APPENDIX 6-2

BAT SURVEY REPORT (INCLUDING APPENDICES)

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1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats, as part of an application for the planning permission of a Proposed Project at Lackareagh Wind Farm, Co.Clare. This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the Proposed Project on bats. Where necessary, mitigation is prescribed to minimise any identified significant effects.

Bat surveys undertaken throughout 2022 were carried out in accordance with the methodologies described in NatureScot 2021 and are consistent with those described in the 2021[1] guidance update. Bat surveys employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level. Surveys in 2022 were based on an indicative turbine layout of seven turbines.

The assessment and mitigation provided in this report has been designed in accordance with NatureScot 2021. Consideration was also given to the Northern Ireland Environment Agency (NIEA) Natural Environment Division (NED) Guidance [2], which was produced in August 2021 and last updated in March 2024, following the completion of the bat surveys at the Proposed Project.

- Where the 'Proposed Project' is referred to this encompasses the entirety of the project for the purposes of this EIA in accordance with the EIA Directive. The Proposed Project is described in detail in Chapter 4 of this EIAR.
- Where proposed development is referred to, this encompasses everything within RLB including the Wind Farm infrastructure and the grid connection infrastructure. Where the 'Proposed Wind Farm' is referred to, this refers to turbines and associated foundations and hardstanding areas, including access roads, underground cabling, permanent meteorological mast, temporary construction compounds, carriageway strengthening works, junction accommodation works, peat and spoil management, tree felling, site drainage, operational stage signage, battery energy storage system, 38kV onsite substation, and all ancillary works and apparatus. The Proposed Wind Farm is described in detail in Chapter 4 of this EIAR.
- Where the 'Proposed Grid Connection Route' is referred to, this refers to underground 38kV cabling connecting to the existing Ardnacrusha 110kV substation, and all ancillary works and apparatus. The Proposed Grid Connection Route is described in detail in Chapter 4 of this EIAR.
- Where 'the site' is referred to, this relates to the primary study area for the EIAR, as delineated by the EIAR Site Boundary in green as shown on Figure 1-1 of Chapter 1.

Further details on project description and components are outlined in Chapter 4 of this EIAR.

1.1 Statement of Authority

MKO employs a dedicated bat unit within its Ecology team, dedicated to scoping, carrying out, and reporting on bat surveys, as well as producing impact assessments in relation to bats. MKO ecologists have relevant academic qualifications and are qualified in undertaking surveys to the levels required. Survey scoping was prepared by Aoife Joyce. The daytime walkover survey, inspections and manual activity surveys were carried out by Sara Fissolo and Stephanie Corkery. At the time of surveys, surveyor Sara Fissolo was licenced under DER-BAT-54-2022. The licence is intended for professionals carrying out surveys with the potential to disturb roosting bats (i.e. roost inspections). Data manual ID

[1] *NatureScot published Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Version: August 2021 (NatureScot, 2021).*
[2] *Northern Ireland Environment Agency Natural Environment Division (NED) published Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland. Volume 1.1. (NIEA, 2024).*

were carried out by Stephanie Corkery. This report was prepared by Stephanie Corkery, Nora Szijarto and Sara Fissolo and was approved by Aoife Joyce. Staff's roles and relevant training are presented in Table 1-1Table 1-1 below.

Table 1-1 Bat Specific Experience and Training of Ecologists Involved in Surveys

Staff	Role	Training
Aoife Joyce (B.Sc., M.Sc.)	Project Director	B.Sc. (Hons) Environmental Science, University of Galway, Ireland. M.Sc. (Hons) Agribioscience, University of Galway, Ireland. Advanced Bat Survey Techniques – Trapping, biometrics, handling (BCI), Bat Impacts and Mitigation (CIEEM), Bat Tree Roost Identification and Endoscope Training (BCI), Bats in Heritage Structures (BCI), Bats and Lighting (BCI), Kaleidoscope Pro Analysis (Wildlife Acoustics).
Sara Fissolo (B.Sc.)	Project Ecologist	B.Sc. (Hons) Ecology and Environmental Biology, University College Cork, Ireland. Advanced Bat Survey Techniques (BCI), Bat Impacts and Mitigation (CIEEM), Bats in Heritage Structures (BCI), Bat Care (BCT), Bats and Lighting (BCI), Manual Activity Surveys (Internal), Bat Roost Inspections (Internal), Endoscope Training (Internal), Kaleidsocope Pro Analysis (Wildlife Acoustics).
Nora Szijarto (B.Sc., M.Sc.)	Bat Ecologist	B.Sc. Biology, University of Lausanne, Switzerland M.Sc. Behaviour, Evolution and Conservation, University of Lausanne, Switzerland Bat Detector and Survey Training (BCI), Kaleidoscope Pro Analysis (Wildlife acoustics), Endoscope Training (Internal), Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal), Emergence and Re-Entry Surveys (Internal).
Stephanie Corkery (B.Sc., M.Sc.)	Ecologist	B.Sc. (Hons) Ecology and Environmental Biology, University College Cork (2018) M.Sc. Marine Biology, University College Cork (2020) Kaleidoscope Pro Analysis (Wildlife Acoustics), Endoscope Training (Internal), Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal), Emergence and Re-Entry Surveys (Internal).

1.2 Background

Wind energy provides a clean, sustainable alternative to fossil fuels in generating electricity. However, wind energy development can impact wildlife, directly through mortality and indirectly through disturbance and habitat loss. Bat fatalities have been reported at wind energy facilities around the world, raising concern about the cumulative impacts of such developments on bat populations (Arnett *et al.* 2016). No large-scale studies have been undertaken in Ireland to date. However, a study from the

UK estimated bat fatalities at 0 – 5.25 bats per turbine per month (Mathews *et al.* 2016). While these results are not directly applicable to Ireland due to differences in bat species and behaviour, Ireland shares more similarities with bat assemblages of Great Britain, when compared to those of mainland Europe.

Investigative research in North America and mainland Europe have revealed the mechanisms for bat mortality at wind turbines. Fatalities arise from direct collision with moving turbine blades (Horn *et al.* 2008, Cryand *et al.* 2014) and barotrauma (Baer Wald *et al.* 2008), i.e., internal injuries caused by air pressure changes. Why bats fly in the vicinity of wind turbines has been attributed to several different behavioural and environmental factors, e.g. habitat associations, weather conditions and, species ecology.

Pre-construction bat surveys are undertaken to provide a baseline to gain an insight into bat activity in the absence of turbines and to predict and mitigate against any future risks identified. Survey design and analyses of results at the Proposed Project was undertaken with reference to the latest policy and legislation, scientific literature and industry guidelines. Any spatial, temporal or behavioural factors that may put bats at risk were fully considered.

1.3 Bat Survey and Assessment Guidance

Several guidelines for surveying bats at wind energy developments have been produced in Europe, the UK and Ireland.

At a European level, the Advisory Committee to the EUROBATS Agreement, to which Ireland is a signatory, have produced *Guidelines for Consideration of Bats in Wind Farm Projects* which outlines an approach for assessing the potential impacts of wind turbines on bats during planning, construction and operation phases (Rodrigues, 2015). However, these guidelines are based on continental scenarios and include more diverse species and behaviours than those typical of Ireland. As such, EUROBATS guidance may recommend a level of survey that may prove inappropriate in Irish scenarios. Nevertheless, the guidance is evidence-based and provides a useful European context, within which Member States are encouraged to produce specific national guidance, focusing on local circumstances.

Bat Conservation Ireland produced *Wind Turbine/Wind Farm Development Bat Survey Guidelines* (BCI, 2012a). This document provides advice to practitioners and decision makers in Ireland on necessary qualifications for surveyors, health and safety considerations, pre-construction and post-construction survey methodologies and information to be included in a report. In the absence of comprehensive Irish research, these guidelines provide generalised methodology rather than detailed technical advice.

The second edition of the UK Bat Conservation Trust *Bat Survey Good Practice Guidelines* (Hundt, 2012) includes a chapter (Chapter 10) on survey methodologies for assessing the potential impacts of wind turbines on bats. The document provides technical guidance for consultants carrying out impact assessments. However, the recommendations are not based on any research findings specific to the UK. A third edition to the guidelines, published in early 2016, removed the chapter on surveying wind turbine developments. The change has been maintained in the guidelines' fourth edition, published in September 2023. Prior to the publication of the BCT guidelines, Natural England's *Bat and Onshore Wind Turbines: Interim Guidance* provided an interpretation of the EUROBATS recommendations, as applied to onshore wind energy facilities in the UK (Natural England, 2014). In addition, the Chartered Institute of Ecology and Environmental Management (CIEEM) publishes advice on best practice as well as updates on the current state of knowledge in the *Technical Guidance Series* and in the quarterly publication *In Practice*.

In August 2021, NatureScot (formerly Scottish Natural Heritage), published *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (NatureScot, 2021). The 2021 version supersedes the 2019 version of the guidance. The purpose of the guidance is to help planners, developers and ecological

consultants to consider the potential effects of onshore wind energy developments on bats. The emphasis is on direct impacts such as collision mortality, but there is reference throughout to the need for a full impact assessment requiring wider consideration of other (indirect) effects. The Guidance replaces previous guidance on the subject; notably that published by Natural England and Chapter 10 of the Bat Conservation Trust publication, *Bat Surveys: Good Practice Guidelines (2nd edition),* (Hundt, 2012) and tailors the generic EUROBATS guidance on assessing the impact of wind turbines on European bats (Rodrigues *et al.* (2014)). The document guides the user through the key elements of survey, impact assessment and mitigation.

The NIEA (NED) recently published *Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland*. This new guidance follows and builds upon the recently updated NatureScot 2021 guidance. The latter guidance has set the industry standard since its publication in 2019. The NED guidance does not aim to replace the NatureScot guidance, but it does provide additional clarifications and recommendations regarding survey requirements and impact assessment in an Irish context.

The survey scope, assessment and mitigation provided in this report are in accordance with NatureScot 2021 Guidance.

1.4 Irish Bats: Legislation, Policy and Status

Ireland has nine resident bat species, comprising more than half of Ireland's native terrestrial mammals (Montgomery *et al.*, 2014).

All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat (*Rhinolophus hipposideros)* is further listed under Annex II of the Directive, requiring the designation of conservation areas for the species. Under this Directive, Ireland is obliged to maintain the favourable conservation status of Annex-listed species. This Directive has been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011(S.I. No. 477/2011, as amended).

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2021). Under this legislation, it is an offence to intentionally disturb, injure or kill a bat, or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

The NPWS monitors the conservation status of European protected habitats and species and reports their findings to the European Commission every 6 years in the form of an Article 17 Report. The most recent report for the Republic of Ireland was submitted in 2019. Table 1-2 summarises the current conservation status of Irish bat species and identified threats to Irish bat populations.

Table 1-2 Irish Bat Species Conservation Status and Threats (NPWS, 2019)

Bat Species	Conservation Status	Principal Threats
Common pipistrelle *Pipistrellus pipistrellus*	Favourable	**A05** Removal of small landscape features for agricultural land parcel consolidation (M) **A14** Livestock farming (without grazing) [impact of anti-helminthic dosing on dung fauna] (M) **B09** Clear--cutting, removal of all trees (M) **F01** Conversion from other land uses to housing, settlement or recreational areas (M) **F02** Construction or modification (e.g. of housing and settlements) in existing urban or recreational areas (M) **F24** Residential or recreational activities and structures generating noise, light, heat or other forms of pollution (M) **H08** Other human intrusions and disturbance not mentioned above (Dumping, accidental and deliberate disturbance of bat roosts (e.g. caving) (M) **L06** Interspecific relations (competition, predation, parasitism, pathogens) (M) **M08** Flooding (natural processes) **D01** Wind, wave and tidal power, including infrastructure (M)
Soprano pipistrelle *Pipistrellus pygmaeus*	Favourable	
Nathusius' pipistrelle *Pipistrellus nathusii*	Unknown	
Leisler's bat *Nyctalus leisleri*	Favourable	
Daubenton's bat *Myotis daubentoni*	Favourable	
Natterer's bat *Myotis nattereri*	Favourable	
Whiskered bat *Myotis mystacinus*	Favourable	
Brown long-eared bat *Plecotus auritus*	Favourable	
Lesser horseshoe bat *Rhinolophus hipposideros*	Inadequate	

2. PROPOSED PROJECT DESCRIPTION

The Proposed Project is located within Lackareagh and neighbouring townlands, Co. Clare, as outlined in Chapter 1 of this EIAR. The approximate centre of the Proposed Wind Farm site is Grid Ref: E163295 N173179. The Proposed Wind Farm site lies under one kilometre east of the town of Kilbane. The site is currently accessed via local roads, farm tracks and forestry tracks. The Proposed Wind Farm site is bisected by the L7080 Local Road (the Gap Road) with a number of internal wind farm roads being proposed both north and south of this road

The main site entrance is accessed via local roads that adjoin the R465, R466, and R463 Regional Roads, which is located to the west, south and east of the site respectively.

The primary land use in the area is a mixture of agriculture and commercial forestry, with mature and immature forestry coverage along with areas of clear fell across the majority of the site. Within the wider landscape, low-medium density housing and commercial forestry comprise the main land uses. A site location map of the site is provided in Figure 2-1.

The proposed development will consist of the provision of the following:

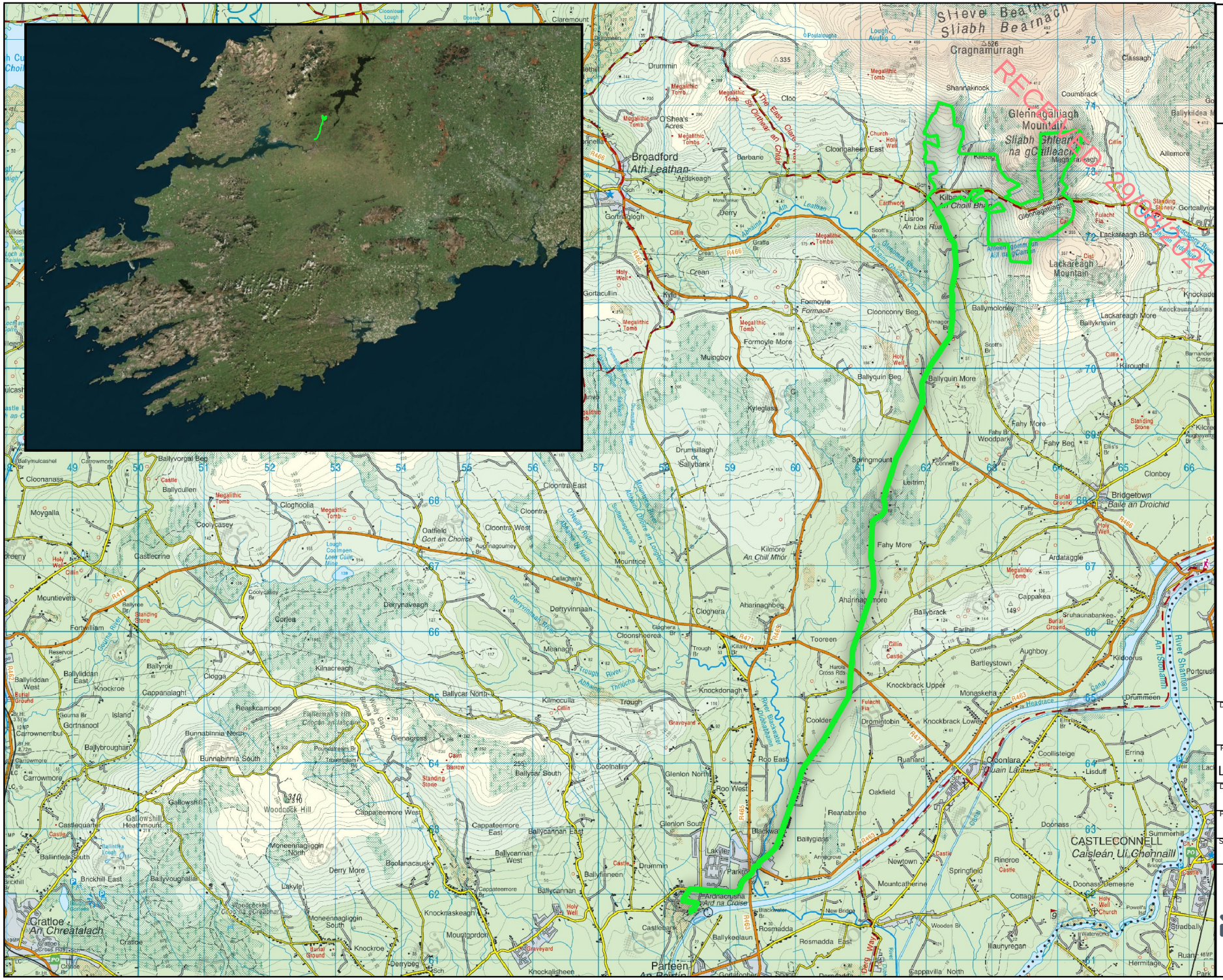
i. *The construction of 7 no. wind turbines with the following parameters:*
    a. *Total tip height range of 179.5m – 180m,*
    b. *Rotor diameter range of 149m – 155m,*
    c. *Hub height range of 102.5m to 105m,*
ii. *Construction of associated foundations, hardstand and assembly areas;*
iii. *All associated wind farm underground electrical and communications cabling connecting the turbines and mast to the proposed electrical substation;*
iv. *Construction of 1 no. permanent 38kV electrical substation including a single-story control building with welfare facilities, all associated electrical plant and equipment, security fencing, entrance on to new access road, all associated internal underground cabling, drainage infrastructure, wastewater holding tank, retention separator tank, and all ancillary works, in the townland of Killeagy (Goonan), Co. Clare;*
v. *A Battery Energy Storage System within the 38kV electrical substation compound;*
vi. *1 no. permanent meteorological mast of c. 36.5m in height, associated foundation and hard-standing area in the townland of Shannaknock;*
vii. *The permanent upgrade of 1 no. existing site entrance off the L7080 ('The Gap Road') for the provision of construction and operational access;*
viii. *Provision of 3 no. new permanent site entrances off the L7080 for the provision of construction and operational access;*
ix. *Provision of 3 no. new temporary site entrances off the L7080 for the provision of construction access;*
x. *Upgrade of existing tracks/ roads, including the L7080, and the provision of new site access roads, 4 no. watercourse crossings, junctions and hardstand areas;*
xi. *1 no. temporary construction compound with temporary offices and staff facilities in the townland of Killeagy (Goonan);*
xii. *1 no. temporary storage area in the townland of Killeagy (Goonan);*
xiii. *1 no. borrow pit in the townland of Killeagy (Goonan);*
xiv. *Peat and Spoil Management;*
xv. *Tree Felling to accommodate the construction and operation of the proposed development;*
xvi. *Operational stage site and amenity signage; and*
xvii. *All ancillary apparatus and site development works above and below ground, including soft and hard landscaping and drainage infrastructure.*

The applicant is seeking a ten-year planning permission for development.

The Proposed Grid Connection Route includes for an underground electrical grid connection cable from the proposed onsite 38kV substation to the existing 110kV Ardnacrusha substation located in the townland of Castlebank and Ballykeelaun.

The cabling will be located within the public road corridor or existing tracks for its entire length. The total length of the proposed underground grid connection route is approximately 14.7km, the full length of the proposed underground grid connection is located within Co. Clare.

All elements of the Proposed Project in the list above, and described in this chapter, have been assessed as part of this EIAR.



