disperse, spread, or otherwise cause to grow any of the scheduled species. Other non-native species are also considered.

The invasive/non-native species listed in Table 9-5 have been recorded within the 10 km grid squares (M25 and M35). Seven invasive or non-native plant species have been recorded in these 10km grid squares, six of which are Third Schedule species requiring control under Regulations 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011 (as amended).

No terrestrial Third Schedule invasive species were observed within the Site or at TDR accommodation works during habitat / botanical surveys. Similarly, no high or medium impact terrestrial invasive species were observed within the Site or TDR accommodation works locations. Of note however was a notice along the L6483 local road identifying the presence of invasive species (confirmed through consultation with Galway County Council Roads Department as the location of Japanese Knotweed, *Reynoutria japonica*). However, no invasive species were identified along this road. There is a possibility of below-ground rhizomes at this location.

The Third Schedule invasive species Water Fern (*Azolla filiculoides*) and Canadian Pondweed (*Elodea canadensis*) occur in the Togher River near the HDD crossing location (noting that *E. canadensi* is not listed European Union (Invasive Alien Species) Regulations 2024).

Of note also is the presence of Crayfish plague (*Aphanomyces astaci (Schikora)*) in the Corrib catchment. This contagious fungal–type disease causes widespread mortality in native crayfish species in Ireland.

Plate 9-21: Invasive Species Signage on L6483 Road

Table 9-5: Invasive Species / Non-native Species Records

Species	10km	Invasive Impact[18]	Legal Status	Recorded within the Proposed Development Boundary or TDR Accommodation Works
Giant Hogweed (*Heracleum mantegazzianum*)	M35	High	Third Schedule	No
Japanese Knotweed (*Reynoutria japonica*)	M35	High	Third Schedule	No
Rhododendron ponticum	M35	High	Third Schedule	No
Spanish Bluebell (*Hyacinthoides hispanica*)	M35	High	Third Schedule	No
Reynoutria japonica x sachalinensis = F. x bohemica	M25	High	Third Schedule	No
Broad-leaved Rush (*Juncus planifolius*)	M35	High	Third Schedule	No
Cherry Laurel (*Prunus laurocerasus*)	M35	High	None	No
Butterfly-bush (*Buddleja davidii*)	M25	Medium	None	No

[18] As per Kelly, J., O'Flynn, C., and Maguire, C. (2013). Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

Species	10km	Invasive Impact[18]	Legal Status	Recorded within the Proposed Development Boundary or TDR Accommodation Works
Sycamore (*Acer pseudoplatanus*)	M25, M35	Medium	None	No
Traveller's-joy (*Clematis vitalba*)	M25	Medium	None	No

9.7.3 Fauna in the Existing Environment

9.7.3.1 Non-Volant Mammals

9.7.3.1.1 Desktop Study

The mammal species listed in Table 9-6 below have been recorded within the 10km grid squares (M35 & M25) in which the Proposed Development Site is located. Seven protected mammal species have been recorded: namely Eurasian badger (*Meles meles*), Eurasian pygmy shrew (*Sorex minutus*), European otter (*Lutra lutra*), Irish hare (*Lepus timidus* subsp. *hibernicus*), Irish stoat (*Mustela erminea* subsp. *hibernica*), pine marten (*Martes martes*) and West European hedgehog (*Erinaceus europaeus*).

While fallow deer (*Dama dama*) have been recorded within the 10km grid squares, and are protected under the Wildlife Acts, they are also listed as invasive species in the European Communities (Birds and Habitats) Regulations 2011 (as amended).

Table 9-6: Historical Mammal Records within 10km of the main wind farm site

Species	Year of Last Record	Survey/Dataset	Protection
Eurasian Badger (*Meles meles*)	2017	Badger Setts of Ireland Database	Wildlife Acts
Eurasian Pygmy Shrew (*Sorex minutus*)	2014	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts
European Otter (*Lutra lutra*)	2010	Atlas of Mammals in Ireland 2010-2015	Annex II and IV Habitats Directive, Wildlife Acts

Species	Year of Last Record	Survey/Dataset	Protection
Fallow Deer (*Dama dama*)	2008	Deer of Ireland Database	Invasive Species - High Impact Wildlife Acts
Irish Hare (*Lepus timidus* subsp. *hibernicus*)	2023	Atlas of Mammals in Ireland 2010-2015	Annex V Habitats Directive; Wildlife Acts
Irish Stoat (*Mustela erminea* subsp. *hibernica*)	2010	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts
Pine Marten (*Martes martes*)	2021	Mammals of Ireland 2016-2025	Annex V Habitats Directive; Wildlife Acts
Red Fox (*Vulpes vulpes*)	2012	Atlas of Mammals in Ireland 2010-2015	None
West European Hedgehog (*Erinaceus europaeus*)	2022	Hedgehogs of Ireland	Wildlife Acts
Wood Mouse (*Apodemus sylvaticus*)	2011	Atlas of Mammals in Ireland 2010-2015	None
Brown Rat (*Rattus norvegicus*)	2017	Mammals of Ireland 2016-2025	Invasive Species – High Impact
European Rabbit (*Oryctolagus cuniculus*)	1990	Badger and Habitats Survey of Ireland	Invasive Species - Medium Impact

9.7.3.1.2 Terrestrial Mammals Survey Results

Generally, evidence of mammal activity in the study area was low and is attributed to the level of disturbance in the area and generally wet peatland habitats – with areas of bare soil exposed to heavy poaching and machine tracks in bog habitats. Mammal tracks were however abundant through areas of scrub (example in **Plate 9-10**) and evidence of three protected mammal species was recorded within the study area during field survey as follows:

Badger

In May 2024 a recently excavated badger sett was recorded within the Proposed Development red line boundary within scrub habitat at the Cloonbar East Wetland. The habitat comprises a small area of relatively open hawthorn-dominated scrub on hummocky terrain.

The sett is an outlier sett, likely recently established by a young badger. Signs of use (i.e. an active sett) included a small spoil heap, nearby snuffle holes and badger prints. The sett is located outside of the footprint of the Proposed Development, c. 10m from proposed infrastructure. The location of the sett is shown in Figure 1 in the Confidential Appendix to the Planning Application. Given that it is an outlier sett, it is assessed as ***Locally Important- Higher Value.***

Plate 9-22: Badger Sett at Cloonbar East Wetland

Otter

No otter resting or breeding sites were recorded within the Proposed Development Site during dedicated otter surveys carried out by Fehily Timoney, which extended 200m upstream and downstream of locations watercourse crossings and where infrastructure was within 150m of any drain or watercourse. Neither were any otter resting or breeding sites recorded during the aquatic surveys of the watercourses in the catchment as conducted by Flynn Furney. However, signs of otter (slides, spraints) were observed on the Togher River and the Black (Shrule) river, and there are prominent mammal paths parallelling the river near T7 which are likely attributable to otter.

The majority of the drainage ditches within the Proposed Development site are small and are thus not suitable for otter given their small size and highly modified channels of low fisheries value, however it is possible that otter utilise some of the larger drains for foraging and commuting.

The Togher and Black (Shrule) rivers and the larger artificial drainage channels within and draining the site were assessed as providing suitable commuting and foraging habitat for otter.

Hare

A hare dropping was observed within the scrub / bog habitat within the red line boundary at Cloonbar Bog. However, no breeding or resting places for this species was observed during field survey.

Plate 9-23: Hare dropping

Other Mammals

Signs of fox and rabbit were observed throughout the Proposed Development lands. These are not listed as protected species.

Other mammal species previously recorded in the study area but not observed during surveys may also occur; Irish stoat, pygmy shrew, hedgehog and pine marten. The edge of the forestry and scrub habitats, and adjacent field edges are suitable for Irish stoat, utilising habitat edges to hunt. Hedgehog if present is likely to use the same habitats. Pygmy shrew could occur where sufficient vegetated ground cover is available. The conifer plantation at the west of the Site is suitable for pine marten, however they are less likely to be present in the forestry near R633.

9.7.3.2 Bats

9.7.3.2.1 Desktop

BCI records indicate 11 known roost locations within 10km of grid references M 31891 53567 and M 34427 55042, none of which are located within the proposed development. The closest previously documented bat roost is a brown long-eared, soprano pipistrelle, whiskered bat, and lesser horseshoe bat roost located c. 5 km from the red line boundary. The BCI data identifies eight bat species recorded within the 10 km search radius of grid reference including common pipistrelle *Pipistrellus pipistrellus sensu stricto*, soprano pipistrelle, Leisler's bat *Nyctalus leisleri*, brown long-eared bat *Plecotus auritus*, Daubenton's bat *Myotis daubentonii*, Natterer's bat *Myotis nattereri*, whiskered bat *Myotis mystacinus* and lesser horseshoe bat *Rhinolophus hipposideros*. Historical records from the NBDC are shown in the table below.

Table 9-7: Historical Records of Bat Species near the Study Area (NBDC)

Species	Survey	Conservation Status	10km Square	Year last recorded
Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	National Lesser Horseshoe Bat Database	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2003
Leisler's bat (*Nyctalus leisleri*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2021
Pipistrelle (*Pipistrellus pipistrellus sensu lato*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2021
Brown Long-eared Bat (*Plecotus auritus*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2018
Common Pipistrelle (*Pipistrellus pipistrellus sensu stricto*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2021
Daubenton's Bat (*Myotis daubentonii*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2018
Soprano Pipistrelle (*Pipistrellus pygmaeus*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25, M35	2021
Whiskered Bat (*Myotis mystacinus*)	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	M25	2018

Bat Landscapes

Based on Lundy et al. (2011), the overall suitability for the two 5x5 km squares encompassing the Proposed Development were scored as having moderate (a portion of the eastern section of the site) and moderate/high (the western section of the site and the other half of the eastern section of the site) habitat suitability for all bat species combined.

With regard to foraging and commuting bats, areas of cutover bog, heath, and grassland habitats were considered to have Low suitability for bats, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2023).

Scrub habitats, riparian areas and conifer/forestry edge habitats were assessed as having Moderate potential for commuting or foraging bats (i.e. habitat that is connected to the wider landscape that could be used by bats for foraging bats such as trees, scrub grassland or water (Collins, 2023). However, these habitats are surrounded by wide expanses of cutover bog habitat and agricultural grasslands.

9.7.3.3 Field Survey

The results of the 2020, 2021 and 2023 and 2024 bat activity and habitat suitability assessments as conducted by Woodrow Sustainable Solutions Ltd. Are presented in detail in Appendix 9.2 and are summarised hereunder.

Based on the results from all 3 years of monitoring along with ground-based assessments, the features of highest foraging and commuting suitability that are in relative proximity to turbines were identified and are shown on Image 9-9 hereunder.

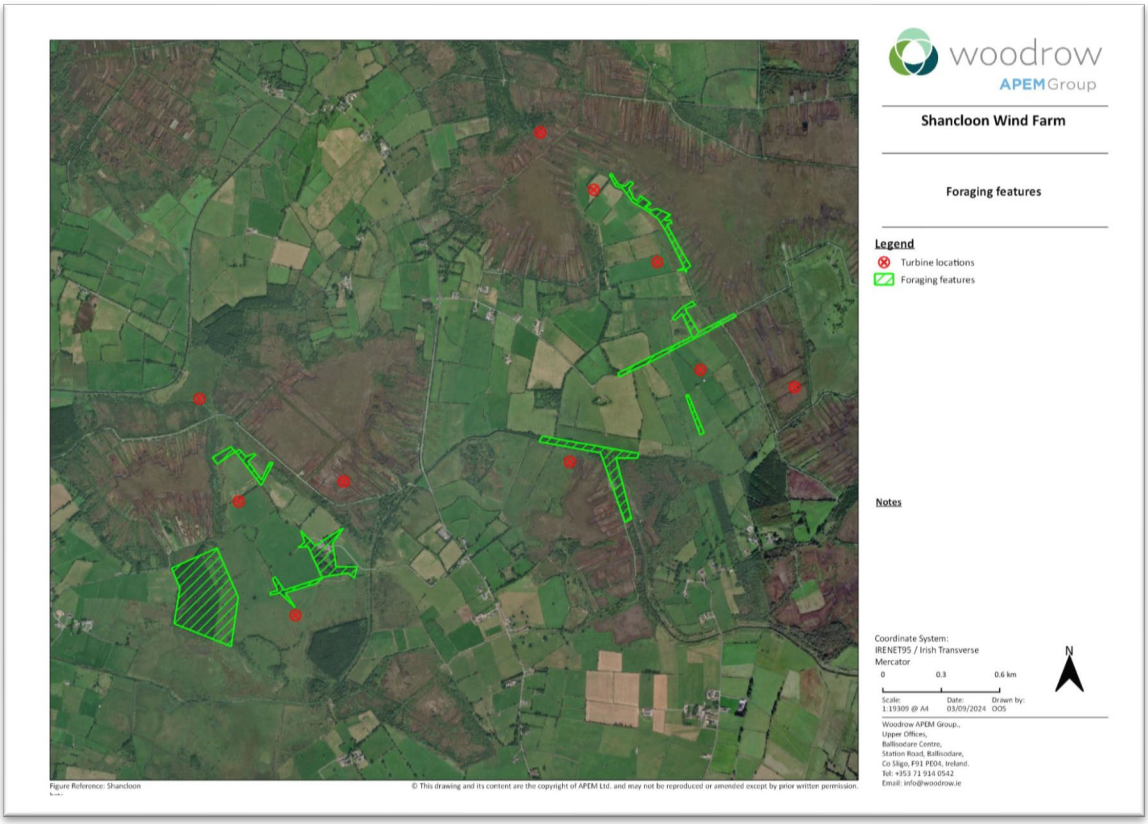


Image 9-8: Bat Habitat Features

9.7.3.3.1 Roost Assessments

NatureScot *et al*. (2021)recommends that "*features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200 m plus rotor radius of the boundary of the proposed development should be subject to further investigation*".

Turbine specification, as well as locations are regularly altered during the design phase of projects and as a precaution Woodrow conduct roost assessment surveys within 300 m of the potential build area, which far exceeds the final turbine array and red line boundary. As such the findings of the roost assessment included lands beyond the recommendations of NatureScot. The surveys were targeted to suitable roost features as determined through desk-based review of habitats, review of available bat data and the findings of walkover surveys as well as proposed turbine and infrastructure locations.

Features within the study area classed as having moderate to high suitability for bats and/or demonstrating likely occupancy were subject to dusk bat emergence and dawn re-entry surveys in September/October 2020, June/July 2021 and September 2021. Winter roost inspections were carried out on the 25-Feb-2021 (see Section 9.5.4.3 for locations of features).

Table 9-8 lists the features confirmed as summer bat roosts. None of the features were assessed as suitable for or confirmed to be winter roosts. Of these features, only F2 remains within the 300 m distance of any turbine (as through design iteration informed by bat survey results turbines were relocated away from roost features) and is located 274.4 m from T8. While building F1 is located beyond the 300m setback from turbines, it is located within the red line boundary. This property (Eircode H54 KH73), and adjacent derelict shed is under the control of the Developer and will be taken out of use as a residential property and will not be occupied for the operational period of the development should the Proposed Development be granted planning permission.

Table 9-8: Summary of roost features and associated species

Roost feature ID	Feature description	Species with confirmed roost	Roost type
F1 (53.529249, -9.025090)	Derelict house and cattle shed in the western section of the site	Brown long-eared (in house) Common pipistrelle (in house) Natterer's bat (in shed)	Hibernation; Night roost (BLE) Night roost (C. pip) Potential Hibernation/ Opportunistic (NB)
F2 (53.541603, -9.003607)	Abandoned cottage to the east of the western section of the site	Soprano pipistrelle	Potential maternity roost
F3 (53.536216, -9.004166)	Derelict house in field south of the eastern section of the site	Leisler's bat Soprano pipistrelle	Transitional (Leisler's) Satellite roost Males/Non-breeding females (S. pip)

Further roost assessments of the wider area (all lands within the red line boundary plus 100m) were carried out in on 17 Jul 2024 and 19 Aug 2024. Two potential bat roost features were identified:

- A potential bat roost (mature ash tree – see Plate 9-24) located 10m outside of the red line boundary (remote from any turbine locations) near turbine delivery accommodation works PoI16 within mixed conifer plantation was identified during survey. However, further inspection of the tree was not feasible for health and safety reasons due to the presence of a wasp nest in the ground adjacent to the tree. As such for the purpose of this EIAR the tree is assumed as a roost.
- Derelict building located 63m southeast of the Proposed Development red line boundary, near the main Site construction compound (building ITM coordinates 535808.32,755314.57). Upon inspection this building was assessed as low - negligible potential for bats generally and lacking suitable void features for lesser horseshoe bats. On inspection no crevice roosting bats were present. This building was confirmed not to be a bat roost.

Plate 9-24: Mature Ash with Potential Bat Roost Features

9.7.3.3.2 Bat Activity/Transect Survey 2020

Results of the 8 activity transects carried out in 2020 and 2021 are presented in Appendix 9.2. The survey area includes lands within the red line boundary and lands within the wider environment. Bat activity was recorded on all surveys. At least six species were recorded (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Myotis spp., brown long-eared bat). Generally, the number of bats recorded were low, with the most frequently recorded species being soprano pipistrelle, followed by lower activity levels for common pipistrelle. A summary of survey findings is set out in **Table 9-9** and discussed thereunder.

Table 9-9: Total bat passes per transect survey

Transect	1	2	3	4	5	6	7	8
Species	02-Jul-20	03-Sep-20	17-Sep-20	01-Oct-20	08-Jun-21	30-Jun-21	14-Jul-21	12-Oct-21
Common pipistrelle	2	34	50	3	2	17	5	1
Soprano pipistrelle	12	405	44	41	45	13	0	64
Pipistrelle species	0	5	0	0	0	0	0	0
Nathusius' pipistrelle	0	1	0	0	0	0	0	0
Leisler's bat	6	3	6	0	26	4	2	0
Myotis species	0	7	0	0	0	0	3	0
Brown long-eared bat	0	21	0	0	0	0	1	0
Total passes	**20**	**476**	**100**	**44**	**73**	**34**	**11**	**65**

- Transect 1 – this includes the riparian area near T5 (soprano pipistrelle and Leisler's bat recorded) and the agricultural grasslands near T3 and T4 (common pipistrelle recorded).
- Transect 2 – includes treeline and hedgerow within agricultural lands within the eastern development parcel. The highest level of activity recorded was during the transect 2, soprano pipistrelle was recorded with 405 passes at Transect 2 and Common pipistrelle with 34 passes and mainly associated with the derelict house at F3. Myotis spp. and brown long-eared bat were also recorded near the derelict house.
- Transect 3 – covered the hedgerows near T8 and the roost F2, the agricultural grasslands near T3 and T4 and the riparian area near T5. Soprano pipistrelle was recorded at the abandoned cottage, however no bats were recorded using the hedgerows to the east towards turbine T8. Common and soprano pipistrelles were recorded foraging along the turbary track adjacent to the Cloonbar East Wetland (which connects to the L-22202 road). Common and soprano pipistrelle and Leisler's bat were recorded in the western lands near T3 and T4. Common pipistrelle was recorded along the river near T5.
- Transect 4 – includes the linear scrubby habitat associated with cutover bog between T1 and T2, the lands near roost features F2 and F3 and the turbary track adjacent to the Cloonbar East Wetland. Very few bats were recorded during this transect, with only soprano pipistrelle recorded.
- Transect 5 – Includes lands near roost feature F1 and the hedgerows near T6. Leisler's bats and soprano pipistrelles were recorded foraging near the derelict house (F1). Common pipistrelle was recorded foraging along the treelines on the road near Cloonbar East Wetland.
- Transect 6 – included the Cloonbar East Wetland and hedgerows between T6 and T8, and well as roads outside of the Site. Most activity was associated with the treelines along the roads outside of the Site.

