APPENDIX 6-2

BAT SURVEY REPORT

Appendix 6-2 – Bat Report

Laurclavagh Renewable Energy Development, Co. Galway

DOCUMENT DETAILS

Client:	**Laurclavagh Ltd.**
Project Title:	**Laurclavagh Renewable Energy Development, Co. Galway**
Project Number:	**210627**
Document Title:	**Appendix 6-2 – Bat Report**
Document File Name:	**Appendix 6-2 Bat Report F - 210627 - 2024.02.27**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
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D2	Draft	16/02/2024	RC	AJ
D3	Final	27/02/2024	RC	AJ

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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 planning permission of a renewable energy development at Laurclavagh and adjacent townlands, near Tuam, Co. Galway. 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 were undertaken throughout 2023 and are consistent with the methodologies described in NatureScot 2021[1]. 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 were based on an indicative turbine layout of 8 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 (amended May 2022).

As detailed in Section 1.1 in Chapter 1 of the EIAR, for the purposes of this Bat Report, the various project components are described and assessed using the following references:

- The 'Proposed Wind Farm' refers to the 8 no. turbines and supporting infrastructure which is the subject of this Section 37E application.
- The 'Proposed Grid Connection' refers to the 110kV substation and supporting infrastructure which will be the subject of a separate Section 182A application.
- The 'Proposed Project' comprises the Proposed Wind Farm and the Proposed Grid Connection, all of which are located within the EIAR Site Boundary (the 'Site') and assessed together within this EIAR.

1.1 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. The reason 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.

[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 (NIEA, 2021).*

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. This report primarily focuses on surveys conducted within the Proposed Wind Farm site. The Proposed Grid Connection (including the underground cabling route) was assessed as part of the multidisciplinary survey effort detailed in Chapter 6. Further details of the bridge assessment along the Proposed Grid Connection underground cabling route are outlined below. Survey design and analyses of results at the Proposed Wind Farm site were 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.

1.2 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. Prior to the publication of the BCT guidelines, Natural England's *Bat and Onshore Wind Turbines: Interim Guidance* provided a pragmatic 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 in August 2021, as amended (May 2022). 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 is accordance with NatureScot 2021 Guidance. This guidance has set the industry standard for best practice surveys at wind farms since its initial publication in 2019.

1.3 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) (as amended). 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, as amended). 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. **Error! Reference source not found.** summarises the current conservation status of Irish bat species and identified threats to Irish bat populations.

Table 1-1 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	

1.4 Statement of Authority

Scope development and project management was overseen by Aoife Joyce (BSc., MSc.) and John Hynes (BSc., MSc., MCIEEM).

Bat surveys were conducted by MKO ecologists Keith Costello (BSc.), Ryan Connors (BSc., MSc.) & Timothy O'Ceallaigh (BSc). All staff have relevant academic qualifications to complete the surveys and assessments that they were required to do.

Data analysis was undertaken, and results were compiled by Laura Gránicz (BSc., MSc.). Impact assessment, the design of mitigation and final reporting was completed by Ryan Connors, and Laura Gránicz under the supervision of Aoife Joyce, John Hynes and Pat Roberts (BSc., MCIEEM), who reviewed and approved the final document.

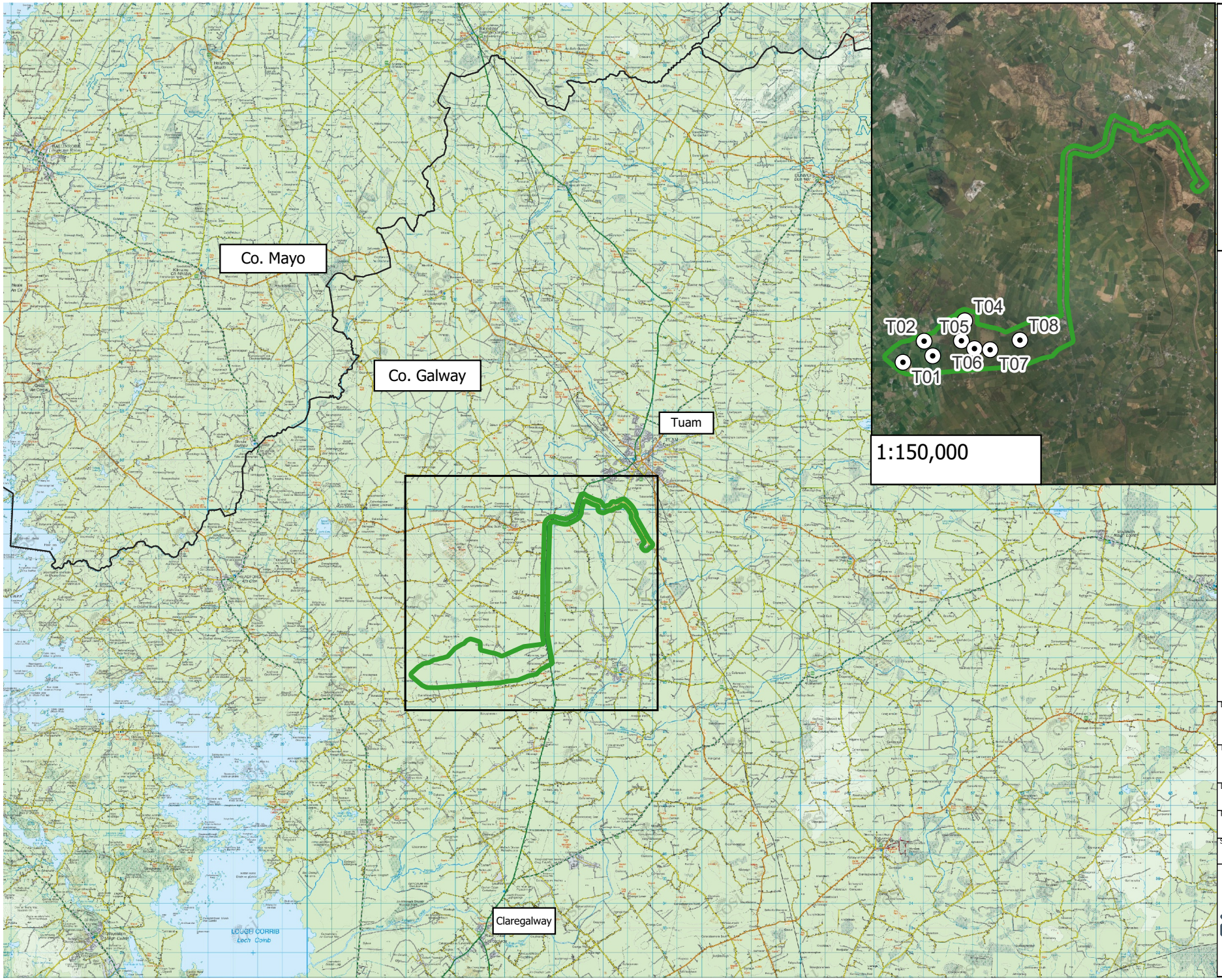
Table 1-2 Bat Specific Experience and Training of Ecologists Involved in Surveys

Staff	Role	Bat Specific Training
John Hynes	Ecology Director	Full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and has over 10 years' professional ecological consultancy experience. Former member of the Bat Conservation Ireland management council.
Pat Roberts	Principal Ecologist	Over 18 years' experience in management and ecological assessment.
Aoife Joyce	Project Director	Advanced Bat Survey Techniques (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).