Map Legend

EIAR Site Boundary

Proposed Turbine Layout

Drawing Title

Site Location

Project Title

Lackareagh Wind Farm, Co.Clare

Drawn By	Checked By
NS	SF
Project No.	Drawing No.
220245	Fig. 2-1
Scale	Date
1:75,000	2024-08-07

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3. METHODS

3.1 Consultation

A scoping exercise was undertaken as part of the EIAR for the Proposed Project. A scoping document, providing details of the application site and the Proposed Project, was prepared by MKO and circulated to consultees in November 2022. As part of this exercise, prominent Irish conservation groups were contacted, and Bat Conservation Ireland (BCI) and National Parks and Wildlife Service (NPWS) were specifically invited to comment on the potential of the Proposed Project to affect bats.

Details of consultation responses specifically related to bats are provided in Section 4.1 below.

3.2 Desk Study

A desk study of published material was undertaken prior to conducting field surveys. The aim was to provide context to the site in order to assist bat survey planning and assessment. This included the identification of designated sites, species of interest or any other potential risk factors within the Proposed Wind Farm and the surrounding region. The results of the desk study including sources of information utilised are provided below.

3.2.1 Bat Records

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. A search of the National Bat Database of Ireland was last carried out on the 13th May 2024 and examined bat presence and roost records within a 10km radius of a central point in the Proposed Wind Farm (Grid Ref: R 63105 72725) (BCI 2012, Hundt 2012, NatureScot 2021). A request for available bat records was requested to Bat Conservation Ireland on 05/12/2022. Results from the National Biodiversity Data Centre were also reviewed for bat species present within the relevant 10km grid squares of the Proposed Project.

In addition, information on species' range and distribution, available in the 2019 Article 17 Reports (NPWS, 2019), was reviewed in relation to the location of the Proposed Project. The aim was to identify any high-risk species at the edge of their range.

3.2.2 Bat Species' Range

EU member states are obliged to monitor the conservation status of natural habitats and species listed in the Annexes of the Habitats Directive. Under Article 17, they are required to report to the European Commission every six years. In April 2019, Ireland submitted the third assessment of conservation status for Annex-listed habitats and species, including all species of bats (NPWS, 2019).

The 2019 Article 17 Reports were reviewed for information on bat species' range and distribution in relation to the location of the Proposed Project. The aim was to identify any high-risk species at the edge of their range (NatureScot, 2021).

3.2.3 Designated Sites

The National Parks and Wildlife Service (NPWS) map viewer and website provides information on rare and protected species, sites designated for nature conservation and their conservation objectives. A search was undertaken of sites designated for the conservation of bats within a 10km radius of the

Proposed Wind Farm (BCI 2012, Hundt, 2012, NatureScot 2021). This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

3.2.4 Landscape Features

3.2.4.1 Ordnance Survey Mapping

Ordnance survey maps (OSI 1:5,000 and 1:50,000) and aerial photographs were reviewed to identify any habitats and features likely to be used by bats. Maps and images of the Proposed Wind Farm and general landscape were examined for suitable foraging or commuting habitats including woodlands and forestry, hedgerows, treelines and watercourses. In addition, any potential roost sites, such as buildings and bridges, were noted for further investigation.

3.2.4.2 Geological Survey Ireland

The Geological Survey Ireland (GSI) online mapping tool and University of Bristol Speleological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10km of the site (BCI, 2012) (last searched on the 24th of February 2023). Furthermore, the archaeological database of national monuments was reviewed for any evidence of manmade underground structures, e.g. souterrains, that may be used by bats (last searched on the 24th of February 2023).

3.2.4.3 National Biodiversity Data Centre Bat Landscape Mapping

The National Biodiversity Data Centre (NBDC) map viewer presents “Bat Landscape” maps for individual species and for all species combined. Lundy *et al.* (2011) used Maximum Entropy Models to examine the relative importance of bat landscape and habitat associations in Ireland. The resulting map provides a 5-point scale, ranging from highest habitat suitability index (presented in red) to lowest suitability index (presented in green). However, squares highlighted as less favourable may still have local areas of abundance.

The location of the Proposed Project was reviewed in relation to bat habitat suitability indices. The aim of this was to assess habitat suitability for all bat species within the site. It is worth noting that these results are based on a modelling exercise and not confirmed bat species records. Regardless, they may provide a useful indication of potential favourable bat associations within the site.

3.2.4.4 Additional Wind Energy Projects in the Wider Landscape

A search for cumulative, existing and permitted wind energy developments within 10 km of the Proposed Project was undertaken (NatureScot, 2021) in conjunction with reviewing the IWEA interactive wind map (iwea.com). Other large infrastructure developments and proposals (e.g. roads) were also noted. Information on the location and scale of these developments was gathered to inform the potential for cumulative effects. Further details on infrastructure developments within the vicinity of the Proposed Project can be found in Chapter 2 of the main EIAR.

3.2.5 Multidisciplinary Surveys

Multidisciplinary walkover surveys were undertaken between 2022 and 2024, as detailed in Table 6-2 of Chapter 6 of the EIAR. Dedicated bat surveys were undertaken in 2022 (Table 3-1) The site was systematically and thoroughly walked in a ground-truthing exercise with the habitats on the site assessed and classified. The habitats (including any culverts/bridges) were assessed for bat commuting, foraging and roosting suitability. The Proposed Grid Connection Route and Turbine Delivery Route (TDR) were visited as part of the multidisciplinary surveys outlined below and in Chapter 6 of the main EIAR.

Dedicated walkover surveys were undertaken within the site of the Proposed Project on the following dates:

Table 3-1 Bat Survey Effort

Dedicated Bat Survey
April 28th 2022
May 11th 2022
June 2nd 2022
June 14th 2022
August 2nd 2022
August 18th 2022
August 24th 2022
August 25th 2022
September 21st 2022
October 18th 2022

3.3 Field Surveys

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2022. During these surveys, habitats within the Proposed Wind Farm were assessed for their suitability to support roosting, foraging and commuting bats. An assessment of the Proposed Grid Connection Route was also undertaken. Connectivity with the wider landscape was considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories, divided into *High*, *Moderate*, *Low* and *Negligible*, are described fully in **Appendix 1**. Iterations made throughout the design process in response of ecological and other relevant constraints reduced the EIAR Study Boundary since the initial walkovers were carried out.

New Collins guidelines were published in September 2023 (Collins, 2023), after the bat habitat appraisal was undertaken. The new protocol includes the None category, where no uncertainty exists on the lack of PRFs on a tree or structure. Trees where further assessment is required are marked as FAR, and trees with obvious PRF are marked PRF, which can be assessed as either PRF-I, which corresponds to the previous Negligible and Low categories, or PRF-M, which marks a sizeable feature suitable to host a maternity roost. While categories were not updated, the assessment and scope of surveys were considered appropriate for the site and in line with recent guidance.

3.3.1.1 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 86.5m) of the Proposed Project footprint (NatureScot, 2021). The aim of these searches was to determine the presence of Potential Roost Features (PRFs) for bats and the need for further survey work or mitigation. The Proposed Wind Farm site was visited in April, May, August, and September 2022. Walkover surveys were carried out in combination with deployment and collection of static detectors, and all structures identified within the search area were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats). This comprised a detailed inspection of the interior, if accessible, and exterior to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

Any potential tree roosts were examined for the presence of rot holes, hazard beams, cracks and splits, partially detached bark, knot holes, gaps between overlapping branches and any other PRFs identified by Andrews (2018).

Due to changes made to the turbine layout and EIAR Site Boundary during the design process, some of the PRFs identified, inspected and surveyed are no longer located within the EIAR Site Boundary.

3.3.1.2 Proposed Grid Connection Route

An assessment of the Proposed Grid Connection was also undertaken as part of a multidisciplinary assessment by Neansai O'Donovan in December 2022 and January 2023. January and December are unsuitable time to carry out bat activity surveys but are suitable to undertake preliminary roost assessments. Any water crossing infrastructure were assessed for their potential to host roosting bats and their suitability to foraging and commuting bats to inform the need for further surveys and potential mitigation.

3.3.2 Manual Activity Surveys

Manual activity surveys were undertaken in Lackereagh throughout 2022, in the form of emergence/re-entry survey at suspected roosts, or as walked transects. Surveyors were equipped with active full spectrum bat detectors, the Batlogger M bat detector (Elekon AG, Lucerne, Switzerland) and all bat activity was recorded for subsequent analysis to confirm species identifications. All surveys were carried out during weather conditions suitable for bat surveying. Details of the surveys are presented in Table 3-2 and described below.

Table 3-2 2022 Survey Effort in 2022 – Manual Surveys

Date	Surveyors	Survey Type	Sunset/ Sunrise	Start-End	Weather	Transect (km)
11th May 2022	Stephanie Corkery and Keith Costello	Dusk Emergence and Transect	21:21	20:50 – 00:20	10 - 13˚C; dry; calm	2.9
2nd August 2022	Sara Fissolo and Stephanie Corkery	Dusk Emergence and Transect	21.25	21.02 – 22.18	14 ˚C; dry; calm	1.7
24th August 2022	Sara Fissolo and Stephanie Corkery	Dusk Emergence	20.40	20.16 – 21.51	13-14 ˚C; dry; calm	N/A
25th August 2022	Sara Fissolo and Stephanie Corkery	Dawn Re-entry	6.32	5.05 – 6.49	10-11 ˚C; dry; light breeze	N/A
21st September 2022	Sara Fissolo and Stephanie Corkery	Dusk Emergence and Transect	19.36	19.21 – 21:53	15 ˚C; light drizzle; calm	4.1

3.3.2.1 Dusk Emergence and Dawn Re-entry Surveys

Dusk emergence surveys were undertaken on the evenings of May 11th, August 2nd, August 24th, and September 21st 2022. A dawn re-entry survey took place on the 25th of August. Emergence surveys commenced at least 15 minutes before sunset and concluded within 1.5 hours after sunset. Dawn re-entry surveys commenced approximately 1.5 hours before sunrise and concluded 15 minutes after sunrise. The location of the PRFs surveyed is detailed in table 3-7 and shown in Figure 2-1.

3.3.2.2 Transect Surveys

A series of representative transect routes were selected throughout the site. A total of three transect surveys took place in 2022 and each of these followed a dusk emergence survey of a potential roosting feature. The aim of these surveys was to identify the bat species using the site and gather any information on bat behaviour and important features used by bats. Transect routes were prepared with

reference to the proposed layout, desktop, and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect routes are presented in Figure 3-1.

Transects were walked or driven by two surveyors, recording bats in real time. Surveys commenced within 30 mins before sunset and were completed within 3 hours after sunset. The driven transects followed the methodology described by Roche et al. (2012) and were conducted along the local roads of the Proposed Project. Surveyors were again equipped with active full spectrum bat detectors, the Batlogger M bat detector (Elekon AG, Lucerne, Switzerland) and all bat activity was recorded for subsequent analysis to confirm species identifications. Table 3-1 summarises survey effort in relation to both roost surveys and manual transects.

3.3.3 Ground-level Static Surveys

Where developments have more than 10 turbines, NatureScot (2021) there is a requirement for one detector per turbine up to 10, plus one detector for every three additional turbines. The scope of bat work was designed considering a 7-turbine proposed layout. Given that 7 turbines were proposed, 7 static bat detectors were deployed to ensure compliance with NatureScot guidance. As layout designs were modified throughout the bat survey season, the addition of one detector was required to achieve a good spatial spread in relation to the Proposed Wind Farm and sample the range of available habitats. Detector locations were based on indicative turbine locations provided before the Spring deployment and differ slightly to the final proposed layout.

Automated bat detectors were deployed at 7 no. locations for at least 10 nights of suitable weather in Spring. Due to a loss of data following an initial Spring deployment, detectors were re-deployed at the start of June for more reliable coverage. The data will be presented as a summary of results as it was not possible to be analysed due to gappy continuity. A total of 8 detectors were then deployed for at least 20 nights in Summer. As high activity was recorded within the site during the first two deployments, detectors were also deployed for at least 20 nights in Autumn to collect more data (NatureScot, 2021).

Keyhole felling will be required where turbines are proposed in areas of forestry within the site. This involves only felling an area required to construct the turbine and associated infrastructure thus creating open areas, within the forest, around proposed turbines (IWEA, 2012). The 'keyhole' size is typically 50m from turbine blade tip to forestry edge, and these keyhole areas remain open during the wind farm lifetime. Further details on proposed key-hole locations can be found in Chapter 4 of the EIAR. Where keyholing is proposed, detectors were located along nearby forestry edge to more closely reflect the likely post-construction habitat (NatureScot, 2021). Detector D04 was not located at the exact proposed turbine location (T6) as the integrity of the equipment and safety of surveyors could not be guaranteed due to bulls and cattle being present. Static detector locations are described in Table 3-3 and presented in Figure 3-1.

Table 3-3 Location of deployed detectors

ID	Location	Habitat	Linear Feature within 50 m	Corresponding Turbine
D01	E162275 N173972	Agricultural grassland GA1	Low Quality Hedgerow	T1
D02	E162304 N173562	Agricultural grassland GA1	Low Quality Hedgerow/ treeline	T2
D03	E163939 N172719	Wet Grassland GS4	Within conifer forestry	T4
D04	E163495 N172439	Agricultural grassland GA1	Moderate Quality Hedgerow/Scrub	T6
D05	E164070 N173259	Conifer Plantation WD4	Within conifer forestry	T3

ID	Location	Habitat	Linear Feature within 50 m	Corresponding Turbine
D06	E163408 N171860	Wet Grassland GS4	Moderate Quality Hedgerow	T7
D07	E162803 N173591	Agricultural grassland GA1	High Quality Hedgerow/treeline	No corresponding
D08	E163951 N172318	Wet Grassland GS4	Edge of conifer forestry	T5

Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed using settings recommended for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset until 30 minutes after sunrise. The Song Meter automatically adjusts sunset and sunrise times using the Solar Calculation Method when provided with GPS coordinates.

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e. minimum 10 no.) with appropriate weather conditions were captured (i.e. dusk temperatures above 8˚, wind speeds less than 5m/s and no or only very light rainfall). Table 3-4 summarises survey effort achieved for each of the detector locations in 2022.

Table 3-4 2022 Survey Effort - Ground-level Static Surveys

Season	Survey Period	Total Survey Nights per detector location	Nights with Appropriate Weather
Lackareagh – 2022			
Spring	28th April - 11th May *	-	-
Spring	2nd June – 14th June 2022	12	11
Summer	2nd August – 8th September 2022	37	22
Autumn	21st September – 10th October 2022	27	24
Total Survey Effort		**76**	**57**

*Data upload failure – data not used for assessment.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Static Detector Locations
- Spring Transect 11.05.2022
- Summer Transect 02.08.2022
- Autumn Transect 21.09.2022

PRFs Inspected

- High
- Low
- Moderate
- Negligible

N

Drawing Title: Survey Effort 2022

Project Title: Lackareagh Wind Farm, Co.Clare

Drawn By	Checked By
NS	SF
Project No. 220245	Drawing No. Fig. 3-1
Scale 1:15,000	Date 2024-08-07

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3.4 Bat Call Analysis

All recordings from Spring, Summer, and Autumn 2022 were analysed using bat call analysis software Kaleidoscope Pro v.5.1.9 (Wildlife Acoustics, MA, USA). The aim of this was to identify, to a species or genus level, what bats were present at the Proposed Project site. Bat species were identified using established call parameters, to create site-specific custom classifiers. All identified calls were also manually verified.

Echolocation signal characteristics (including signal shape, peak frequency of maximum energy, signal slope, pulse duration, start frequency, end frequency, pulse bandwidth, inter-pulse interval and power spectra) were compared to published signal characteristics for local bat species (Russ, 1999). Myotis species (potentially Daubenton's bat *(M. daubentonii),* Whiskered bat *(M. mystacinus),* Natterer's bat *(M. nattereri)*) were considered as a single group, due to the difficulty in distinguishing them based on echolocation parameters alone (Russ, 1999). The echolocation of Soprano pipistrelle *(P. pygmaeus)* and Common pipistrelle *(P. pipistrellus)* are distinguished by having distinct peak frequencies (peak frequency of maximum energy in search flight) of ~55 kHz and ~46 kHz respectively (Jones & van Parijs, 1993).

Plate 3-1 below shows a typical sonogram of echolocation pulses for Common pipistrelle recorded with a SM4BAT bioacoustic static bat recording device. The recorded file is illustrated using Wildlife Acoustics Kaleidoscope software.

Individual bats of the same species cannot be distinguished by their echolocation alone. Thus, 'bat passes' were used as a measure of activity (Collins, 2023). A bat pass is defined as a recording of an individual species/species group's echolocation containing at least two echolocation pulses and of maximum 15s duration. All bat passes recorded in the course of this study follow these criteria, allowing comparison. Due to the volume of bat activity data recorded, where multiple bat passes were recorded within the same registration, rarer or harder to record species were identified. Underreporting of common species is possible using this method and is accounted for within the assessment.

Echolocation calls by Brown long-eared bats (*Plectous auritus*) are quiet and intrinsically hard to record by static equipment. All data collected, including Noise files and Auto ID files are checked to ensure all calls for this species have been captured. However, a level of underrepresentation is expected for this species and is accounted for in the assessment of activity levels.

Echolocation by Lesser horseshoe bats (*Rhinolophus hipposideros*) is directional and can be missed by detectors, particularly manual detectors. MKO employs omni-directional microphones to limit under-recording for the species.

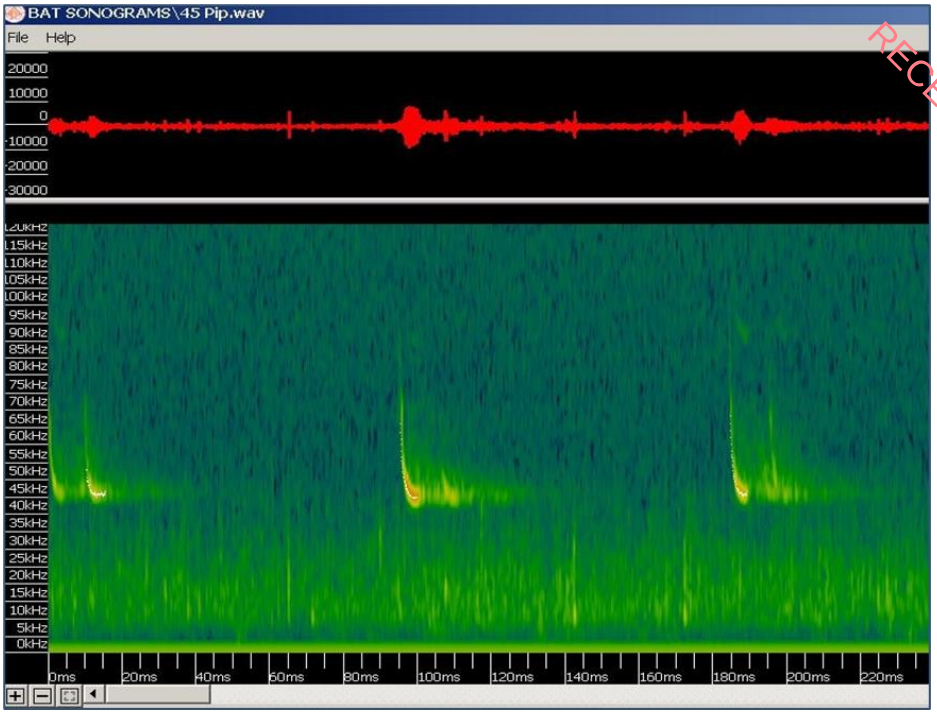

Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

The online database tool Ecobat (www.mammal.org.uk) was recommended by NatureScot 2021 to assess bat activity levels within a proposed wind farm site. This web-based interface, launched in August 2016, allowed users to upload activity data and to contrast results with a comparable reference range, allowing objective interpretation. Uploaded data then contributes to the overall dataset to provide increasingly robust outputs. Ecobat generated a percentile rank for each night of activity and provided a numerical way of interpreting levels of bat activity in order to provide objective and consistent assessments. Table 3-5 defines bat activity levels as they relate to Ecobat percentile values (NatureScot, 2021).