- Transect 7 – included the hedgerows and scrubby habitat around T9, T8, T6 and T11, and parts of Cloonbar East Wetland. No bats were recorded in the wetland itself, however common pipistrelles were recorded along the adjacent turbary road which adjoins the L-22202 road. Common pipistrelles were recorded along the treeline surrounding this fields where T9, T8 and T6 are proposed. Bat numbers here were generally low.
- Transect 8 – included roads in the wider environment north of T10 and the fields near T9. Between two and three soprano pipistrelles (equating to 64 passes) were recorded foraging between 5 and 20m height along the scrubby treelines which surround the agricultural lands at T9. No bats were recorded in the open above the fields.

9.7.3.4 Static Detector Surveys and bat Pass Analysis

Static detector surveys were carried out in 2020, 2021 and 2023. The surveys were in compliance with NatureScot *et al*. (2021) guidelines which requires static bat detectors to be deployed three times per season over the active seasons. In total seven species were recorded during 2021, 2022 and 2023; common pipistrelle, soprano pipistrelle, Leisler's bat, Myotis spp., brown long-eared bat, lesser horseshoe bat and Nathusius' pipistrelle.

Bat pass analysis concluded that the median activity levels on a site-wide basis showed that both common and soprano pipistrelles were recorded moderate/high activity levels, Leisler's bats were recorded as having moderate activity levels while all other species recorded showed low activity levels. Geographical and temporal context for activity levels was examined through the analysis of the data using the software R. Graphs have been created which shows the level of activity at each detector in relation to the number of bat passes per hour and in relation to activity levels relative to sunset and can be found in Appendix 9.2.

Detailed results from the static monitoring surveys for each of the three seasonal deployments showing the average medium passes per hour, and the standard deviation can be found in Appendix 9.2.

In summary the most significant results are:

- There was a general trend of increased activity in autumn, with the exception of autumn 2023, most notably in common and soprano pipistrelles.
- Common and soprano pipistrelles were recorded throughout the survey area at all deployments. Soprano pipistrelles were the species most frequently recorded. Common pipistrelles were the next most frequently recorded species.
- In 2020, common and soprano pipistrelle and Leisler's bat were most commonly recorded. This was mainly associated with static detector deployment locations on or directly adjacent to linear habitat features such as treelines, hedgerows, and plantation forestry. None of these habitat features are within the bat buffer of any turbine as per NIEA (2021), and NatureScot (2021). These guidelines prescribe that when siting wind turbines a minimum 50m buffer to all habitat features used by bats (e.g. hedgerows, tree lines) should be applied (this buffer is measured between the blade tip of the turbine and the nearest point of the habitat feature rather than between the hub and the habitat feature and as such equates to an 88m buffer).
- In 2021, common and soprano pipistrelle and Leisler's bat were most commonly recorded. Again, predominantly associated with linear features such as drains, treelines and riparian zones. There are no turbines located within the bat buffer of such habitat features. The static detector at D.04b represents the riparian habitat associated with the Togher river. Turbine T5 is located 88m from the bank of the Togher river and 60m from the riparian gorse/willow scrub which parallels the river.

- In 2023, common pipistrelles and Leisler's bats were most commonly encountered in spring, with common pipistrelles and soprano pipistrelles most common in the summer. In autumn 2023, activity was generally lower, with common pipistrelles and soprano pipistrelles most commonly recorded.
- Lesser horseshoe bat was recorded within the survey area, though only in the form of sporadic individual passes. Most calls across all years indicate low numbers commuting through the area, with no calls recorded at the same detector locations between seasons or years indicating that there is no habitat within the site that is of particular importance as part of a core foraging range or commuting corridor for lesser horseshoe bat. Only one detector showed a greater number of passes in summer 2020 at S.09, located on a hedgerow c. 180m south of T6. Calls suggest foraging or commuting.

9.7.4 Aquatic Ecology

9.7.4.1 Desktop Study

Inland Fishers Ireland surveyed eight sites within the Black (Shrule) sub-catchment in 2020. There were six fish species recorded in the Black (Shrule) sub-catchment during the 2020 survey; brown trout, salmon, European eel, lamprey sp., stone loach and three-spined stickleback.

NPWS and NBDC records include White-clawed crayfish and otter in hectad M35 while otter has also been recorded in M25. There are no known records of freshwater pearl mussel and white-clawed crayfish in the Togher or Black (Shrule) Rivers.

9.7.4.2 Field Survey

Flynn Furney Environmental Consultants conducted aquatic ecology surveys at 12 locations within the Black (Shrule) river and its tributaries which included drains and watercourses within the Site as well as within the wider catchment upstream and downstream. The detailed baseline assessment of the aquatic environment, the context of which the Proposed Development is located, is presented in Appendix 9.3 and is summarised hereunder.

Three species of fish were observed in the study area namely, three-spined stickleback (*Gasterosteus aculeatus*), brown trout (*Salmo trutta* sp.) and salmon (*Salmo salar*). The watercourses provide some suitable habitat for European eel (*Anguilla anguilla*) and lamprey spp. also.

No freshwater pearl mussels (*Margaritifera margaritifera*) were observed during the surveys. Watercourses surveyed were deemed unsuitable for this species due to historic dredging and straightening of river channels a lack stable riverbed substrates such as boulder, cobble and gravel. From this, combined with unsuitable geology and the lack of any historical records of its presence in the Black (Shrule) and Togher Rivers, it can be concluded that freshwater pearl mussel is absent from this river catchment.

No White-clawed crayfish were found at any of the invertebrate sampling sites. Much of the survey sites were deemed low-moderate potential for crayfish due to historic dredging and straightening and therefore, a lack of suitable habitat.

The majority of both the Togher River (and associated tributaries) and the Black (Shrule) River have been heavily impacted by historical dredging, deepening and widening. A kick sample for macroinvertebrates was not acquired at several sample sites due to the unsuitability of substrates and deep water. Biological analysis indicated water quality status of poor-moderate status throughout the Togher and Black (Shrule) Rivers and associated tributaries. This means that the watercourses area slightly to moderately polluted and are of unsatisfactory status.

No aquatic flora communities with the Annex I habitat '*Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*' (3260) (i.e. 'floating river vegetation') were present at any of the survey sites.

9.7.4.3 Aquatic Ecological Value

Generally, the watercourses in the catchment have been subjected to straightening and deepening due to arterial drainage. The findings of desktop assessment and field survey informed the assessed ecological importance of these aquatic habitats as set out in Table 9-9.

Table 9-10: Aquatic Ecological Value

Site	Fishery Habitat Value	Ecological Q-Value	Aquatic Ecological Value Appraisal
Site 1 – Kilshanvy stream, tributary of the Black (Shrule) river	Low fishery potential (noting however that IFI has recorded brown trout downstream)	Q3 value	Local Importance (higher value)
Site 2 – Black (Shrule) river	High fisheries potential	Q3	County Importance
Site 3 – Arterial drainage channel	Low fishery potential	Q3	Local Importance (lower value)
Site 4 – Black (Shrule) river	High fisheries potential	Q3-4	County Importance
Site 5 – Arterial drainage channel	Low fishery potential	Q3	Local Importance (lower value)
Site 6 – near source of Togher River (tributary of the Black (Shrule))	Low fishery potential	N/A	Local Importance (lower value)
Site 7 – Arterial drainage channel	Moderate fisheries potential.	Q3	Local Importance (higher value)
Site 8 – Togher River (tributary of the Black (Shrule))	Moderate-High fisheries potential	N/A	County Importance
Site 9 – Togher River (tributary of the Black (Shrule))	High fisheries potential	Q3-4	County Importance
Site 10 - Black (Shrule) river	High fisheries potential	N/A	County Importance
Site 11 - Black (Shrule) river	High fisheries potential	Q3-4	County Importance
Site 12 - Black (Shrule) river	High fisheries potential	Q3	County Importance

The Proposed Development includes three infrastructure crossings of the BLACK (SHRULE)_010 (Togher River, IE_WE_30B020200):

- Culvert crossing near the source of the river (Culvert No CV14, ITM 535417.3152, 755371.7636): the baseline aquatic environment of this this section of watercourse is represented by aquatic survey Site 6.
- New bridge crossing (ITM 533089.53, 754307.53) on Togher River the baseline aquatic environment of this this section of watercourse is represented by aquatic survey Site 8
- HDD crossing (ITM 529758.48,753338.06) on Togher River: the baseline aquatic environment of this this section of watercourse is represented by aquatic survey Site 9 and Site 10.

The Proposed Development site is drained by a network of land drains and arterial drainage channels which flow into the Togher River. The majority of the land drains in the catchment are of local importance (lower value) in terms of their aquatic ecology – see Site 5 as a representative example of land drains in the catchment and have an artificial alignment, poor structure and silty substrate which are of low fisheries value. This is due to ongoing and historical drainage and peat extraction pressures, with a high level of siltation noted in the drains. This significantly reduces the quality and presence of aquatic biodiversity. Drains and arterial drainage channels within the catchment of the Proposed Development were assessed generally as ***Local Importance (lower value),*** with only one arterial drainage channel, represented by aquatic survey Site 7, assessed as ***Local Importance (higher value)***. This artificial drainage channel will be crossed at three locations by the proposed internal access track for the Proposed Development (for access to T8, T6 and T10).

Of note is the biological water quality of all the watercourses in the catchment (≤Q3 poor status to Q3-4 moderate status), which is likely due to morphological pressures from drainage, and is contributary to the reduced water quality and habitat generally for salmonids, white-clawed crayfish, Freshwater Pearl Mussel and other aquatic species and habitats of conservation value.

Notwithstanding that the tributaries of the Togher River are of lower ecological value, the main channel of the river itself has a greater ecological value. The Togher River, while having a poor to moderate Q-value is a larger watercourse with wider and deeper channels and higher flow rates and as such is better able to buffer against impacts from arterial drainage and turbary. The river therefore provides a higher quality aquatic environment than neighbouring drains and channels as evidenced by the presence of salmonids, Otter and Kingfisher on the watercourse, and is assessed as being of ***County Importance***.

9.7.5 Amphibians and reptiles

Common Frog *Rana temporaria,* common lizard *Zootoca vivipara* and smooth newt *Lissotriton vulgaris* have been recorded within the 10 km grid squares overlapping the Site.

Common frog was recorded on several occasions throughout the Site. The species is likely to breed in wetland areas within the Proposed Development Site, and is assessed as ***Locally Important- Higher Value***

Common lizard (Zootoca vivipara) while not recorded during the site visits, is likely to occur within the Site. It is considered that suitable habitat for these species is widespread in the Proposed Development Site, and is assessed as ***Locally Important- Higher Value***.

9.7.6 Invertebrates

The endangered Wall Butterfly *Lasiommata megera*, vulnerable Marsh Fritillary *Euphydryas aurinia* (Annex II species), and vulnerable Dark Green Fritillary *Argynnis aglaja* have been recorded within 10 km grid square M35. The near threatened Small Heath *Coenonympha pamphilus* was also recorded within 10 km grid square M35. There are no other threatened or protected terrestrial invertebrates were present in records covering 10 km grid squares M25 & M35.

During field walkover survey, the following terrestrial invertebrate species were recorded:

- Small Tortoiseshell (*Aglais urticae*),
- Small White (*Pieris rapae*),
- Meadow Brown (*Maniola jurtina*)
- Peacock (*Inachis io*),
- Large White (*Pieris brassicae*)
- 7-spot Ladybird (*Coccinella septempunctata*)
- Blue-tailed Damselfly (*Ischnura elegans*)
- Heath bumble bee (*Bombus jonellus*)
- Common Darter (*Sympetrum striolatum*)
- Common Heath (*Ematurga atomaria*)

Marsh Fritillary larval web search survey confirmed the presence of the species at one location: Tonacooleen West wetland. As such, this wetland is assessed as being of ***County Importance***. However, it is located outside of the red line boundary but was included as part of the survey scope as it was considered as part of early design iterations for the development of the 110 kV substation. This wetland is located 695m west of the Proposed Development.

Two locations within the Site were assessed through habitat walkover survey as having potential to support Marsh Fritillary: the wet grassland near T2 and the patches of Devils-bit scabious along the turbary road adjacent to cutover bog at Cloonbar Bog.

The wet grassland towards T2 includes the footplant for Marsh Fritillary butterfly: Devils-bit scabious *(Succisa pratensis* in patches. However, as per the NBDC Habitat Condition Assessment for March Fritillary and having regard to Table 9-2, the grassland is classified as unsuitable for Marsh Fritillary given the low frequency of *Succisa* per m^2 (~5%) and the level of grazing at this location (allowing invasion of gorse). The habitat along the turbary road was patchy and has a high frequency of gorse scrub invasion. As such these habitats, in terms of their ability to support Marsh Fritillary are assessed as ***locally important, lower value.***

Desktop assessment determined historic records (1970 record) for Common Whorl snail (*Vertigo pygmaea*) – near threatened species, at Castlegrove East, Galway – likely associated with the lakeside habitat of Lougharlaureen. This lake is located 1.1km northeast of the Proposed Development red line boundary and there are no hydrological or ecological links between the lake and the Proposed development. Field survey did not identify any protected whorl snail species on site. Other mollusc species were recorded during the survey, none of which are listed as threatened in the Irish non-marine mollusc group: *Bathyomphalus contortus, Cepaea hortensis, Punctum (Punctum) pygmaeum, Nesovitrea (Perpolita) hammonis, Vallonia pulchella, Galba (Galba) truncatula and Radix balthica*.

9.8 Identification of Key Ecological Receptors

Table 9-10 lists all identified ecological receptors and assigns them an ecological importance in accordance with the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009). This table also provides the rationale for this determination and identifies the habitats and species that are Key Ecological Receptors (KERs). The potential effects of the Proposed Development on these ecological receptors is considered in the impact section of this report and mitigation/ measures will be incorporated into the Proposed Development where required, to avoid potential significant effects on these receptors.

Table 9-11: Ecological Receptors

Category	Feature	Evaluation	Rationale for KER	KER
European Designated Sites	Lough Corrib SAC (000297), Lough Corrib SPA (004042), Lough Carra SPA (004051) and Lough Mask SPA	Internationally Important	Special Area of Conservation (SAC) and Special Protection Areas (SPA) identified in the AA Screening which accompanies the planning application as having S-P-R connectivity with the Proposed Development.	Yes
Nationally Designated Sites	Rostaff Turlough pNHA (000385) Lough Corrib pNHA (000297)	National Importance	Nationally Designated Site identifies as having S-P-R connectivity with the Proposed Development via the potential connectivity with the BLACK (SHRULE)_030 river.	Yes
Terrestrial Habitats	Improved agricultural grassland (GA1)	Local Importance – Lower Value	Intensively managed and artificial habitat of limited biodiversity value	No
	Hedgerows (WL1), Treelines (WL2), Stone Walls (BL1) and Scrub (WS1) – including small area of Bog woodland (WN7)	Local Importance – Higher Value	These linear habitats, while having a generally low floristic composition provide valuable ecosystem services for flora and fauna species in the locality in terms of cover, refuge and connectivity.	Yes
	Wet grassland (GS4)	Local Importance – Lower Value	Wet grassland within the study area is generally species-poor, heavily grazed and typically in mosaic with improved grassland. Although the wet grassland near T2 contains small areas of seminatural habitat that are of some importance for local wildlife they are common and widespread in the local and wider landscape.	No

Category	Feature	Evaluation	Rationale for KER	KER
	Cutover bog (PB4)	Local Importance – Higher Value	While areas of bare peat within the Proposed Development Site are of low ecological importance, the more heath-like habitat associated with cutover bog consists of semi-natural habitats with a higher biodiversity value in the local context. The cutover bog habitats within the Site do not however correspond to habitat types that are listed on Annex I of the EU Habitats Directive.	Yes
	Uncut Raised bog (PB1)	Local Importance – Higher Value	There is no infrastructure proposed within the high bog habitat within the red line boundary at Cloonbar Bog. The high bog habitat within the Site is generally firm underfoot indicating drier conditions. The habitat lacked a diverse or abundant Sphagnum component. The hydrology and species composition are indicative of 'Marginal ecotope and Sub-marginal ecotope' habitats. Given the prevailing hydrological conditions of high bog within the red line boundary, as driven by the presence of the Black (Shrule) river/arterial drainage channel, there is no reasonable expectation of re-establishing vegetation with peat-forming capability within 30 years. As such it does not correlate to Annex I type habitat Degraded Raised Bog.	Yes
	Dry calcareous and neutral grassland (GS1) and Dry calcareous heath (HH2)	Local Importance – Higher Value	The main construction compound for the Proposed Development (Construction Compound 1), is located at the east of the Site within dry heath habitat (HH2) grading to dry calcareous and neutral grassland (GS1).	Yes

Category	Feature	Evaluation	Rationale for KER	KER
			These are semi-natural habitats of moderate value to biodiversity, however of note is the to encroaching scrub and large areas of *Molinia*.	
	Dry Humid-Acid grassland (GS3)	Local Importance – Lower Value	This habitat is within the Cloonbar East Wetland and is heavily grazed (horses and sheep, but also signs of hare and rabbits) with a very short sward and mosses evident in all areas. It is of limited use to pollinators and ground nesting birds. A badger sett is located within Cloonbar East Wetland, but is associated with the scrub habitat. The grassland does provide feeding opportunity for badger (snuffle holes noted) however such feeding opportunities are they are common and widespread in the local and wider landscape.	No
	Broadleaved woodland (WD1)	Local Importance – Higher Value	The broadleaved woodland on site surrounds the farmyard buildings within the western land parcel (derelict house and cattle shed adjacent to occupied farmhouse – Location F1 in Bat survey report). Mature trees which are considered to be of Local Importance, Higher value due to their ecological corridor functionality and ecosystem services for local ecological receptors.	Yes
	Conifer Plantation (WD4) and (Mixed) Conifer Woodland (WD3)	Local Importance – Lower Value	Intensively managed and artificial habitat of limited biodiversity value.	No
	Derelict Buildings which are bat roosts (BL3)	Local Importance – Higher Value	Existing farm tracks and turbary roads which are adopted into the footprint of the Proposed Development, are assessed as local importance, lower value.	Yes

Category	Feature	Evaluation	Rationale for KER	KER
			The existing OPW bridge crossing structure ref. 9664 B2 on channel C4/13 is of local importance, lower value. Derelict buildings on the Site hold bat roots and so are of Local Importance -Higher value.	
Aquatic Habitats and Associated Species	Depositing/lowland rivers (FW2)	County Importance	While the Togher and Black (Shrule) rivers are the subjects of historic dredging and straightening, the watercourses support several protected species and have a high fishery value.	Yes
	Drainage ditches (FW4)	Local Importance – Higher Value	The site of the Proposed Development is drained by numerous artificial drainage ditches. These are predominantly small man-made, slow flowing channels that are often devoid of vegetation. These drains are assigned Local Importance (Lower Value) given their artificial nature and limited biodiversity value. However, there are other artificial drains which host breeding amphibians and to have some fishery value.	Yes
	Freshwater pearl mussels (*Margaritifera margaritifera*)	Nationally Important	Togher and Black (Shrule) rivers are not suitable to support this species.	No
	White-clawed crayfish *Austropotamobius pallipes*	County Importance	While not present in the watercourses surveyed as part of the EIAR, there is suitable habitat downstream, along with historic records.	Yes
	Fisheries - European eel (*Anguilla anguilla*), brown trout (*Salmo trutta* sp.) and salmon (*Salmo salar*) and lamprey spp	County Importance	Present in the Togher and Black (Shrule) rivers to which the proposed development site will drain.	Yes
Protected Flora	Pennyroyal (*Mentha pulegium*)	National Importance	Located outside the ZoI of the Proposed Development.	No