Laura Gránicz	Project Ecologist	Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal), Emergence and Re-Entry Surveys (Internal), Advanced Bat Survey Techniques (BCI), Kaleidoscope Pro Analysis (Wildlife Acoustics).
Keith Costello	Ecologist	Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal), Emergence and Re-Entry Surveys (Internal), Kaleidoscope Pro Analysis (Wildlife Acoustics).
Ryan Connors	Seasonal Bat Ecologist	Surveying Trees for Bats (BRTS), Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal), Emergence and Re-Entry Surveys (Internal), Kaleidoscope Pro Analysis (Internal).
Timothy O'Ceallaigh	Ecologist	Emergence and Re-Entry Surveys (Internal), Manual Transect Surveys (Internal), Structure & Tree Inspection (Internal). Bat Habitat Appraisal (Internal).

2. PROJECT DESCRIPTION

The Proposed Project is located within a rural setting in northwest Galway, approximately 8km southwest of Tuam and 10km north of Claregalway. The N83 National Road runs in a north-south direction directly to the east of the Proposed Wind Farm Site. Land use currently comprises a mix pastural agricultural land. The surrounding land use is primarily pastural agricultural lands, as well as one-off rural housing. Existing access is via the N83 onto the L61461 Local Road in a westerly direction, a temporary road between the N83 and the L61461 will facilitate construction stage access to the Proposed Wind Farm. The site location context is shown in Figure 2-1. The full description of the Proposed Project is provided in Section 4.1 of Chapter 4 of this EIAR.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout

Drawing Title

Site Location

Project Title: Laurclavagh Renewable Energy Development	
Drawn By: RC	Checked By: AJ
Project No.: 210627	Drawing No.: Figure 2-1
Scale: 1:200,000	Date: 2024-02-22

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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 May 2023. 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 Proposed Wind Farm 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 site 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. The most recent search examined bat presence and roost records within a 10 km radius of a central point within the Proposed Wind Farm site (IG Ref: M 37195 43787) (BCI 2012, Hundt 2012, NatureScot, 2021). Available bat records were provided by Bat Conservation Ireland on 24/11/2023. Results from the National Biodiversity Data Centre were also reviewed for bat species present within the relevant 10km grid squares of the Proposed Wind Farm site.

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 Wind Farm site. 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 site (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 site 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 a central point in the Proposed Wind Farm site (BCI, 2012) (last searched on the 23rd January 2024). 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 23rd January 2024.

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 Proposed Wind Farm 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 Proposed Wind Farm site.

3.2.4.4 Additional Projects in the Wider Landscape

A search for proposed, existing and permitted wind energy developments within 10km of the Proposed Wind Farm site was undertaken in February 2024 (NatureScot, 2021). The Wind Energy Ireland (WEI) interactive wind map (windenergyireland.com) was reviewed in conjunction with planning application register portals of Galway County Council and An Bord Pleanála. Other infrastructure developments and proposals (e.g. large road projects) were also noted. Information on the location and scale of these developments was gathered to inform cumulative effects. More details on other 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 throughout 2021 to 2023. 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 associated with the Proposed Grid Connection underground cabling route) were assessed for bat commuting, foraging and roosting suitability.

Multidisciplinary walkover surveys were undertaken on the following dates:

Table 3-1 Multidisciplinary Survey Effort

Multidisciplinary Survey	Dedicated Bat Survey
30th of July 2021	15th May 2023
4th of July 2022	6th June 2023
11th of July 2022	18th July 2023
20th of September 2022	16th Aug 2023
17th August 2023	27th Sept 2023
	16th Oct 2023

3.3 Field Surveys

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2023. During these surveys, habitats within the Proposed Wind Farm site were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High, Moderate, Low* and *Negligible*, and are described fully in **Appendix 1**.

3.3.2 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 81.5m) of the proposed turbine locations (NatureScot, 2021). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The Proposed Wind Farm site was visited in May, June, July, August, September and October of 2023. A daytime walkover was carried out and structures were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats).

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 potential roost features (i.e. PRFs) identified by Andrews (2018).

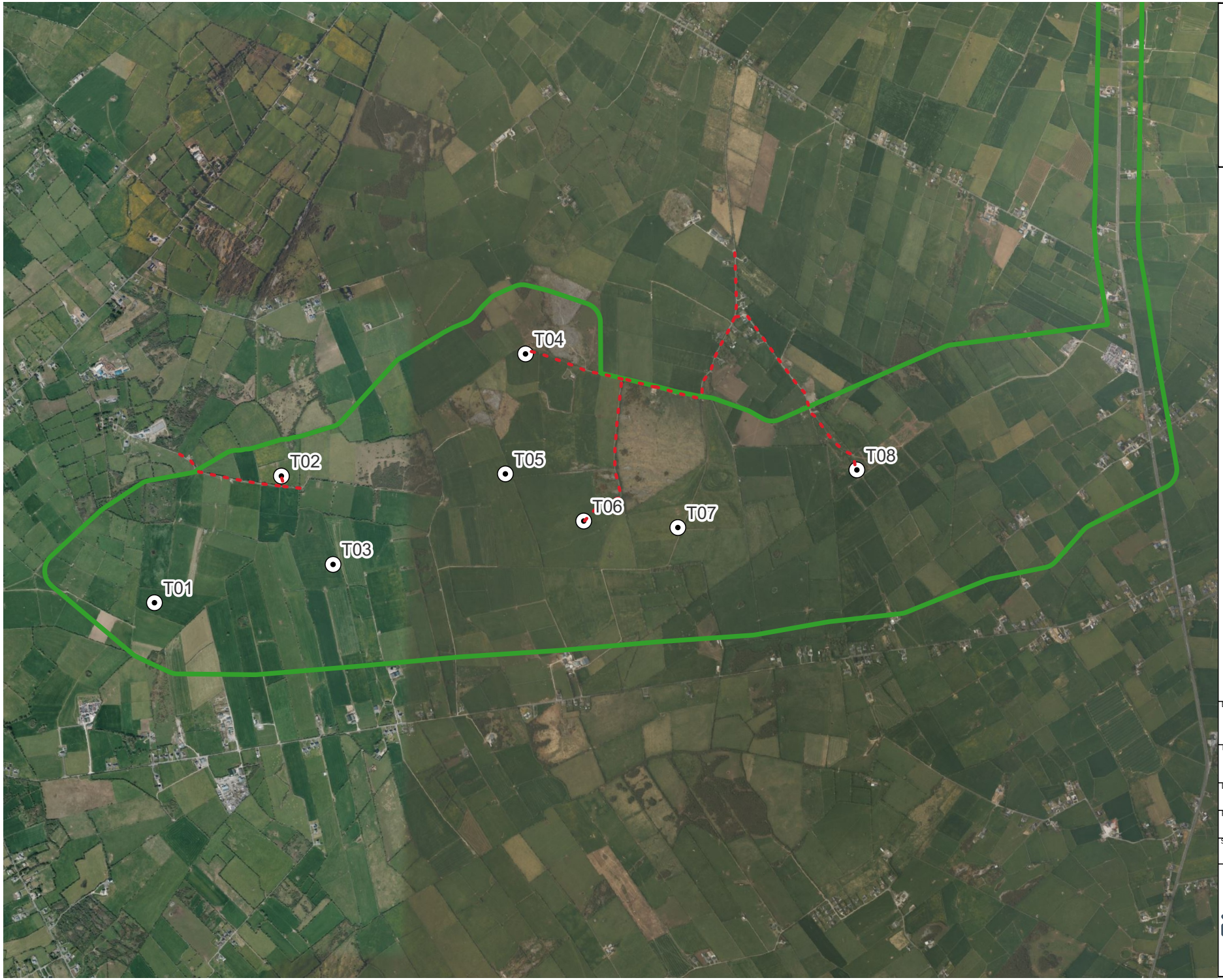
3.3.3 Manual Transects

Manual activity surveys comprised walked/driven transects at dusk. A series of representative transect routes were selected throughout the Proposed Wind Farm site . The aim of these surveys was to identify 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 turbine layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes mainly followed existing roads and tracks. Transect routes and results are presented in Figures 3-1 - 3-3.