Table 3-5 Ecobat Percentile Score and Categorised Level of Activity (NatureScot, 2021)

Ecobat Percentile	Bat Activity Level
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

Ecobat was unavailable for a cross-site analysis of 2022 data as the platform has been undergoing maintenance since late 2022 with no proposed timeline of a relaunch. Therefore, data were assessed on a site-specific basis.

Following preliminary analysis and manual verification using Kaleidoscope Pro, statistical analysis and visualisation was performed using RStudio (version 2023.12.1+402.) and R (version 4.3.3). RStudio, an integrated development environment for the R programming language, was employed for data cleaning, exploration, and data visualisation. The 'ggplot2' R package was particularly instrumental in creating the data visualisations shown in the results section. Data was standardised into bat pass rates, calculated as bat passes per hour (total bat passes / night length) to account for seasonal changes in night length (Matthews et al. 2016). Activity is often variable between survey nights. Therefore, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). During all calculations, data was rounded to at least three decimal places. When visualising the

bat pass rates per season, survey effort was defined as detector hours (sum of recorded hours across all detectors). This was defined to circumvent any issues arising from differences in survey effort between detectors in a season.

Activity levels were assessed according to the site activity and the species were assessed separately, where two pipistrelle species (*Pipistrellus pipistrellus, Pipistrellus pygmaeus*), noctules (*Nyctalus leisleri*), *Myotis* spp. are widespread, Nathusius' pipistrelles (*Pipistrellus nathusii*) are rare, and brown long-eared bats (*Plecotus auritus*) and lesser horseshoe bats (*Rhinolophus hipposideros*) are rare or hard to record species. Median and maximum nightly activity (bpph) at each detector location were then categorized as Low, Medium, or High for each recorded season. Any figure below 25% of the maximum/average maximum nightly pass rate was considered Low activity, while figures above 75% were classified as High. Values falling between these two quartiles were defined as Medium. To prevent skewing the activity threshold towards high levels, any evident outliers recorded across the detectors were excluded. Table 3-6 presents activity ranges per species group identified.

Table 3-6 Site-specific Activity Level Categories based on Maximum Bat Passes per Hour (bpph)

Assessment Level	Activity Threshold as Bat Passes per Hour (bpph) for Bat Species				
	Widespread *Pipistrellus* spp.	*Nyctalus* spp.	*Pipistrellus' nathusii*	*Myotis* spp.	Other groups
Low <	5.2	3	0.7	2.3	0.4
< Medium <	5.2 - 15.6	3 - 9	0.7 - 2.1	2.3 - 6.8	0.4 - 1.3
High >	15.6	9	2.1	6.8	1.3

3.6 Assessment of Collision Risk

3.6.1 Population Risk

NatureScot (2021) provides a generic assessment of bat collision risk for UK species, based on species behaviour and flight characteristics. In the guidelines, this measure of collision risk is used, in combination with relative abundance, to indicate the potential vulnerability of British bat populations. No such assessment is provided for Irish bat populations.

In Table 3-7, an adapted assessment of vulnerability for Irish bat populations to collision with wind turbine blades is provided. This adaptation of NatureScot Guidance Table 2 was based on collision risk and species abundance of Irish bat populations. Species' collision risk follows those described in NatureScot (2021). Relative abundance for Irish species was determined in accordance with Wray *et al.* (2010) using population data available in the 2019 Article 17 reports (NPWS, 2019). Feeding and commuting behaviours, and habitat preferences for bat species in Ireland were also considered.

Table 3-7 Population Vulnerability of Irish Bat Species (Adapted from NatureScot, 2021)

Relative abundance	Low Collision Risk	Medium Collision Risk	High Collision Risk
Common species			Common pipistrelle Soprano pipistrelle
Rarer species	Daubenton's bat Brown long-eared bat Lesser horseshoe bat		Leisler's bat
Rarest species	Natterer's bat		Nathusius'pipistrelle

	Whiskered bat		
	Low Population Vulnerability	Medium Population Vulnerability	High Population Vulnerability

3.6.2 Site Risk

The likely impact of a Proposed Project on bats is related to site-based risk factors, including habitat and development features. The cross-tablature result of habitat risk and project size determines the site risk (i.e. Low, Medium or High) (Table 3-8) i.e. Table 3a (NatureScot, 2021). Table 5-1 in the results section describes the criteria and site-specific characteristics used to determine an indicative risk level for the site. All site assessment levels, as per NatureScot (2021) are presented in **Appendix 2**.

Table 3-8 Site-risk Level Assessment Matrix (Table 3a, NatureScot, 2021)

		Project Size		
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Low/Lowest Site Risk (1-2)	Medium Site Risk (3)	High/Highest Site Risk (4-5)

3.6.3 Overall Risk Assessment

An overall assessment of risk was made by combining the site risk level (i.e. Low/Medium/High) and the population risk (i.e. site-specific bat activity outputs), as shown in the overall risk assessment matrix table (Table 3-9) i.e. Table 3b (NatureScot, 2021). The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values).

Table 3-9 Overall Risk Assessment Matrix (Table 3b, NatureScot, 2021)

	Ecobat activity category					
Site Risk Level	Nil (0)	Low (1)	Low-Moderate (2)	Moderate (3)	Moderate-High (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	16	20
Highest (5)	0	5	10	15	20	25

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (15-25)

This exercise was carried out for each high collision risk species. Plate 3-2 above outlines high collision risk species. Overall risk assessments were also considered in the context of any potential impacts at the population level, particularly for species identified as having high population vulnerability (Plate 3-2).

4. RESULTS

4.1 Consultation

4.1.1 Bat Conservation Ireland

No response received from Bat Conservation Ireland as of the 13th May 2024.

4.1.2 Development Applications Unit - NPWS

A detailed scoping exercise was undertaken for the Proposed Project. A response from the Department of Culture, Heritage and the Gaeltacht provided recommendations regarding nature conservation, including bats. The relevant excerpts, specifically relating to bats, are summarised below and the full details of the scoping and consultation exercise are described in the main EIAR. The response was received on the 19/01/2023 and the letter is provided in Appendix 2-1 of the EIAR.

Hedgerows and Related Species

Hedgerows and scrub should be maintained where possible, as they form wildlife corridors and provide areas for birds to nest in. Hedgerows provide a habitat for woodland flora, roosting places for bats and Badger setts may also be present. The EIAR should provide an estimate of the length/area of any hedgerow/scrub that will be removed. Where it is proposed that trees or hedgerows will be removed there should be suitable planting of native species in mitigation incorporated into the EIAR. Hedgerows, trees, scrub and uncultivated vegetation (including semi-natural habitats) should not be removed during the nesting season (i.e. March 1st to August 31st), noting the protection afforded under the Wildlife Act 1976-2018.

Bats

Bat roosts may be present in trees, buildings and bridges. Bat species are protected under the Wildlife Act, 1976 to 2018, and are subject to a regime of strict protection pursuant to the requirements of the Habitats Directive (92/43/EEC) as transposed in Irish law in Regulation 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended). Therefore, damage/disturbance to any such roosts must be avoided in the first instance. While the Minister may grant a derogation licence under Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011-2015, a licence can only be granted once a number of strict criteria have been met (see Regulation 54). An assessment of the impact of the proposed wind farm on bat species should be carried out noting recent guidance available, "Bat and Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019" published jointly by Scottish Natural Heritage and Bat Conservation Trust and other stakeholders. The Department would like to highlight new research on patterns of bat activity in upland wind farms1 which indicates it is more appropriate to use 30 day survey periods with static automated detectors, in each season, and in different weather conditions to reduce sampling bias and to accurately determine when the curtailment mitigation is required during the operational phase. This survey should include use of detectors at different heights. Any proposed bat friendly lighting should be proven to be effective and follow up-to-date guidance.

All recommendations made by the Department were fully considered in the design of bat surveys and the preparation of this report.

4.2 Desk Study

4.2.1 Bat Records

National Biodiversity Data Centre

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10km radius of the site (approx.. centre of the Proposed Wind Farm site: IG Ref: R 63014 72873; last search on the 25th March 2024). Six of Ireland's nine resident bat species were recorded within a 10 km hectad of the site. The results of the database search are provided in Table 4-1.

Table 4-1 NBDC Bat Records within 10 km of the Proposed Project

Grid Square	Species	Record Count	Date	Dataset	Designation
R67	Brown Long-eared Bat (*Plecotus auritus*)	4	24/08/2009	National Bat Database of Ireland	Annex IV
R67	Common Pipistrelle (*Pipistrellus pipistrellus* sensu stricto)	15	20/06/2017	National Bat Database of Ireland	Annex IV
R67	Daubenton's Bat (*Myotis daubentonii*)	37	27/08/2021	National Bat Database of Ireland	Annex IV
R67	Pipistrelle (*Pipistrellus pipistrellus* sensu lato)	2	26/08/2009	National Bat Database of Ireland	Annex IV
R67	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	16	18/06/2017	National Bat Database of Ireland	Annex IV
R57	Common Pipistrelle (*Pipistrellus pipistrellus* sensu stricto)	6	05/09/2017	National Bat Database of Ireland	Annex IV
R57	Daubenton's Bat (*Myotis daubentonii*)	6	05/09/2017	National Bat Database of Ireland	Annex IV
R57	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	48	05/09/2017	National Bat Database of Ireland	Annex II Annex IV
R57	Lesser Noctule (*Nyctalus leisleri*)	3	14/08/2017	National Bat Database of Ireland	Annex IV
R57	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	9	05/09/2017	National Bat Database of Ireland	Annex IV

Bat Conservation Ireland

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10km radius of the proposed site (IG Ref: R 63080 72714). Available bat records were provided by Bat Conservation Ireland on 27th March 2024. A number of observations have been recorded within 10 km; twenty roosts, four transects and sixty-three ad-hoc observations. At least six of Ireland's nine resident bat species were recorded within 10 km of the site including Common and Soprano pipistrelle, Leisler's bat, Brown long-eared bat, Daubenton's bat and Lesser horseshoe bats. The results of the database search are provided in Table 4-2 to Table 4-4.

Table 4-2. BCI roost records

Name	Grid reference	Address	Species observed
Private	R7069	Knockadromin, Ballina, Co. Tipperary	Pipistrellus spp. (45kHz/55kHz),Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz)
Private	R6973	BallyvallyKillaloeCo. Clare	Plecotus auritus,Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz)
Private	R6973	Private Residence, Knockyclovaun, Killaloe, Co. Clare	Pipistrellus pipistrellus (45kHz),Pipistrellus spp. (45kHz/55kHz),Nyctalus leisleri,Pipistrellus pygmaeus
Private	R6972	Knockyclovaun, Killaloe, Co. Clare	Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Pipistrellus spp. (45kHz/55kHz)
Cave: Dane's Hole, Drumminakela, Kilkishen	R530715	Dane's Hole, Drumminakela, Kilkishen, Co. Clare	Rhinolophus hipposideros
Private	R6163	Clonlara, Co. Clare	Nyctalus leisleri
Private	R7071	Moys, Killaloe, Co. Clare	Plecotus auritus
Private	R6979	Loughderg, Killaloe,	Plecotus auritus
Private	R6878	Tinarana, Killaloe, County Clare	Unidentified bat
Private	R7072	Moys, Killaloe,Co. Clare	Plecotus auritus,Myotis mystacinus/brandtii,Myotis natterreri,Pipistrellus pygmaeus,Pipistrellus spp. (45kHz/55kHz),Nyctalus leisleri
Private	R6582	Raheen, Co. Clare	Plecotus auritus
Private	R6979	Rahena More, Co. Tipperary	Plecotus auritus,Pipistrellus pygmaeus
Private	R6669	Kilcredaun, O' Briens' Bridge, Co. Clare	Plecotus auritus
Private	R5381	Rosslara, Tulla, Co. Clare, Co. Clare	Rhinolophus hipposideros
Private	R6973	Knockyclovaun,Killaloe,Co. Clare	Nyctalus leisleri,Unidentified bat,Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
St Flannan's Cathedral	R7043972876	Killaloe, Co. Clare	Plecotus auritus
St Flannan's Oratory	R7042172898	Killaloe, Co. Clare	Myotis daubentonii
Private	R6382	Tuamgraney, Co. Clare	Pipistrellus spp. (45kHz/55kHz),Plecotus auritus,Pipistrellus pygmaeus,Unidentified bat

Name	Grid reference	Address	Species observed
St. Flannan\\\'s Cathedral crypt	R7037772914	St. Flannan's Cathedral,Killaloe,Co. Clare	Myotis daubentonii
Tree Roost, R494 Ballina - Birdhill	R707713	Mature beech treeline just north of garage	Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz)

Table 4-3. BCI transect records

Name	Grid reference start	Grid ref easting start	Grid ref northing start	Species observed
Errina Bridge	R6400064800	164000	164800	Myotis daubentonii,Unidentified bat
Killaloe Town Centre Transect	R6980073300	169800	173300	Myotis daubentonii,Unidentified bat
O Briensbridge	R661668	166100	166800	Myotis daubentonii,Unidentified bat
World's End, Castleconnell	R6587763590	165877	163590	Unidentified bat,Myotis daubentonii

Table 4-4. BCI Ad-hoc observations

Survey	Grid reference	Grid ref easting	Grid ref northing	Date	Species observed
Consultancy Surveys	R7100268955	171002	168955	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7144268981	171442	168981	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7100269016	171002	169016	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7100569048	171005	169048	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7086670296	170866	170296	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7084970452	170849	170452	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7085070537	170850	170537	23/05/2019	Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7104868683	171048	168683	23/05/2019	Nyctalus leisleri
Consultancy Surveys	R7192369318	171923	169318	23/05/2019	Nyctalus leisleri
Consultancy Surveys	R7276169808	172761	169808	23/05/2019	Nyctalus leisleri
Consultancy Surveys	R7087970168	170879	170168	23/05/2019	Nyctalus leisleri

Survey	Grid reference	Grid ref easting	Grid ref northing	Date	Species observed
Consultancy Surveys	R7123268816	171232	168816	23/05/2019	Pipistrellus pygmaeus
Consultancy Surveys	R7093269769	170932	169769	23/05/2019	Pipistrellus pygmaeus
Consultancy Surveys	R7048372626	170483	172626	10/10/2017	Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis daubentonii
Consultancy Surveys	R7048372626	170483	172626	12/05/2017	Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis daubentonii
Consultancy Surveys	R7045872234	170458	172234	10/05/2017	Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis daubentonii
Consultancy Surveys	R7045872234	170458	172234	12/05/2017	Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis daubentonii
Consultancy Surveys	R7023471536	170234	171536	10/05/2017	Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis daubentonii
Consultancy Surveys	R7023471536	170234	171536	12/05/2017	Nyctalus leisleri,Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis daubentonii
Consultancy Surveys	R6822277626	168222	177626	10/05/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Myotis daubentonii,Nyctalus leisleri
BATLAS 2010	R6304372678	163043	172678	28/07/2008	Myotis spp.,Pipistrellus pipistrellus (45kHz),Plecotus auritus
BATLAS 2010	R6750071245	167500	171245	28/07/2008	Pipistrellus pygmaeus
BATLAS 2010	R6696070672	166960	170672	28/07/2008	Nyctalus leisleri,Myotis daubentonii
BATLAS 2010	R632819	163200	181900	27/10/2009	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
BATLAS 2010	R6283063597	162830	163597	10/09/2009	Nyctalus leisleri,Myotis mystacinus/brandtii
BATLAS 2010	R656662	165600	166200	15/07/2009	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri
BATLAS 2010	R5937665553	159376	165553	10/09/2009	Nyctalus leisleri,Myotis daubentonii
BATLAS 2010	R6003467004	160034	167004	10/09/2009	Pipistrellus pygmaeus
BATLAS 2010	R5742272668	157422	172668	10/09/2009	Pipistrellus pygmaeus,Nyctalus leisleri,Myotis daubentonii
BATLAS 2010	R5491073474	154910	173474	10/09/2009	Pipistrellus pipistrellus (45kHz),Myotis daubentonii
BATLAS 2020	R6284363593	162843	163593	30/07/2018	Pipistrellus pygmaeus,Nyctalus leisleri
BATLAS 2020	R6556563708	165565	163708	30/07/2018	Pipistrellus pygmaeus,Nyctalus leisleri

Survey	Grid reference	Grid ref easting	Grid ref northing	Date	Species observed
BATLAS 2020	R5937665553	159376	165553	22/08/2018	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri
BATLAS 2020	R5670966637	156709	166637	22/08/2018	Pipistrellus pygmaeus
BATLAS 2020	R5428167256	154281	167256	22/08/2018	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
BATLAS 2020	R6460568071	164605	168071	31/07/2018	Pipistrellus pygmaeus
BATLAS 2020	R6754469205	167544	169205	16/06/2017	Pipistrellus pipistrellus (45kHz)
BATLAS 2020	R6876971968	168769	171968	16/06/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
BATLAS 2020	R7028572234	170285	172234	12/05/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri,Myotis daubentonii
BATLAS 2020	R6174072460	161740	172460	14/06/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
BATLAS 2020	R6411372606	164113	172606	13/06/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
BATLAS 2020	R5742272668	157422	172668	14/08/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri,Myotis daubentonii
BATLAS 2020	R7036972970	170369	172970	10/05/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri,Myotis daubentonii,Plecotus auritus,Myotis natterreri
BATLAS 2020	R5491073474	154910	173474	05/09/2017	Pipistrellus pygmaeus,Myotis daubentonii,Rhinolophus hipposideros
BATLAS 2020	R5600474469	156004	174469	14/08/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri,Myotis daubentonii,Rhinolophus hipposideros
BATLAS 2020	R5410075800	154100	175800	15/08/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
BATLAS 2020	R5590076200	155900	176200	14/08/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Myotis daubentonii
BATLAS 2020	R6869176422	168691	176422	18/06/2017	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri,Myotis daubentonii
BATLAS 2020	R5480079000	154800	179000	15/08/2017	Pipistrellus pygmaeus
BATLAS 2020	R6883279027	168832	179027	20/06/2017	Pipistrellus pipistrellus (45kHz),Nyctalus leisleri,Myotis daubentonii
BATLAS 2020	R5550079300	155500	179300	14/08/2017	Pipistrellus pygmaeus
BATLAS 2020	R6033679874	160336	179874	20/06/2017	Pipistrellus pipistrellus (45kHz)
BATLAS 2020	R7060068200	170600	168200	18/06/2019	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri
BATLAS 2020	R7030068400	170300	168400	18/06/2019	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus,Nyctalus leisleri

Survey	Grid reference	Grid ref easting	Grid ref northing	Date	Species observed
Consultancy Surveys	R638828	163800	182800	06/09/2003	Myotis daubentonii,Nyctalus leisleri,Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R6700068000	167000	168000	17/07/2005	Pipistrellus pygmaeus
Consultancy Surveys	R6900074000	169000	174000	13/04/2000	Pipistrellus pygmaeus
Consultancy Surveys	R6900079000	169000	179000	19/04/2007	Pipistrellus pipistrellus (45kHz),Pipistrellus pygmaeus
Consultancy Surveys	R7030072900	170300	172900	08/05/2007	Pipistrellus pygmaeus,Myotis daubentonii
Consultancy Surveys	R7039972970	170399	172970	16/06/2009	Myotis daubentonii,Pipistrellus pygmaeus,Nyctalus leisleri,Pipistrellus pipistrellus (45kHz)
Consultancy Surveys	R7024071680	170240	171680	24/05/2011	Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Nyctalus leisleri,Myotis spp.
Consultancy Surveys	R704730	170400	173000	02/05/2012	Pipistrellus pygmaeus,Pipistrellus pipistrellus (45kHz),Myotis spp.,Nyctalus leisleri,Plecotus auritus
Consultancy Surveys	R704730	170400	173000	03/05/2012	Pipistrellus pygmaeus,Nyctalus leisleri

4.2.2 Bat Species Range

The potential for negative impacts is likely to increase where there are high risk species at the edge of their range (NatureScot, 2021). Therefore, range maps presented in the 2019 Article 17 Reports (NWPS, 2019) were reviewed in relation to the location of the Proposed Project.