Category	Feature	Evaluation	Rationale for KER	KER
Protected Terrestrial Mammals	Eurasian Badger (*Meles meles*)	Local Importance – Higher Value	Badger are protected under the Wildlife Act. One badger sett (outlier sett), is located outside of the footprint of the Proposed Development, c. 10m from proposed infrastructure.	Yes
	Otter (*Lutra lutra*)	Local Importance – Higher Value	Otter are protected under theEU Habitats Directive Annex II and Annex IV and Wildlife Act. While no otter resting or breeding sites were recorded within the Proposed Development Site (or 200m thereof) during dedicated otter surveys otter signs were noted on the Togher River. The population at this location is unlikely to be associated with the Lough Corrib SAC given distance and availability of suitable habitat for this species.	Yes
	Pine Marten (*Martes martes*)	Local Importance – Higher Value	No signs of Pine Marten during any field survey.	No
	Irish Hare (*Lepus timidus* subsp. *hibernicus*)	Local Importance – Higher Value	No breeding or resting placed observed and suitable supporting habitat for hare is common and widespread in the local and wider landscape.	No
	Bats	Local Importance – Higher Value	Bat species have been assessed as of Local Importance (Higher Value) as they represent a resident or regularly occurring populations assessed to be important at the local level and are listed in Annex IV of the EU Habitats Directive. The habitats within the Site have been shown to support bats.	Yes

Category	Feature	Evaluation	Rationale for KER	KER
Reptiles and Amphibians	Common lizard (Zootoca vivipara)	Local Importance – Higher Value	Common lizard (Zootoca vivipara) while not recorded during the site visits, is likely to occur within the Site. It is considered that suitable habitat for these species is widespread in the Proposed Development Site. Suitable supporting habitat is common and widespread in the local and wider landscape.	No
	smooth newt *Lissotriton vulgaris*	Local Importance – Higher Value	Not recorded during the site visits and habitat for this species does not occur within the Site.	No
	Common Frog *Rana temporaria*	Local Importance – Higher Value	No evidence of populations of frogs being significant at more than a local level was recorded.	No
Invertebrates	Marsh Fritillary *Euphydryas aurinia*	County Importance	This species is listed under Annex II of the EU Habitats Directive and there are records for the area. During the design process, areas which were identified as potential suitable habitat and confirmed as supporting marsh fritillary were avoided by the Proposed Development. No areas identified as providing suitable habitat for this species are located within the red line boundary. No larval webs were recorded during dedicated marsh fritillary surveys.	No
	Whorl snail species	County Importance	Protected whorl snail species were not recorded within the Site	No
Other protected species	The site surveys did not identify any other protected species with the potential to be significantly affected by the Proposed Development at the population level.			No

9.9 Assessment of Effects on Biodiversity

9.9.1 Do-Nothing Scenario

If the Proposed Development does not proceed, the site would continue to be managed as it has been operating, i.e. as intensively managed agricultural grasslands, turbary, forestry operations (thinning, harvesting and replanting) and arterial drainage. Agricultural practices such as intensive farming and overgrazing would continue.

In the absence of the Proposed Development, it is likely that faunal assemblages would be the same as those currently utilising the bog, grassland and forestry habitats within the study area. The currently encroaching scrub across the cutover bog would likely continue to colonise drier areas of the site and would provide potential habitat for a range of bird and mammal species. Wet grassland habitat near T2 would likely become overgrown with scrub, as such species richness would likely reduce. The Cloonbar East Wetland would likely continue to be heavily grazed and as such would be unlikely to evolve successionally. Turbary at the bogs within the study are: Cloonbar bog, Shancloon Bog and Beagh More West Bog is expected to continue under S.I. No. 40/1951 - Turbary Rights Order, 1951 (as amended). Otter would likely continue to use the streams and rivers within and surrounding the site for commuting and foraging.

9.9.2 Effects on Designated Sites

None of the elements of the Proposed Development are located within the boundaries of any Nationally or European designated sites. There will be no direct effects on any designated site as a result of the construction, operation and decommissioning the Proposed Development.

In relation to European sites, an Appropriate Assessment Screening Report and Natura Impact Statement (NIS) have been prepared to provide the competent authority with the information necessary to complete an Appropriate Assessment for the Proposed Development in compliance with Article 6(3) of the Habitats Directive.

As per the EPA Guidance (2022), "*a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European Sites contained in a Natura Impact Statement" but should "incorporate their key findings as available and appropriate*".

The Screening for Appropriate Assessment concluded that it cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the European sites, that the Proposed Development, individually or in combination with other plans and projects, would be likely to have a significant effect on European sites.

A Natura Impact Statement was therefore prepared which examined the potential pathways for adverse effect on European Sites and prescribed mitigation to ensure the pathway by which such effects may occur has been robustly blocked through the use of avoidance, appropriate design and mitigation measures. The measures ensure that the construction, operation and decommissioning of the Proposed Development does not adversely affect the integrity of any European sites. Therefore, it can be objectively concluded that the Proposed Development, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site.

There are no NHAs with S-P-R connectivity with the Proposed Development.

A potential pathway for indirect effects on the following pNHAs as a result of deterioration of water quality arising from run-off of pollutants during construction, operation and decommissioning of the Proposed Development was identified: Rostaff Turlough pNHA (000385) and Lough Corrib pNHA (000297). Note measures prescribed in the NIS to prevent adverse effects on the Lough Corrib SAC and Lough Corrib SPA equally will ensure no significant effects on the Lough Corrib pNAH (000297).

A range of best practice pollution prevention measures are embedded into the wind farm design as described in Chapter 3 – Development Description and Chapter 12 - Hydrology of this EIAR and in the CEMP included as Appendix 2.1 to this EIAR, to ensure that there is no potential for effects on water quality within and downstream of the Proposed Development.

9.9.3 Effects During Construction Phase

9.9.3.1 Effects on Habitats and Flora

Potential effects on habitats and flora include:

- Long-term direct loss of habitat within the Proposed Development footprint, noting that the consent application is seeking an operational period of 30 years,
- temporary to short-term deterioration in habitat adjacent to works areas due to disturbance from vehicle movements, runoff and precipitation of dust from works areas, drawdown of groundwater table due to dewatering of excavations,
- temporary to short-term deterioration of aquatic habitat quality due runoff from construction areas.

The Proposed Development will result in the long-term loss of a number of habitats of Local importance (higher value) within the footprint of the Proposed Development, the following of which are identified as KERs in Table 9-10: Hedgerows (WL1), Treelines (WL2), Stone Walls (BL1) and Scrub (WS1) – including small area of Bog woodland (WN7), Cutover bog (PB4), Uncut Raised bog (PB1), Dry calcareous and neutral grassland (GS1) and Dry calcareous heath (HH2), Broadleaved woodland (WD1), Buildings and artificial surfaces (BL3) (whereby identified as bat roost), and Drainage ditches (FW4).

There is potential also for the temporary deterioration of aquatic habitats of watercourses which drain the Proposed Development lands due to run-off of pollutants during the construction of the Proposed Development. The Black (Shrule) river and the Togher River are identified as depositing/lowland rivers (FW2) of County Importance.

Table 9-12 provides details of the extent of the recorded terrestrial habitats within the development boundary and the extent of the habitat that will be lost to facilitate the Proposed Development.

Table 9-12: Habitats Occurring Within the Proposed Development Boundary

Habitat Type	Selected as a KER	Area within the Proposed Development Boundary (m or m^2)	Area of Habitat that will be Lost long term (m or m^2)
Improved agricultural grassland (GA1)	No	849,074.42 m2	99,174.78 m2
Hedgerows (WL1), Treelines (WL2), Stone Walls (BL1)	Yes	5,682 m	2,032 m
Scrub (WS1) and Bog woodland (WN7)	Yes	128,618.50 m2	71,112.20 m2
Wet grassland (GS4)	No	56,015.90 m2	4,743.68 m2
Cutover bog (PB4)	Yes	195,394.89 m2	32,403.71 m2
Uncut Raised bog (PB1)	Yes	28,291.40 m2	304.89 m2
Dry calcareous and neutral grassland (GS1) and Dry heath (HH2)	Yes	125,380.80 m2	46,077.22 m2
Dry Humid-Acid grassland (GS3)	No	46,159.04 m2	5,703.42 m2
Broadleaved Woodland (WD1)	Yes	16,856.85 m2	168 m2
Conifer Plantation (WD4) and (Mixed) Conifer Woodland (WD3)	No	6,742.25 m2	5,432.74 m2
Buildings and other artificial surfaces (BL3)	Yes	45,238.32 m2	143 m2

The potential effects on habitats which are KERs as a result of the Proposed Development are discussed in detail in the sections below.

Table 9-13: Assessment of Effects on Hedgerows (WL1), Treelines (WL2), Stone Walls (BL1)

Description of Effect	Assessment of Significance	Is Mitigation Required
Generally, the footprint and layout of the Proposed Development has been designed to utilize existing gaps in treelines and hedgerows so as to reduce the amount of linear habitat removal required for the construction and operation of the wind farm. However, 2,032 m of hedgerow and treeline will be removed within the footprint of the Proposed Development. Removal of this combined length of hedgerow/treeline is required within the footprint of the works but also to achieve the required buffer distance to the canopy of the nearest habitat feature in order to deter bats from encroaching into the area of the turbines (as required by NIEA (2021). At T3 170m of gappy hedgerow comprising hawthorn with lower levels of gorse and intermittent ash and bramble will be removed. This habitat is of Local Importance – Higher Value. At T4, 60m of treeline of Local Importance – Higher Value will be removed to accommodate the bat buffer. This treeline comprises ash and beech with hawthorn understory, with occasional gorse, holly, ivy and bramble. Hedgerows at T6 and T8 are heavily managed and cut back. Cumulatively, the removal of hedgerow at these turbines equates to the loss of 806m of hedgerow of low ecological value. One mature beech tree is located just at the edge of the bat buffer associated with T6 (location F7 in bat roost assessment). This tree was assessed as having low roost potential and field survey did not confirm any roost at this location. Notwithstanding, it will not be necessary to remove this tree as part of the Proposed Development. At T9, 279m of mature hawthorn hedgerow with intermittent ash trees will be removed. This hedgerows grades into gappy gorse scrub to the west. The hedgerow is of local importance (higher value) given its intact nature and well-established understory.	Removal of hedgerow and treeline will constitute a long term, but reversible negative effect on the habitat within the Site. This equates to **a slight long-term effec**t given the majority of hedgerow and treeline within the site is species poor and gappy and provide only a low level of linear connectivity to the wider landscape. However, where areas of more established/mature treeline and hedgerow (i.e. at T4 and T9) are to be removed, this would constitute a **significant long-term effect** on a local scale.	Yes, to compensate for the removal of linear habitat and to provide alternative habitat connectivity for mammals and bats.

Description of Effect	Assessment of Significance	Is Mitigation Required
Access road to T8 will necessitate the removal of one mature ash with evidence of ash dieback. Assessed as low suitability for bats given the intensively managed nature of surrounding hedgerows and the absence of roost features in the tree.		

Table 9-14: Assessment of Effects on Scrub (WS1) and Bog woodland (WN7)

Description of Effect	Assessment of Significance	Is Mitigation Required
Much of the proposed development is located within marginal scrubby cutover bog and agricultural grassland habitat and as such will necessitate the removal of 71,112.20 m^2 of scrub habitat (predominantly comprising gorse and willow) This habitat will be removed from within the footprint of the works and also from within bat buffers associated with the turbines. A small area of bog woodland (c. 3,462.75 m^2 in area) will also be removed from within the footprint of T1. This habitat does not equate to Annex I bog woodland as it is on cutover. One location of note is the riparian area of the Togher River near T5 which will require scrub removal in order to accommodate the bat buffer. The scrub habitat at this location is gappy comprising gorse and willow. The habitat on the opposite (northern) bank of the river is intact treeline and provides a much more suitable commuting corridor for bats. Notwithstanding, a corridor of 5m riparian scrub will be retained on the southern bank beyond the bat buffer for T5.	The loss of scrub habitat within the landscape is not **a slight long-term effect** as it covers a very small percentage of the overall scrub habitat within the wider landscape.	No, no significant effects are anticipated as a result of the removal of these habitats.

Table 9-15: Assessment of Effects on Uncut Raised Bog (PB1)

Description of Effect	Assessment of Significance	Is Mitigation Required
The Proposed Development has been specifically designed to avoid areas of remnant uncut raised bog where possible. The construction of the floated access road to T11 will be along the periphery of Cloonbar Bog, within scrub habitat. The habitat within the infrastructure footprint is scrub and is of local importance (higher value). The adjacent habitat comprises uncut raised bog (which does not correlate to Annex I type habitat) which is heavily drained due to the proximity of the Black (Shrule) river and land drains. This habitat is assessed as Local Importance – Higher Value. A sheet pile construction technique will be used at this location to ensure ground stability for the proposed floated road. As such a construction platform (imported stone aggregate) will be required that will likely have a footprint beyond that of the proposed road and will therefore encroach into the uncut raised bog within the red line boundary. There will also be temporary loss of this habitat. This area will be reinstated following completion of construction works and excavated turves of vegetation replaced.	Raised bog is a groundwater dependent terrestrial ecosystem (GWDTE). Excavation of vegetation and peat during the construction of the floated road in Cloonbar Bog will result in permanent loss of this habitat and has the potential to cause localised disruption and interruption to groundwater flow thereby causing an alteration/change in the quality or quantity of groundwater feeding the GWDTE. Additionally, there is potential for temporary works (piling platform) associated with the sheet piled construction for the floated road to result in peat compaction, which will increase water losses locally from the peat and result in further drying out and as such associated habitat change. However, given the existing hydrological pressures (Black (Shrule) river to the south and a deep drainage ditch to the north of the works area) and the already dry conditions of the peat at this location, this would be a **moderate permanent effect** i.e. the drying out of peat at this location is ongoing and is consistent with existing and emerging baseline trends. The infrastructure is confined to heavily modified and drained peatland vegetated with dense scrub. It is also buffered from the larger uncut and undrained areas of raised bog by an existing land drain. No significant drainage related effects on uncut raised bog habitat is anticipated as a result of the Proposed Development. The permanent loss of this degraded peat habitat at the location of the access track is a **moderate permanent effect.**	No. The Proposed Development has been deliberately designed to minimise the potential for effects on uncut raised bog habitat. The intact raised bog that might be affected is of poor integrity given drainage pressures. As such, the construction stage impact of soil compaction and loss of scrubby habitat would not change the already degraded nature of this habitat beyond the existing trend of dessication. The construction activities will not encroach into areas of higher value intact raised bog given that these are outside of the Proposed Development red line boundary. Notwithstanding the above, a Biodiversity Enhancement and Management Plan has been prepared for the Proposed Development which includes for drain-blocking peat reprofiling at the location of cutover bog near T11 and immediately adjacent to the facebank at Cloonbar Bog. Peat excavated from within the Site will be transported here and reprofiled. The peat will be used to block the existing drain along the face bank of Cloonbar Bog and will be built up to a similar level as the raised bog so as to act as buffer to the drawdown of water levels at the adjacent raised bog, with the objective of rewetting the intact peat which has been degraded by artificial drainage and turbary. The Biodiversity Enhancement and Management Plan that is provided as Appendix 9.1 to this EIAR and is mapped in Figure 9.4

Description of Effect	Assessment of Significance	Is Mitigation Required
	Of note, is the potential for sheet piling to break the hydrological connectivity between the Black (Shrule) river and the bog at this location. That is, the piling could be allowed to act as a barrier to the artificial draw down of peat soil moisture content as created by the artificially deepened and channelized Black (Shrule) River. Potentially providing an opportunity for degraded intact bog habitat to be rewetted. This would be a **significant permanent positive effect** (given that sheet piles are proposed to be left in situ post decommissioning). Alternatively, the piles can be designed so as to allow the continuation of the existing hydrological regime at this location on the bog.	

Table 9-16: Assessment of Effects on Cutover Bog (PB4)

Description of Effect	Assessment of Significance	Is Mitigation Required
The construction of the proposed windfarm and associated infrastructure will result in the direct loss of 32,403.71 m2 of cutover bog. This is predominantly in relation to the excavations required for turbine foundations and hard standings, with access roads tending to be located within adjacent agricultural grasslands. Roads in areas of peat will be floated and as such much of the peat will remain in situ with the exception of a small depth taken as part of vegetation removal within the road footprint.	The cutover habitats within the Site are highly modified from their original state (i.e. previously enact raised bog) and are of Local Importance (Higher Value). The scrub, woodland and heath habitats that have colonised these areas of cutover do not correlate to Annex I type habitats. The reduction in the overall area of cutover bog habitat is a permanent slight negative effect at the local scale. The cutover habitats within the Site are extensively drained.	No, the loss of cutover bog habitat is not a significant effect as it covers a very small percentage of the overall habitat within the wider landscape.

Description of Effect	Assessment of Significance	Is Mitigation Required
Notwithstanding, the loss of cutover bog habitat within the footprint of the works will be a direct, permanent effects as it is proposed that all the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for agriculture access.	No significant drainage related impacts on are anticipated as a result of the Proposed Development, having regard to the drainage design for the development.	

Table 9-17: Assessment of Effects on Dry calcareous and neutral grassland (GS1) and Dry calcareous heath (HH2)

Description of Effect	Assessment of Significance	Is Mitigation Required
The main construction compound for the Proposed Development (Construction Compound 1), peat storage area, and access to the Site is located at the east of the Site within dry heath habitat (HH2) grading to dry calcareous and neutral grassland (GS1). This grassland and heath habitats do not conform to the Annex I type habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) or Dry Heath Annex I habitat type respectively. The access road will remain in situ post decommissioning of the Proposed Development and as such will result in a permanent irreversible loss of 5,871.42m2 of this habitat mosaic. The construction compound will be a temporary feature of the Proposed Development, and the lands will be reinstated at this location following the 24-month construction period.	The disturbance to and loss of heath/grassland mosaic is considered a moderate effect as it covers a very small percentage of the overall habitat within the wider landscape and this habitat is likely to suffer successional scrub encroachment over time, thereby reducing species diversity.	No, the effect on heath/grassland habitat is considered to be only at a small scale within the site and is considered to be moderate as it only affects a small percentage of the overall habitat type within the site and the surrounding landscape. Notwithstanding the above, a Biodiversity Enhancement and Management Plan has been prepared for the Proposed Development which includes the management of scrub encroachment within this habitat within the Site for the duration of the operation of the Proposed Development.

Description of Effect	Assessment of Significance	Is Mitigation Required
The peat storage area will be a permanent feature of the Proposed Development and it is proposed that this will be allowed to vegetate naturally. The heath/grassland mosaic is subject to significant scrub encroachment by willow and gorse and in time would likely evolve into scrub habitat, which is similarly the anticipated fate of the peat storage area and construction compound lands.		

Table 9-18: Assessment of Effects on Broadleaved Woodland (WD1)

Description of Effect	Assessment of Significance	Is Mitigation Required
The broadleaved woodland on site surrounds the farmyard buildings within the western land parcel (derelict house and cattle shed – Location F1 in Bat survey report). This habitat itself is of low ecological value in terms of the species mix, and in this regard the abundant presence of the invasive species sycamore is noted within the woodland. However, the habitat is of importance given that it surrounds a confirmed bat roost (location F1). However, the habitat will be unaffected by the Proposed Development. The access road to T4 will parallel a section of this woodland, however there will be no requirement for the removal of trees associated with this woodland (notwithstanding that sections of interconnecting treeline will be removed).	The woodland will not be affected, as such the Proposed Development will have neutral effects.	No. However, it is noted that as part of the Biodiversity Enhancement and Management Plan for the Proposed Development it is proposed to enhance habitat availability for bats at this location through mixed woodland planting.