Transects were walked or driven by two surveyors, recording bats in real time. Dusk surveys commenced 15 minutes before sunset and were completed for up to 3 hours after sunset. 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. Transects surveys were undertaken in Spring, Summer and Autumn of 2023. Table 3-2 summarises survey effort in relation to walked transects.

Table 3-2 Survey Effort - Manual Transects

Date	Surveyors	Sunrise / Sunset	Type	Weather	Walked/ Driven (km)
6th June 2023	Keith Costello & Ryan Connors	21:52	Dusk	17˚C, dry, calm, 15-20% cloud cover	4.3 km
18th July 2023	Keith Costello & Ryan Connors	21:53	Dusk	16˚C, dry, calm, 30-50% cloud cover	14.2 km
16th October 2023	Ryan Connors & Timothy O'Ceallaigh	18:39	Dusk	8 ˚C, dry, calm, 5-50% cloud cover	14.5 km
Total Survey Effort					**33 km**



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Spring Transect Route 6th June 2023

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Drawing Title
2023 Spring Transect Route

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 3-1
Scale	Date
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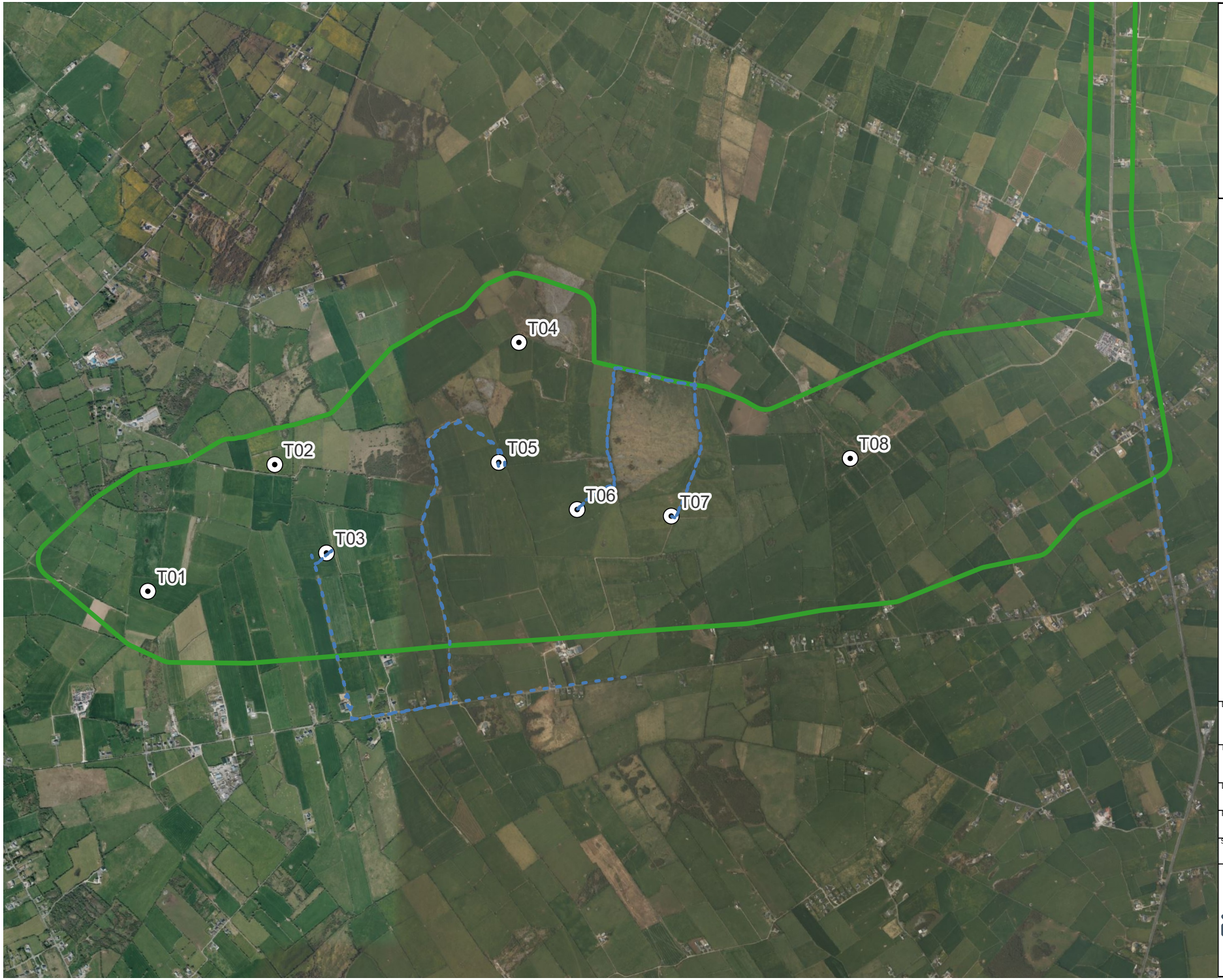

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Summer Transect Route 18 July 2023

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Drawing Title
2023 Summer Transect Route

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 3-2
Scale	Date
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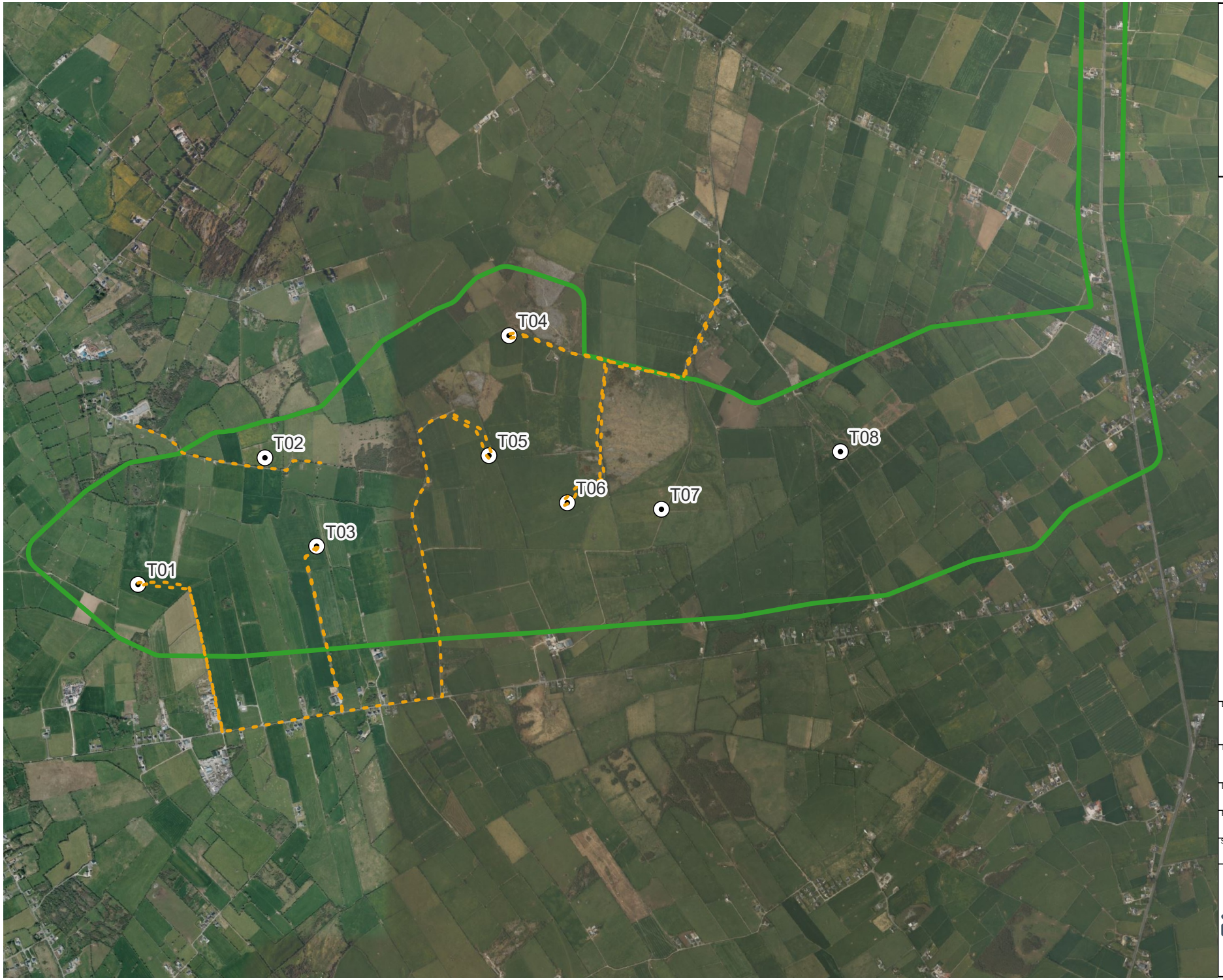