The Proposed Project is within the range for all resident bat species in Ireland, as mapped in the Article 17 reporting.

4.2.3 Designated Sites

Within Ireland, the Lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the proposed site is situated outside the known range of this species. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs and pNHAs within a 10 km radius of the Proposed Wind Farm found no sites designated for the conservation of bats.

4.2.4 Landscape Features

A review of mapping and photographs provided insight into the habitats and landscape features present at the site. In summary, the primary land use within the site is plantation forestry, while the remainder of the wind farm infrastructure site supports marginal farmland habitats.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the Proposed Wind Farm, and a search of the National Monuments Database did not reveal the presence of any manmade subterranean sites within the Proposed Wind Farm.

A search of the UBSS Cave Database for the Republic of Ireland found no caves within the site or within 10 km of the Proposed Wind Farm.

A review of the NBDC bat landscape map provided a habitat suitability index of 23.5 (yellow). This indicates that the Proposed Project area has moderate habitat suitability for bat species.

4.2.5 Additional Wind Energy Projects in the Wider Landscape

Table 4-2 provides an overview of wind farms in the vicinity of the Proposed Project. No other large infrastructure developments and proposals (e.g. roads) were identified within the vicinity of the Proposed Project.

Table 4-5 Wind Farm Developments within 10km of the Proposed Project Site

Wind Farm Name and Location	No. Turbines	Status
Within 5 km of proposed Lackareagh Wind Farm		
Carrownagowan	19	Permitted
Fahybeg	8	Permitted
Oatfield	11	Proposed
Within 10 km of proposed Lackareagh Wind Farm		
Knockshanvo	9	Proposed
Ballycar	12	Proposed

4.3 Overview of Study Area and Bat Habitat Appraisal

The habitats within the Proposed Wind Farm are dominated by Agricultural Grassland (GA1), Wet Grassland (GS4) and Conifer plantation (WD4). Other habitats encountered within the Proposed Wind Farm site are presented below and detailed in Chapter 6 of the EIAR:

- Improved agricultural grassland (GA1)
- Dry meadows and grassy verges (GS2)
- Conifer plantation (WD4)
- Mixed broadleaved woodland (WD1)
- Hedgerows (WL1)
- Treelines (WL2)
- Scrub (WS1)
- Dense bracken (HD1)
- Wet heath (HH3)
- Upland blanket bog (PB2)
- Stone walls (BL1)
- Spoil and bare ground (ED2)
- Earth banks (BL2)
- Buildings and Artificial Surfaces (BL3)

Results from the desktop review and walkover surveys were used to assess habitats for their suitability to support foraging and commuting bats, and roosting bats, according to Collins (2016). Suitability categories, divided into *High*, *Moderate, Low* and *Negligible*, are described fully in **Appendix 1.**

With regard to foraging and commuting bats, overall the site provides *Moderate* suitability. Areas of closed canopy forestry as well as exposed areas of grassland and peatland habitats were considered of *Negligible* suitability. Low quality hedgerows and treelines lining agricultural fields were considered of *Low* potential for bats, while forestry edge habitats created by commercial forestry and roadways, and mature treelines such as the ones lining the western boundary of the Proposed Wind Farm site, showed more potential for foraging and commuting bats. These were assigned *Moderate* suitability, as they were surrounded by wide expanses of agricultural grassland and peatland habitats and thus, were not very well connected to the surrounding landscape.

The bat habitat appraisal for the Proposed Grid Connection Route is presented separately below, for clarity. More information on roost assessments carried out within the Proposed Wind Farm is provided below.

Proposed Grid Connection Route

The underground grid connection cabling route will involve three No. bridge crossings. The crossing methodologies to be used to traverse these watercourses are cable strapping and Horizontal Direction Drilling (HDD). The construction methodologies for both of these approaches are outlined in Section 5 and 6 of the report included in Appendix 4-6 of the EIAR. Each of the water crossing locations along the underground cable route were assessed by means of a visual inspection survey on 5th January 2023, for their suitability to support roosting bats (Table 4-4). No evidence of bat use, including live or dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises were identified at any of the water crossings.

Crossing existing culverts will be implemented using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. The grid connection underground electrical cabling route will include for 9 no. culvert/pipe crossing locations which will be crossed via a flat formation undercrossing. None of the culverts were found to provide bat roosting potential.

Table 4-6 Water Crossings along Grid Connection Route

Watercourse Crossing Reference No.	Watercourse Bridge Type	Extent of Works	Bat Habitat Suitability
Bridge 1 (Blackwater River)	Stone masonry arch	Stainless Steel Pipe Fixture	***Moderate*** *– some gaps present in bridge arch where mortar has become dislodged. No evidence of bat use identified.*
Bridge 2	Stone masonry arch	Ducting in Trefoil within Bridge Deck	**Low –** *low to ground, assessment precautionary as arch could not be fully investigated. Use considered unlikely.*
Bridge 3	Stone masonry arch	Horizontal Directional Drilling	**Low –** *overgrown on both sides of the structure, however stone work presents minor suitable gaps.*

The underground cable route will be confined to existing public roads. Other than the features presented in Table 4-4 above, no potential roost features were identified along the underground cable route. No trees are proposed for felling along the underground cable route.

4.3.2 Roost Surveys

4.3.2.1 PRF Structures

Four structures were identified and inspected as part of the roost survey effort. These structures were identified at different stages of the design process and no longer fall within the EIAR Site Boundary and are not located within close proximity of any works. The structures will not be impacted by the Proposed Project, however results of the surveys undertaken during the iterative design process are presented below.

Derelict Shed

One of the PRF structures identified was a derelict stone shed with a broken-down corrugated roof located in the vicinity of newly built farm buildings (IG Ref: R 62688 73403, Plate 4-1 Plate 4-2). The structure is located approximately 408m east of proposed turbine T2. No evidence of roosting bats was found within the derelict shed, however a small number of gaps suitable for crevice dwelling bats was identified. It was assigned a *Low* roosting potential. The shed was subject to a dusk emergence survey on 24th August 2022, as detailed in Section 4.4.1. A newly built shed located in its proximity was assigned *Negligible* roosting potential.

Plate 4-1 Derelict shed's north-eastern aspect. New shed behind it.

Plate 4-2 Derelict shed's north-western aspect.

Derelict Dwelling

The second structure was a derelict dwelling (Plate 4-3 to Plate 4-6) with associated outbuildings located south-east of the Proposed Wind Farm site (IG Ref: R 62726 71659). The house is located approximately 710m west from proposed turbine T6.

An exterior inspection of the structure was carried out on 5th May 2022. No evidence of roosting bats was found, however suitable access points were identified along the fascia as well as within gaps in the roof slates and via open windows. On 5th May, no interior access to the dwelling was granted to surveyors. The interior of the derelict outbuildings was inspected, where health and safety allowed it. The outbuildings consisted of a lean-to shed to the north of the dwelling and a separate stone milking parlour. Both were in advanced state of dereliction, with broken down corrugated roofs and vegetation overgrowth throughout. They were both assigned *Moderate* roosting potential. The house was subject to a dusk emergence survey on the same night.

An interior inspection of the dwelling was carried out on 24th August 2022. The structure was built in the early 1900s and subsequently extended and renovated. It comprised two floors with two rooms each and a mezzanine bathroom extension. All floors were covered with discarded clothing and other materials, but most areas of the house were accessible for inspection. A small attic space was present along the roof apex, but was not accessible for inspection. A significant number of bat droppings was identified in one room of the second floor, under gaps in the ceiling opened into the attic apex and scattered within the room. Scattered droppings and some urine splashes were also found in the rest of the dwelling, in minor concentrations. No other evidence of bat use was found. Mustelid droppings of various sizes, possibly belonging to stoat and pine marten, were also identified in the dwelling. The house was assigned a *High* roosting potential. A second emergence survey was carried out on the same night and the dwelling was confirmed as a Lesser Horseshoe bat roost.

Details of the emergence surveys are presented in Section 4.4.1. The dwelling will not be affected by the works.

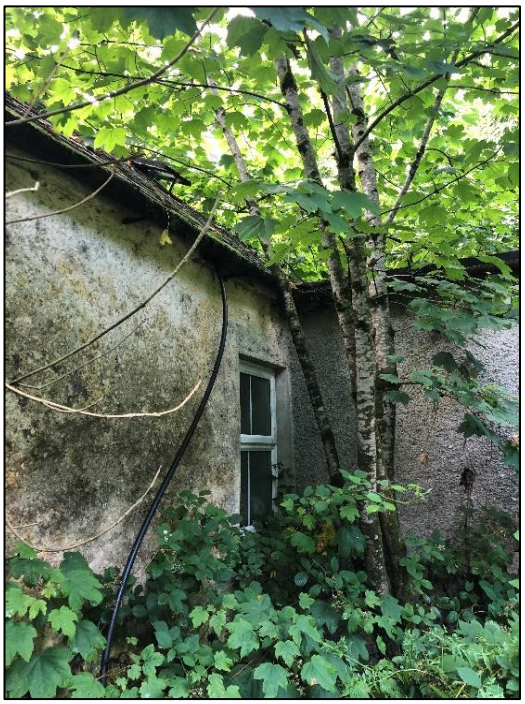

Plate 4-3 Back of derelict dwelling with large gaps along fascia.

Plate 4-4 Lean-to derelict shed.

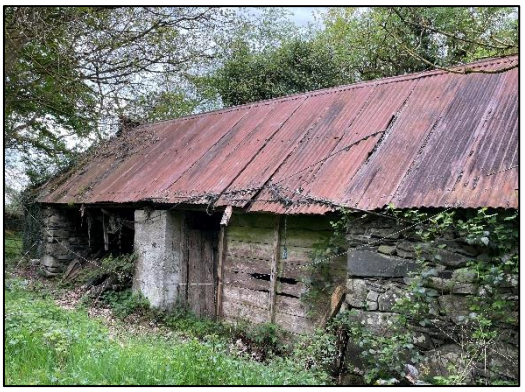

Plate 4-5 Derelict milking parlour

Plate 4-6 Interior of dwelling with exposed attic space.

Farm Sheds

The third structure identified is a cluster of four farm sheds located within the same land ownership as turbine T6 and is located approximately 490m west of the proposed turbine (IG Ref: R 62886 72346). The sheds were all open corrugated sheds in use by cattle (Plate 4-7). No suitable roosting spaces were identified within the sheds, and they were assigned a *Negligible* roosting potential. A stone wall partially overgrown by ivy was also present outside the sheds (Plate 4-8). The wall was well-pointed and any gaps identified were considered too shallow to host roosting bats. The stone wall was assigned a *Low* potential due to the dense ivy cover, which could provide opportunistic shelter. No evidence of bat use such as droppings or grease marks were identified.

Plate 4-7 Farm shed with Negligible potential

Plate 4-8 Stone wall with Low potential

4.3.2.2 PRF Trees

The Proposed Wind Farm comprised a network of treelines and hedgerows bordering existing tracks and roads, as well as agricultural grassland. Large areas of conifer plantation were also found in the eastern sections of the site. These were identified as having *Negligible* roosting potential for bats. Deciduous treelines identified throughout the site were assessed for their potential to host roosting bats. The majority of linear features comprised hedgerows with sparse, immature trees with *Negligible* potential roosting features. The following clusters of trees presenting suitable roosting features were identified:

- A mature treeline located approximately 200m south-west of proposed turbine T1, with *Low* to *Moderate* potential (IG Ref: R 62085 73754). The treeline also includes conifer trees with *Negligible* potential.
- A mature treeline with *Moderate* potential, approximately 120m long, located in proximity of a preliminary turbine location which was subsequently dropped at design stage due to existing constraints (IG Ref: R 62798 73568). The treeline is close to detector D07.
- A number of deciduous trees with *Low* potential surrounding the farm shed located west of proposed turbine T6 (IG Ref: R 62833 72340).

Plate 4-9 Moderate potential tree located south of proposed turbine T1

Plate 4-10 Moderate potential tree located outside of the Proposed Wind Farm .

Plate 4-11 Low potential tree located west of proposed T6, outside of the Proposed Wind Farm .

Where a potential for impact on the trees as a result of the Proposed Project was identified (i.e. felling), the trees were subject to further assessment, as described in Section 4.4.1 below.

4.4 Manual Activity Surveys

Manual bat activity surveys took place in the Spring, Summer, and Autumn of 2022. Bat activity was recorded on all surveys, with a total of 1,768 bat passes (Plate 4-12). Common pipistrelle (n=1,422) was the species recorded most frequently, followed by soprano pipistrelle (n=233), Leisler's bat (n=72), and lesser horseshoe bat (n=29). *Myotis* spp. (n=10) and brown long-eared bat (n=2) were recorded in low numbers. The following sections detail the results of emergence/re-entry surveys and transect surveys carried out throughout 2022.

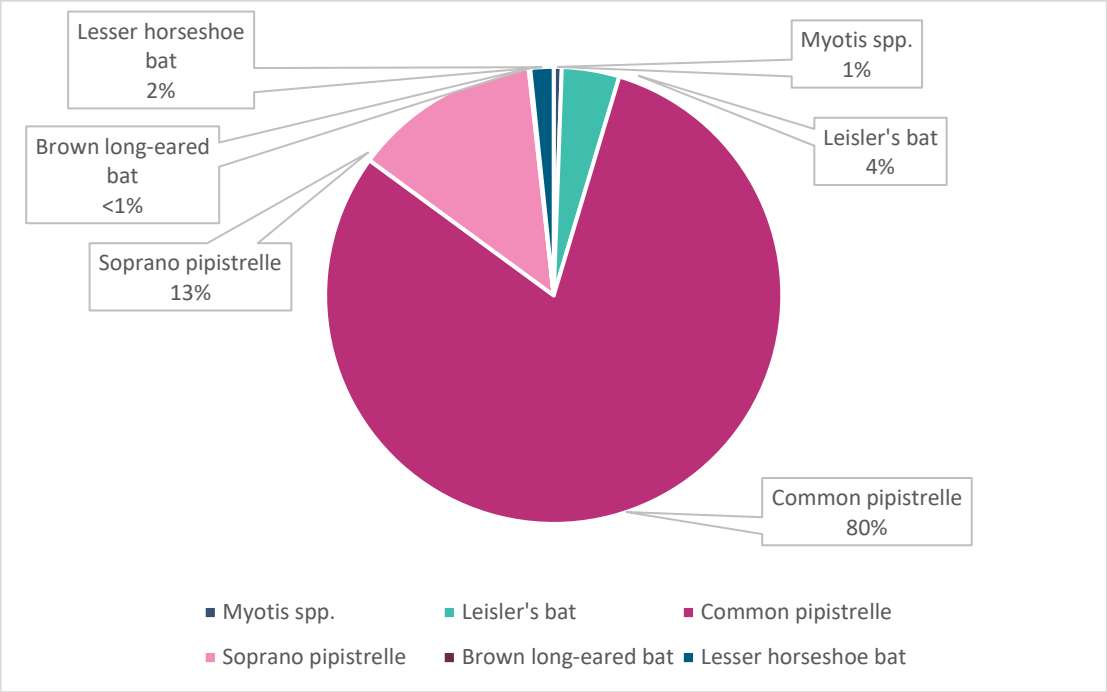

Plate 4-12. Species composition recorded during manual activity surveys.

4.4.1 Dusk Emergence and Dawn Re-entry Surveys

Two structures with roosting potential and two mature treelines were identified within the site during surveys carried out at early design stages. Of these, only the mature treeline in proximity of turbine T1 remains within the site. Table 4-7 details the survey effort in relation to dusk emergence and/or dawn re-entry surveys carried out to identify and classify potential roosts. Figure 4-1 details the results from the surveys of the 24th and 25th August.

Table 4-7 Manual activity surveys at PRFs.

PRF	IG Ref.	Date (2022)	Survey Type	Results
Derelict Dwelling	R 62726 71659	11th May	Dusk Emergence	No roost confirmed, lesser horseshoe bat roost suspected.
		24th August	Dusk Emergence	3-5 Lesser horseshoe bat observed emerging.
Derelict Shed	R 62688 73403	2nd August	Dusk Emergence	No roosting bats.
Mature Treeline at dropped turbine location	R 62798 73568	2nd August	Dusk Emergence	High activity, no roosting bats.
Mature treeline T1	R 62085 73754	25th August	Dawn re-entry	No roosting bats.
		21st September	Dusk emergence	No roost identified.

Derelict Dwelling

Two dusk emergence surveys were carried out at the derelict house located 710m west of proposed turbine T6. During the first survey, one lesser horseshoe bat was observed potentially emerging from the structure from the lean-to shed. Leisler's bats and soprano and common pipistrelles were also recorded foraging within the farmyard by both surveyors, which were located at the front and back of the house. Another dusk emergence, which was carried out in August following the interior inspection of the house, found lesser horseshoe bats emerging from a large gap in the fascia at the back of the house. A small number of bats, comprising 3 to 5 individuals, was observed. The bats continued foraging along the surrounding treeline for the remainder of the survey. No other species was observed emerging, however activity by Leisler's bats and soprano and common pipistrelles was recorded.

Derelict Shed and Mature treeline by D07

A dusk emergence survey was conducted on the 2nd of August, with one surveyor observing the mature treeline east of a proposed turbine which has since been dropped at design stage and the second surveyor observing the derelict shed located south of the treeline. Very low activity was recorded by the shed, and no bats were observed emerging. At the treeline, primarily common pipistrelles were observed foraging along the trees early into the survey, however no bats were observed emerging from the trees.