Table 9-19: Assessment of Effects on Buildings and Artificial Surfaces (BL3)

Description of Effect	Assessment of Significance	Is Mitigation Required
With the exception of the structures discussed in relation to bats (see Section 9.9.3.5), none of the buildings or artificial surfaces within the study area were assessed as being of ecological value.	No potential for significant effects.	No.

9.9.3.2 Introduction and Spread of Invasive Species

Third Schedule invasive species Japanese Knotweed has been recorded by Galway County Council on the road verge of the L6483 local road. However, no evidence of Japanese knotweed or any other invasive species were identified along this road during field surveys which support this EIAR. Notwithstanding, it is expected that below-ground rhizomes are likely present at this location. As such there is potential for disturbance of the ground at this location and pert of turbine delivery works to result in the spread of this species.

Japanese knotweed is a highly invasive, non-native species which was originally introduced as an ornamental plant but has since spread along transport routes and rivers to outcompete floristic biodiversity by forming dense stands which suppresses growth of other species. The spread of Japanese Knotweed would be a significant short term but reversible effect.

The Third Schedule invasive species Water Fern and Canadian Pondweed occur in the Togher River. Additionally, Crayfish plague is confirmed in the Corrib catchment. The management of aquatic invasive species can be difficult due to the propensity for these species to be transported downstream. The effects of the spread of these invasive species would likely be significant and long-term, albeit reversible.

9.9.3.3 Effects on Aquatic Environments and Associated Aquatic Fauna

The potential effects on water quality during the construction phase of the Proposed Development are described in Chapter 12 – Hydrology and Water Quality of this EIAR and are described here specifically in relation to biodiversity. As such this section assesses the potential for likely significant effects on aquatic receptors including aquatic habitats (i.e. The Black (Shrule) and Togher Rivers, arterial drainage channels and land drains), salmonids, lamprey, white-clawed crayfish, European eel, aquatic invertebrates, and other aquatic species identified during the desk study and detailed survey work and likely to occur downstream of the Proposed Development.

The Black (Shrule) and Togher Rivers (Depositing/lowland rivers - FW2) have been assessed as being of County Importance, while drainage ditches and arterial drainage channels (FW4) in the study area are assessed and being of Local Importance – Higher Value.

The layout of the Proposed Development has been specifically designed to ensure that the major wind farm infrastructure (i.e. turbines, hardstands, substation, met mast and construction compounds) avoid the main watercourses within the study area, with the locations of such infrastructure achieving a minimum 50m setback from watercourses. However, the Proposed Development lands are heavily drained and there will be interaction with land drains as part of the Proposed Development. While these land drains are not themselves ecologically important habitat and do not support aquatic KERs, they do provide connectivity to the larger watercourses in the study area. As such, there is potential for degradation or loss of aquatic habitat of ecological value during the works through indirect effects resulting from water pollution. Additionally, there is potential for disturbance to aquatic fauna during in stream works as associated with the sheet piling adjacent to Cloonbar Bog, and at culvert and bridge crossings associated with internal access roads within the Site. These works will also result in the loss of riparian habitat within the footprint of the bridge/culvert and piling works. Such effects are significant long-term negative effects.

Culvert crossing near the source of the Black (Shrule) river (EIAR culvert reference: Culvert No CV14) and the sheet piled solution for the floated road through Cloonbar bog will include works on the river. At these locations the river is a narrow arterial drainage channel (OPW channel reference CH4/13/7) of low fishery potential with sluggish flows and soft, muddy substrate. River width is 2m – 3m and riparian vegetation is low growing scrub. The watercourse is subject to OPW arterial drainage and is subject to a 4-6 year cycle of drainage maintenance, with the most recent cycle having been carried out between 2020 and 2024[19]. It will be necessary to temporarily overpump the flow in the watercourse to allow the installation of the culvert. This will be carried out in accordance with Inland Fisheries Ireland (2016) guidelines. Driving a pile into the sediment with an impact hammer introduces high intensity impulsive sound waves into the water column that result in a rapid rise in pressure which can potentially cause injury in fish. However, it is noted that the construction methodology proposed for the piles is press in piles, which has a low associated noise effect. Notwithstanding, given that the aquatic habitat on this section of the Black (Shrule) River is subject to intermittent disturbance from arterial drainage maintenance and is of low fishery value, any loss of or disturbance to in-stream or riparian habitat would be of moderate effect and similarly potential for disturbance to fisheries is low i.e. a moderate long-term negative effect.

A new bridge crossing is proposed on the Togher River (ITM 533089.53, 754307.53) The Togher River has good fishery value, albeit the in-stream habitat is suitable for adult salmonids only: comprising pools with softer substrate with only low amounts of hard substrates present. The Togher River is part of the Corrib Headford arterial drainage scheme (channel CH4/13 Sect. 2) and is subject to regular (every 4 to 6 years) disturbance due to maintenance works, most recently in-stream silt and vegetation management and embankment maintenance. The river channel width at the proposed bridge crossing is 5-6m. The new bridge crossing will be 5.4m in width with an overall length of 18.5m and will require removal of riparian vegetation to allow construction. The bridge footings will be 2.5m setback landward from the riverbank and as such will retain a riparian area that will revegetate over time and will ensure suitable habitat for otter (and other mammal) passage. It will be necessary to temporarily flume the watercourse to allow the construction of the bridge. This will be carried out in accordance with best practice guidelines: SEPA (2009) guidelines and IFI (2016) guidelines. Flume pipes are constructed by installing one or more sections of pipe in the watercourse to allow uninterrupted flow of water within the watercourse and to allow the bridge crossing construction essentially under dry conditions i.e. the flume forms a physical barrier between the construction area and the watercourse. The flume pipes will be sized in accordance with expected flows and will be oversized to compensate for any modelled 1 in 100 plus climate change flood flows. The timeframe for fluming the watercourse will be 3-5 days. The flume will be left in situ for the duration of the bridge construction works (which will carried out over a 3-6 month period).

There is potential for the flume pipe, if not properly designed and installed, to result in scouring of riverbed and bank, impediment of fish passage, and damage to fishery habitat through compaction and isolation from river flow and sedimentation of the downstream watercourses through bed disturbance during installation and removal. Given the ecological value of the watercourse such impacts could have a negative effect on the value of fishery habitat and access to upstream supporting habitat (noting that generally the upstream sections of the Black (Shrule) river provide low potential spawning habitat for lamprey and salmonids as shown in IFI monitoring station 30_2343_78A_a and Site 6 in the Aquatic Report, Appendix 9.3, however the arterial drainage channel upstream of the bridge crossing, as represented by Site 7 in Appendix 9.3 does have Brown Trout and Brook Lamprey spawning potential). Such effects would constitute a significant long-term negative effect.

[19] See Natura Impact Statement for the drainage scheme:
https://assets.gov.ie/73176/4139f67ed05d48a8a6e6203410f3611d.pdf

Additionally, while the section of watercourse to be flumed will be electro-fished before fluming, there is potential for smaller lamprey ammocoetes to remain present in depositing areas containing mud and silt and as such there is potential for direct mortality of small lamprey larvae during fluming. However, given that larger ammocoetes would be removed to an alternative habitat on the river, such a loss of smaller ammocoetes would not affect the long-term population of this species. As such effects in this regard would be moderate and temporary.

The existing OPW bridge crossing structure ref. 9664 B2 is also located on arterial drainage channel CH4/13 Sect. 2 on the Togher River. This will be used to access lands in which turbines T1 to T4 will be constructed. The existing bridge width is sufficient for turbine delivery, as such it will not be necessary to extend the bridge. The existing bank will remain undisturbed and there will be no requirement for instream works. Effects on the aquatic environment will be neutral.

With the exception of arterial drainage channel CH4/13/5, all other arterial drainage channels or land drains within and downstream of the Site, are not ecologically sensitive and provide poor fisheries and aquatic faunal habitat. There is no potential for significant effects as a result of direct habitat loss for fisheries and aquatic fauna on these channels. For arterial drainage channel CH4/13/5, there will be a need to extend an existing farm access crossing (OPW ref 9675) on the channel. Characterisation of this arterial drainage channel is represented by Site 7 in the Baseline Aquatic Ecology Assessment included in Appendix 9.3. The channel width is c. 2m at the farm crossing and the existing crossing is 3m wide comprising a concrete blockwork structure. There is some scouring upstream of the crossing. The channel substrate upstream and downstream has suitable lamprey and brown trout spawning gravels. The existing structure will be removed and replaced with a piped culvert (culvert reference CV3) 5m in length. The culvert will be installed in accordance with IFI 2016 guidelines. The culvert will need to be installed under dry works conditions and as such will require overpumping of the arterial drainage channel. Such activities, if not properly mitigated have potential to cause degradation of spawning habitat, sedimentation of downstream fishery habitat, and impediment to fishery movement. Given the quality of the aquatic habitat on this arterial drainage channel in the context of the poorer fishery habitat in the channels, streams and rivers in the upper catchment of the Black (Shrule) / Togher rivers, such impact would equate to a significant short-term effect.

The HDD crossing for the 33 kV cable (ITM 529758.48,753338.06) on the Togher River will require excavation of agricultural lands. No riparian habitat will be affected, and no in-stream works are required. The lands will be reinstated post cable installation. Effects will be temporary and not significant in terms of potential for loss or damage to the aquatic and riparian environment.

There is potential for construction activities associated with the Proposed Development, including construction of turbine hardstands and access tracks, to result in the run-off of and infiltration of pollutants, including silts, hydrocarbons and cementitious material to drains and other watercourses within the Proposed Development Site. This could also result from the removal of vegetation, movement of peat or the use of concrete and other construction materials. This represents a potential indirect short-term significant effect on aquatic receptors in the form of habitat degradation as a result of water pollution during the construction phase of the Proposed Development.

9.9.3.4 Effects on Terrestrial Fauna During Construction

The Proposed Development has the potential to result in habitat loss and disturbance impacts on faunal species that were recorded on the site but were not included as KERs. Such effects are assessed as not significant given the Proposed Development will not result in a significant loss of suitable habitat for these species and no evidence of populations of these species being significant at more than a local level was recorded during desktop assessment of field survey.

As such, the potential for effects on Badger, Otter and Bats in terms of habitat loss/fragmentation and disturbance/displacement is discussed hereunder. The Proposed Development has been specifically designed to avoid, where feasible, the breeding and resting places of these protected wild animals.

9.9.3.4.1 Badger

One single entrance to an active outlier badger sett was identified on Site during field walkover survey and is located c. 10m from proposed infrastructure. As per NRA Guidelines on the Treatment of Badgers, badger sett underground tunnel systems can extend up to c. 20m from sett entrances. Therefore, while the sett entrance will not be damaged by the Proposed Development, there is potential for underground tunnels to exist below the footprint of the works. It is noted that the proposed road infrastructure at this location will be floated road, requiring only minimal site clearance / soil excavation. Notwithstanding, there is a potential for damage to badger sett (and possibly direct mortality to badger) through ground compaction above the tunnel system leading to sett collapse. While this would have a permanent slight negative effect on the badger population at a local level (given that this is only an outlier sett), mitigation is still proposed within this EIAR to avoid the potential for mortality to badger(s) associated with the sett. Given that works are proposed quite close to the badger sett it would be likely that badger would be temporarily disturbed from using the sett, which would not be significant in the context of alternative available habitat.

Sheet piling activities associated with the proposed floated road at Cloonbar Bog are located beyond the 150m zone of influence prescribed in the NRA guidelines. Similarly, the closest turbine foundation is located over 200m from the badger sett. As such disturbance effects from piling are unlikely.

While the badger activity generally in the study area was low, there is potential for badger to use the environment for foraging. As such, there is potential for injury to badgers through interaction with open excavations at turbine foundations, which would likely amount to a slight negative effect on the badger population at a local level. Notwithstanding, mitigation is proposed to prevent injury or mortality of badger during construction.

Proposed Development will not result in any fragmentation of badger habitat, as there will be no barriers to movement throughout the site as a result of the Proposed Development. The development will result in small scale reduction in available foraging habitat for badger. However, this is only slight in significance given the availability of foraging habitat in the wider environmental context.

9.9.3.5 Otter

The Proposed Development has been deliberately designed such that all major infrastructure (turbine foundations, hardstandings, substation and construction compounds) avoids the main watercourses within the Site. While here will be a requirement for instream works to facilitate the installation of a culverts these works are minor and are generally on drainage channels of low fishery value. The new bridge crossing on the Togher River will require removal of riparian vegetation to allow construction. The bridge footings will be 2.5m setback landward from the riverbank and as such will retain a riparian area that will revegetate over time and will ensure suitable habitat for mammal passage. There will be no permanent fragmentation of otter habitat.

No otter resting or breeding sites were recorded during field survey. There is no potential for direct effects on otter resting or breeding sites. However, evidence of otter usage was observed in the catchment. There is potential therefore to temporary interruption to otter commuting along the riverbanks at the locations of the culvert and bridge crossings and sheet piling works due to proximity to the watercourses at these locations, resulting in a short-term, slight negative effect.

In the absence of mitigation, the indirect effect of water pollution on otter during construction has the potential be a short-term negative significant but reversible effect.

9.9.3.6 Bats

For lesser Horseshoe Bat, the nearest SAC associated with this species, Kildun Souterrain [002320], a winter hibernaculum, is located approximately 13.5 km west of the Site. Given that the known migration range from winter hibernacula to summer roosting locations is up to 10 km, and core foraging range is 2.5 km (Collins 2023), any lesser horseshoe bats recorded within the Site are not par of the SAC population.

As per NatureScot (2021) Guidance, wind farms present three potential risks to bats during the construction stage of development:

- Loss or damage to commuting and foraging habitat
- Loss of, or damage to, roosts and
- Displacement of individuals or populations.

Loss or Damage to Commuting and Foraging Habitat

The Proposed Development will result in the loss and fragmentation of hedgerow and treeline habitats as well as scrub and conifer woodland. This will equate to a loss / degradation of commuting/foraging habitat for bats with an associated reduction in the carrying capacity of the local environment for the local bat populations.

The habitats within the study area are of low to moderate potential for commuting and foraging bats (with suitability being higher for pipistrelle bats). The Proposed Development is mainly located in cutover bog and agricultural grassland which have a lower potential to support bats i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2023). However, there are areas of the Proposed Development where the habitat suitability for bats is greater i.e. the riparian habitat associated with the Togher River, the edge habitat along the conifer forestry on the 33kV cable route and at TDR PoI 16, and the mixed broadleaf treelines/woodland surrounding bat roost location F1.

The new bridge crossing on the Togher River will be 5.4m in width with an overall length of 18.5m and will require removal of riparian vegetation to allow construction. The bridge footings will be 2.5m setback landward from the riverbank and as such will retain a riparian area that will revegetate over time and will ensure suitable habitat for bat commuting. The bridge parapet will be timber post and rail fence and as such will not be an impediment to bat passage, additionally the bridge soffit level will be c. 1m above the existing ground level and equally allowing bat passage. While there will be a short-term loss of riparian habitat, the bat species recorded along the river (common and soprano pipistrelle, Myotis spp., Brown long eared and Leisler's bat) are not particularly sensitive to short gaps in treelines / hedgerows.

Additionally, an area of scrub habitat along the Togher River will be removed as part of the bat buffer for Turbine T5. The habitat here is fragmented and gappy and of low suitability as foraging and commuting habitat, particularly in comparison to the stronger riparian treeline on the opposite bank of the river. As such the removal of riparian vegetation associated with the new bridge crossing and T5 bat buffer will equate to a slight effect.

The Proposed Development will involve the loss of only a very small percentage of the available forestry and woodland habitat within the Site and vegetative connectivity within the Site and to the wider landscape will be largely unaffected e.g. near T4, along the 33kV cable and at PoI16. The loss of such habitat is assessed as having a permanent slight effect on the bat foraging and commuting habitat at a local level.

Notwithstanding the slight effect of the Proposed Development on bat foraging and commuting landscape, the Proposed Development Design includes a Biodiversity Enhancement and Management Plan which includes additional woodland, treeline and hedgerow planting which will ensure landscape connectivity as well as foraging opportunity.

Loss or Damage Bat Roosts

The Proposed Development is predominantly located within agricultural grassland and cutover bog. No roosts were recorded within these habitats and the habitats do not provide suitable roosting habitat for bat species. A small number of mature trees and hedgerow will require removal from agricultural grasslands as part of the Proposed Development, but these have been confirmed through surveys not to be bat roosts. Additionally, a linear strip of conifer forestry will be permanently removed from within the Site to accommodate the 33kV cable. Bat surveys have confirmed no roosts at this location.

Several mature trees (referred to as feature references F9, F10, F11, F12, and 13 in the Bat Survey Report, Appendix 9.2 Vol III) are located within or in proximity to the red line boundary at TDR PoI16, where mixed conifer woodland will be removed. Excluding F13, all of the other potential tree features were assessed as having low roost potential with no roost confirmed. F13 was assessed as having moderate bat roost potential. Notwithstanding the assessment of these features, none of these trees will require felling for the purpose of the works. As such there will be neutral effects on potential bat tree roost features.

In terms of buildings or structures, the following are confirmed bat roosts:

- F1- Derelict house and cattle shed is a confirmed bat roost. This building is located 70m from the nearest works area, and a small section of treeline will be removed from near the roost to accommodate the works. The buildings will be retained as part of the Proposed Development. As such there is no potential for damage to or destruction of the roost.
- F2 - Abandoned cottage is located 274.4 m from T8. This building is located 20m from the nearest works area. The buildings will be retained as part of the Proposed Development. As such there is no potential for damage to or destruction of the roost.
- F3 - Derelict house in field, is located 34m outside of the red line boundary. The buildings will be retained as part of the Proposed Development. As such there is no potential for damage to or destruction of the roost.

Additionally, a lambing shed (F4) will be demolished to accommodate access to T6. This shed was surveyed and assessed as having negligible roost potential. As such there is no potential for damage to or destruction of any roost at this location.

The Proposed Development will have no significant effect on bat roosts.

Displacement of individuals or populations

As described above, there will be no significant loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no significant permanent displacement of individuals or populations is anticipated.

However, there are a number of confirmed bat roosts within and in proximity to the Site (F1, F2 and F3) which may potentially be disturbed during construction through noise and lighting effects. This will be a temporary significant effect, particularly whereby nearby works coincide with the non-hibernation season in which these roosts are confirmed as being occupied.

9.9.4 Potential Effects During the Operational Phase

9.9.4.1 Protected Sites

A Natura Impact Statement (NIS) has been prepared for the Proposed Development. The NIS addresses potential impacts on European Sites during the operation of the Proposed Development and concludes no potential for adverse effects on site integrity.

The potential pathway for effects on protected sites is via local hydrology. At operational stage there is no potential for runoff from the Site. The site drainage will be in place and operational, and areas of earthworks will vegetate within one season. While there may be minor leaks / spills of fuels or oils from maintenance vehicles, these will be confined to on-site infrastructure which is set back from all of the main watercourses and is serviced by the on-site drainage which will remain operation during the operation stage of the Proposed Development. No effects on protected sites are likely.

9.9.4.2 Effects on Habitats and Flora

The operation of the Proposed Development will not result in any additional land take and as such there is no potential for any significant effects on habitats of ecological value within the Site.