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Autumn Transect Route 16th October 2023

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Drawing Title
2023 Autumn Transect Route

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 3-3
Scale	Date
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3.3.4 Ground-level Static Surveys

Where developments have less than 10 turbines, NatureScot requires 1 detector per turbine (up to 10 turbines, plus 1 detector for every 3 additional turbines). Given that 8 turbines were proposed, 8 detectors were deployed to ensure compliance with NatureScot guidance. Automated bat detectors were deployed for at least 10 nights of suitable weather in spring (April-mid June), 20 nights in summer (mid June-mid August) and 10 nights in autumn (mid-August-October), (NatureScot, 2021, NIEA, 2021). Detector locations were based on indicative turbine locations. Figure 3-4 presents static detector locations in relation to the final turbine layout. Static detector locations are described in Table 3-3.

Table 3-3 Ground-level Static Detector Locations

Detector ID	Location (IG Ref:)	Habitat	Linear Feature within 50m	Corresponding/ Nearest Turbine(s)
D01	M 35405 43751	Improved agricultural grassland (GA1)	N/A	T01
D02	M 35405 43751	Improved agricultural grassland (GA1)	Shrubs (WS1)	T02
D03	M 35698 43323	Improved agricultural grassland (GA1)	Stone wall	T03
D04	M 36647 44396	Dry calcareous and neutral grassland (GS1)	Stone wall	T04
D05	M 36557 43766	Dry calcareous and neutral grassland (GS1)	Hedgerow	T05
D06	M 36557 43766	Improved agricultural grassland (GA1)	N/A	T06
D07	M 36927 43522	Improved agricultural grassland (GA1)	Stone wall	T07
D08	M 37433 43724	Improved agricultural grassland (GA1)	Tree line	T08

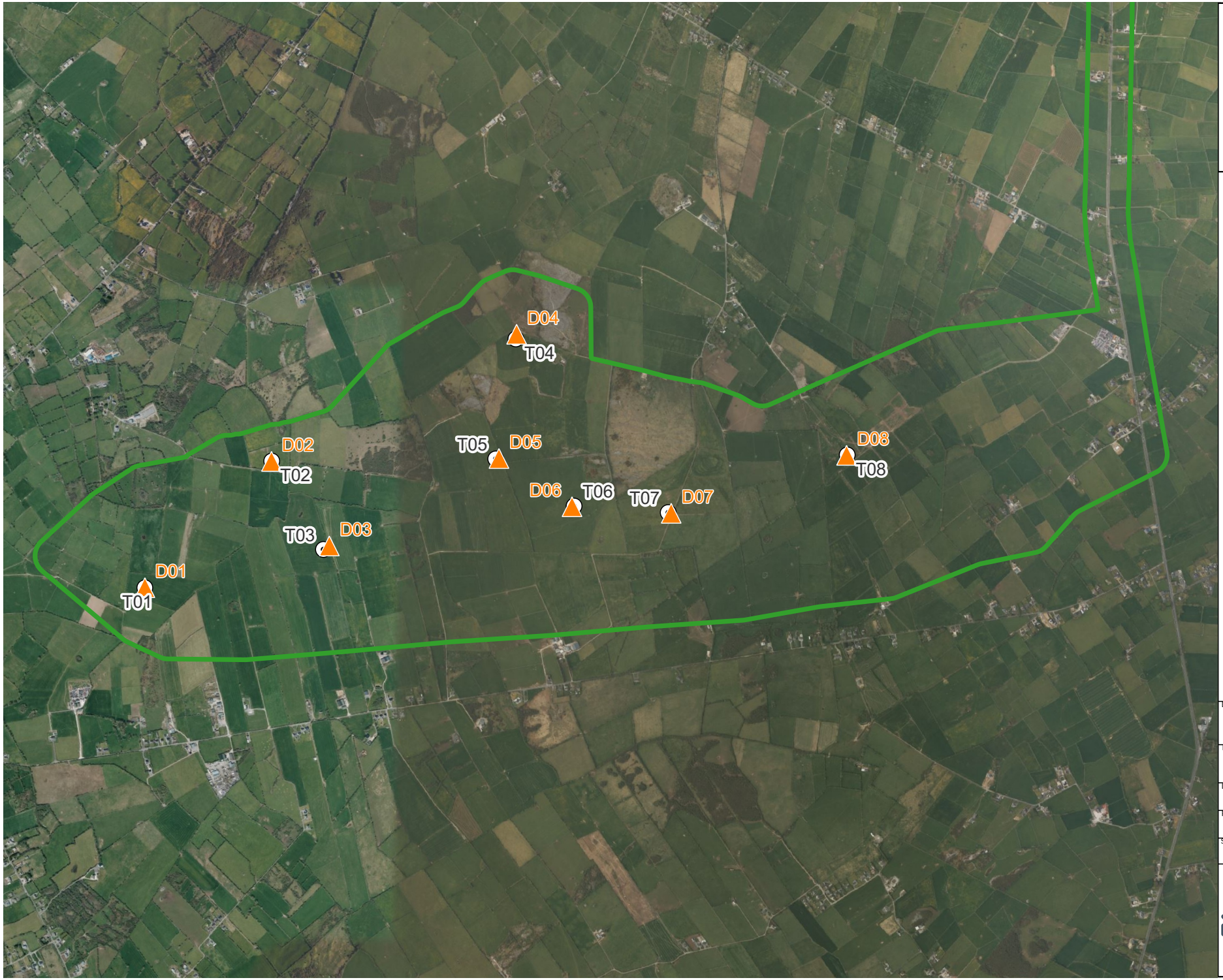
Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed using settings recommended for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset 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˚C, wind speeds less than 5m/s and no or only very light rainfall). Table 3-4 summarises survey effort achieved in 2023 for each of the detector locations.

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

Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	15th May – 6th June 2023	23	23
Summer*	18th July – 16th August 2023	29	24
Autumn	27th September – 16th October 2023	19	14
Total Survey Effort		**71**	**61**

**In the Summer of 2023, D02 was redeployed from the 16th August until the 27th September (42 nights, 31 nights with appropriate weather), while D05 was redeployed from 23rd August until 27th September (35 nights, 29 nights with appropriate weather) due to technical difficulties. These detectors will herein be referred to as D02 (R) and D05 (R).*



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Static Detector Locations

N

Drawing Title
2023 Static Detector Locations

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 3-4
Scale	Date
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Website: ww.mkoireland.ie

3.4 Bat Call Analysis

All recordings were later analysed using bat call analysis software Kaleidoscope Pro v.5.4.8 (Wildlife Acoustics, MA, USA). The aim of this was to identify, to a species or genus level, what bats were present at the Proposed Wind Farm site. Bat species were identified using established call parameters, to create site-specific custom classifiers and were 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 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' was used as a measure of activity (Collins, 2016). A bat pass was 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.