Mature Treeline T1

Two surveys were carried out along the treeline comprising mature deciduous trees located approximately 200m southwest of proposed turbine T1. During the dawn re-entry survey carried out in August, bats were observed foraging around the trees and primarily commuting west. Activity stopped approximately 40 minutes prior to dawn, no bats were observed returning to the trees for roosting. During the dusk emergence survey carried out in September, activity started early after sunset, with bats observed coming from the south-western corner of the treeline. No roost was identified however it was considered likely for the PRFs present within the trees to be used as transitional roosting spaces. Species recorded during the surveys at these locations were Leisler's bats, common and soprano pipistrelles.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout

Dusk 24.08.22 & Dawn 25.08.22 Results

- Myotis spp.
- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Brown long-eared bat
- Lesser horseshoe bat

N

Drawing Title: Dusk and Dawn Summer

Project Title: Lackareagh Wind Farm, Co.Clare

Drawn By	Checked By
NS	SF
Project No.	Drawing No.
220245	Fig. 4-1
Scale	Date
1:15,000	2024-04-12

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4.4.2 Transect Surveys

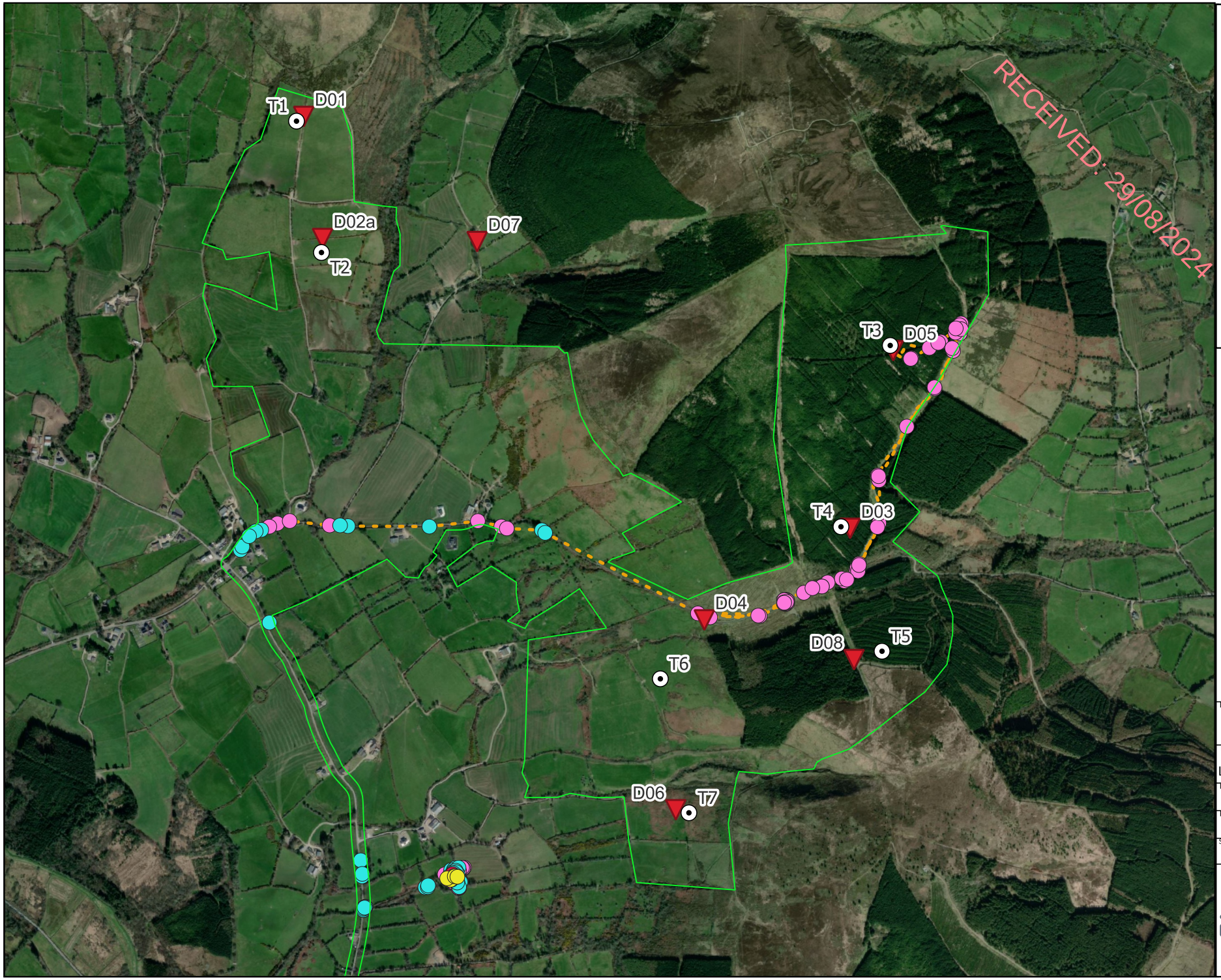
Manual activity surveys also comprised walked and driven transects at dusk. Transect surveys followed dusk emergence surveys at PRFs and were aimed at assessing the use of linear features and other habitats by bats.

The Spring walked transect followed local roads and forestry tracks near proposed turbines T3 and T4. Bat activity was dominated by common pipistrelles, with most of this taking place along forestry tracks. Soprano pipistrelles were also recorded to a lesser extent, predominantly along deciduous treelines, and hedgerows.

The Summer transect followed the existing tracks to the derelict shed which was surveyed. Activity was dominated by common pipistrelles, in particular at the mature treeline located north of the shed and identified as a PRF.

The Autumn transect covered farm tracks near proposed turbines T1 and T2. Little activity by a small number of pipistrelle bats was recorded along the tracks leading to the turbines, which were lined by patchy hedgerows with sparse trees, whereas most of the activity was recorded along the mature treeline described above, with bats also being observed foraging within the nearby stream gully, which run along the western field boundary beyond the treeline. A very small number of pipistrelle bats were observed commuting north along the treeline and across the existing agricultural fields.

Figure 4-2 to Figure 4-4 present the spatial distribution of bat activity across the manual activity surveys at the Proposed Wind Farm site.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Transect 11.05.2022

Transect Results 2022.11.05

- Myotis spp.
- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Lesser horseshoe bat

Drawing Title

Manual Results Spring

Project Title

Lackareagh Wind Farm, Co.Clare

Drawn By	Checked By
NS	SF
Project No.	Drawing No.
220245	Fig. 4-2
Scale	Date
1:15,000	2024-08-07

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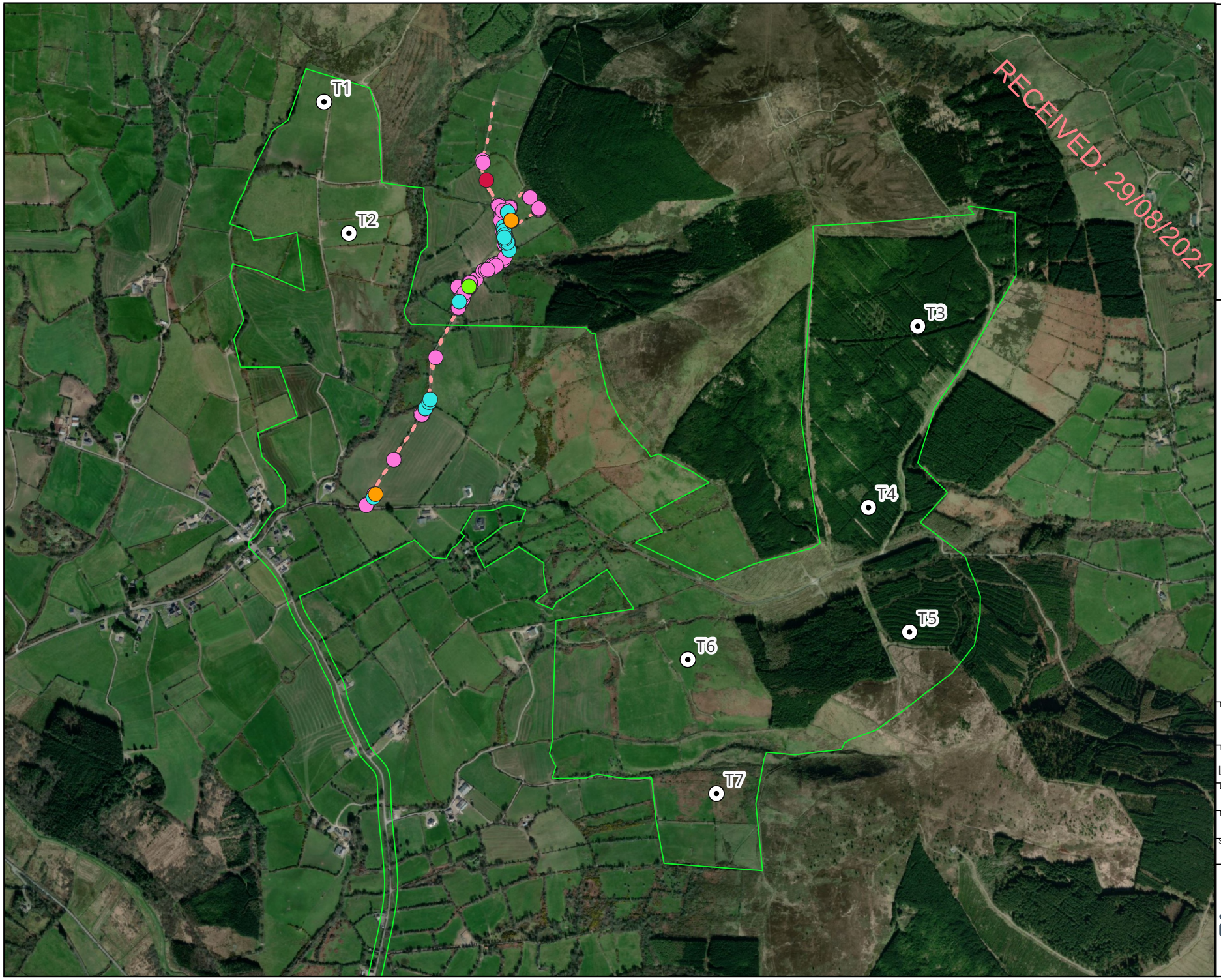

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Transect 02.08.2022

Transect Results 02.08.2022

- Myotis spp.
- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Brown long-eared bat

Drawing Title

Transect Results Summer

Project Title

Lackareagh Wind Farm, Co.Clare

Drawn By	Checked By
NS	SF
Project No.	Drawing No.
220245	Fig. 4-3
Scale	Date
1:15,000	2024-04-12

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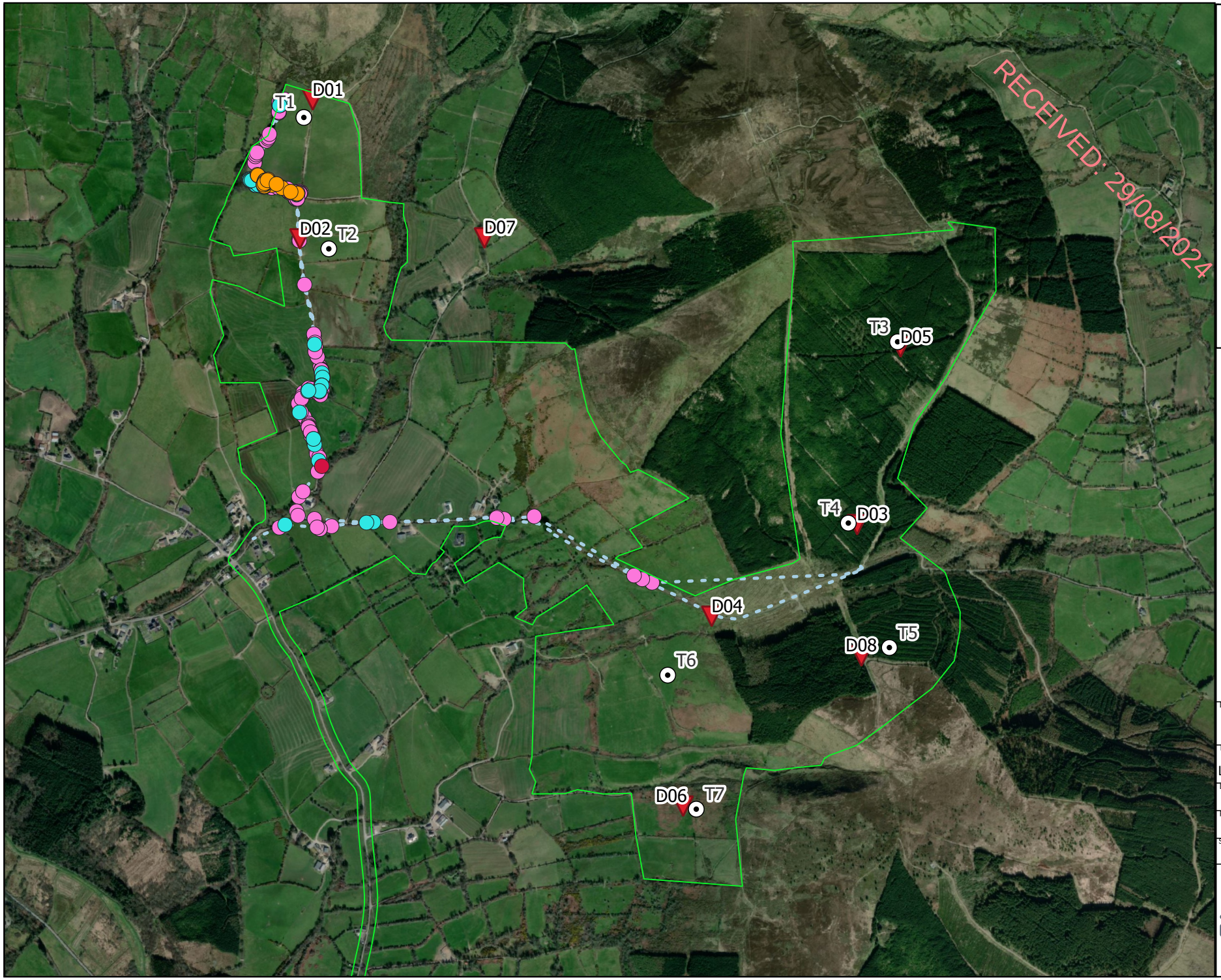

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Autumn Transect Route

Autumn Transect Results
2022.09.21

- Myotis spp.
- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

Drawing Title
Manual Results Autumn

Project Title
Lackareagh Wind Farm, Co.Clare

Drawn By	Checked By
NS	SF
Project No.	Drawing No.
220245	Fig. 4-4
Scale	Date
1:15,000	2024-08-07

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4.4.3 Ground-level Static Surveys

In total, 75,245 bat passes were recorded across all deployments. In general, common pipistrelle (n=58,020) occurred most frequently, soprano pipistrelle (n=8,035), Leisler's bat (n=6,400), *Myotis* spp. (n=1,707) and brown long-eared bat (n=877) were significantly less. Few instances of Nathusius' pipistrelle (n=156) and lesser horseshoe bat (n=50) were also recorded. Plate 4-13 presents species composition across all ground-level static detectors.

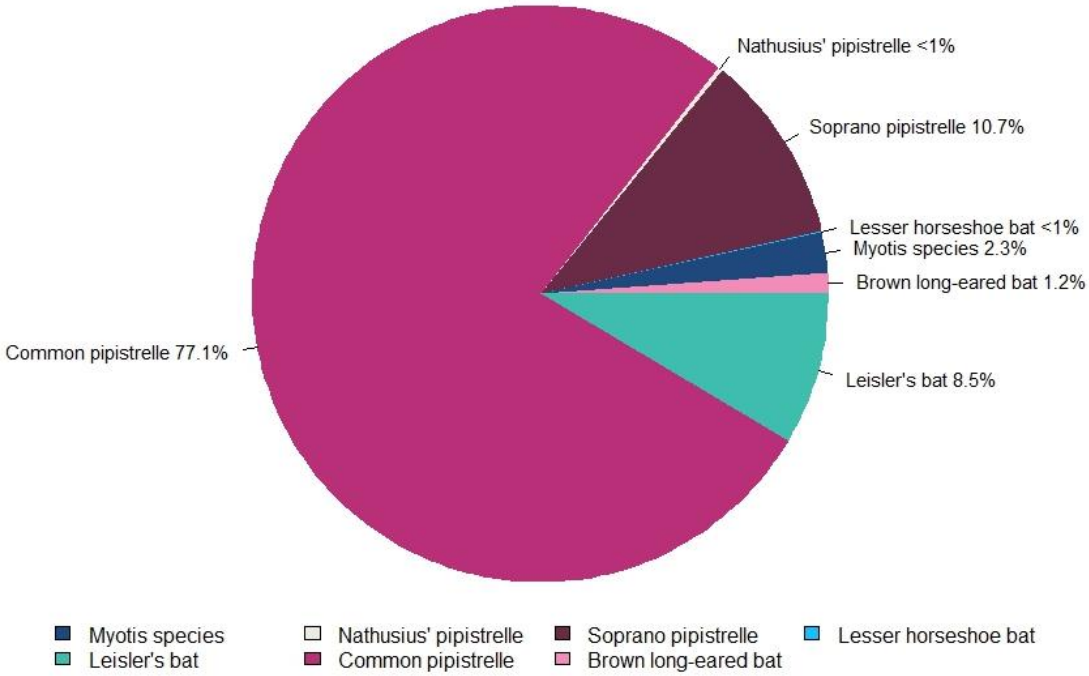

Plate 4-13 Static Detector Surveys: Species Composition Across All Deployments 2022

Bat activity was calculated as total bat passes per hour (bpph) per season to account for any bias in survey effort resulting from varying night lengths between seasons. Plate 4-14 presents the results by seasons. Species composition remained similar across seasons, with higher activity levels recorded in Summer for all species, with the exception of Nathusius' pipistrelle, which were more prevalent during the spring deployment.

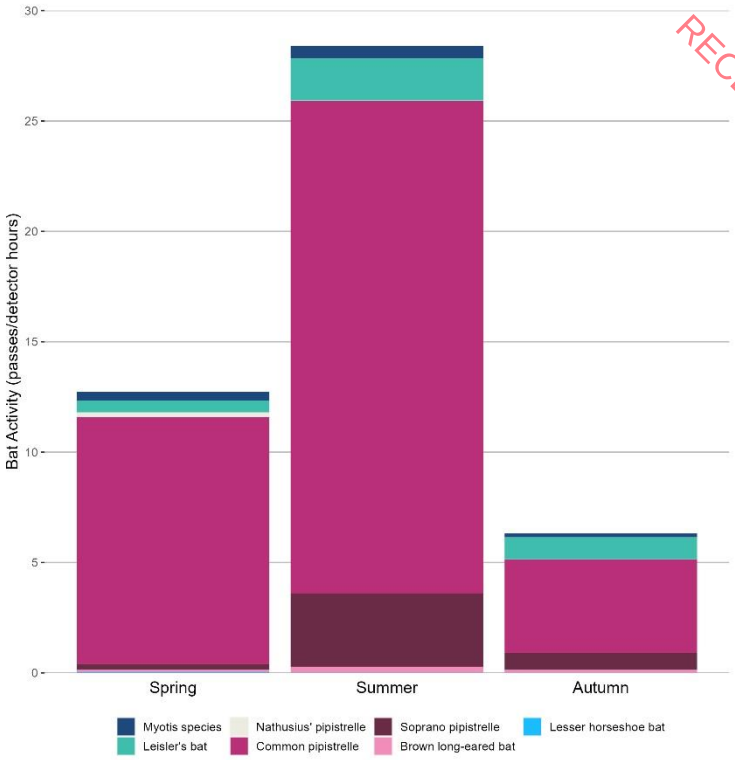

Plate 4-14. Bat activity per season 2022. The number of passes was divided by the total number of hours recorded by all detectors.

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the Proposed Wind Farm site. As activity is often variable between survey nights, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018).