However, the Proposed Development has the potential to result in enhancement of the surrounding habitats through habitat enhancement measures that will be undertaken throughout the operational phase of the Proposed Development as part of the Biodiversity Enhancement and Management Plan.

There are no invasive species within the Site and as such the translocation/spread of same is unlikely.

9.9.4.3 Effects on Aquatic Environments and Associated Aquatic Fauna

The Proposed Development will result in an overall increase in the area of low permeability or non-permeable surfaces (i.e. roads, hardstandings and foundations) which has potential to result in increased surface water runoff from the Proposed Development. However, Proposed Development Design includes for the operation and maintenance of settlement ponds that will be designed to ensure the primary settling out of suspended solids from aqueous suspension before diffuse flow overland and back into natural drains down slope. The theory behind the design of the settlement ponds is the application of Stoke's Law. The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Pond design will be such that flow rates for storm events will be maintained at or below greenfield run-off rates.

There is also potential for runoff of pollutants due to accidental spillage or release of hydrocarbons from site vehicles during any routine maintenance works during the operational phase of the Proposed Development. However, such runoff will be captured in the settlement ponds and any spills can be managed through best practice measures. As such the potential for pollution of the local drains and watercourses is unlikely.

There will be no instream works activity during the operational phase of the Proposed Development and therefore no potential for loss of aquatic habitat or disturbance of aquatic species.

Significant effects on water quality are not anticipated at any geographic scale during the operation of the Proposed Development.

9.9.4.4 Effects on Terrestrial Fauna During Operation

The operation of the Proposed Development will not result in any additional habitat loss and, with the exception of the 110 kV substation site which will be surrounded by palisade fencing, will not impede the free movement of terrestrial fauna through the environment. The substation site is located within an agricultural grassland and the field boundaries will remain intact. As such ecological corridors will not be impacted as result of the operation of the substation.

Riparian corridors of the higher value watercourses within the Site are being retained as part of the Proposed Development design, either by citing the infrastructure a 50m setback from the watercourses or ensuring the new bridge crossing retains a 2.5m riparian corridor. As such ecological connectivity at a landscape level will not be impacted.

A Biodiversity Enhancement and Management Plan (Appendix 9.1) is included as part of the Proposed Development Design and includes for the creation of new woodland habitat within the Site as well as the planting of new treelines/hedgerows to enhance landscape connectivity for fauna. Also, a proposed peat storage area will be actively managed for habitat enhancement for Marsh Fritillary, while another peat storage area has been specifically selected with the aim of reducing the rate of water drawdown from the adjacent bog face bank. These measures will have an overall long term, positive significant effect on local biodiversity relative to the existing baseline scenario and the likely evolution thereof through natural changes.

9.9.4.4.1 Bats

For Lesser Horseshoe Bat, the nearest SAC associated with this species, Kildun Souterrain [002320], a winter hibernaculum, is located approximately 13.5 km west of the Site. Given that the known migration range from winter hibernacula to summer roosting locations is up to 10 km (Collins 2023), it is unlikely that any lesser horseshoe bats recorded within the Site are associated with the SAC population.

As per NatureScot (2021) Guidance, wind farms present a potential risk to bats during the operational stage through collision risk and barotrauma.[20] Many overseas turbine/bat mortality studies are at wind farms, with significantly large numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries (Bat conservation Ireland, 2012). There is currently no evidence that mortality of bats on the same scale occurs in Ireland. Notwithstanding, as part of wind farm design, turbines were specifically located a 50m plus rotor setback from all high value bat features in order to reduce the risk of collision or barotrauma for bats.

During bat activity surveys carried out between 2020 and 2023, the following species of bats were recorded: Common pipistrelle, Soprano pipistrelle, Pipistrelle species, Nathusius' pipistrelle, Leisler's bat, Myotis species, Brown long-eared bat and Lesser horseshoe bat.

According to NatureScot, 2021 the high collision risk species are Leisler's bat, Common pipistrelle, Soprano pipistrelle and Nathusius' pipistrelle. According to NatureScot guidance there is no requirement to complete an Overall Risk Assessment for low-risk species i.e. Myotis species, Brown long-eared bat and Lesser horseshoe bat, which in any case were recorded at only low numbers in the study area.

Using the NatureScot guidelines outlined in Table 9-20, the following risk assessment for the static detectors best representing the individual turbines locations in relation to each bat species recorded was completed using the following values:

- Project Size = Large (comprising turbines >100m in height)
- Habitat Risk = Moderate

(20) *It should also be noted that although mortality of bats at wind farms include barotrauma (that results from exposure to the pressure variations caused by rotating turbine blades) as first presented by Baerwald et al. (2008) a number of studies since, including NREL (2012). *Reducing Bat Fatalities From Interactions with Operating Wind Turbines* and Lawson et al. (2020). *An investigation into the potential for wind turbines to cause barotrauma in bats*, dispute the hypothesis that barotrauma is responsible for a significant number of wind-turbine-related bat fatalities. However, the more recent studies have been undertaken on several mammal species (representative of bat species) as there is no data available on pressure change levels that cause barotrauma in bats.

Table 9-20: Risk Assessment Extracted from NatureScot (2021)

Site Risk Level (1-5)*		Project Size		
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	Description
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

The Impact assessment is determined by multiplying the Site Risk Assessment value (4 as outlined above) by the bat activity values (which are taken from the Tables 3.15 to 3.17 in the Bat Report in Appendix 9.2).

The bat activity is firstly converted to the percentile score as shown in Table 9-20. The bat activity levels for each of the High Risk (Leisler's, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle) species were converted to the percentile score and an average taken over the survey periods.

The Impact Assessment is then carried out for the individual turbines using the overall site assessment value (3) and compared to the Risk Assessment Matrix (Table 9-20) in order to determine the level of overall risk to the population. It should be noted that the Impact Assessment is based on the median values to determine overall risk to population.

Table 9-21: Risk Assessment Matrix

	Bat activity percentile					
Site Risk	Nil (0)	Low (1)	Low – Moderate (2)	Moderate (3)	Moderate – High (4)	High (5)
Low (1)	0	1	2	3	4	5
Moderate (3)	0	3	6	9	12	15
High (5)	0	5	10	15	20	25

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

Low Overall Risk (0-4)	Medium Overall Risk (5-14)	High Overall Risk (15-25)

On the basis of the above methodology, the risk assessments for each detector location over each survey year was determined and are presented in Table 3.21 to Table 3.23 of Appendix 9.2 of this EIAR. The average Bat Risk Assessment for each turbine location was estimated and it was determined that site bat risk is low to moderate (see Table 9-22) (noting no to low risk for Nathusius' pipistrelle).

Table 9-22: Average risk level for proposed turbine location

Proposed Turbine	Detector Location Accurate (A)	Detector Location Representative (R)	Average Risk Level			
			NYCLEI	PIPPIP	PIPPYG	PIPNAT
1		S.01 D.06 D.08 D.19	Medium	Medium	Low	N/A
2	D.14		Medium	Medium	Low	Low
3	D.15		Low	Low	Medium	N/A
		S.08 D.03	Medium	Medium	Medium	N/A
4	D.01a / b		Low	Medium	Medium	N/A
		S.02 S.12	Medium	Medium	Medium	N/A
5	D.16		Medium	Medium	Medium	N/A
		S.01 D.06 D.08 D.19	Medium	Medium	Low	N/A
6	D.17		Low	Medium		N/A
		S.02a S.12	Medium	Medium	Medium	N/A
7	D.06		Medium	Low	Low	N/A
		S.01 D.06 D.08	Medium	Low	Low	N/A
8		S.02 S.12 D.01 D.17	Medium	Medium	Medium	N/A
9		S.02 S.12 D.01 D.17	Medium	Medium	Medium	N/A
10		S.01 D.06 D.08 D.19	Medium	Medium	Low	N/A
11	D.19		Medium	Medium	Low	N/A
12		S.01 D.06 D.08	Medium	Low	Low	N/A

Site-level collision risk for high collision risk bat species (following NatureScot 2021 guidance) was generally Low to Medium, noting that this takes into account static detectors that were specifically placed away from the turbine locations and along high-quality bat foraging and commuting habitat. Overall bat activity levels were typical of the nature of the site, which is predominantly agricultural and peatland habitats with low scrubby vegetation and managed hedgerows. Greater levels of activity were recorded in proximity to the confirmed bat roost sites.

Analysis of static detector data, supported by transect and roost surveys, demonstrates that bat activity within the study area is strongly associated with linear features such as treelines, hedgerows, and riparian corridors. The strategic turbine placement aligns closely with the precautionary principles outlined in NatureScot et al. (2021), which recommend maintaining minimum buffers from high-use linear features and siting turbines in low-activity habitats. It is notable also that the majority of activity per species was detected at wind speeds of less than 5.5m/s for all seasons. i.e. bat passes are concentrated in the low wind range, suggesting that any activity occurring near turbines is unlikely to coincide with operational conditions.

In relation to the potential for indirect effects on bat roosts through collision and barotrauma, the abandoned cottage (F2) is located 274.4 m from T8, roost at F1 is located 366m from the nearest turbine T4 and F3 is located 350m to the nearest turbine F5. All are located outside of the 200m plus rotor buffer (as per NIEA, 2021 and NatureScot, 2021). As such effects on the roosts are unlikely.

As indicated in Richardson et al (2021) common pipistrelle bats may be attracted to wind turbines. The study showed common pipistrelle activity was 37% higher at turbines than at control locations. Soprano pipistrelle shows no increase in activity between the turbine and control locations. The study further discussed, the observed higher levels of activity could be because there are more bats around turbines, or because animals spend more time in these locations relative to controls, even if the number of individual common pipistrelles remains the same. We cannot distinguish between these possibilities using acoustic data. However, either way, higher levels of activity around turbines is likely to increase fatality risks and help to explain why fatality rates are often not predicted by acoustic surveys for common pipistrelle activity conducted prior to facility construction.

It has been suggested that lights for civil aviation above the nacelle may also attract bats; a 2014 study by Bennett and Hale (2014) however found there was no increased attraction of bats when red flashing lights were used versus no lighting, indicating the mode and colour of lighting are key factors in whether bats are attracted to aviation lighting. It has been observed that intense lighting can attract insects, which in turn may attract foraging bats. Light sources with an ultraviolet component or a high blue spectral content have been observed to be more attractive to night-flying insects (Bat Conservation Trust/ILP, 2018), and studies have shown that Leisler's and pipistrelle bats can congregate around white mercury streetlights (Rydell J et al 1993, Blake et al. 1994) and white metal halide lamps (Stone et al 2015b) feeding on the insects drawn by the light. This can affect the manner in which bats use the local landscape and can draw bats towards the turbines, thereby potentially resulting in population impacts, which would constitute a significant long-term negative effect.

As such, regarding the potential for aviation obstruction lighting to attract bats, the use of red light over white light is preferable, as is flashing over steady light. Therefore, operational stage mitigation in this area is required to ensure the type of aviation lighting selected does not increase the attractiveness of turbine locations to bats.

9.9.5 Potential Effects During the Decommissioning

Decommissioning is described in Chapter 2 Development Description. Following the end of their service life, the Proposed Development will be decommissioned fully.

It is proposed that turbine foundations and hardstand areas will be left in place and covered with local soil/topsoil and allowed to revegetate at the decommissioning stage. Internal access tracks will be left in place also and used as agricultural tracks (this includes the sheet piled floated road along the edge of Cloonbar Bog). The 33kV underground cables will be removed and the ducting left in place. The 110kV grid connection, ducting and substation will be left in situ as part of the national grid.

It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. Therefore, no impacts associated with these elements of the proposed development infrastructure are likely to occur during decommissioning stage. Hence no mitigation measures are required for these elements.

There will be no additional habitat loss associated with the decommissioning of the Proposed Development given that all decommissioning operations can be carried out from the access tracks. Soil used to cover the hardstandings will be the original earthworks surrounding the hardstandings or will be taken from the peat storage area and as such there will be no requirement for importation of soil. Of note is that the peat storage area at T11 will not be used as a source of material to cover the hardstands nor will the peat from the marsh fritillary enhancement area identified in the BEMP.

The decommissioning works will be at a much smaller scale than that of the construction stage and as such potential for significant effects is much reduced. However, mitigation to prevent significant impacts on terrestrial fauna and on water quality and associated aquatic fauna will be applicable to the decommissioning phase given that the potential impacts as the same as those at construction stage: sediment runoff, disturbance to species, risk of spills (noting however that bridges and culverts will remain in situ and as such no in-stream works are required).

9.10 Mitigation Measures for Biodiversity

9.10.1 Protected Areas

None of the elements of the Proposed Development are located within the boundaries of any Nationally or European designated sites. There will be no direct effects on any designated site as a result of the Proposed Development.

In relation to European sites, an Appropriate Assessment Screening Report and Natura Impact Statement (NIS) have been prepared to provide the competent authority with the information necessary to complete an Appropriate Assessment for the Proposed Development in compliance with Article 6(3) of the Habitats Directive. The mitigation measures set out in the NIS will be adopted and should be read in conjunction with this Chapter. The potential pathways for effects that are mitigated in the NIS (insofar as they relate to biodiversity as opposed to ornithology, which is addressed under separate chapter) are as a result of potential for deterioration of water quality arising from run-off of pollutants. As such the construction phase mitigation for hydrology and water quality will follow that outlined in Chapter 12 – Hydrology and Water Quality.

9.10.2 Mitigation By Avoidance

Mitigation is prescribed in accordance with the Environmental Protection Agency EPA guidance on EIAR (EPA,2022) which requires mitigation by avoidance as a first approach. Where this is not feasible, measures to prevent impacts from giving rise to significant effects should be adopted (e.g. design of bunded storage). Where impacts cannot be avoided e.g. generation of noise, mitigation by reduction of impact is required to limit the exposure of the receptor to an acceptable level (often achieved by interrupting the pathway between the source and receptor).

As part of the design evolution for the Proposed Development the Design Team and the Planning and Environmental Teams worked closely together to ensure that constraints were considered from the outset, in order to formulate a development which would avoid, by design and at source, potential for significant effects. In this regard, the following measures are incorporated into the Proposed Development design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind turbine has been kept to the minimum necessary for the maximum turbine range proposed, including all site clearance works to minimise land take of habitats and flora.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams. Buffers of a minimum of 50m from natural watercourses have been maintained, excepting where crossing points occur.
- Clear-span bridge design has been selected to avoid instream works on the Togher River, and to minimise disturbance of banks and associated indirect effects such as siltation.
- Directional drilling is the proposed installation method where the grid connection crosses the Togher River. As such, in-stream works will not be required and the potential for contaminant or pollutant input will be greatly reduced as a result.
- A 50m buffer was ensured between wind turbines and features of high bat commuting and foraging potential within the study area (as identified by Woodrow through field survey).
- A detailed habitat constraints assessment was carried out to identify sensitive habitat in the study area. Turbines were specifically located within agricultural and cutover bog habitat of lower biodiversity.
- Where the internal access track traverses Cloonbar Bog the alignment chosen was purposely selected as it is already significantly degraded due to hydrological influences from neighbouring land drainage.
- Intensive site investigations were undertaken to ascertain a detailed understanding of the peat profile and karst risk within the Site and to inform the optimum wind farm design by avoiding peat risk areas. Karst risk on the Site was confirmed as low.
- The footprint of the Proposed Development has been kept to the minimum necessary, including the use of layout design methods including existing roads and stream crossings to minimise excavation works and loss of habitat.

Mitigation measures are described below which will avoid, reduce and where possible, offset likely significant effects arising in relation to biodiversity from the construction, operation and decommissioning of the Proposed Development. These mitigation measures shall be implemented in full.

9.10.3 Biodiversity Enhancement

A Biodiversity Enhancement and Management Plan has been prepared for the Proposed Development which includes measures for the enhancement of the local environment. The BEMP is provided as Appendix 9.1 this EIAR and is mapped in Figure 9.4. The BEMP will provide a biodiversity net gain to the Proposed Development.

Section 9.9.3.1 of this Chapter identifies that the removal of treelines and hedgerows as part of the proposed Development constitutes a significant effect in terms of loss of habitat connectivity for mammals and bats. As such mitigation is outlined hereunder in terms of hedgerow and treeline reinstatement. No other significant effects on habitats or flora were identified as likely as part of the Proposed Development. Notwithstanding, the BEMP includes the following habitat enhancement measures within the Proposed Development boundary:

- drain-blocking peat reprofiling at the location of cutover bog near T11 and immediately adjacent to the facebank at Cloonbar Bog
- management of scrub encroachment within the dry calcareous and neutral grassland (GS1) and dry calcareous heath (HH2) near the main construction compound for the Site,
- enhance habitat availability for bats within the landscape through mixed woodland planting,
- translocation of wet grassland turves from lands at T2 and management of same for Marsh Fritillary,
- Installation of bat bricks on the new bridge crossing,
- Creation of two woodland corridors adjacent to existing conifer forestry plots located adjacent to (outside) of the red line boundary so as to ensure future commuting and foraging edge habitat for bats following the future felling of these conifer plantations.

Further details on these measures can be found in the BEMP in Appendix 9.1, and (with the exception of hedge/treeline replanting) are noted not to be mitigation measures required to reduce any significant effects identified in this EIAR.

9.10.4 Mitigation Measures at Construction Stage

Construction is expected to cause significant effects on local ecological receptors, as outlined in Section 9.9. The mitigation measures described below will reduce these effects such that significant effects will not occur. Mitigation is prescribed having regard to the following guidelines:

- Bennun et al. (2021). Mitigating biodiversity impacts associated with solar and wind energy development. Guidelines for project developers.
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (2008)
- The Inland Fisheries Ireland publication 'Guidelines on protection of fisheries during construction works in and adjacent to waters' (IFI, 2016).
- (SEPA) (2009) Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes (NRA, 2006b);
- Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. (Marnell et. al, 2022)
- Guidelines For the Treatment of Otters Prior to the Construction of National Road Schemes and NRA (2009)
- Guidelines For the Treatment Of Badgers Prior to The Construction of National Road Schemes
- NRA (2010) Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads. National Roads Authority, Dublin.
- Irish Water IW-AMP-SOP-009 Information and Guidance Document on Japanese knotweed
- Best Practice Management Guidelines for Japanese Knotweed (Invasive Species Ireland, 2015)

9.10.4.1 Mitigation by Management - Project Ecologist/Ecological Clerk of Works (ECoW)

A Project Ecologist/Ecological Clerk of Works (ECoW) will be employed for the duration of the construction phase to ensure that all the mitigation measures set out in the EIAR, NIS and any conditions of consent pertaining to biodiversity are employed. The Project Ecologist/ECoW will advise on environmental effects and communicate with the project owner and contractor to ensure the required actions to implement the mitigation prescribed in this EIAR are carried out. The Project Ecologist/ECoW will be awarded a level of authority and will be allowed to stop construction activity if there is potential for significant environmental effects other than those predicted and mitigated in the EIAR.

A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development (Appendix 2.1 of the EIAR). The CEMP will be finalised and implemented by the appointed contractor. The implementation of proposed mitigation measures, environmental commitments, as well as the monitoring and supervision of these measures will be managed through the CEMP. Mitigation measures to prevent significant negative effects to the KERs identified in this chapter will be incorporated into the development through the CEMP.

9.10.4.2 Water Quality

The main potential for significant effects during the construction phase on the aquatic environment is via water pollution. Construction phase mitigation for hydrology and water quality will follow that outlined in Chapter 12 – Hydrology and Water Quality, and the mitigation measures outlined will be adhered to in conjunction with those outlined in this chapter, relating to the protection of specific aquatic species, noting that all measures for the protection of water quality, as detailed in Chapter 12, will also protect the aquatic ecology and fisheries value of downstream watercourses, particularly the habitats supporting sensitive aquatic species and with connectivity to the Lough Corrib SAC.