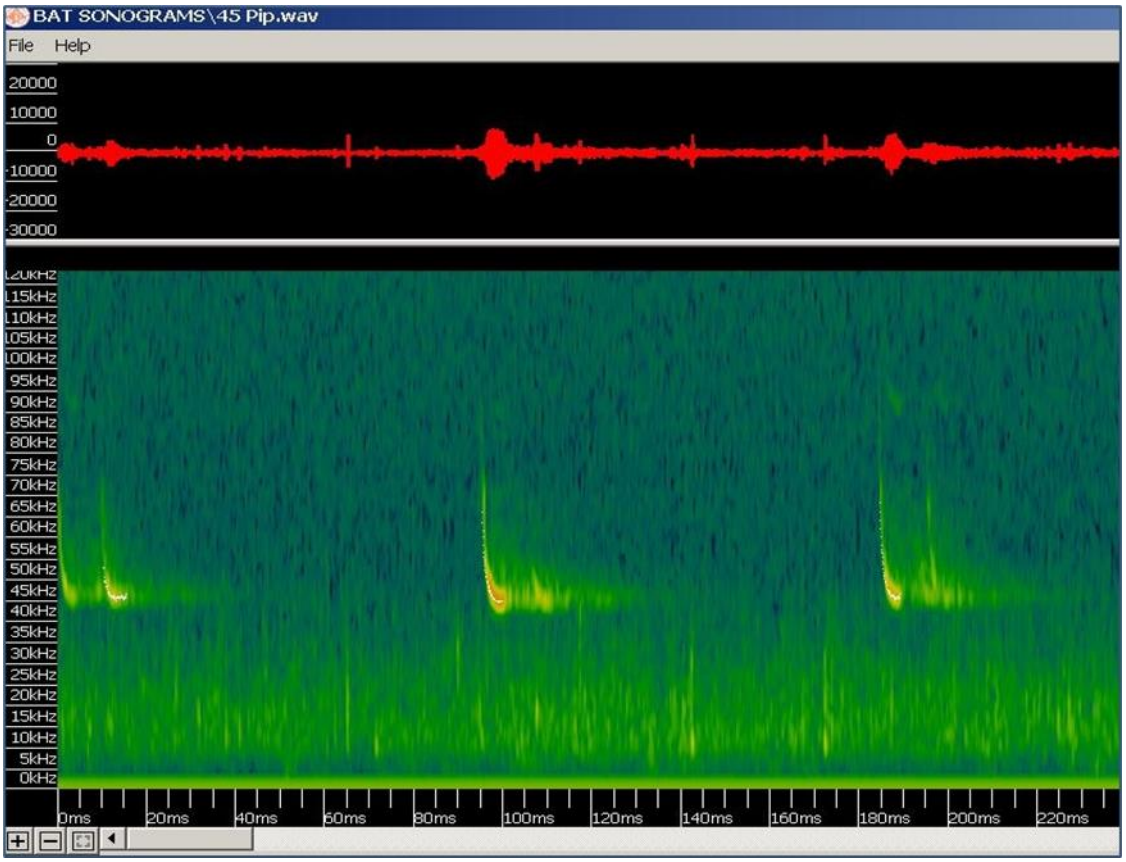

Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

The online database tool Ecobat (mammal.org.uk) is recommended by NatureScot 2021 to assess bat activity levels within a proposed wind-farm site. This web-based interface, launched in August 2016, allows 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 generates a percentile rank for each night of activity and provides 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 2023 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.

All statistical analyses and graphical representations in this report were conducted using R (version 4.3.2), and RStudio (version 2023.09.+494.). R is a powerful statistical programming language and provided the framework for data manipulation and statistical testing. To allow this, data were standardised into bat passes per hour. RStudio, as an integrated development environment for R, facilitated efficient coding, visualization, and reproducibility. The 'ggplot2' package in R was particularly instrumental in creating the detailed graphs presented in the results section.

The methodology for assessing activity levels across the site was adapted from Mathews *et al.* (2016), where activity ranges of pipistrelle species were defined using an average of maximum nightly pass rates (in total passes during the survey period) across the site, divided into tertiles.

Pipistrelle species' activity ranges were determined using an average of maximum nightly pass rates (total passes during the survey period) across the Proposed Wind Farm site, divided into quartiles. The same process was applied to Leisler's bats, while for other species groups, the maximum nightly pass rate (bpph) recorded across the site was divided into quartiles.

The use of bat passes per hour rates was deemed more appropriate to account for seasonal changes in night length (Matthews *et al.* 2016). Activity levels were assessed according to the site activity and the species were assessed separately into four distinct groups: two Pipistrelle species (*Pipistrellus pipistrellus, Pipistrellus pygmaeus*), the widespread noctules (*Nyctalus leisleri*) and *Myotis spp.* and the rare or hard to record species; Nathusius' pipistrelles (*Pipistrellus nathusii*), brown long-eared bats (*Plecotus auritus*) and lesser horseshoe bats (*Rhinolophus hipposideros*). 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 prior to the removal of outliers.

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			
	Pipistrellus spp.	*Nyctalus* spp.	*Myotis* spp.	Other groups
Low	< 39.56	< 16.13	< 0.4	< 0.93
Medium	39.56 – 79.13	16.13 – 32.26	0.4 – 0.8	0.93 – 1.86
High	79.13 <	32.26 <	0.8 <	1.86 <

The calculated activity thresholds in Table 3-6 were considerably high for all species surveyed. Thresholds were therefore adapted to more representative activity levels for agricultural/wet grassland habitats based on MKO's experience with similar habitats, as presented in Table 3-7.

Table 3-7 Adapted Activity Level Categories

Assessment Level	Activity Threshold as Bat Passes per Hour (bpph) for Bat Species			
	Pipistrellus spp.	*Nyctalus* spp.	*Myotis* spp.	Other groups
Low	< 6.17	< 4.03	< 0.1	< 0.17
Medium	6.17 – 12.33	4.03 – 8.06	0.1 – 0.2	0.17 – 0.33
High	12.33 <	8.06 <	0.2 <	0.33 <

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 Plate 3-2, an adapted assessment of vulnerability of wind turbine collision for Irish bat populations is provided. This adaptation of the 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.

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 Whiskered bat		Nathusius' pipistrelle
	Low Population Vulnerability	Medium Population Vulnerability	High Population Vulnerability

Plate 3-2 Population Vulnerability of Irish Bat Species (Adapted from NatureScot, 2021)

3.6.2 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 cross-tablature result of habitat risk and project size determines the site risk (i.e. Low, Medium or High) (Plate 3-3) 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 Proposed Wind Farm site. All site assessment levels, as per NatureScot (2021) are presented in **Appendix 2**.

		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)

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

3.6.3 Overall Risk Assessment

An overall assessment of risk was made by combining the site risk level (i.e. Medium) and the population risk (i.e. High), as shown in the overall risk assessment matrix table (Plate 3-4) i.e. Table 3b (NatureScot, 2021). The assessment was carried out for both median and maximum bat passes per hour in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values). (**Appendix 3**).

	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	15	18
Highest (5)	0	5	10	15	20	25

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

Plate 3-4 Overall Risk Assessment Matrix (Table 3b, NatureScot, 2021)

This exercise was carried out for each 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 above).

3.7 Limitations

A comprehensive suite of bat surveys has been undertaken at the Proposed Wind Farm site in 2023. The surveys undertaken, in accordance with NatureScot Guidance, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Wind Farm site on bats receptors.

The information provided in this report accurately and comprehensively describes the baseline environment; provides an accurate prediction of the likely effects of the Proposed Project; prescribes mitigation as necessary; and describes the predicted residual effects. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines.

No limitations in the scope, scale or context of the assessment have been identified. Overall, a comprehensive assessment has been achieved.