Plate 4-15 shows median nightly bat passes per detector each season. Activity per nights tended to vary in activity level and species composition. Peak bat activity was reached in summer on the night of 10th of August where bat passes per hour across the site exceeded 500. Bat species using the site on a regular basis corresponded to common and soprano pipistrelles, Leisler's bat and *Myotis* spp. and instances of brown long-eared bats. Nathusius' pipistrelles and lesser horseshoe bats were recorded occasionally. The busiest night recorded for lesser horseshoe bats and Nathusisus' pipistrelle occurred on the same date, 4th June with respectively 1.8 and 11 bat passes per hour.

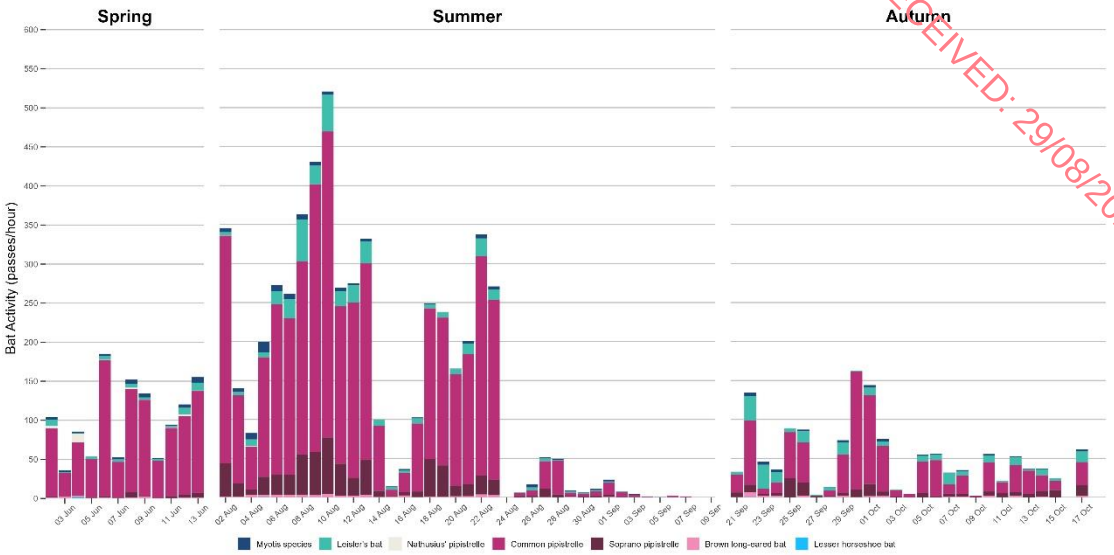

Plate 4-15. Total Bat activity per nights across the seasons 2022. The total number of passes is divided by the number of hour of one detector.

Weather conditions (rainfall, windspeed and temperature) at night during deployments 2022 are presented below (Plate 4-16). Autumn had the highest level of rainfall.

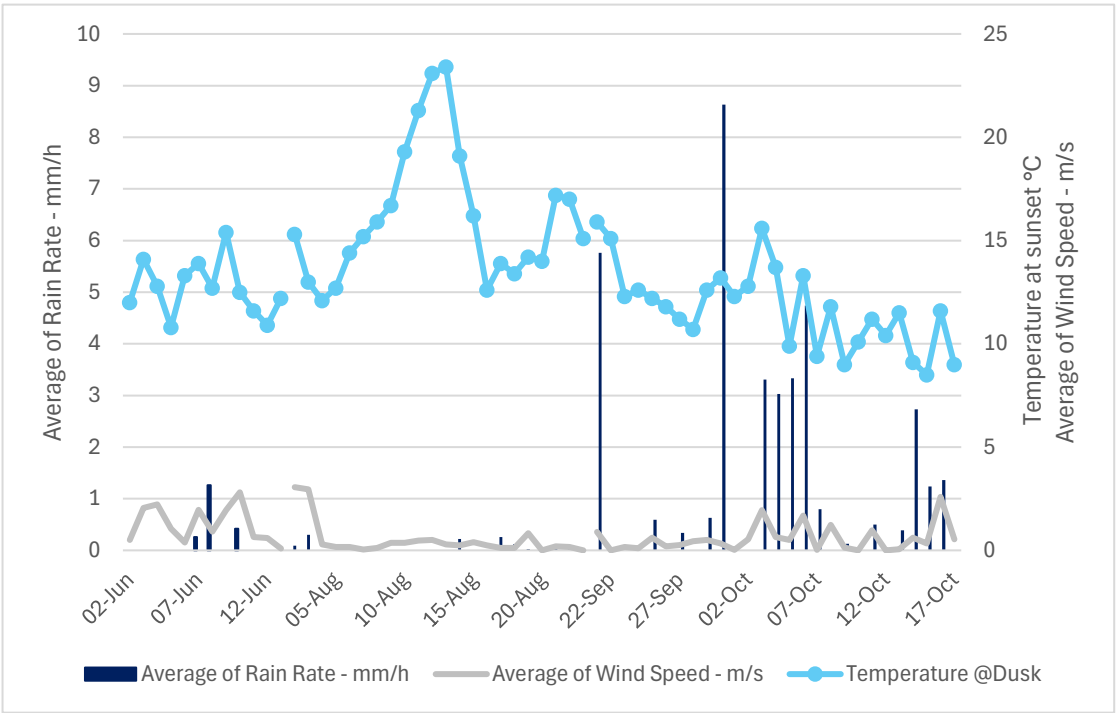

Plate 4-16 Weather Conditions recorded in 2022.

Median bat passes per detector was used to assess the level of activity per location and per season. The plates below illustrate the median bat passes per detector across the seasons with varied y-axis (Plate 4-17) and same y-axis (Plate 4-18) allowing for comparison. It should be noted that a median of zero does not necessarily mean that were was no bat activity recorded at the location.

In spring, median bat activity tended to differ by location. D05 had the highest median values made up mostly by recordings from common pipistrelles (*median = 36.75 bpph*). The second highest results was at D07, with a median twice lower than D05. This location also presented the vast majority of passes

made up by common pipistrelles (*median = 17.3 bpph)*. All other detectors had a median below 10 passes per hour.

In summer, species composition by location tended to have a higher proportion of median soprano pipistrelles activity. D07 and D08 tended to have the highest median bat activity of the season (*median D07 = 72.75 bpph; median D08 = 62.2 bpph)*. In comparison to spring, D05 median bat activity tended to reduce while D07 it tended to increase. *Myotis* spp. reached their highest median bat activity across the three seasons at D04.

In autumn, the median bat activity tended to be lower than in spring and summer. The lowest median values was calculated at D03 and D05 where both detectors median equalled zero for all bat species. The highest proportion of Leisler's bats per detector across the three seasons was recorded at D08 in Autumn.

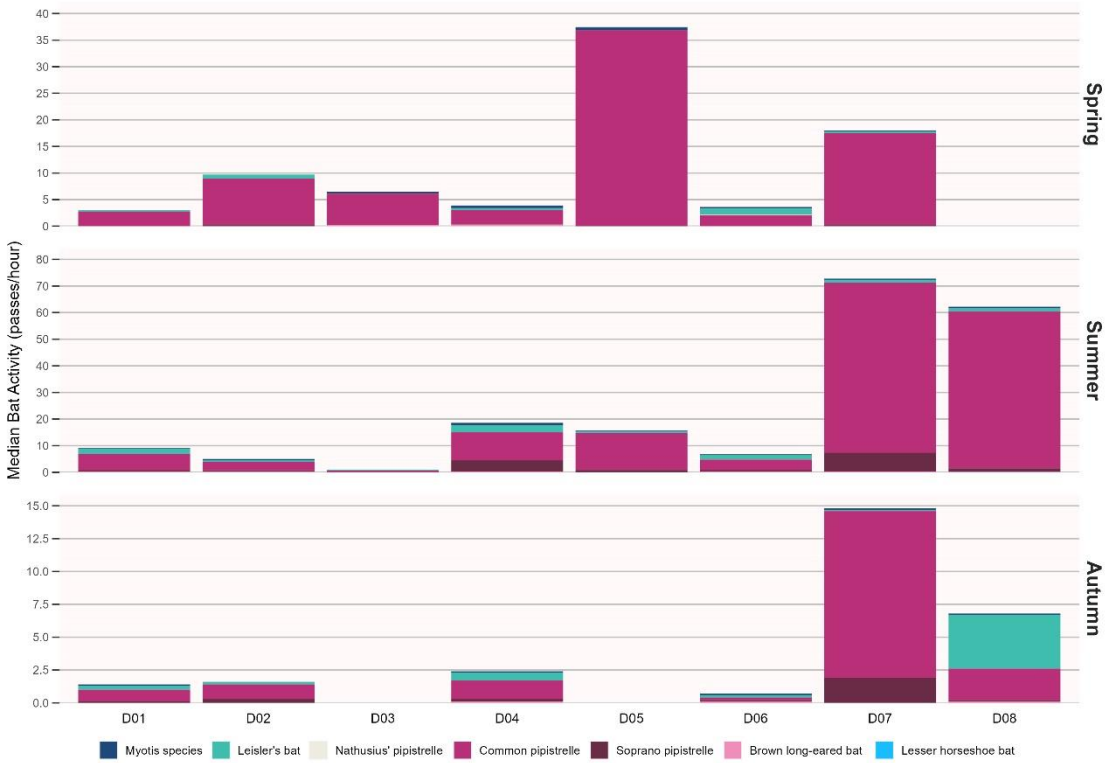

Plate 4-17 Median bat activity per detector across the seasons 2022 with different y-axis. There was no Detector D08 deployed in Spring.

Plate 4-18 Median bat activity per detector across the seasons 2022 with same y-axis allowing for comparisons. There was no Detector D08 deployed in Spring.

4.4.3.1 Initial Spring Deployment

Ground level-statics were initially deployed at the site on the 28th April 2022. The data, collected on May 11th, was partially deleted during the upload process to the cloud. Partial data were retrieved and are presented below in Table 4-8, with more details in **Appendix 3**. No further assessment was carried out as the data was incomplete across nights and did not allow for full per hour statistical analysis, however it allowed qualitative data for comparison with the early June deployment which followed to replace it.

Table 4-8 Initial Spring Deployment – 28th April to 11th May 2022 – Total bat passes

Species	Total	Percentage
Myotis spp.	37	<1%
Leisler's bat	790	11%
Common pipistrelle	5764	78%
Soprano pipistrelle	797	11%
Brown long-eared bat	26	<1%
Total	**7414**	**100%**

4.5 Assessment of Bat Activity Levels

4.5.1 Adapted Site-specific Ranges

Low, Medium, and High Activity levels were assigned to Median and maximum pass rates (bpph) identified during Spring, Summer and Autumn at the detectors deployed across the site, as adapted from Mathews et al. (2016). Table 4-9 shows the results of the site-level assessment. Where no Median Activity at a detector is reported, no data was recorded for that species throughout the deployment.

Myotis species presented generally low activity throughout the site, with maximum peak activity assessed as High at D02 and D08. D02 was located along a hedgerow well connected to more suitable habitats for these species, including the mature treeline in proximity of T01. T08 was located within a suitable foraging habitat and commuting corridor comprising of a gap between two forestry edges.

Leisler's bat Median Bat Activity was recorded mostly Low across seasons. Moderate activity was recorded in Summer at D01, D04 and D07: all of these detectors were located in proximity of agricultural grassland, which comprises favoured commuting and foraging grounds for the species. High activity peaks for the species were recorded across the site during at least one season. Detector D08 recorded High median activity in Autumn, as well as the highest activity peak for the species.

Common pipistrelle was the most common species recorded across the site. Median Activity was recorded as High in Spring at D05 but reduced in other seasons. The detector was located along forestry tracks providing suitable foraging habitat. Most detectors, with the exception of D03, recorded High maximum activity in Summer, with D07 and D08 also recording high median activity. High foraging activity was confirmed in proximity of D07 also during the manual activity surveys. These detectors and D04 also recorded High peaks in Autumn, however activity levels for the species were lower than previous seasons throughout.

Soprano pipistrelle activity was lower throughout the site, with Moderate median activity only recorded at D07 in Summer. High peaks were recorded at D04, D07 and D08 in Summer, and D07 in Autumn. All these detectors were located in particularly suitable locations for foraging activity.

Nathusius' pipistrelle and Lesser horseshoe bat recorded relatively Low Median Activity in comparison to other species. High peak Activity Nathusius' pipistrelle occurred at D03 and D06 in the Spring only. Lesser horseshoe bat Maximum Activity was Moderate in Spring at D03 in Summer, however this accounted for 1.8 bpph per night. The closest detector to the identified roost only recorded minimal activity.

Median Bat Activity for brown long-eared bat was also recorded as Low throughout the site during all three seasons. The relative High activity threshold identified for the species were quite low in comparison to others, but it was found to widespread across the whole site in similar capacity, particularly during Summer and Autumn.

*Table 4-9. Bat activity assessment level. Cells are coloured according to Table 3-6 representing High, Moderate and Low activity. *Outliers values not used for the thresholds' calculation.*

Species	Season	Bat activity (bpph)	D01	D02	D03	D04	D05	D06	D07	D08
Myotis spp.	Spring	Median	0.05	0	0.35	0.5	0.6	0.3	0.2	0
		Maximum	0.4	0.4	2.7	2.4	2.2	0.6	1	0
	Summer	Median	0.25	0.55	0	0.9	0.4	0.2	0.45	0.65
		Maximum	1.3	3.8	0.8	1.7	0.8	1.2	1.2	11*
	Autumn	Median	0.1	0	0	0.1	0	0.1	0.1	0.1
		Maximum	1	1.4	0.1	1.8	0.3	0.6	1.9	1.1
Leisler's bat	Spring	Median	0.25	0.75	0	0.4	0	1.1	0.3	-
		Maximum	1.5	2	0.8	2	0.3	5.7	1.5	-
	Summer	Median	1.9	0.55	0.4	2.65	0.5	1.8	1.1	1.15
		Maximum	12	1.8	8.5	8.7	8	6.5	3.8	11.6
	Autumn	Median	0.3	0.2	0	0.6	0	0.2	0.1	4.1
		Maximum	7.6	7.8	1.4	2.6	0.5	2.9	1.5	26.2
Nathusius'pipistrelle	Spring	Median	0	0	0.05	0	0	0.1	0	0
		Maximum	0.1	0.3	11*	0	0.3	2.8	0	0
	Summer	Median	0	0	0	0	0	0	0	0
		Maximum	0.5	0.1	0	0.1	0	0	0.1	0
	Autumn	Median	0	0	0	0	0	0	0	0
		Maximum	0	0.1	0	0.1	0	0	0	0
Common pipistrelle	Spring	Median	2.75	8.75	5.85	2.6	36.75	2.1	17.3	0
		Maximum	5	31.2	40.6	14.7	97	10.3	29.3	0
	Summer	Median	6.1	3.15	0.5	10.5	13.95	3.9	63.85	58.95
		Maximum	26.1	42.7	4.2	58	78.3	28.3	128.2	150.2
	Autumn	Median	0.9	1.1	0	1.4	0	0.2	12.7	2.4
		Maximum	4.5	9.8	0.1	41.9	3.3	6.1	120.6	31.3
Soprano pipistrelle	Spring	Median	0	0.2	0.05	0.1	0.1	0	0.2	0
		Maximum	0.3	5.8	1.3	1.3	0.4	0.3	1.7	0
	Summer	Median	0.5	0.55	0.1	4.2	0.8	0.55	7.1	1.3
		Maximum	8.9	10.2	3.6	19.6	14.2	9.4	45.3	25.4
	Autumn	Median	0.1	0.3	0	0.2	0	0.1	1.9	0.1
		Maximum	0.7	2	0.2	7.6	0.8	1	23.6	2.7
Brown long-eared bat	Spring	Median	0	0	0.2	0.3	0	0	0	0
		Maximum	0	0	1.6	0.6	0.1	0.1	0.5	0
	Summer	Median	0.3	0.2	0	0.3	0	0.3	0.25	0.15
		Maximum	1.1	0.5	0.7	1.1	0.5	1.6	1.7	1
	Autumn	Median	0	0	0	0.1	0	0.1	0	0.1
		Maximum	0.7	0.9	0.2	1.1	0.3	1	1.8	0.8
Lesser horseshoe bat	Spring	Median	0	0	0	0	0	0	0	0
		Maximum	0	0.1	1.8	0	0	0	0.1	0
	Summer	Median	0	0	0	0	0	0	0	0
		Maximum	0.1	0.2	0	0.1	0	0.2	0.1	0.1
	Autumn	Median	0	0	0	0	0	0	0	0
		Maximum	0.1	0.1	0.1	0.3	0	0	0.1	0.2

4.5.1.1 Results Discussion

Overall, the species composition and activity levels recorded did not represent unexpected results for a site of this nature, with the conifer plantation edges present within the Proposed Wind Farm providing the most suitable foraging habitat within the site. The habitats present are not considered of high quality for bats due to a lack of diversity and limited connectivity across open habitats, primarily represented by agricultural grassland and upland peatland habitats. High activity peak levels were recorded for Leisler's bats, in particular during the Autumn season at D08, a detector located in a corridor between forestry edges considered highly suitable for foraging and commuting. This is the only high-flying

species present in Ireland and is at particular risk of collision with wind turbines. Records for this species were overall low throughout the site, with the summer recording more consistent moderate levels. The species loud echolocation signals (~24kHz) are also easy to pick up by detectors even when flying at higher levels than other species. A slightly higher percentage of passes was recorded for this species during the initial spring deployment carried out in April-May 2022 (11%), with potentially higher activity levels than those recorded in June. No further assessment was possible with the initial spring data, however the sample recorded was found not to add any new information in terms of the species usage of the site and potential impacts.

All other activity recorded during the initial spring deployment was similar in terms of levels and distributions to the data collected during the re-deployment carried out in June. No lesser horseshoe bats were recorded.

Myotis spp. levels were low as anticipated as the habitats within the site do not support roosting for these populations, and represent mostly low quality foraging habitat, as these species are generally associated with woodland environments. Commuting along the western section of the site, along hedgerows and treelines in the areas surrounding proposed turbines T1 and T2, is likely to explain peak activity levels recorded at D02 in Summer, with the mature broadleaves located south west of turbine T1 also being used for foraging and potentially roosting. Another likely commuting spot was the hedgerow in proximity of D04 where these species recorded the highest median activity.

4.6 Results Summary

In 2022, the Proposed Wind Farm was surveyed for bats in Spring, Summer and Autumn. Seven static detectors were deployed at or near the Proposed Wind Farm turbine locations during each season. In complement, a bat habitat appraisal and manual activity surveys were conducted.

The static surveys revealed that the site was mainly used by common pipistrelles (n=58,020). Soprano pipistrelles bat passes (n=8,035) were the second highest bat species recorded on site followed by Leisler's bat (n=6,400), *Myotis* spp. (n=1,707) and brown long-eared bat (n=877). Nathusius' pipistrelle (n=156) and lesser horseshoe bats (50) were present in lower numbers. These bats species were the only ones which used the site inconsistently over the deployments.

Median activity levels were assessed for each species by detector location. In Spring, Leisler's bat had low median activity across the site, while common pipistrelles were recorded with a high activity at D05. Little soprano pipistrelle activity was recorded. In Summer, high activity levels were recorded primarily by common pipistrelles, with high activity peaks at all detectors by D03. In Autumn, high median activity was recorded at D08 for Leisler's, with common pipistrelle activity peaking at D07. The turbine originally proposed in proximity of D07 has been removed during the iterative design process.