Works within and adjacent to watercourses, as part of HDD, culvert and new bridge construction, will adhere the guidelines set out in the best practice documents as listed below for the control of water pollution:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.

- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

9.10.4.3 Aquatic Ecology

Mitigation to control runoff from Site is presented in Chapter 12 – Hydrology and Water Quality and will be adopted to ensure the protection of the aquatic environment during construction.

The installation of the flume on the Togher River and the construction of the culvert on arterial drainage channel CH4/13/5 will be carried out outside of the salmonid and lamprey spawning seasons. Salmon spawning is from November to March, while lamprey spawning occurs in early Summer (April to June). This will be done so as to ensure access to spawning habitat and no impacts on species populations. It will not be necessary to curtail the works on the Black (Shrule) River to outside of the spawning season given the unsuitability of the habitat at the works and upstream for spawning. Once the flume is in place on the Togher river, bridge construction works will be carried out and without curtailment of timing of the works.

Similarly, the HDD crossing works for the Togher River will be carried out outside of the salmonid and lamprey spawning seasons.

For all in-stream works the flows will be either over-pumped or flumed. Mitigation for the prevention of downstream pollution/ sedimentation of the watercourses is prescribed in Chapter 12 – Hydrology and Water Quality.

Where works areas are to be isolated from flow, it will be necessary to firstly electrofish the section of the watercourse for the purpose of fish salvage / translocation. Electrofishing will be carried out in accordance with '*Guidelines for Electric Fishing Best Practice'* by Beaumont et al., (2002) and 'Electrofishing team leader training manual' by SFCC (2007) and Guidance for wadable stretches CFB (2008). Fish salvage / translocation operations will only be conducted by qualified ecologists/technicians and under licence issued under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962. The electrofishing work will be expected to require the use of both back packs and also generator gear mounted in a flat-bottomed boat given the range in depth of the watercourses within the Site.

Prior to works taking place, the affected section of watercourse will be cordoned off using stop nets. The stop nets will be extend to the river bed and will be weighted with lead rope, chain or equivalent. The top of the net can be floated on the surface of the river with floats or can be suspended by alternative means. The stop net will prevent fish returning to the section once the removal exercise has been completed. The net will remain in place until the instream works has been completed to ensure that fish populations do not re-colonise the fished area. The net mesh size will be a maximum of 2mm in diameter. The cordoned off areas will generally be workable sections/units of around 250m^2. The entire section will be fished using standard multi-pass electrical fishing. In the event that fish from outside the cordoned off area are drawn into the electric field, the operator will suspend fishing for a few seconds to allow such fish to escape. Depletion fishing will be undertaken until it can be shown that <90% of the fish have been captured.

Captured fish will be removed using a dip net (not an anode net) and temporarily placed in a bucket of river water. Fish species and age will be quickly documented, before being transported upstream of the works and released into suitable habitats. Lampreys will be spread out in suitable habitats at a density of <10 m^2.

In the event of a dewatered area becoming flooded, then the above fish removal works will be repeated.

Specific mitigation will be implemented targeted towards the protection of aquatic species at three locations within the Proposed Development boundary:

1. The fluming of the Togher River to accommodate the new bridge crossing will require mitigation for lamprey juvenile and the protection of other fisheries.
2. Piling works on the Black (Shrule) River – the riverbed is suitable for juvenile lamprey, albeit no spawning habitat exists on this channel. Notwithstanding as a precautionary measure mitigation is proposed for juvenile lamprey.
3. The new culvert on arterial drainage channel CH4/13/5 will require mitigation for suitable lamprey and brown trout spawning gravels.

Mitigation for Lamprey

Suitable juvenile lamprey habitat occurs on the Togher River (at the new bridge crossing) and on the Black (Shrule) River (at the location of piled floated road and upstream culvert). Mitigation is proposed hereunder to ensure the juvenile lamprey are effectively removed from works areas in advance of the construction activities so as to ensure the protection of the populations in the catchment. Because juvenile lampreys live in burrows in soft sediment can be more difficult to encourage them to move away from an affected area in the same way as it is for fish and eels, who can be discouraged during the installation of stop nets. It is therefore proposed to capture juvenile lampreys present in the areas using electrical fishing in advance of any works taking place coupled with dredging/removal of bottom sediment.

Electrofishing for lamprey ammocoetes will follow the Lamprey ammocoete survey methodology given in Harvey J & Cowx I (2003). This method will not be feasible in deeper water (i.e. at the new bridge crossing) due to deep waters and poor visibility. In such a case dredging only will be used as the lamprey recovery method. For areas to be electrofished, the selected areas of suitable in-stream habitat within the works areas will be electricofished using a pulsed DC electrical fishing. The affected area will be fished in a zigzag pulse and draw manner with a minimum effort of 1 minute fishing per m^2. A fishing operation will be started with the gear constantly ‘on’ followed by a regular on/off sequence. While the gear is ‘on’ the anode will be slowly pulled backwards in the water to cause lampreys to emerge from burrows as a result of electro-taxis. This procedure will be repeated throughout the operation, working though consecutive adjoining 1m^2 areas. By keeping the anode 1-15cm above the sediment and pulling the anode backwards, the number of lampreys stunned within the substrate will be reduced. Captured lampreys (and other fish) will be removed quickly using the anode net or dip net and placed into a bucket of river water. Lampreys captured will be translocated to suitable nursery habitats located upstream of the proposed works.

Following electrofishing procedure, the river-bed sediment will be dredged from the watercourse (using a long reach machine and bucket) and will be checked for the presence / absence of lamprey and these will be collected from the spoil. Juvenile lampreys will be in the top c. 20cm of substrate in the river (oxygenated area), so the dredging will first remove the top 200cm of silt using the machine bucket and spread this out on a flat wooden sheeting/pallet for examination. Lampreys captured will be translocated to suitable nursery habitats located upstream of the proposed works and spread out at a density of <10 m^2.

Mitigation for spawning gravels on arterial drainage channel CH4/13/5

The habitat on arterial drainage channel CH4/13/5 where the existing crossing is proposed to be replaced by a larger culvert hosts suitable salmonid spawning gravels. In the first instance at this location, water quality protection measures and electrofishing measures will be implemented (as described above). Following dewatering, the spawning gravels will be removed from within the works area for later reinstatement, all of which will be done under the instruction of the ECoW. These will be stored locally and following culvert installation (which will be in accordance with IFI guidelines, and will be embedded 500mm below existing bed level), the gravels will be reinstated.

9.10.4.4 Habitats and Flora

Hedgerow/Treeline Reinstatement

Where hedgerow and treeline removal is required for the Proposed Development, these will be reinstated with native hedgerow and tree species which are indigenous to the local area and will include Willow *Salix* sp., Birch *Betula* sp., Rowan *Sorbus aucuparia*, Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa* . Locally sourced willow cuttings will be used. Semi-mature specimens of native provenance will be included to accelerate establishment. A proportion of smaller trees/hedge planting will also be planted with the semi-mature specimens in order to create a level of diversity thereby allowing natural ground flora establishment.

Note Ash (*Fraxinus excelsior*) is not proposed to be used, due to its vulnerability to ash dieback disease.

Mitigation Measures for Tree Felling

Tree felling will be required on the 33kV cable route and at TDR accommodation works PoI16 and at bat buffer zones. To ensure the tree clearance methodology reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following best practice guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- Forestry Service (2000). Forest Service Forestry and Water Quality Guidelines;
- Forestry Service (2000b). Forest Harvesting and Environmental Guidelines;

Management of the spread of non-native invasive species

The importation of all construction material to Site will be in accordance with Ireland's Invasive Alien Species Soil and Stone Pathway Action Plan 2023 – 2027 (NPWS, June 2023) which requires implementation of biosecurity measures in advance of bringing material to site.

Japanese Knotweed

According to Invasive Species Ireland (ISI) invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity. Invasive species negatively impact Ireland's native species; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

Third Schedule invasive species Japanese Knotweed has been recorded by Galway County Council on the road verge of the L6483 local road (although no evidence of same was observed during field survey).

According to Invasive Species Ireland Japanese Knotweed is "one of the highest risk (most unwanted) non-native invasive species in Ireland". The species poses a risk to open and riparian areas where it spreads rapidly to form dense stands, excluding native vegetation and prohibiting regeneration. This process has been known to reduce diversity and alter semi-natural and locally important habitats for wildlife. Once stands become established, they are extremely persistent and difficult to remove. Japanese knotweed can grow through weaknesses in both tarmac and concrete.

Although Japanese knotweed plants flower, all flowers in Ireland and Britain are female, precluding the possibility of sexual reproduction. The means of spread is entirely through the movement of rhizomes or rhizome fragments in soil or cut stems. Japanese knotweed has an extraordinary ability to spread vegetatively from crown, stem and rhizome (underground root) if disturbed. Even tiny amounts of cut stem, crown or rhizome can produce a new plant.

Controlling the spread of the species is therefore dependent on preventing the spread of the stem, crown or rhizome. Red/purple shoots appear early in spring, which in some cases have an asparagus-like appearance but, as the canes grow, the leaves unfurl, and the plant takes its more characteristic appearance. The mature canes are like bamboo, being hollow, and have a characteristic pattern of purple speckles. The leaves are shield-shaped with pointed tips and a flat base, arranged in a zig-zag formation. The plant can grow to over 3m in height. Flowering occurs in late summer/autumn (End July – typically August) and consists of small creamy white flowers. During the winter the leaves die back and reveal orange/brown woody erect stems. Rhizomes are bright orange inside and can extend to a depth of 3m and a width of 7m around the visible growth above ground.

Specific consideration will be given to turbine delivery and access to site via the L6438 road, due to the potential for disturbance of soil which might contain Japanese rhyzomes. Containment of possible Japanese knotweed along the L6438 roar will be achieved as follows (noting that this infestation is already under treatment control by the Local Authority and as such treatment will not be necessary as part of the Proposed Development). As such measures to avoid the spread, i.e. containment, are proposed:

- A pre-construction survey to reconfirm the findings of the EIAR during the growing season immediately prior to the construction phase and this will include consultation with Galway County Council to understand the status of ongoing treatment. This will mark out the extent/likely extent of the invasive plant material.
- The potentially infested area will be covered with terram sheeting or similar and stone placed on top. This will act as a barrier to any vehicle wheels rutting the soil and potentially transporting rhizomes. This stone and terram will be removed off site following construction works and treated as a contaminated material.
- Footwear and clothing of operatives working near invasive species will be checked for rhizomes, seeds, fruits, or other viable material before exiting the site. Such operatives will also use boot brushes prior to exiting the site.
- All vehicles exiting the area of knotweed infestation will be examined to prevent the transport of seeds/rhizomes/plant material.

- No contaminated material (contamination from non-native species) or invasive species vegetation shall be removed from site unless by an appropriately licensed waste contractor to a suitably licenced facility.
- The area will also be cordoned off where it is beyond the required footprint for turbine delivery. This will prevent plants with underground rhizomes being transported to other sections of the site and it will also prevent contact with plants which could result in the transport of vegetation to other parts of the site. No construction works will occur within exclusion zones.
- New sightings of the invasive plant species identified within the Site shall be relayed to the contractor for invasive species control. These areas shall follow the same protocol as the current infected area.

General measures for the prevention of the spread of invasive species will be achieved by:

- The full implementation of the invasive species management measures outlined in this chapter in conjunction with a competent and experienced Invasive Species Specialist Contractor.
- Supervision of control measures and treatment works by an appropriately qualified ecologist or invasive species specialist.
- Raising awareness to site workers via toolbox talks given by a suitably qualified person as part of site introduction; informing workers what to look out for and what procedure to follow if they observe an invasive species.
- Only planting or sowing native species.
- Where invasive species have been physically removed and soil disturbed, this soil will be seeded or replanted (including 5cm deep mulch) with native plant species. This will prevent erosion and the easy colonisation of bare soil by invasive species in the area.
- Unwanted material originating from the site (including soil, rhizomes and other material) will immediately be transported off site by an appropriately licensed waste contractor and disposed of properly at a suitably licenced facility, in accordance with the (NRA, 2010) guidelines, i.e., where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains rhizomes, flower heads or seeds will be disposed to licensed landfill. All disposals will be carried out in accordance with the Waste Management Acts.
- Signs will warn people working within the site that there is invasive species contamination.

Periodic re-surveying (as determined by the ECoW) for all invasive species will be required, to ensure that treatment measures were effective, and to trigger further treatment if necessary. Please note that the schedule may require amendment following any given site visit. The following will be documented:

- Check that the area of infestation is still cordoned off and a warning/information sign is still in place
- Photographs of the area(s) of invasive species infestation
- Map the extent via recording GPS coordinates and measure the length and width of infestation (including above and below ground rhizome growth) and plot on map
- Evaluate the status/condition of the infestation

Recommendations will be made by the ECoW for further containment measures as may be deemed necessary.

Aquatic Invasive Species

The Third Schedule invasive species Water Fern and Canadian Pondweed occur in the Togher River. Additionally, Crayfish plague is confirmed in the Corrib catchment.

In order to control the spread of all aquatic invasive species and crayfish plague, the Check-Clean-Dry protocol will be rigidly employed under the supervision of the Project Ecologist/ECow at this Site. All plant, equipment and footwear/clothing that comes into contact with the aquatic environment will be Checked, cleaned and thoroughly dried equipment and clothing before using again. If everything cannot be dry for at least 48 hours before re-entering the water, then disinfectant will be required.

- CHECK plant, equipment, clothing and footwear for living plants and animals. Pay particular attention to areas that are damp or hard to inspect.
- CLEAN and wash all equipment, footwear and clothes thoroughly (in situ before leaving the area). If you do come across any plants and animals, leave them at the water body where you found them.
- DRY all equipment and clothing for at least 48 hours – some species can live for many days or weeks in moist conditions. Make sure you don't transfer water elsewhere.
- DISINFECT everything if complete drying is not possible. Use disinfectant such as Milton (follow product label), Virkon Aquatic (3mg/L), Proxitane (30mg/L) or an iodine based product for 30 minutes. Items difficult to soak can be sprayed or wiped down with disinfectant.

9.10.4.5 Mammals (excluding bats)

A preconstruction mammal survey will be undertaken no later than 12 months pre-construction to reconfirm the findings of the EIAR.

An ecologist will supervise areas where vegetation removal and tree felling will occur immediately prior to and during construction as appropriate (e.g., an ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any Site-specific issues in relation to wildlife not currently present on Site will be reconfirmed prior to commencement of works to allow appropriate mitigation measures to be put in place.

In the event that protected mammals, or their resting places are recorded, the consenting authority will be updated, consulted with, relevant guidelines will be followed for the management of such species.

Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Where works must occur at night all artificial lighting will be cowled away from treelines and hedgerows and dense scrub.

Badger

A badger sett is present within the Site. Pre-construction the sett will be clearly marked and the extent of bounds prohibited for vehicles using fencing and signage. The sett is an outlier and not significant to the local badger population. In order to protect badgers from injury, the badgers will be excluded from the sett prior to the commencement of the construction phase as necessary. The outlier sett will be monitored for 2 weeks prior to construction using a camera trap to determine if it is in use. If the sett is found to be in use exclusion measures will be put in place prior to construction in line with NRA Guidelines to ensure that the sett is evacuated. As per NRA guidelines exclusion from an active sett will only be carried out during the period of July to November inclusive in order to avoid the badger breeding season. During the breeding season (December to June inclusive) no works will be undertaken within 50m of an active sett or pile driving within 150m of active setts.. Exclusion zone fencing and appropriate signage will be put in place around the sett to ensure that there will be no vehicles tracking that could impact the sett. All of the above works will be undertaken or supervised by an appropriately qualified ecologist in advance of construction.

If the sett is found to be inactive inactive it will be soft-blocked and then hard-blocked. If found to be active the entrance will have one-way gate installed (plus proofing around sides of gates) to allow badgers to exit but not to return. The gates will be tied open for three days prior to exclusion. Sticks will be placed at arm's length within the gated tunnels to establish if badgers remain within the sett. Gates will be left installed, with regular inspections, over a minimum period of 21 days (including period with gates tied open) before the sett is deemed inactive. Any activity at all will require the procedures to be repeated. The sett will be monitored regularly for signs of occupancy. If no activity is observed, works may proceed following the 21-day exclusion period, and the closed gates will be left in place until construction is complete.

While the sett is outside of the works footprint, Badger sett tunnel systems can extend up to c. 20m from sett entrances (albeit this is less likely for a smaller outlier sett). Therefore, following sett exclusion, the excavation of ground within 30m of the sett will be monitored by the ecologist to determine any damage to the sett and this excavation will be carried out slowly, in the unlikely event of any badger remaining in the sett. A vehicle barrier (non-intrusive to the ground, e.g. herras fencing) will be installed at the closest boundary to the works, so as to keep vehicle movements setback from the sett as far as possible.

The Consenting Authority will be contacted immediately should any of the following events occur:

- A new sett is recorded within the study area during works;
- There is evidence of badger persecution during surveys; and
- Hard-blocked setts are re-occupied by badger during construction.

Pre-mitigation monitoring and ecological supervision will ensure correct implementation of badger mitigation measures at construction stage

Otter

Signs of otter were recorded along the Black (Shrule) River indicating that it is used as a commuting corridor. The Proposed Development will not be an impediment to otter movements or access to suitable habitats. Mitigation is not required.

A pre-construction mammal survey will be undertaken (no later than 12 months prior to construction) within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, if an Otter holt should be encountered at any point, then NPWS will be informed and NRA Guidelines for the Treatment of Otters Prior To the Construction of National Road Schemes will be followed

Other Mammals

Red Squirrel

Felling of trees in forestry areas (i.e. at PoI16 and on the 33kV cable will be limited to time periods outside which Red Squirrel may have young in dreys (peak period January to March).

Irish Hare, Pygmy Shrew and Hedgehog

These species are mobile and will disperse, however, hibernating Hedgehogs and the young of Irish Hare, Pygmy Shrew or Hedgehog are vulnerable during clearance of vegetation. An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary). Where habitat is too dense the ecologist will supervise vegetation removal during clearance works.

- The ECoW will supervise the removal of vegetation, scrub and hedgerow with regards to leverets, October to March for hibernating Hedgehog and September to October for breeding Pygmy Shrew as is appropriate and in the event that such species are found, a buffer zone will be determined in which construction activities cannot take place until further instructed by the ECoW i.e. once the species have been confirmed as absent.

9.10.4.6 Bats

The following mitigation measures for bats will be implemented in full:

Supervision of vegetation clearance

An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any Site-specific issues in relation to wildlife not currently present (e.g., Bat roost locations) on Site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the unlikely event that a bat roost is found, the NPWS will be informed, and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Retention of trees

Several species of bats roost in trees. Treelines and mature trees within the Site will generally be avoided and retained intact. Retained trees within e the red line boundary will be protected from root damage by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

Where mature trees with low bat roosting potential are proposed to be felled, these trees will be left in situ for 24 hours prior to disposal. This will allow any bats present to escape.

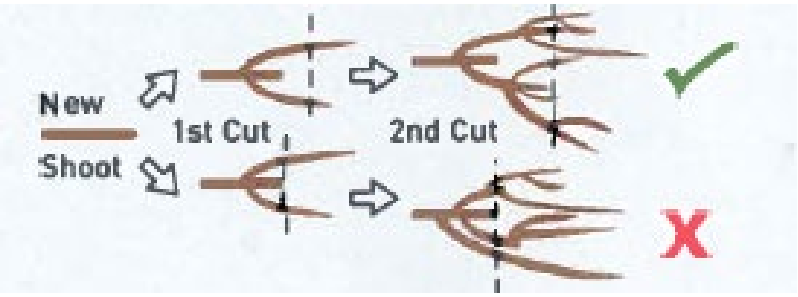
Compensation for loss of commuting routes/Diversion from felling buffers

Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife).