4. SURVEY RESULTS

4.1 Consultation

4.1.1 Bat Conservation Ireland

Bat Conservation Ireland were invited to comment on the potential of the Proposed Project to affect bats. As of 29/11/2023, no response has been received.

4.1.2 Development Applications Unit - NPWS

The Development Applications Unit were also invited to provide any feedback, comments or suggestions they might have relating to the Proposed Project. A response was received from the Department of Housing, Local Government and Heritage on the 30th of June 2023, in which they stated that they were not in a position to make specific recommendations on this particular development at this time.

4.2 Desk Study

4.2.1 Bat Records

Bat Conservation Ireland

A data request was sent to Bat Conservation Ireland for records of bat activity and roosts within a 10km radius of an approximate central point within the Proposed Wind Farm site (IG Ref: M 37083 43525; last search 24/11/2023). Available bat records were provided by BCI on 24th November 2023. The search included roosts, transects and ad-hoc observations. A number of ad-hoc observations (n=44) have been recorded. At least eight of Ireland's nine resident bat species were recorded within 10km of the Proposed Wind Farm site. The results of the database search are provided in Table 4-1.

Table 4-1 National Bat Database of Ireland Records within 10km

Northern Section of Proposed Wind Farm site (IG Ref: E 263983 N 259683)				
Record	**Species**	**Grid Reference**	**Date**	**Location**
Roost	Unidentified bat	M436521	N/A	Clare Tuam, Tuam, County Galway
	Myotis natterreri	M436521	N/A	Clare Tuam, Tuam, County Galway
	Myotis natterreri, Myotis daubentonii, Rhinolophus hipposideros	M4002949590	N/A	Clare Tuam Bridge, N17, Claretuam, Tuam, Galway
	Myotis daubentonii, Myotis natterreri	M4260043400	N/A	Corrofin Bridge, Corrofin, Co. Galway
	Myotis natterreri, Plecotus auritus, Rhinolophus hipposideros	M3537	N/A	Cregg, Corrandulla, Co. Galway
	Unidentified bat	M354378	N/A	Corandulla,Co. Galway
	Myotis natterreri	M3141	N/A	Headford, Co. Galway
	Plecotus auritus	M3048	N/A	Headford, County Galway
	Rhinolophus hipposideros	M329476	N/A	Carrowcohlaun Fort, Belclare, Co. Galway

Northern Section of Proposed Wind Farm site (IG Ref: E 263983 N 259683)				
	Rhinolophus hipposideros	M337487	N/A	Castlehackett, Belclare, Co. Galway
	Rhinolophus hipposideros	M3247	N/A	Co. Galway
Transect	*Unidentified bat, Myotis daubentonii*	M3174135178	N/A	Addergoole Bridge Transect
	Unidentified bat	M3174135178	N/A	Addergoole Bridge Transect spot 1
	Myotis daubentonii, Unidentified bat	M3230434984	N/A	Addergoole Bridge Transect spot 10
	Unidentified bat	M3171535125	N/A	Addergoole Bridge Transect spot 2
	Myotis daubentonii, Unidentified bat	M3178234968	N/A	Addergoole Bridge Transect spot 4
	Myotis daubentonii, Unidentified bat	M3187934998	N/A	Addergoole Bridge Transect spot 5
	Unidentified bat, Myotis daubentonii	M3196534991	N/A	Addergoole Bridge Transect spot 6
	Unidentified bat, Myotis daubentonii	M3204434937	N/A	Addergoole Bridge Transect spot 7
	Unidentified bat, Myotis daubentonii	M3212634944	N/A	Addergoole Bridge Transect spot 8
	Unidentified bat, Myotis daubentonii	M3219934986	N/A	Addergoole Bridge Transect spot 9
	Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus pipistrellus, Unidentified bat	M430517	N/A	M24 (14) 2003-
	Pipistrellus pipistrellus , Pipistrellus spp. , Nyctalus leisleri, Pipistrellus pygmaeus	M388534	N/A	M24 (15) 2003-
	Pipistrellus spp., Nyctalus leisleri, Pipistrellus pygmaeus, Pipistrellus pipistrellus	M386492	N/A	M24 (16) 2003-2008
	Pipistrellus pipistrellus , Pipistrellus spp. , Pipistrellus pygmaeus	M355473	N/A	M24 (17) 2003-2008
	Pipistrellus pipistrellus, Pipistrellus spp. , Pipistrellus pygmaeus	M333453	N/A	M24 (18) 2003-2008
	Pipistrellus pygmaeus, Pipistrellus pipistrellus , Pipistrellus spp.	M304453	N/A	M24 (19) 2003-2008
	Pipistrellus pygmaeus, Pipistrellus spp. , Pipistrellus pipistrellus	M296476	N/A	M24 (20) 2003-2008
	Myotis daubentonii, Unidentified bat	M2799452633	N/A	Shrule Village Transect
Ad-hoc	*Pipistrellus pipistrellus , Pipistrellus pygmaeus, Nyctalus leisleri*	M325506	26/08/2009	BATLAS 2010
	Pipistrellus pipistrellus , Pipistrellus pygmaeus	M2802252649	04/08/2009	BATLAS 2010
	Pipistrellus pygmaeus, Nyctalus leisleri	M2802252649	14/10/2009	BATLAS 2010
	Pipistrellus pygmaeus, Pipistrellus spp. , Nyctalus leisleri, Myotis daubentonii, Plecotus auritus	M4181536435	25/06/2009	BATLAS 2010
	Pipistrellus pygmaeus, Nyctalus leisleri, Plecotus auritus	M3570037600	27/09/2009	BATLAS 2010
	Pipistrellus pipistrellus , Pipistrellus pygmaeus	M3535037800	27/09/2009	BATLAS 2010

Northern Section of Proposed Wind Farm site (IG Ref: E 263983 N 259683)				
	Pipistrellus pipistrellus , Pipistrellus pygmaeus	M317413	22/05/2009	BATLAS 2010
	Myotis spp., Pipistrellus spp. , Pipistrellus pygmaeus	M365426	22/05/2009	BATLAS 2010
	Pipistrellus pipistrellus , Pipistrellus pygmaeus	M328479	22/05/2009	BATLAS 2010
	Pipistrellus pygmaeus	M417529	24/05/2009	BATLAS 2010
	Pipistrellus pipistrellus , Nyctalus leisleri	M4424034589	22/05/2018	BATLAS 2020
	Pipistrellus pipistrellus	M4467635566	22/05/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri	M3074636087	27/08/2018	BATLAS 2020
	Pipistrellus pipistrellus , Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii	M4179536439	20/05/2018	BATLAS 2020
	Pipistrellus pygmaeus	M3322237358	27/08/2018	BATLAS 2020
	Pipistrellus pygmaeus	M2904637575	27/08/2018	BATLAS 2020
	Pipistrellus pipistrellus , Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii	M3533337857	29/08/2018	BATLAS 2020
	Pipistrellus pipistrellus , Pipistrellus pygmaeus	M2802838392	27/08/2018	BATLAS 2020
	Pipistrellus spp.	M3660040700	17/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri, Myotis spp.	M2960041200	30/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Myotis daubentonii	M3170041300	16/08/2018	BATLAS 2020
	Pipistrellus pipistrellus	M3380042300	16/08/2018	BATLAS 2020
	Pipistrellus pipistrellus , Nyctalus leisleri	M2720046900	10/05/2017	BATLAS 2020
	Pipistrellus pygmaeus, Unidentified bat	M3050047300	16/08/2018	BATLAS 2020
	Pipistrellus pipistrellus , Nyctalus leisleri	M3690047300	16/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Myotis mystacinus	M3560049400	10/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii	M3090049500	10/08/2018	BATLAS 2020
	Pipistrellus pipistrellus	M3250050600	08/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri	M2810052600	29/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri	M3710052900	28/08/2018	BATLAS 2020
	Pipistrellus pipistrellus , Pipistrellus pygmaeus, Nyctalus leisleri	M3810053470	28/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri	M3702550315	10/09/2009	Consultancy Surveys
	Pipistrellus pipistrellus , Pipistrellus pygmaeus	M3702550315	07/08/2010	Consultancy Surveys
	Pipistrellus pipistrellus , Pipistrellus pygmaeus, Nyctalus leisleri	M4184036480	26/08/2019	Consultancy Surveys
	Myotis daubentonii	M4400046000	11/05/2002	Consultancy Surveys
	Myotis daubentonii	M4500041000	11/05/2002	Consultancy Surveys
	Pipistrellus pipistrellus , Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii	M4200052000	16/06/2005	Consultancy Surveys