The manual activity surveys, carried out during each season, covered potential roosts and tracks near proposed T1 and T2, the roadway and forest track in proximity of T6, T5, T4 and T3 and a central hedgerow and mature treeline leading to detector D07. The species composition recorded throughout the transects was similar to the static results, except for Nathuisus' pipistrelle, which were not recorded during manual surveys. The surveys allowed to identify forest tracks and edges as foraging habitat and commuting corridors for a small number of bats, as well as an area of mature trees in proximity of proposed turbine T1 as foraging habitat for common and soprano pipistrelles.

These trees were also assessed as having potential to host roosting bats during the bat habitat appraisals. A number of structures were inspected for presence of bats. None of the structures are located within the EIAR Site Boundary. A lesser horseshoe roost was identified however this is not located in proximity to any works and will not be affected by the Proposed Project. No other roosts were identified during the surveys carried out in 2022.

4.7 Importance of Bat Population Recorded at the Site

Ecological evaluation within this section follows a methodology that is set out in Chapter three of the '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes'* (NRA, 2009).

All bat species in Ireland are protected under the Bonn Convention (1992), Bern Convention (1982) and the EU Habitats Directive (92/43/EEC). Additionally, in Ireland bat species are afforded further protection under the Birds and Natural Habitats Regulations (2011) and the Wildlife Acts 1976-2021. Bat roosts were identified within the footprint of the Proposed Project. Bats as an Ecological Receptor have been assigned ***Local Importance (Higher value)*** on the basis that the habitats within the Proposed Wind Farm Site are utilized by a regularly occurring bat population of Local Importance.

A lesser horseshoe bat roost of ***Local Importance*** was identified outside the EIAR Site Boundary. Lesser horseshoe bats were identified leaving the derelict one-storey roosting site in Spring and Autumn. Evidence of bat use was identified in the derelict structure. No roosting site of National Importance (i.e. site greater than 100 individuals) was recorded within the site. The identified roost will be avoided by the Proposed Project.

Tree roosting resources were identified in proximity of proposed Turbine T1: while no roost was confirmed during surveys, it is possible that the trees will be used in the future. It was recommended to retain these features due to their proximity to suitable commuting and foraging habitats despite the proximity to the turbine, and as the turbine will be located on higher ground than the trees, in an exposed area where little activity was recorded.

4.8 Survey Limitations

A comprehensive suite of bat surveys was undertaken at the Proposed Wind Farm. The surveys undertaken in accordance with existing Guidance, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Wind Farm on bats receptors.

Access limitations can relate to static deployments and roost inspections:

- No significant access issues were encountered within the Proposed Wind Farm site during static deployments. All detectors were deployment where intended, with the exception of one detector which had to be deployed outside the range of cattle. The detector was located in a similar habitat with no significant limitations identified as a result of this change.
- Access was gained throughout the site and within all structures identified.

Survey limitations can relate to deployment coverage, data storage, equipment failure or deployment-related incidents:

- Good survey coverage of the Proposed Wind Farm site has been achieved, with eight detectors being deployed across the site, covering the range of habitats present at the site. One detector was added in Summer for coverage of an added proposed location (T5) and as such did not present data for the Spring season. This is not considered a significant limitation for the purpose of this report, as similar habitats were well represented.
- Data from the first spring deployment in April-May 2022 failed to fully upload to cloud storage. It was considered appropriate to replace the data with a full new deployment, which was carried out in early June. According to NIEA (2021), "*for upland sites (i.e. >200m), where weather conditions often limit bat activity, the spring period should be considered to be between mid-April and mid-June"*, the Proposed

Project is mostly located upland. The data retrieved from the first deployment has been presented in the report to provide a qualitative metric of comparison. The use of June data was considered sufficient to assess the early activity of bats across the site and no significant limitation was identified.

- SD card corruption or fill-up can prevent data from being collected during deployments – no data corruption was reported.
- Bat detector's microphones are checked before every season to ensure they have good sensitivity for data collection, and detectors' software updates are installed as soon as they become available - no issues related to equipment were encountered during the surveys.
- Incidents during deployments, such as tampering or livestock interference, can prevent data from being collected effectively – No incidents were reported.

Activity assessment limitations can relate to data analysis procedures and a lack of standardised and Ireland-based assessment methods:

- MKO's data analysis methods include manually checking of 100% of bat passes identified by Auto ID Software, as well as noise and no ID files. Where multiple species, or multiple individuals of the same species, are identified within the same call, only one is reported, prioritising hard to detect species. This is due to the large volumes of data collected. While this method is likely to introduce a bias, it is not believed to affect the overall conclusions of the assessment, as only commonly recorded species might be underreported.
- No activity threshold currently exists for Irish bat species to objectively assess batactivity within a certain habitat, and no standardised assessment method has beenproposed across the country. Ecobat software recommended by existing guidelineswas not available for use at the time of the assessment, as under maintenance. MKOexperience surveying habitats similar to those present within the Proposed WindFarm site aided with the assessment.
- While the bat surveys for the Proposed Wind Farm were carried out in 2022 and are therefore considered out of date according to existing guidance, the site has been visited by MKO ecologists in 2023 and 2024, and no significant changes in the baseline environment were identified to justify repeated surveys

No significant limitations in the scope, scale or context of the assessment have been identified.

5. RISK AND IMPACT ASSESSMENT

This risk and impact assessment has been undertaken in accordance with NatureScot Guidance. As per the NatureScot Guidance, wind farms present four potential risks to bats:

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

For each of these four risks, the detailed knowledge of bat distribution and activity within the Proposed Wind Farm has been utilized to predict the potential effects of the wind farm on bats.

5.1 Collision Mortality

5.1.1 Assessment of Site-Risk

The likely impact of a proposed wind farm on bats is related to site-based risk factors, including habitat and development features. The site risk assessment, as per Table 3a of the NatureScot guidance, is provided in Table 5-1 below.

Table 5-1 Site-risk Level Determination for the Site (Adapted from NatureScot 2021)

Criteria	Site-specific Evaluation	Site Assessment
Habitat Risk	The habitats within the site provide potential suitable foraging habitat for bats and is connected to the wider landscape by blocks of woodland and mature hedgerows. However, it does not provide an extensive and diverse habitat mosaic of high quality for foraging bats or meet any of the criteria of a high-risk site as set out in Table 3a of NatureScot, 2021.	Moderate
Project Size	Following the criteria set out in NatureScot, 2021 the project is of Medium scale as it consists of 7 no. turbines. Whilst those turbines are over 100m in height, it is well below the number of turbines that would constitute a Large development (NatureScot, 2021). Two other wind energy developments within 5km. Comprising turbines >100 m in height.	Medium
Site Risk Assessment (from criteria in Plate 3.3)		**Medium Site Risk (3)**

The Proposed Wind Farm is located in an area of commercial coniferous forestry and agricultural grassland. As per table 3a of the NatureScot Guidance (2021), it has a Moderate habitat risk score. As per Table 3a, the Proposed Project is a Medium project (7 turbines) with other wind energy developments within 5km.

The cross tabulation of a Medium project on a Moderate risk site results in an overall risk score of **Medium** (NatureScot Table 3a).

5.1.2 Assessment of Collision Risk

The following high-risk species were recorded during the dedicated surveys:

- Leisler's bat,
- Common pipistrelle,
- Soprano pipistrelle,
- Nathusius' pipistrelle

The Overall Risk Assessment for high collision risk species is provided in the sections below. Overall Risk was determined, in accordance with Table 3b of NatureScot guidance (**Appendix 4**), by a cross tablature of the site risk level (i.e. Medium) and Ecobat bat activity outputs for each species. The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values). NatureScot recommends that the most appropriate activity level (i.e. median or maximum) be utilised to determine the overall risk assessment for a species.

As per NatureScot guidance there is no requirement to complete an Overall Risk Assessment for low-risk species. During the extensive suite of surveys undertaken that following low risk species were recorded:

- Myotis sp.,
- Brown long-eared bat,
- Lesser horseshoe bat.

Overall activity levels were low for the above species; therefore, no significant collision related effects are anticipated.

5.1.2.1 Leisler's bat

This site is within the current range of the Leisler's bat (NPWS, 2019). Leisler's bats are classed as a rarer species of a high population risk which have a high collision risk (Plate 3-2). Leisler's bats were recorded during activity surveys across the Proposed Wind Farm site

When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021), overall activity risk for Leisler's bat in 2022 was found to be ***Low*** at typical activity levels in Spring, Summer and Autumn. Peak activity levels were ***Medium*** in Spring and ***High*** in Summer and ***Medium*** Autumn for Leisler's bat (See Table 5-2 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site. However, considering that High levels were recorded during Summer activity peaks for this species across the site, a precautionary approach was adopted for this species, as particularly susceptible to collision in open habitats

Thus, there is a **Medium** collision risk level assigned to the local population of Leisler's bat.

Table 5-2 Leisler's Bat - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)
Summer		Low (1)	Typical Risk is Low (3)	High (5)	Peak Risk is High (15)
Autumn		Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)

Detector locations with High median Leisler's bat activity levels

A summary of bat activity results, as shown in Table 4-9, provides key metrics for Leisler's bat recorded, per detector, per survey period. One detector recorded High Median activity for this species, at D08 in Autumn, where the highest Max activity was also recorded (26.2 bpph).

5.1.2.2 Soprano pipistrelle

The site is within the current range of the soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelles are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-2). Soprano pipistrelles were recorded during activity surveys across the Proposed Wind Farm site.

When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021), overall activity risk for soprano pipistrelle in 2022 was found to be ***Low*** at typical activity levels in Spring, Summer and Autumn. Peak activity levels were ***Low*** in Spring and Autumn and ***Medium*** in Summer for soprano pipistrelle (See Table 5-3 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is primarily agricultural grassland and conifer plantation, with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is **Low** collision risk level assigned to the local population of soprano pipistrelle.

Table 5-3 Soprano Pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)
Summer		Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)
Autumn		Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)

Detector locations with High median Soprano pipistrelle activity levels

No detectors registered nights with High Median levels of soprano pipistrelle activity across any season. The highest Max activity recorded for this species on a night was at detector D07 in Summer.

5.1.2.3 Common pipistrelle

This site is within the current range of the common pipistrelle bat (NPWS, 2019). Common pipistrelles are classed as a common species of a medium population risk which have a high collision risk (Plate 3-2). Common pipistrelles were recorded during activity surveys across the Proposed Wind Farm site.

When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021), overall activity risk for common pipistrelle in 2022 was found to be ***Medium*** at typical activity levels in Spring and Summer and ***Low*** in Autumn. Peak activity levels were ***High*** in Spring, Summer and Autumn for common pipistrelle (See Table 5-4 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is primarily agricultural grassland and conifer plantation, with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is **Medium** collision risk level assigned to the local population of common pipistrelle.

Table 5-4 Common Pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Medium (3)	Moderate (3)	Typical Risk Medium (9)	High (5)	Peak Risk is High (15)
Summer		Moderate (3)	Typical Risk Medium (9)	High (5)	Peak Risk is High (15)
Autumn		Low (1)	Typical Risk is Low (3)	High (5)	Peak Risk is High (15)

Detector locations with High median Common pipistrelle activity levels

A summary of bat activity results, as shown in Table 4-9, provides key metrics for Common pipistrelle recorded, per detector, per survey period. Detector D05 registered nights with High Median levels of Common pipistrelle activity during Spring. Detector D07 and Detector D08 registered nights with High Median levels of Common pipistrelle activity in Summer. Detector D07 is no longer within the EIAR Site Boundary. Given that high Median activity levels were recorded near turbines T3 and T5, an adaptive monitoring and mitigation strategy has been devised for the Proposed Wind Farm in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in Section 6.2 below.

No other detectors recorded High levels of Median Common pipistrelle activity across any other season. The highest Max activity recorded for this species on a night was at detector D08 in Summer.

5.1.2.4 Nathusius' pipistrelle

This site is within the current range of the Nathusius' pipistrelle bat (NPWS, 2019). Nathusius' pipistrelle bats are classed as a rarer species of a high population risk which have a high collision risk (Table 5-5). Nathusius' pipistrelle bats were recorded during activity surveys across the Proposed Wind Farm site.

When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Nathusius' pipistrelle bats was found to be ***Low*** at typical activity levels across all seasons and Medium in Spring at peak activity levels (See Table 5-5 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site. No Nathusius' pipistrelles were recorded during transects undertaken.

Thus, there is **Low** collision risk level assigned to the local population of Nathusius' pipistrelle bat.

Table 5-5 Nathusius' pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)
Summer		Nil (0)	Typical Risk is Low (0)	Low (1)	Peak Risk is Low (3)

Autumn		Nil (0)	Typical Risk is Low (0)	Low (1)	Peak Risk is Low (3)

Detector locations with High median Nathusius' pipistrelle activity levels

No detectors registered nights with High Median levels of Nathusius' pipistrelle activity across any season. The highest Max activity recorded for this species on a night was at detector D06 in Autumn.

5.1.3 Collision Risk Summary

Site-level collision risk for high collision risk bat species was typically *Medium*. Overall bat activity levels were typical of the nature of the site, which is agricultural and wet grassland, with upland commercial forestry, with regular levels of bat activity recorded during the static detector surveys as well as the walked and driven transects undertaken.

However, following per detector site-specific analysis, detectors D05, D07 and D08 showed high median activity levels across at least one season for common pipistrelle and Leisler's bat (Table 5-6). Detector D07 does not correspond to any turbine location. Taking a precautionary approach and given the potential for high collision risk was recorded at median activity levels at detectors D05 and D08, an adaptive monitoring and mitigation strategy has been devised for the Proposed Wind Farm, in line with the case study example provided in Appendix 5 of the NatureScot (2021) Guidance and based on the site-specific data. This will involve curtailment during periods with high common pipistrelle and Leisler's bat activity (i.e. Spring at T3, Summer and Autumn at T5), with simultaneous activity monitoring taking place. Turbines will be curtailed during the weather conditions most suitable for bat activity at the site, see Section 6.1.1.2 "Determining curtailment" below. Proposed curtailment and monitoring is outlined in section 6.2.1 below.

Table 5-6 Summary of High Median Bat Activity Per Detector 2022

Survey Period	Nights Recorded	Detector ID	Corresponding Turbine	Median Bat Activity	Median Bat Activity Level	Max Bat Activity	Max Bat Activity Level
Common pipistrelle							
Spring 2022	12	D05	T3	36.75	High	97	High
Summer 2022	22	D07	n/a	63.85	High	128.2	High
Summer 2022	22	D08	T5	58.95	High	150.2	High
Leisler's bat							
Autumn 2022	27	D08	T5	4.1	High	26.2	High

5.2 Loss or damage to Commuting and Foraging Habitat

In absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. The Proposed Wind Farm site is predominantly located within agricultural and wet grassland, as well as conifer plantation at various stages of development, with limited availability of high quality habitats for bats.

A total of 13.8 hectares of forestry will be permanently felled within and around the footprint of the Proposed Project. The felling of trees is provided to achieve the required buffer distance for the protection of bats, from the turbines to the canopy of the nearest habitat feature, as recommended by

the Natural England (2014) and NatureScot (2021). Further details on buffer calculations can be found in section 6.1.3 of this report.

It should be noted that forestry on the Proposed Wind Farm site was originally planted as a commercial crop and will be felled in the future should the Proposed Wind Farm be granted permission and constructed or not. Overall, the proposed works will retain areas of linear forestry edge habitats. Three of the proposed turbines will be located in key-holed conifer forestry with no resulting loss of linear features.

Where upgrades to existing roads and site tracks are proposed, there will be some requirement for road widening to facilitate the initial construction phase.

Given the extensive area of habitat that will remain undisturbed throughout the site and the avoidance of the most significant areas of faunal habitat (i.e. natural woodlands and watercourses), no significant effects with regard to loss of commuting and foraging habitat are anticipated.

5.3 Loss of, or Damage to Roosts

The Proposed Wind Farm is predominantly located within agricultural and wet grassland, as well as conifer plantation at various stages of development, with limited availability of high quality habitats for bats. The trees in the plantation do not provide potential roosting habitat of significance for bats.

There are no structures identified within the turbine's respective search buffers. A number of structures, including a vacant dwelling hosting a minor Lesser horseshoe bat roost, were inspected and assessed as part of the Proposed Project but are not included within the EIAR Site Boundary. The structures and surrounding habitats identified as providing suitable connective habitat will not be affected by the Proposed Project. A number of mature trees identified as having potential to host roosting bats located in proximity of proposed turbine T1 will be retained, together with existing linear habitat connecting to them. No loss of roosting habitat is anticipated.

There will be no requirement to fell trees/forestry as part of the Proposed Grid Connection Route underground electrical cabling. Therefore, there will be no loss of tree roosting habitat associated with these works.

Horizontal Directional Drilling (HDD) is proposed for Bridge 3 and ducting on deck is proposed for Bridge 2, as such no loss of roosting habitat is anticipated. Bridge 1 will be equipped with a stainless steel pipe fixture which will run in conjunction with other existing services (Plate 5-1), to limit aquatic works and the spread of existing invasive species. The bridge was identified as having roosting potential however roosting features were identified within the arch and not the sides of the structure. No potential damage or loss of roosting habitat is anticipated. A potential for temporary disturbance during works was identified and will be mitigated as described in section 6.2.3.

Plate 5-1 Bridge 1 existing ducted services.

No potential for significant effects with regard to the loss of, or damage to, roosting habitat as a result of the Proposed Wind Farm, Proposed Grid Connection Route, or the Turbine Delivery Route, is anticipated.

5.4 Displacement of Individuals or Populations

There will be no net 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 displacement of individuals or populations is anticipated.

6. BEST PRACTICE AND MITIGATION MEASURES

This section describes the best practice and site-specific mitigation measures that are in place to avoid and reduce the potential for significant effects on local bat populations.

6.1 Standard Best Practice Measures

6.1.1 Noise Restrictions

During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (S.I. No. 632 of 2001).

6.1.2 Lighting Restrictions

Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. Exterior lighting, during construction and post construction, shall be designed to minimize light spillage, thus reducing the effect on areas outside the Proposed Project, and consequently on bats i.e. lighting will be directed away from mature trees/treelines around the periphery of the site to minimize disturbance to bats. Directional accessories can be used to direct light away from these features, e.g. through the use of light shields (Stone, 2013). The luminaries will be of the type that prevent upward spillage of light and minimize horizontal spillage away from the intended lands.

Any proposed lighting around the site shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/23 Bats and artificial lighting in the UK.

In addition, the applicant commits to the use of lights during construction, operation and decommissioning (such that they are necessary) in line with the following guidance that is provided in the Dark Sky Ireland Lighting Recommendations:

- Every light needs to be justifiable,
- Limit the use of light to when it is needed,
- Direct the light to where it is needed,
- Reduce the light intensity to the minimum needed,
- Use light spectra adapted to the environment,
- When using white light, use sources with a “warm” colour temperature (less than 3000K).

With regard to the potential for lighting to increase collision risk, it is noted that there will be some illumination of the turbines in the form of aviation lighting, and whilst this lighting is unlikely to result in any significant increase in collision risk, a comprehensive and site-specific mitigation and monitoring programme, described in section 6.1, is proposed for a period of at least 3 years post construction. No significant effects of lighting on bats are anticipated as a result of habitat illumination and consequent abandonment; however, if in the course of this monitoring, any potential for significant effects on bats is identified, specific measures will be implemented to avoid any such impacts (i.e. curtailment).