Where woodland edges, treelines and hedgerows are affected by turbine felling buffers, bats will be directed away from tree-free buffers along an alternative commuting route. This will be achieved by planting new hedgerows as per Figure 9.4.

All hedgerow planting will only use plants of native provenance. The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. The following fast-growing damp tolerant species will be planted along the inner edges of hedgerows: grey willow *Salix cinerea,* goat willow *Salix caprea,* and alder *Alnus glutinosa.* The following native fruiting hedgerow species will be planted along the outer edges of these hedgerows: hawthorn *Crataegus monogyna* (75% of total), blackthorn *Prunus spinosa*, bird cherry *Prunus padus,* elder *Sambucus nigra,* dog rose *Rosa canina,* crab apple *Malus sylvestris,* field rose *Rosa arvensis.*

Tightly cut hedgerows with flat tops as currently dominates the Site provide little benefit to wildlife, taller and bulky hedgerows are required as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut (see Image 9-9) as cutting back to the exact same point depletes the energy of the hedgerow, forms a build-up of scar tissue which discourages new growth.



Source:Teagasc

Image 9-9: Hedgerow Level of Cut

Light annual cutting of hedgerows is not good for wildlife as it limits the production of flowers and fruit. The sites hedgerows will be cut every three to four years in rotation if cutting is required, as this will leave areas of undisturbed hedgerows. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow. A finger-bar cutter will be used as the most appropriate tool to minimise fraying and smashing of branches (Heritage Council, 2017). A flail-type hedge cutter is unsuitable for hedge trimming in situations where hedgerow health is a priority.

Hedgerow maintenance will not be carried out between the 1st of March and 31st of August as this is the nesting period for birds and any maintenance at this time will disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

Lighting restrictions

In general, artificial light creates a barrier to bats so lighting has been avoided where possible. Construction operations within the wind farm Site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works along the cable route and wind farm Site may occur at night but the project ecologist/ECoW will limit night-time works to sections of the route / Site which avoid sensitive features (e.g. mature treelines, conifer plantation edge and tracks). Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This will be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

Pre-construction Surveys

If three years lapse from between EIAR/planning-stage surveys and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (Hundt, 2012; Collins, 2016; NatureScot, 2021; NIEA, 2021) and includes static detector, activity and roost inspection surveys.

9.10.4.7 Other Species

In the event that construction is required to proceed during the breeding season of common frog (approximately January – midsummer), a preconstruction amphibian survey will be completed and, where it is not feasible to delay works until froglets have moved away, translocation under licence will be required where active breeding drains are within the development footprint.

9.10.5 Mitigation measures during operation

9.10.5.1 Habitats and Flora

Mitigation measures outlined in Chapter 12 - Hydrology and Water Quality of this EIAR, will be implemented, in addition to those described in the NIS, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Invasive species will continue to be monitored, and where required, treated within the project area according to the invasive species management measures set out in this Chapter for as long as they persist within the Site.

9.10.5.2 Designated Nature conservation Sites

Mitigation measures outlined Chapter 12 - Hydrology and Water Quality of this EIAR, will be implemented, in addition to those described in the NIS to minimise and prevent the identified indirect effects on water quality as outlined previously.

9.10.5.3 Mammals

No additional measures are required during operation.

9.10.5.4 Bats

According to NatureScot (2021) guidance:

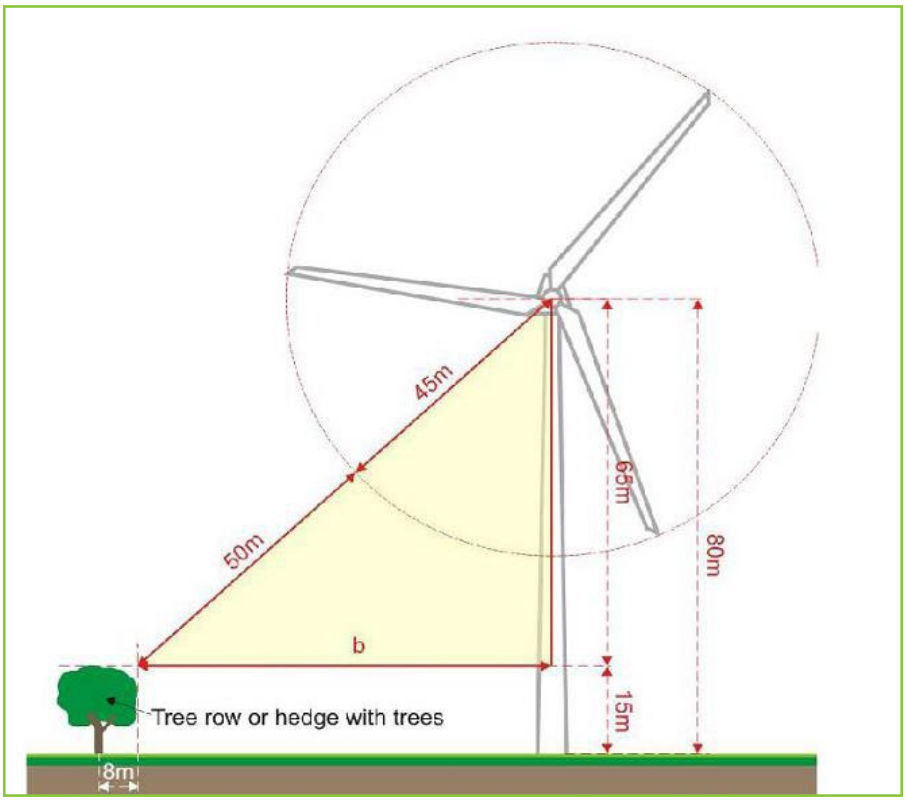
> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation Sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning."*

At initial project design stage, the habitats within the study area were assessed for suitability to support bats and appropriate setback buffers were employed such that turbines are located away from habitat features that had high suitability for bats. This approach is intended to reduce the potential for effects on bats species which follow habitat features such as trees, hedgerows or woodland and is based on NIEA (2021) 'Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments'. These guidelines prescribe that when siting wind turbines a minimum 50m buffer to all habitat features used by bats (e.g. hedgerows, tree lines) should be applied (this buffer is measured between the blade tip of the turbine and the nearest point of the habitat feature rather than between the hub and the habitat feature).

Additionally, for higher quality habitat features, such as semi-natural woodlands, significant watercourses, and roost features a greater turbine buffer distance of up to 200m is prescribed in the guidelines. This setback approach has been adopted when locating turbines within the Proposed Development lands.

To minimize risk to bat populations, a vegetation clearance buffer zone will be provided around the turbines. The following formula was used to calculate the required felling buffer for the turbines (with example image taken from Natural England – note not reflective of turbine dimensions the subject of this EIAR). Calculations were run for the proposed optional turbine dimensions in terms of hub height and blade length, and the largest bat buffer area is assessed in the EIAR.

EXAMPLE



b (bat buffer)= √ {(50 + bl)2 − (hh - fh)2}

where: b = the distance on the ground between the edge of the bat habitat feature and the turbine (m) i.e. the bat buffer

bl = blade length (m) 77.5m

hh = hub height (m) 102m

fh = feature height (m) 10m (noting that trees on site are mainly low growing hawthorn and ash noted to be between 5-8m in height). fh of 10m is used to account for future growth.

$$b = \sqrt{\{(50 + 77.5)^2 - (102 - 10)^2\}} = 88m$$

A 90m buffer (rounded up from 88 m) has been adopted for all turbines with the exception of T4 which uses a 100m buffer on the basis that a feature height of 20m was used to represent the larger tree species (beech and sycamore) at this location and as such resulting in a 'b' value of 98m (rounded to 100m).

Existing treelines, hedgerows and scrub within the bat buffers for any proposed turbine locations will be removed (note these habitat have been assessed for suitability to support other flora and fauna and have been determined as having local value – mitigation pertaining to site clearance will be employed at these areas). Buffers will be maintained throughout the lifetime of the wind farm as tree-free areas. This will be achieved through mechanical means only; the use of chemical substances is prohibited.

Feathering of Blades

As per NatureScot 2021 guidelines the turbine blades will be feathered during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power. Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn et al., 2008). The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50% (NatureScot 2021).

As such, the feathering of blades to prevent 'idling' during low wind speeds will be implemented for all turbines.

Cut-in Speeds/Curtailment

Increasing the cut-in speed (i.e. the wind speed at which the turbines will become operational) above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett *et al*., (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano and common pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

The bat activity recorded at the Site occurred overwhelmingly at wind speeds below 5.5 m/s, a threshold widely recommended as a mitigation cut-in speed to reduce bat mortality at turbines (NatureScot, 2021; Whitby et al., 2024). Therefore, increased cut-in speeds (as set out below) will be implemented for all turbines from commencement of operation.

For all turbines cut-in speeds will be applied as blanket curtailment and will be increased during the bat activity season (April-October) and where weather conditions are optimal for bat activity (see below) from 30 minutes prior to sunset and to 30 minutes after sunrise at all turbines.

Cut-in speeds restrictions will be operated according to specific weather conditions:

1. When the air temperature is above approximately 10 to 11°C at nacelle height; and
2. Where the wind speed range is between 5.0 to 6.5m/s (at nacelle height).

Due to the considerable down time resulting from the proposed "blanket curtailment" (above), a SMART curtailment regime is proposed as described below from year four of operation. A SMART System will be used to detect bats in real time and curtail the individual turbines accordingly. This will focus on times and dates, corresponding with periods when the highest level of bat activity occurs within the Site. This includes the use of the SCADA (Supervisory Control and Data Acquisitions) operating system (or equivalent) to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

Post-constructions surveys will be undertaken for the first three years of operation to confirm if blanket curtailment restrictions can be amended in line with post-construction activity levels.

The post construction surveys will be used to update the current curtailment regime (blanket curtailment) designed around the values for the key weather parameters and other factors that are known to influence collision risk. This will include all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

If these surveys show that a SMART system is not appropriate for the site, then blanket curtailment will continue.

Post Construction surveys

Monitoring will take place for at least 3 years from operation commencing, providing sufficient data to detect any significant change in bat activity relative to pre-construction levels. It will assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment.

During years one to three of operation (under blanket curtailment restrictions) bat activity will be measured continuously between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

Modern remotely operated wind turbines as proposed here allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Adams et al., 2021, Arnett et al., 2008, 2011, 2013; Baerwald et al., 2009). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

Monitoring Curtailment

If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring (refer below), increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15, 20, 25 and 30 with further review after each monitoring period.

Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) a reduction on the timing restrictions for these measures will be imposed as per the recommendations of the ECoW. This will be notified to An Bord Pleanála.

Post construction acoustic surveys will utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity season.

Acoustic monitoring will be supplemented with thermal imaging cameras etc. to provide more detailed information on bat activity in the vicinity of turbines. Due to the level of Leisler's activity within the study area, nacelle-level surveys5F[21] are also proposed for the post construction surveys. These will be used to identify the level of Leisler's bat activity above the tree canopy and within the height of the rotor-swept area.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by NatureScot (2021) as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

Lighting

It appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland (2009), indicates that intermittent lighting is less likely to cause species to collide with turbines.

As such, flashing red aviation obstruction lights will be provided on perimeter turbines, subject to approval by the IAA. These will not negatively impact bats (Bennett and Hale 2014).

Buffer zones

The tree-free buffer zones around the turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only (no chemicals / herbicides) and maintained on an annual basis in the same condition as during first clearance.

Due to mitigation by design, all other turbines are proposed to be Sited at a suitable separation distance from trees and trees or shrubs which establish are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundancies affected elsewhere on the Site). This will be achieved through physical management of habitats without the use of toxic substances.

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project will be monitored for a period of no less than three years post construction and appropriate measures taken to enhance these if and where required.

Bat fatality monitoring

Whilst no significant residual impacts on bats are predicted, the proposed development could provide an opportunity to gain baseline data on bat/turbine interaction and the scheme will be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 7, 10, 15, 20, 25 and 30 as part of the additional monitoring schedule.

[21] Used to supplement ground-based equipment designed to replicate the survey effort undertaken at the pre-application stage (see Roemer et al., 2017). They are particularly useful at woodland key-holed Sites.

The primary components bat mortality study will be as follows (whether curtailment is in place or not):

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring.

b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on the hard standing) (NatureScot, 2021) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.

c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

d) Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 9-23: Monitoring schedule proposed for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 7, 10, 15, 20, 25 and 30 post construction.

Table 9-24: Summary of Operational-phase Mitigation Measures for Bats

Moderate-High Level Bat Mitigation Applies to all turbines	Category
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Feathering
Implement blanket curtailment during year 1-3 while post construction surveys are undertaken. The curtailment will involve operating the selected wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.5 m/s during specified weather conditions (10-11 °C and wind speed 5.0 to 6.5 m/s at nacelle hight) and during the active bat season (April to October).	Blanket curtailment
Implement a monitoring programme during years 1 – 3 post construction to detect any large-scale changes in bat activity including carcass surveys. Bat activity will be measured continuously between April and mid-October at each turbine location. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.	Post construction monitoring
If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring, increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15, 20, 25 and 30 with further review after each monitoring period.	Smart curtailment

Moderate-High Level Bat Mitigation Applies to all turbines	Category
Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then a derogation will be sought from Galway County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures through SCADA (or equivalent) operating systems.	
Undertake a carcass search during years 1-3, and subsequently in years 5, 7, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule.	Carcass monitoring
Maintain immediate area (90 m) around the wind turbines in a manner that does not attract insects (and 100m buffer around T4).	Maintain vegetation free buffer

9.10.5.5 Aquatic Ecology

The operational wind farm will have a negligible effect on aquatic ecological interests and fisheries, as there are no further potential impacts on surface water run-off or watercourses within the Site. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the Site. Any potential TDR works during the operational phase will be limited to temporary accommodation works in the event that turbine replacement is required.

It is not envisaged that maintenance will involve any significant impacts on the hydrological regime of the area. Weekly inspections of the erosion and sediment control measures on Site will be required during the construction period, followed by fortnightly inspections until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

9.10.6 Mitigation Measures during Decommissioning

Mitigation measures for the wind farm and TDR that will apply for the decommissioning phase relate to the protection of water quality (as outlined in Chapter 12- Hydrology and Water Quality. There will be no additional vegetation removal, and infrastructure removal will be of the turbines foundations and hardstand areas left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. The grid connection cable, ducting and substation will be left in situ as part of the national grid, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required for these elements.

9.10.7 Enhancement Measures

A series of enhancement measures are proposed to increase the biodiversity value of the proposed Site. These are detailed in the Biodiversity Enhancement and Management Plan (BEMP) (see Appendix 9.1, Volume III).

9.10.8 Vulnerability to Major Accidents or Disasters

Should a major accident or natural disaster occur, the potential sources of pollution onsite during the construction and operational phases of the Shancloon Wind Farm are limited. The primary sources with the potential to cause significant environmental pollution and associated negative impacts on human health and the environment include the bulk storage of hydrocarbons, chemicals and wastes. In the case of the proposed Shancloon Wind Farm, the storage of chemicals of this kind are strictly limited. For biodiversity, the main possible impacts are considered to be the release of sediment and pollutants into watercourses, which could negatively impact upon aquatic habitats and species.

Potential vulnerabilities relevant to the proposed project are limited to:

- Flooding;
- Fire;
- Major incidents involving dangerous substances;
- Catastrophic events; and
- Landslides.

The risk of flooding is addressed in Chapter 12: Hydrology and Water Quality, which concludes that the wind farm Site will have a negligible impact on flood risk in the surrounding area, as a result of the proposed development. Furthermore, there is no expected increase to flood risk along the GCR or TDR.

In the event of extreme weather conditions, the proposed surface water drainage will manage storm water avoiding significant negative impact on the project's infrastructure. Therefore, it is unlikely that the proposed development will result in increased flood risk, and it is unlikely that flood risk would result in effects on human safety (including traffic), water quality, biodiversity, soil stability, material assets and archaeological or architectural heritage, as the increased flood risk is considered negligible.

Mitigation measures are set out in Chapter 12: Hydrology and Water Quality to avoid potential negative impacts during the construction stage with respect to flood risk.

The potential for fire at the proposed Shancloon Wind Farm is mitigated against by design. Furthermore, the wind farm will be remotely monitored, and potential accidents will be quickly identified and reported.

In line with IWEA Health and Safety Guidelines for the Onshore Wind Industry (2011), Emergency Response Plans will include emergency response procedures for initial actions in the event of a fire. Records will be kept for testing of fire alarms and drills and maintenance/inspection of fixed and portable firefighting equipment. Information will be provided to employees on fire safety and fire prevention, including risks of and control measures to prevent fire outbreak, evacuation procedures and those responsible for their implementation, and the use of firefighting equipment, in line with HSA guidance.

During the construction phase of the proposed development, an emergency response plan will be in place as set out in the CEMP, included in Appendix 2.1 of Volume III of this EIAR.

Given the nature of the proposed development, coupled with the lack of proximity to established Seveso Sites, there is a negligible potential risk of negative impact to the proposed development and its receiving environment, as set out throughout this EIAR, arising from the occurrence of major incidents involving dangerous substances.

Potential catastrophic events associated with operational wind turbines include:

- Wind turbine toppling (due to foundation or tower failure);
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure); and
- Fire.

The primary mitigation against a catastrophic event that may endanger biodiversity has been implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of negative impact in the event of wind turbine collapse.

Turbines have been Sited with consideration for existing ground conditions to minimise the risk of turbine foundation failure, toppling and landslide. Intrusive Site investigations have been carried out to confirm ground conditions at turbine locations as well as slope stability analysis throughout the wind farm Site. Other design mitigation measures employed for the siting of wind turbines include the following:

- Areas mapped by GSI as having a high susceptibility to landslides have been avoided;
- Turbine locations have been assessed by Site investigation and visually by geotechnical engineers prior to confirmation of final siting.
- Care has been taken in design of road and hard standing alignments, cutting and filling and drainage;
- Peat probing has been carried out at turbine locations.

As detailed in Chapter 11: Soils, Geology and Hydrogeology susceptibility to slope failure is considered ‘low’ to on the Site.

Wind turbines are fitted with sophisticated remote monitoring and control systems to manage rotational speed. Turbines also have the capability to shut down in storm conditions through adjustment of blade pitch. Turbines are also fitted with emergency power supply (EPS) units to provide backup power in the event of a loss of mains power supply that could impact the control system.

Wind turbines will be fitted with fire suppression systems and will have emergency escape procedures in place for operational staff in the event of fire in a wind turbine.

In relation to potential vulnerability of the project to major accidents and natural disasters it is concluded that the potential susceptibility to natural disaster of the proposed Shancloon Wind Farm is negligible. Therefore, the potential for any related effects on biodiversity and the environment arising from fire or pollution are also negligible.

9.11 Residual Ecological Impacts

9.11.1 Designated Sites

The mitigation prescribed in the Natura Impact Statement and in Chapter 12- Hydrology and Water Quality will ensure no adverse effects on designated sites. With the implementation of the detailed mitigation measures it is concluded beyond reasonable scientific doubt that the integrity of the protected sites will not be adversely affected.

9.11.2 Habitats and Flora

No residual effects are predicted for the Habitats and Flora.

Construction of the wind farm will lead to some permanent loss of habitat. The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure and associated felling buffers. For clarity, associated infrastructure includes the construction compounds and a substation. Land take at junctions along the proposed turbine delivery route will be minimal.