Northern Section of Proposed Wind Farm site (IG Ref: E 263983 N 259683)				
	Pipistrellus pygmaeus	M4260043400	16/10/2005	Consultancy Surveys
	Pipistrellus spp. , Myotis daubentonii	M353379	24/09/2019	National Biodiversity Data Centre Bat Records
	Nyctalus leisleri	M362482	14/07/2022	National Biodiversity Data Centre Bat Records
	Pipistrellus spp.	M310418	27/02/2021	National Biodiversity Data Centre Bat Records
	Pipistrellus spp.	M310418	12/05/2021	National Biodiversity Data Centre Bat Records
	Pipistrellus spp.	M294412	30/06/2022	National Biodiversity Data Centre Bat Records
	Pipistrellus pygmaeus, Myotis daubentonii	M4380052300	23/04/2005	Consultancy Surveys

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 Proposed Wind Farm site (last search 06/11/2023). Hectads M34 and M44 fall within this 10km radius. Seven of Ireland's nine resident bat species were recorded within 10km of the Proposed Wind Farm site. The results of the database search are provided in **Error! Reference source not found.**.

Table 4-2 NBDC Bat Records within 10km of the Proposed Wind Farm site

Hectad	Species	Database	Designation
M34, M44	Brown Long-eared Bat (*Plecotus auritus*)	National Bat Database of Ireland	HD Annex IV, WA
M34, M44	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	National Lesser Horseshoe Bat Database	HD Annex II & IV, WA
M34, M44	Lesser Noctule (*Nyctalus leisleri*)	National Bat Database of Ireland	HD Annex IV, WA
M34, M44	Natterer's Bat *(Myotis nattereri)*	National Bat Database of Ireland	HD Annex IV, WA
M34, M44	Common Pipistrelle (*Pipistrellus pipistrellus sensu lato*)	National Bat Database of Ireland	HD Annex IV, WA
M34	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	National Bat Database of Ireland	HD Annex IV, WA
M44	Daubenton's Bat *(Myotis daubentonii)*	National Bat Database of Ireland	HD Annex IV, WA

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 Wind Farm site. The Proposed Wind Farm site is located outside the current known range for Nathusius' pipistrelle, while remaining within range for all other species.

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 Wind Farm site is situated inside the known range of this species (NPWS, 2019). A search of all SACs within a 15km radius of the Proposed Wind Farm site

found two sites designated for the conservation of bats. A brief description of these sites is provided in Table 4-34-3.

The Proposed Wind Farm site is located 2.3 km away from the border of Lough Corrib SAC. However, the Lesser horseshoe bat roost for which the SAC is designated is located 27.8 km from the Proposed Wind Farm site, significantly outside the core foraging range (2.5 km) of the species (NPWS, 2013).

There is therefore no potential for significant effect on the Lesser horseshoe bat populations for which the SAC has been designated.

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 10km radius of the Proposed Wind Farm site found one site designated for the conservation of bats. Potential pathways for impacts are outlined in further detail in Chapter 6 of the main EIAR.

Table 4-3 - Sites Designated for Conservation of Bats within 15km

Designated Site	Description	Distance to Proposed Wind Farm site	Distance to Designated Roost
Lough Corrib SAC (000297)	Lesser horseshoe bat summer roosts	2.3 km	27.8 km
Ross Lake and Woods SAC (001312)	Lesser horseshoe bat winter roost	14.8 km	16.9 km
Castle Hackett Souterrain pNHA (002038)	Lesser horseshoe bat	4.5 km	4.5 km

4.2.4 Landscape Features and Habitat Suitability

A review of mapping and photographs provided insight into the habitats and landscape features present at the Proposed Wind Farm site. In summary, the primary land use within the site is a mix of pastural agricultural land with field boundaries delineated by stonewalls, hedgerows and treelines.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the Proposed Wind Farm site. A search of the National Monuments Database revealed the presence of two manmade subterranean sites within the Proposed Wind Farm site of which the Proposed Project has avoided (Table 4-4).

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

A review of the NBDC bat landscape map provided a habitat suitability index of 27.78 (yellow) for all bats. This indicates that the Proposed Project area has a medium habitat suitability for bat species.

Table 4-4 Man-made Subterranean Sites within the Proposed Wind Farm site

Class	Location (ITM)	Description	Compiled by
Souterrain GA057-122	Townland: Kilcurrivard 537993, 743012	On level ground, in an area shown on 3rd ed. of OS 6-inch map (1933) as outcropping rock but now reclaimed pastureland. Named and marked by a small open circle on 3rd ed. According to local information, there is a 'cave' at this spot, but no visible surface trace survives.	Olive Alcock, Kathy de hÓra and Paul Gosling 05-Aug-10

Class	Location (ITM)	Description	Compiled by
Souterrain GA057-117001	Townland: Cicoria'd 537856, 743200	In W half of a ringfort (GA057-117—). A drystone-built souterrain, L-shaped in plan, which has been infilled and is now inaccessible. Two sections are discernible: the 1st (L 5.5m, Wth 1.1m) runs E-W. There is a gap to E between it and the 2nd section (L 4m, Wth 1.43m) which runs on a N-S axis. One roof lintel is visible in both parts.	Olive Alcock, Kathy de hÓra and Paul Gosling 05-Aug-10

4.2.5 Additional Projects in the Wider Landscape

Table 4-5 provides an overview of wind farms in the vicinity of the Proposed Project.

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

Wind Farm	Status	No. of Turbines	Turbine Height
5 to 10km			
Cloonlusk	Existing	2	Tip Height 117
Shancloon Wind Farm	Proposed	13	Turbine Dimensions unknown to the public
Turbine at Cloonascragh	Permitted	1	Tip Height 168m
Domestic Turbine at Montiagh	Existing	1	Tip height 15.05m

In addition to wind energy developments, four other EIA planning applications were noted within 10km of the Site. These include the following:

- EIA Portal Ref: 2020071 - Extraction of rock by blasting means from 4.35Ha. area down to minus 5mOD; Occasional processing using mobile plant; Storage of aggregate on completion of extraction; Landscaping & restoration; 5-year permission.
- EIA Portal Ref: 2021107 - Application to An Bord Pleanála for Substitute Consent for the unauthorised continuation of quarrying operations and the unauthorised continued use and/or operation of buildings, structures, plant and machinery at Cartron Quarry, Tuam, Co. Galway.
- EIA Portal Ref: 2022039 - Permission to construct serviced dwelling house and domestic garage. This application is accompanied by a Natura Impact Statement.
- EIA Portal Ref: 2022149 - Quarrying operations including the extraction of sand and gravel over an area of 6.5ha; the recovery of inert waste from construction and demolition activity via inert waste recycling and recovery of natural materials for use in restoration of site.