6.1.3 Buffering

In accordance with NatureScot Guidance, a minimum 50m buffer to all habitat features used by bats (e.g., hedgerows, tree lines etc.) will be applied to the siting of all wind turbines (See example provided

in Plate 6-1 below). An exception to this buffer has been proposed for turbine T1; the applied buffer would include areas of high suitability such as mature treelines and riparian habitats where most of the activity recorded in the area during manual surveys seemed to concentrate. In this case, it is considered detrimental to bats to remove these habitats, as the turbine is located on an hill, with the turbine base effectively being located above the tree crowns and not anticipated to affect the local bat community.

NatureScot recommends that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features) is adequate mitigation. This 50m buffer will be implemented from the outset and monitored as per the post construction monitoring. The success of the buffer mitigation will be assessed as part of post construction monitoring and updated where necessary, as described in section 6.2.

The formula below is presented to provide appropriate mitigation in relation to bats, and the relevant input required from turbine parameters, is the combination of the blade length and hub height. The bat buffer calculation takes into account theoretical precautionary conditions by using the longest blade on the lowest hub. The proposed wind turbines to be installed on the site will have the following dimensions:

- Turbine Tip Height – Maximum height 180 metres, Minimum height 179.5 metres
- Hub Height – Maximum height 105 metres, Minimum height 102.5 metres
- Rotor Diameter - Maximum diameter 155 metres, Minimum diameter 149 metres.

This mitigation measure is included within the forestry felling calculation outlined in Chapter 4, Section 4.3.10 of the EIAR and shown in Figure 4-20, and assumes the largest rotor diameter (155m) and the minimum hub height (102.5m), therefore providing the maximum tip height of 180m, and also detailing the maximum forestry buffer that would be required (97.2m), as this can only be based on the longest blade being placed on the lowest hub height (any other combination could only be based on a shorter rotor diameter or higher hub height which would therefore result in a reduction in the buffer requirement). The precautionary scenario has therefore been considered in the bat impact assessment. These vegetation-free areas will be maintained during the operational life of the Proposed Wind Farm.

It is necessary to calculate the distance between the edge of the habitat feature and the centre of the tower (b). Using the formula:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

Where, **bl** =Blade length, **hh** = hub height, **fh** = feature height all in metres. i.e. (below) **b** = 69.3m (in the example given in Plate 6-1)

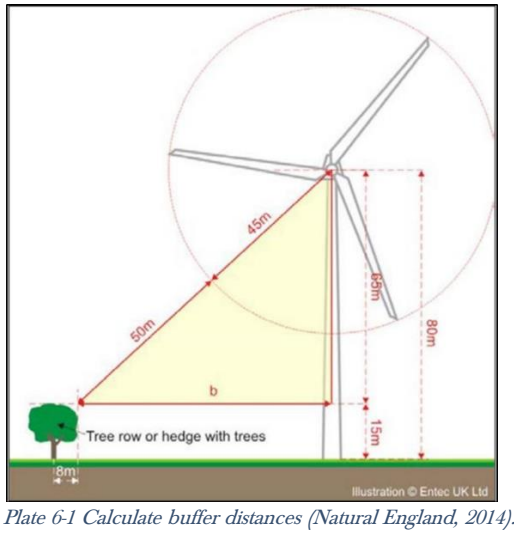

Plate 6-1 Calculate buffer distances (Natural England, 2014).

6.1.4 Blade Feathering

NIEA Guidelines also recommend that, in addition to buffers applied to habitat features, all wind turbines are subject to 'feathering' of turbine blades when wind speeds are below the cut-in speed of the proposed turbine. This means that the turbine blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed to below two revolutions per minute while idling. This measure has been shown to significantly reduce bat fatalities (by up to 50%) in some studies (NIEA, 2021).

In accordance with NIEA Guidelines, blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine.

6.1.5 Proposed Linear Habitat Replanting

There will be a permeant loss of approx. 2104.2m of native hedgerow (and associated stone walls), 247.2 of native treeline and 0.05ha of linear broadleaved woodland to accommodate the footprint of the Proposed Wind Farm, including turbines (and associated bat buffers), wind farm roads and other key infrastructure.

This will be mitigated through the establishment and enhancement of approx. 2,673m of planting comprising native broadleaved trees, shrubs and hedgerow habitat within the Proposed Wind Farm site.

This habitat creation will provide an establishment of approx. 890m of new native broadleaved treelines, approx. 1,240m of new native hedgerow and enhancement of approx. 550m of treelines and 530m of hedgerows via supplementary planting. Additionally, broadleaved tree planting will be undertaken along the Kilbane Stream to produce a linear woodland of approx. 1.4 ha to enhance the watercourse. Planting will be of semi-mature specimens to ensure connectivity is immediate and will be of local provenance outlined below. In cases where semi-mature specimens cannot be obtained then fast-growing species such as Willow may be supplemented. A variety of broadleaved species should be considered to ensure a monoculture does not establish.

Hedgerow, shrub and treelines will be replanted within Biodiversity Enhancement Areas 2 and 3 as shown in Table 3-2 of the Biodiversity Enhancement Plan to ensure the loss of linear features is compensated for and the site is enhanced for use by bats and other wildlife. There is an extensive network of existing linear landscape features in the wider area that will be retained, and the proposed replanting will enhance connectivity across the Proposed Wind Farm site and wider landscape.

A combination of whips and advanced nursery stock (10cm – 12 cm girth trees) will be used for both tree and hedgerow planting across the Proposed Wind Farm site to increase structure diversity and to ensure connectivity gains are immediate.

The following section describes the best practice and site-specific mitigation measures that are in place to avoid and reduce the potential for significant effects on local bat populations.

6.2 Bat Mitigation and Monitoring Plan

Overall risk levels for high collision risk bat species was typically ***Medium***. This risk level is reflective of the nature of the site, which is predominantly located within agricultural and peatland habitats, as well as conifer plantation at various stages of development, with limited availability of high quality habitats for bats.

However, taking a precautionary approach and given that high collision risk was recorded at median and peak activity levels, an adaptive monitoring and mitigation strategy has been devised for the Proposed Wind Farm in line with the case study example provided in Appendix 5 of the NatureScot (2021) Guidance and based on the site-specific data.

6.2.1 Curtailment

Curtailment involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation (blade feathering) below the cut-in speed.

However, following per detector analysis, detectors D05 (i.e. Turbine T3) and D08 (i.e. Turbine T5) showed high median activity levels across at least one season (Table 5-6). Both turbines will be key-holed within forestry. Taking a precautionary approach and given the potential for high collision risk was recorded at median activity levels at these detectors, an adaptive monitoring and mitigation strategy has been devised for the Proposed Wind Farm. The strategy is in line with the case study example provided in Appendix 5 of the NatureScot Guidance and has been informed by the extensive suite of site-specific survey data. Curtailment will be implemented during periods with high median bat activity (i.e. Spring at T3, Summer and Autumn at T5), with simultaneous activity monitoring taking place. Turbines will be curtailed during the weather conditions most suitable for bat activity at the site. On a precautionary basis, due to the absence of a detector at D08 (T5) in Spring, and the high activity recorded at this location in Summer and Autumn, turbine T5 will also be curtailed in Spring.

Recent research used to inform NatureScot guidance has found that 90% of all bat activity can occur on sites when temperature exceeded 11.5˚C and windspeed was below 5m/s. In addition, the bat activity is generally recorded 30 minutes after sunset and 40 minutes prior to sunrise. These conditions are largely consistent with the high seasonal activity peaks recorded at the Proposed Wind Farm site. Therefore, a software module will be programmed into the SCADA system controlling the turbines to curtail turbines when all these criteria are met. Curtailment is achieved by opening the blade pitch into the fully-feathered position, which reduces blade rotation speed to <1rpm.

The effectiveness of curtailment will be monitored in order to determine (a) whether it is working effectively (i.e. whether bat mortality is detected, thereby confirming its effectiveness), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties.

A summary of the proposed seasonal curtailment is provided in Table 6-1 below.

Table 6-1 Turbine Specific Curtailment Strategy for High-risk Species

Turbine No.	Proposed Curtailment Period		
	Spring (April to May)	Summer (June to mid-August)	Autumn (mid-August to October)
Turbine 3	Yes	No	No
Turbine 5	Yes	Yes	Yes

6.2.2 Operational Monitoring

To assess the effects of the Proposed Wind Farm on bat activity, at least 3 years of post-construction monitoring is proposed. Post-construction monitoring will include static detector surveys, walked survey transects and corpse searching to record any bat fatalities resulting from collision.

The results of post-construction monitoring shall be utilised to assess any potential changes in bat activity patterns and to monitor the implementation of the mitigation strategy. Results of Year 1 surveys will assess whether adaptations to the monitoring plan are required, and further mitigations such as curtailment will be considered. If a curtailment requirement is identified, a programme can be devised around key activity periods and weather parameters, as well as a potential increase in buffers.

At the end of each year, the efficacy of the mitigation and monitoring plan will be reviewed, and any identified efficiencies incorporated into the programme. This approach allows for an evidence-based

review of the potential for bat fatalities at the Proposed Wind Farm, post construction, to ensure that the necessary measures, based on a new baseline post-construction, are implemented for the protection of bat species locally. The effectiveness of any mitigation/curtailment needs to be monitored in order to determine (a) whether it is working effectively (i.e. the level of bat mortality is incidental), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties.

The below subsections provide additional detail on the proposed survey effort, timing, and mitigation.

6.2.2.1 Monitoring Year 1

6.2.2.1.1 *Bat activity surveys*

The post-construction surveys will be carried out as per the pre-construction survey effort. Static monitoring shall take place at each turbine during the bat activity season (between April and October) (NatureScot, 2021, NIEA, 2021). Full spectrum recording detectors shall be utilised for the same duration as during pre-application surveys and at the same density (NatureScot, 2021). The assessment of bat activity levels will be as described in Section 3.5 above. Walked transect surveys will also be conducted.

Key weather parameters and other factors that are known to influence collision risk will be monitored and will include:

- Windspeed in m/s (measured at nacelle height)
- Temperature (ºC)
- Precipitation (mm/hr)

6.2.2.1.2 *Carcass searches*

Carcass searches, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with NatureScot Guidance (See section 6.1.2.3 below). This shall include searcher efficiency trials and an assessment of scavenger removal rates to determine the appropriate correction factor to be applied in relation to determining an accurate estimate of collision mortality. Surveys should cover all activity seasons and the use of a trained dog detection team will be carried out to ensure maximum efficiency.

6.2.2.2 Monitoring Years 2 & 3

Monitoring surveys shall continue in Year 2 and 3, and where a curtailment requirement has been identified, the success of the curtailment strategy shall be assessed in line with the baseline data collected in the preceding year(s).

The performance of the curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed shall be analysed to confirm it is neither significantly over- nor under- curtailing during different periods of bat activity.

At the end of each year, the efficacy of the mitigation/curtailment programme shall be reviewed, and any identified efficiencies incorporated into the programme. The requirement for continued post-construction monitoring will also be considered. Should no bat fatalities be recorded in Year 1, curtailment in Year 2 and Year 3 could be reduced/re-evaluated or removed with monitoring continuing to inform this strategy.

6.2.3 Confirmatory Pre-construction Bridge Survey

Bridge 1 will require work to be carried out in proximity of the structure to install ducting for the proposed grid connection cabling. Bridge 1 was assessed as having *Moderate* potential for roosting bats. Construction of the Proposed Grid Connection Route will result in increased human activity and noise along the underground cable route. As such, the potential for disturbance to bats requires consideration. Bridge 1 is located along a busy road and it is likely that any bats using the structure have become accustomed to some level of disturbance. However, in the absence of appropriate design, the proposed cable works have the potential to temporarily disturb bats through noise production and illumination of potential roosting, commuting and foraging areas.

Following the precautionary principle, a pre-construction survey will be undertaken by a qualified ecologist prior to any works on Bridge 1, to ensure there are no roosting bats present. The function of this survey will be to assess any changes in baseline environment since the time of undertaking the assessment in 2023.

If bats are found to be roosting in Bridge 1 prior to commencement, a bat derogation licence will be obtained for the temporary disturbance of an active roost.

With the implementation of the prescribed mitigation measures, no significant effects are predicted.

6.3 Residual Impacts

Taking into consideration the sensitive design of the project, the proposed best practice and adaptive mitigation measures; significant residual effects on bats with regard to 1) Collision mortality, barotrauma and other injuries, 2) Loss or damage to commuting and foraging habitat, 3) Loss of, or damage to, roosts and 4) Displacement of individuals or populations are not anticipated.

There is anticipated to be ***No Significant Effect*** on bat populations due to the Proposed Project.

6.4 Cumulative effects

The Proposed Project was considered in combination with other plans, existing and approved projects and planning applications pending a decision, in the surrounding area that could result in cumulative impacts on bats. This included a review of online Planning Registers and served to identify past, present and future plans and projects, their activities and their predicted environmental effects. The plans and projects considered are listed in Chapter 2 of the EIAR: Background of the Proposed Project.

Following the detailed assessment provided in the preceding sections, it is concluded that, the Proposed Project will not result in any residual adverse effects on bats, when considered on its own. There are five no. existing, permitted and proposed wind farm sites located within 10km of the Proposed Wind Farm. These projects are small to medium scale, and therefore, no potential for the Proposed Project to contribute to any cumulative adverse effects on any bat populations when considered in-combination with other plans and projects.

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed Project.
Taking into consideration the reported residual impacts from other plans and projects in the area and the predicted impacts with the current proposal, no residual cumulative impacts have been identified regarding bats.

7. CONCLUSION

This report provides a full and comprehensive assessment of the potential for impact on bat populations at the Proposed Project site. The surveys and assessment provided in this report are in accordance with NatureScot guidance. Following consideration of the residual effects (post mitigation) it is noted that the Proposed Project will not result in any significant effects on bats.

Provided that the Proposed Project is constructed and operated in accordance with the design, best practice and mitigation that is described within this report, significant effects on bats are not anticipated at any geographic scale.

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APPENDIX 1

BAT HABITAT SUITABILITY ASSESSMENT

HABITAT SUITABILITY ASSESSMENT

Guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2016)

Potential Suitability	Description	
	Roosting Habitats in Structures	**Potential Flight- Paths and Foraging Habitats**
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[a] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation[b]). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.[c]	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[a] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, treelined watercourses and grazed parkland. Site is close to and connected to known roosts.

a) For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.
b) Larger numbers of Common pipistrelle may be present during autumn and winter in large buildings in highly urbanised areas, based on evidence from the Netherlands (Korsten et al. 2015).
c) Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

Updated guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2023)

Potential Suitability	Description	
	Roosting Habitats in Structures	**Potential Flight- Paths and Foraging Habitats**
None	No habitat features on site likely to be used by any roosting bats at any time of the year. (i.e. a complete absence of crevices/ suitable shelter at all ground/ underground levels).	No habitat features on site likely to be used by any commuting or foraging bats at any time of the year (i.e. no habitats that provide continuous lines of shade/protection for flight-lines or generate/shelter insect populations available to foraging bats).
Negligible[a]	Negligible habitat features on site likely to be used by roosting bats; however, a small element of uncertainty remains as bats can use small and apparently unsuitable features on occasion.	No obvious habitat features on site likely to be used as flight-paths or by foraging bats; however, a small element of uncertainty remains in order to account for non-standard bat behaviour.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically at any time of the year. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[b] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats, i.e. unlikely to be suitable for maternity and not a classic cool/stable hibernation site but could be used by individual hibernating bats[c].	Habitat that could be used by small numbers of bats as flight-paths such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[b] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only, such as maternity and hibernation - the categorisation described in this table is made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for flight-paths such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure with one or potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions[b], and surrounding habitat. These structures have the potential to support high conservation status which is established after presence is confirmed.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by bats for flight-paths such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

a) Negligible is defined as 'so small or unimportant as to be not worth considering, insignificant'. This category may be used where there are places that a bat could roost or forage (due to one attribute) but it is unlikely that they actually would (due to another attribute).

b) For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.

c) Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten et al., 2016 and Jansen et al., 2022). Common pipistrelle swarming has been observed in the UK (Bell, 2022 and Tomlinson, 2020) and winter hibernation of numbers of this species has been detected at Seaton Delaval Hall in Northumberland (National Trust, 2018). This phenomenon requires some research in the UK, but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in prominent buildings in the landscape, urban or otherwise.

BCT Protocol for categorising the suitability of trees for bats (Collins, 2023).

Assessment	Description
NONE	Either no PRFs in the tree or highly unlikely to be any
FAR	Further assessment required to establish if PRFs are present in the tree
PRF	A tree with at least one PRF present

BCT Guidance for categorising suitability of PRFs for bats (Collins, 2023).

Assessment	Description
PRF-I	PRF is only suitable for individual bats or very small numbers of bats either due to size or lack of suitable surrounding habitats.
PRF-M	PRF is suitable for multiple bats and may therefore be used by a maternity colony

APPENDIX 2

SITE RISK ASSESSMENT

Table 3a: *Stage 1 - Initial site risk assessment*

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.

APPENDIX 3

INITIAL SPRING DEPLOYMENT RAW DATA

INITIAL SPRING DEPLOYMENT: 28TH APRIL – 11TH MAY

Total Passes per Night, per Species

Species	28-Apr	29-Apr	30-Apr	01-May	02-May	03-May	04-May	05-May	06-May	07-May	08-May	09-May	10-May
Myotis spp.	4	9	4	2	9	1	2	3	1	1		1	
Leisler's bat	73	91	86	111	193	91	32	67	6	30	4	1	5
Common pipistrelle	323	1150	683	813	889	1043	305	337	86	19	11	63	42
Soprano pipistrelle	47	195	74	129	126	95	29	70	8	5		9	10
Brown long-eared bat	4	1	1	4	3	6	3	1	1	1	1		
Noise	500	747	434	617	293	184	117	149	57	60	1068	68	49
Total	**951**	**2193**	**1282**	**1676**	**1513**	**1420**	**488**	**627**	**159**	**116**	**1084**	**142**	**106**

Total Passes per Detector, Per Species

Detector	D01	D02	D03	D04	D05	D06	D07	Grand Total
Myotis spp.		12	2	13	1	4	5	**37**
Leisler's bat	42	87	97	350	25	96	93	**790**
Common pipistrelle	218	405	18	1403	266	756	2698	**5764**
Soprano pipistrelle	29	119	5	165	29	55	395	**797**
Brown Long-eared Bat	1	6		4			15	**26**
Total	1240	2115	488	2977	352	995	3590	**11757**

APPENDIX 4

OVERALL RISK ASSESSMENT

Table 3b: *Stage 2 - Overall risk assessment*

Site risk level (from Table 3a)	Ecobat activity category (or equivalent justified categorisation)					
	Nil (0)	Low (1)	Low-moderate (2)	Moderate (3)	Moderate-high (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Med (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

The scores in the table are a product of multiplying site risk level and the Ecobat activity category (or equivalent). The activity categories equate to those given in Table 1 for high collision risk species. Nil (0) means no bat activity was recorded across the whole site, but caution is needed here, because although the values given in this column are "0", at sites where pre-construction surveys found no bat activity, there remains the possibility that new turbines could attract some bat species, thereby altering the level of risk that applies in reality.

Overall assessment:

Low (green)	0-4
Medium (amber)	5-12
High (red)	15-25

It is important to have an understanding of both "typical" and unusually high levels of bat activity at a site so that potentially important peaks in activity are not overlooked. It is therefore recommended that both the highest Ecobat activity category and the most frequent activity category (i.e. the median) are assessed separately in Table 3b and presented in the overall risk assessment. A judgement can then be made on which is the most relevant. 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).