Not all land take is permanent as modifications along the turbine delivery route will be reinstated and felling areas will become different habitats rather than being lost within the development footprint. The construction compounds supporting grasslands will be allowed to recolonise naturally following construction.

The BEMP includes for an overall uplift in biodiversity in the area through woodland planting and grassland management. Loss of hedgerow, scrub and treelines will be fully compensated for by replanting. Additionally, following the implementation of mitigation, there will be no significant residual negative effect on raised bog habitat. The BEMP provides for the protection of existing degraded bog through peat infilling of cutover and associated drain blocking measures designed to improve the overall condition of the habitat by maintaining water levels close to the surface of the peat.

Mitigation measures as outlined in the current chapter and Chapter 12 - Hydrology and Water Quality' as well as the use of HDD at a grid connection watercourse crossing will ensure no significant loss of aquatic habitat of higher value.

With the application of the mitigation measures as outlined, it is concluded that there will be no significant residual effects on habitats and flora as a result of the construction, operation or decommissioning of the proposed development.

9.11.3 Mammals

Measures to protect mammals restricting felling operations to outside their breeding periods, and pre-felling surveys where this cannot be facilitated. Pre-clearance vegetation checks to protect Badger, Irish Hare, Pygmy Shrew and Hedgehog will be carried out by an ecologist as required. The badger sett which is to be removed is not considered to be significant to the population.

Some permanent loss of areas of grassland and plantation forestry habitats which could be used by foraging and breeding mammals for shelter/breeding will occur form constructing the Proposed Development. While Scrub may develop in these areas. The implementation of mitigation measures will reduce residual impacts during construction, operation and decommissioning phases to *Long-term Imperceptible Negative Reversible Impacts* in the local context.

The habitats used by protected mammal species within the proposed development footprint and felling areas represent a small amount of the total available within the study area and are also present within the wider landscape.

Following the implementation of mitigation, there will be no significant residual effect on mammals as a result of the Proposed Development.

9.11.4 Bats

There is no potential for the construction of the Proposed Development to result in Significant effects on the local bat population at any geographic scale, given the small area of suitable habitat to be lost relative to the area of suitable habitat in the wider landscape and given the standard best practice measures outlined above which will be implemented during construction combines with the purposeful design of the Proposed Development so as to avoid high value bat habitat. Similarly, during operation, the mitigation proposed will ensure no significant residual effect on local bat populations.

9.11.5 Aquatic Ecology

The watercourses on the Proposed Development are generally low value land drains, arterial drainage channels and highly sedimented streams and rivers. However, sensitive and protected species occur in the catchment and downstream of the Proposed Development: notably salmonid species and lamprey. Effects will be effectively reduced to an imperceptible negative effect during construction, operation and decommissioning phases with the mitigation measures from the Proposed Development as set out in Chapter 12- Hydrology and Water Quality and within this chapter.

All mitigation measures provided for the protection of aquatic ecology and fisheries (particularly Annex II Species recorded during the current surveys) within the Proposed Development Site will effectively protect aquatic ecological interests downstream.

It is noted that with the implementation of mitigation measures, the Proposed Development will not cause any WFD Waterbody to deteriorate in terms of water quality of hydromorphology and will not in any way prevent or jeopardise any WFD Waterbody meeting the biological and chemical characteristics for good status under the WFD. This is equally applicable to both categorised and uncategorised WFD Waterbodies.

Following the implementation of mitigation, there will be no significant residual effect on aquatic habitats or species as a result of the Proposed Development. The design of the Proposed Development (including a 50m buffer between the main watercourses within the Proposed Development and the main infrastructure and the best practice measures to be implemented for the protection of water quality will ensure that there is no significant residual effect on watercourses or aquatic fauna.

9.11.6 Other Species

Residual effects are assessed as *Not Significant Reversible Residual Impacts* and in the local context.

9.11.7 Overall Residual Effects

With the implementation of the detailed mitigation measures (outlined in the Natura Impact Statement, this chapter, Chapter 11 Soils, Geology and Hydrogeology and Chapter 12 Hydrology and Water Quality and the CEMP) there will be no significant residual impacts from Proposed Development on biodiversity.

9.12 Potential Cumulative Impacts on Biodiversity

A review of completed, permitted and proposed developments within the wider landscape was undertaken in order to assess the potential for cumulative impacts on biodiversity. The developments assessed as listed in Chapter 2 – Development Description. Given the scale and location of other developments relative to the Proposed Development and the control of significant effects through mitigation, no cumulative effects on biodiversity are likely.

10. BIBLIOGRAPHY

Anon (2004) Margaritifera. Stage 1 and Stage 2 survey guidelines. Irish Wildlife Manuals, No. 12. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Arnett, E.B., Brown, W.K., Erickson, W.P., Fiedler, J.K., Hamilton, B.L., Henry, T.H., Jain, A., Johnson, G.D., Kerns, J., Koford, R.R., Nicholson, C.P., O'Connell, T.J., Piorkowski, M.D. and Tankersley Jr., R.D. (2008). Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72, 61–78.

Arnett E.B., Huso M.M., Schirmacher M.R., Hayes J.P. (2011) Altering turbine speed reduces bat mortality at wind-energy facilities. Front Ecol Environ 9(4):209–14. http://dx.doi.org/10.1890/100103.

Aughney, T., Kelleher, C. and Mullen, D. (2008). Bat Survey Guidelines: Traditional Farm Buildings Scheme. The Heritage Council, Áras na hOidhreachta, Church Lane, Kilkenny.

Baerwald, E.F., D'Amours, G.H., Klug, J.B. and Barclay, R.M.R. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18, 695–696.

Bat Conservation Trust/ILP (2018). Guidance Note 08/18: Bats and artificial lighting in the UK. Bats and the Built Environment series

Bennun, L., van Bochove, J., Ng, C., Fletcher, C., Wilson, D., Phair, N., Carbone, G. (2021). Mitigating biodiversity impacts associated with solar and wind energy development. Guidelines for project developers. Gland, Switzerland: IUCN and Cambridge, UK: The Biodiversity Consultancy.

Byrne, A. W., Moorkens, E. A., Anderson, R., Killeen, I. J., & Regan, E. (2009). Ireland Red List no. 2: Non-marine molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

Bat Conservation Ireland, (2012). Wind Turbine / Wind Farm Development Bat Survey Guidelines version 2.8. Bat Conservation Ireland.

Bat Conservation Trust, BCT (2020) Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats. Bat Conservation Trust, London. https://www.bats.org.uk/resources/guidance-for-professionals/bat-species-core-sustenance-zonesand-habitats-for-biodiversity-net-gain

(Bat Tree Habitat Key, 2018). A Guide to Identification and Assessment for Tree-Care and Ecology Professionals

Beaumont, W.R.C., Taylor, M.J., and Welton, J.S. (2002) *Guidelines for Electric Fishing Best Practice*. CEH Report Ref. No: C01614. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/538371/sw2-054-tr-e-e.pdf

Bennett, V.J. and Hale, A.M. (2014). Red aviation lights on wind turbines do not increase bat-turbine collisions. Animal Conservation 17: Issue 4, 354-358

Blake, D., Hutson, A.M., Racey, P.A., Rydell, J., Speakman, J.R. (1994). Use of lamplit roads by foraging bats in southern England. J. Zool. 234, 453–462.

Blamey, M., Fitter, R. and Fitter, A. (2003). Wild Flowers of Britain and Ireland. London: A and C Black.

Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. & Regan, E.C. (2009) Ireland Red List No. 2: Non-marine Molluscs, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Carlin, C. AJ. (2014). Bats and onshore wind turbines - Interim Guidance (3rd edition). Technical Information Note TIN051.

CFB (2008) Methods for the Water Framework Directive: Electric fishing in wadable reaches. Central Fisheries Board, Dublin.

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester.

CIRIA (2001). Control of water pollution from construction Sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.

CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.

CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.

CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.

CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.

Collins (2016). Bat Surveys: Best Practice Guidelines (2nd edition). Bat Conservation Trust.

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

Couzens, D., Swash, A., Still, R., Dunn, L.,(2017) Britain's Mammals; A field guide to the mammals of Britain and Ireland. Princeton University Press

DAFM (2018). Draft Plan for Forestry and Freshwater Pearl Mussel in Ireland. Department of Food, Agriculture, Food and Marine.

DAFM (2019). Standards for Felling and Reforestation. October 2019. Department of Food, Agriculture, Food and Marine.

Department of Environment, Heritage and Local Government [DEHLG], (2010). Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities

Department of Environment Community and Local Government [DoECLG], (2018). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment

DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019

Edgar P, Foster J and Baker J (2010) Reptile Habitat Management Handbook. Amphibian and Reptile Conservation, Bournemouth.

Environment Agency (2003) River Habitat Survey in Britain and Ireland Field Survey Guidance Manual: 2003 Version' published by the Environment Agency, United Kingdom.

Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.

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

European Commission (2020). Guidance document on wind energy developments and EU nature legislation. wind_farms_en.pdf

Fawcett Williams (2021) Thermal Imaging: Bat Survey Guidelines

Feeley, H. B., Baars, J. R., Kelly-Quinn, M., & Nelson, B. (2020). Ireland Red List No. 13: Stoneflies (Plecoptera). National Parks and Wildlife Service.

Finn, R. N. (2007). The physiology and toxicology of salmonid eggs and larvae in relation to water quality criteria. Aquatic Toxicology, 81(4), 337-354.

Forest Service (2000a). Forest Harvesting and the Environment Guidelines. Department of Agriculture, Fisheries and Food.

Forest Service (2000b). Forest and Water Quality Guidelines. Department of Agriculture, Fisheries and Food.

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

Foster, G. N., Nelson, B. H. & O Connor, Á. (2009) Ireland Red List No. 1 – Water beetles. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Gent T and Gibson S (2003). Herpetofauna Workers Manual. JNCC, Peterborough.

Griffiths RA, Raper SJ and Brady LD (1996). Evaluation of a Standard Method for Surveying Common Frogs (Rana temporaria) and Newts (Triturus cristatus, T. helveticus and T. vulgaris). JNCC, Peterborough.

Grunkorn, T. (2011). Proceedings: Conference on wind energy and wildlife impacts, 2-5 May 2011,Trondheim, Norway. Trondheim : NINA,.

Hendry, Keith & Cragg-Hine, D & O'Grady, M & Sambrook, H & Stephen, A. (2003). Management of Habitat for Rehabilitation and Enhancement of Salmonid Stocks. Fisheries Research. 62. 171-192. 10.1016/S0165-7836(02)00161-3.

Holdich, D. (2003). Ecology of the White-clawed Crayfish. Conserving Natura 2000 Rivers Ecology Series No. 1. English Nature, Peterborough.

Horn, J., E. B. Arnett, and T. H. Kunz. 2008. Interactions of bats with wind turbines based on thermal infrared imaging. Journal of Wildlife Management 72:123–132.

Hoetker, H., Thompson, K.H., Jeromin, H. (2006), Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats- facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Bergenhusen : Michael-Otto-Institut im NABU.

Hundt, L. (2012). Bat Survey Guidelines: Best Practice Guidance- 2nd Edition. Bat Conservation Trust.

Inland Fisheries Ireland (IFI) (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus Co. Dublin. IFI/2016/1-4298.

IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.

Institute of Air Quality Management (IAQM) (2024) Guidance on the assessment of dust from demolition and construction (Version 2.2)

IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.

JNCC (2004) Common Standards Monitoring Guidance for Terrestrial Mammals, Version August 2004, JNCC, Peterborough, ISSN 1743-8160.

Kelly, J., O'Flynn, C., and Maguire, C. (2013). Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

Kelly-Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Kilfeather, (2007) Maintenance and protection of the inland fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board.

King, J., Marnell, F., Kingston, N., Rosell, R., Roche, W. & Cassidy, D. 2011. Ireland Red List No. 5: Fish, amphibians and reptiles National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Krijgsveld, K.L., Akershoek, K., Schenk, F. Dijk, F., Dirkson, S. Ardea, (2009). Collision risk of birds with modern large wind turbines. Vol. 97.

Lawton, C. 2021. Species Profile - Red Squirrel Vincemt Wildlife Trust Ireland [online] available at https://www.vincentwildlife.ie/species/red-squirrel (accessed 21/10/2021)

Lockhart, N., Hodgetts, N., and Holyoak, D. (2012). Ireland Red List No. 8: Bryophytes. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht. Dublin, Ireland.

Long, M.P. & Brophy, J.T. (2013) Survey, habitat and population assessments of Vertigo geyeri, Vertigo moulinsiana, Oxyloma sarsi and Omphiscola glabra at selected sites. Report to National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

Lundy, M.G., Aughney, T, Montgomery, W.I. and Roche, N. (2011). Landscape conservation for Irish bats and species-specific roosting characteristics. Bat Conservation Ireland.

Maitland PS (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Madsen, J., Boertmann, D. (2008) Animal behavioural adaptation to changing landscapes: spring-staging geese habituate to wind farms. Landscape Ecology, Vol. 23, pp. 1007-1011. (Madsen and Boertmann, 2008)

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.

Murphy, (2004). Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.

Natural England (2014). Bats and onshore wind turbines: Interim guidance. Natural England Technical Note TIN051.Third edition 11th March 2014. Peterborough: Natural England. Available at www.naturalengland.org.uk.

NIEA, Natural Environment Division, (2021, updated April 2024) Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments – Version 1.1

NBDC Biodiversity Maps [online] available at: https://maps.biodiversityireland.ie/Map

Nelson, B., Ronayne, C. & Thompson, R. (2011). Ireland Red List No.6: Damselflies & Dragonflies (Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

NRA, (2005). Guidelines for the treatment of badgers prior to the construction of national road schemes. National Raods Authority.

NRA, (2005). Guidelines for the treatment of otters prior to the construction of national road schemes. National Raods Authority.

NRA, (2006a). Best Practice Guidelines for the conservation of Bats in National Road Schemes. National Roads Authority.

NRA, (2006b). Guidelines for the Treatment of Bats during the construction of National Road Schemes. NRA.

NRA (2008a). Environmental Impact Assessment of National Road Schemes – A practical guide. NRA.

NRA (2008b). Guidelines for the Crossing of Watercourses during the construction of National Road Schemes. National Roads Authority.

NRA (2009a). Guideline for the Assessment of Ecological Impacts of National Road Schemes, National Roads Authority

NRA (2009b). Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2

O'Boyle, S., Trodd, W., Bradley, C., Tierney, D., Wilkes, R., Ní Longphuirt, S., Smith, J., Stephens, A., Barry, J., Maher, P., McGinn, R., Mockler, E., Deakin, J., Craig, M. and Gurrie, M. (2019). Water Quality in Ireland 2013-2018. Environmental Protection Agency.

O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Office of the Planning Regulator (OPR) (2021a) Practice Note PN01 Appropriate Assessment Screening for Development Management

Office of the Planning Regulator (OPR) (2021b) Practice Note PN02 Environmental Impact Assessment Screening

Parnell, J: Curtis, T; and Cullen, E. (2012): Webb's an Irish Flora. Hardback, 8th Edn (March 2012), Trinity College Dublin.

Peay S (2003) Guidance on habitat for white-clawed crayfish and how to restoreit. R&D Technical Report W1-067/TR. Environment Agency, Bristol.

Perrin, P.M., Martin, J., Barron, S., O'Neill, F., McNutt & Delaney, A. (2008). National Survey of Native Woodlands 2003-2008. NPWS.

PPG1 - General Guide to Prevention of Pollution (UK Guidance Note)

Pottier, G., et al (2020) 'Electrofishing eel, salmon and trout: impact of waveform and frequency on capture-per-unit-effort and spinal damage'. Knowl. Manag. Aquat. Ecosyst. 2020, 421, 42

Reid, N., Dingerkus, S.K., Stone, R.E., Pietravalle, S., Kelly, R., Buckley, J., Beebee, T.J.C. & Wilkinson, J.W. (2013) National Frog Survey of Ireland 2010/11. Irish Wildlife Manuals, No. 58. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Richardson, S.M., Lintott, P.R., Hosken, D.J. et al. Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Sci Rep 11, 3636 (2021). https://doi.org/10.1038/s41598-021-82014-9

Robinson, C., Lye, G. Battleby (2012). Pauls Hill Windfarm: Flight Activity and Breeding success of Hen Harrier.: Scottish Natural Heritage/Natural Power Consultants, 2012. Sharing Good Practice: Assessing the Impacts of Windfarms on Birds.

Rodrigues, L. B.-S.-J. (2008). Guidelines for consideration of Bats in Wind Farm Projects: EUROBATS Publication Series No.3. UNEP/EUROBATS Secretariat.

Rodrigues, L. Bach, M. J. Cubourg-Savvage, B. Karapandza, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman (2015): Guidelines for consideration of bats in wind farm projects - Revision 2014.EUROBATS Publication Series No. 6 (English Version) UNEP/EUROBATS Sccretarist, Bonn, Germany, 133 pp. http://www.eurobats.org/Sites/default/files/documents/publications/publication_series/pubseries_no6_english.pdf

Rydell J & Racey, P A (1993) Street lamps and the feeding ecology of insectivorous bats. Recent Advances in Bat Biology Zool Soc Lond Symposium abstracts.

Russ, J., Hutson, A., Montgomery, W., Racey, P., & Speakman, J. (2001). The status of Nathusius' pipistrelle (Pipistrellus nathusii Keyserling & Blasius, 1839) in the British Isles. Journal of Zoology, 254(1), 91-100. doi:10.1017/S0952836901000589

SFCC (2007) *Electrofishing team leader training manual.* Scottish Fisheries Co-ordination Centre. http://www.gov.scot/resource/doc/295194/0096726.pdf

Scottish Environmental Protection Agency (SEPA) (2009) Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods. First edition (Document reference: WAT-SG-29)

Scottish Natural Heritage (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage.

NatureScot (2021). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Version 2. Battleby: SNH.

SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

Shawn, K. et al. (2010). Novel scavenger removal trials increase wind turbine-caused avian fatality estimates. Smallwood, 5, Journal of Wildlife Management, Vol. 74, pp. 1089-1097.

Skinner, A., Young, M. & Hastie, L. (2003) Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2 English Nature, Peterborough.

Smith, G. F., & Crowley, W. (2020) The Habitats of Cutover Raised Bog. Irish Wildlife Manuals 128. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland

Smith, G., O'Donoghue, P., O'Hora, K., and Delaney, E. (2011). Best Practice Guidance for Habitat Survey and Mapping. Kilkenny,Ireland.: The Heritage Council.

Stone, E.L., Wakefield, A., Harris, S., Jones, G. (2015b). The impacts of new street light technologies: experimentally testing the effects on bats of changing from low-pressure sodium to white metal halide. Philos. T. R. Soc. B. 370, 20140127.

Technical Committee CEN/TC 230. (2005). Water Quality - Guidance standard for assessing the hydromorphological features of rivers, (EN 14614:2004)

The British Bryological Society. (2010). Mosses and Liverworts of Britain and Ireland – a field guide. Eds: Atheron, I., Bosanquet, S. and Lawley, M. Latimer Trend & Co. Ltd, Plymouth, UK.

Toner, P., Bowman, K., Clabby, K., Lucey, J., McGarrigle, M, Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MaCarthaigh, M., Craig, M., and Quinn, R. 2005. Water Quality in Ireland 2001-2003. Environmental Protection Agency, Wexford.

Whitby, M., Jones, G., & Mathews, F. (2024). Operational mitigation to reduce bat fatalities at wind turbines: A review of current evidence and best practice. Renewable and Sustainable Energy Reviews, 173, 113204.

Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. and 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.

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