Three extractive industries are also present within 10km of the Site. Details of these industries are presented in Table 4.6

Table 4-6 Extractive industries within 10 km of the Site

File Number	Applicant Name	Development Address	Distance to Site
2260819	McTigue Quarries Ltd	Cloonascragh, Galway	0.2 km
20419	Mortimer Quarries Ltd	Cartron, Galway	2.4
21442	Mortimer Quarries Ltd.	Claretuam, Galway	2.5 km

4.3 Field Surveys

4.3.1 Bat Habitat Suitability Appraisal

A total of fifteen habitats were recorded within the Proposed Wind Farm site, including;

- Improved agricultural grassland (GA1)
- Dry calcareous and neutral grassland (GS1)
- Dry meadows and grassy verges (GS2)
- Exposed calcareous rock (Limestone pavement) (ER2)
- Stone walls (BL1)
- Dry calcareous heath (HH2)
- Immature woodland (WS2)
- Oak-ash-hazel woodland (WN2)
- Hedgerows (WL1)
- Treelines (WL2)
- Scrub (WS1)
- Dense bracken (HD1)
- Horticultural land (BC2)
- Spoil and bare ground (ED2)
- Buildings and Artificial Surfaces (BL3)

Habitats within the Proposed Wind Farm site are dominated by improved agricultural grassland, delineated by stone walls and treelines/hedgerows. Other habitats include smaller areas of dry calcareous and neutral grassland, dry meadows and grassy verges, oak-ash-hazel woodland, heath, scrub and buildings and artificial surfaces.

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, areas of grassland habitats as well as exposed areas of calcareous rock and were considered to have *Low* suitability, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2016).

Stone walls, treelines and hedgerows show potential for foraging and commuting bats. However, these habitats are surrounded by wide expanses of grassland habitat and thus, are not very well connected to the surrounding landscape. As such, these habitats were classified as *Low* suitability, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2016).

With regard to roosting bats, an assessment of the treeline habitats was undertaken. Trees present on site comprise a mixture of immature woodland, gappy hedgerows and semi-mature treelines. Overall trees within the Proposed Wind Farm site did not provide optimal habitat for roosting bats and were assessed as having *Negligible – Low* roosting potential.

All other habitats present were assigned a *Negligible* value.

4.3.1.1 Proposed Grid Connection

It is intended to connect the Proposed Wind Farm to the national grid via an onsite 110kV substation and 110kV underground cabling route connecting to the existing Cloon 110kV electrical substation in the townland of Cloonascragh, Co. Galway. The Proposed Grid Connection underground cabling route will be approximately 14.3km in length and will be primarily located within the public road network.

Habitats along the wider underground cabling route include:

- Stone walls (BL1),
- Dry meadows and grassy verges (GS2),
- Agricultural grasslands (GA1),
- Wet grasslands (GS4),
- Hedgerows (WL1)
- Treelines (WL2)
- Buildings and Artificial Surfaces (BL3)

Further details of habitats within the Proposed Grid Connection underground cabling route are outlined in Chapter 6, Section 6.7.1.

The habitat at the proposed 110kV on-site substation and adjacent temporary construction compound consists entirely of *Improved agricultural grassland (GA1)* with no proposed removal of any trees or hedgerows during the construction process. As such, no loss of commuting/foraging or roosting habitat for bats is anticipated.

With regard to commuting and foraging bats, features along the Proposed Grid Connection underground cabling route such as stone walls, grassland habitats, hedgerows and treelines were assessed as having *Low* to *Moderate* suitability i.e. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water (Collins, 2016).

With regard to roosting bats, habitat features along the Proposed Grid Connection underground cabling route, including grassland habitats, hedgerows, stone walls and immature woodland, were assessed as having *Negligible* suitability i.e. Negligible habitat features likely to be used by roosting bats/trees of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential (Collins, 2016).

There are 4 no. watercourse crossings and 1 no. motorway crossing along the Proposed Grid Connection underground cabling route which are described further below. On the 17th of August 2023, the structures of the existing 4 no. watercourse crossings were inspected for signs of bat roosts and were assessed for bat roost potential. No signs of bat roosts were found at any of the structures. Due to safety constraints, a comprehensive inspection of the motorway crossing was not feasible. The crossing, constructed with solid concrete, was assessed from the ground, and appears to lack suitable features for roosting bats. However, due to the uncertainty stemming from the absence of a close inspection, the crossing was precautionarily assessed as having *Low* roosting suitability. The findings are summarized in Table 4-7 below. The locations of the watercourse and motorway crossings are shown on Chapter 4, Figure 4-15.

Table 4-7 Bat Roost Suitability of Bridges/ culverts along the Proposed Grid Connection underground cabling route

Crossing ID	ITM	Culvert type	Photo	Bat Roost Potential	Extent of Works
WC1	540063 749583	Two concrete pipes and stone wall		No evidence of bats found. Some small crevices present within wall. *Low* bat roost potential.	Standard Trench Detail
WC2	540920 749751	Concrete flatbed bridge over the Clare River		No evidence of bats found during inspection. *Low* suitability attributed on a precautionary basis due to potential for crevices and gaps in joints.	Horizontal Directional Drilling

Crossing ID	ITM	Culvert type	Photo	Bat Roost Potential	Extent of Works
WC3	541950 749970	Single stone arch		No evidence of bats found. Some crevices present within stonework. *Low* bat roost potential.	Flatbed Over Existing Pipe
WC4	543287 749508	Concrete pipe culvert		No evidence of bats found. The inlet of the culvert consists of a stone structure and is heavily vegetated. *Negligible* suitability.	Standard Trench Detail

Crossing ID	ITM	Culvert type	Photo	Bat Roost Potential	Extent of Works
MC1	541711 750265	Motorway crossing		Access limited due to its presence on active motorway. Solid concrete construction. *Low* suitability assigned on a precautionary basis.	Horizontal Directional Drilling

4.3.1.2 Turbine Delivery Accommodation Works

As described in Chapter 4, Section 4.4.2.2 of this EIAR, to facilitate the delivery of large turbine components and other abnormal loads during the construction period, some accommodation works are required. However, these are limited to the temporary relocation of some road signs and street furniture. Habitats associated with the accommodation works were considered to have *Negligible* suitability i.e. Negligible habitat features likely to be used by roosting bats/trees of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential (Collins, 2016) for commuting/foraging or roosting.

4.3.2 Roost Surveys

Following a search for roosts in 2023, no structures containing potential suitable bat roost features were identified within 200m plus the rotor radius (81.5m) of the proposed turbines.

The assessment of the Proposed Wind Farm site also included an examination of potential tree roost features. The Proposed Wind Farm site is dominated by agricultural fields, typically bordered by stone walls which are often bare or else associated with hedgerow and treeline habitat, dominated by hawthorn (*Crataegus monogyna* – both hedgerow height and taller mature specimens), blackthorn (*Prunus spinosa),* hazel (*Corylus avellana),* bramble (*Rubus fruticosus agg.)* and ash (*Fraxinus excelsior).* Due to their size and lack of PRFs, the majority of trees within the Proposed Wind Farm site do not provide significant suitable potential for roosting bats.

However, during the assessment, five ash trees (Plate 4-1) located to the north of T08, were identified as having potential suitability for roosting bats (IG Ref: M 38343 43894). These trees are situated approximately 100 meters from the nearest turbine location and fall outside the bat buffer for vegetation clearance identified in Chapter 6, Appendix 6-4, Biodiversity Management and Enhancement Plan (BMEP). The ash trees were subject to a ground level inspection using an endoscope where accessible. These trees will be retained and avoided as part of the Proposed Project.

A broken branch was observed in one of the ash trees (IG Red: M 38346 43897) identified as a PRF (Plate 4-2). On further inspection, no evidence of bats or bat use was identified. The other trees were covered in dense ivy and no other PRFs were identified; however, they may present some potential for roosting bats (Plates 4-3 & 4-4). The trees are located in an area with limited connectivity to the wider landscape and as such were assessed as having *Low* roosting potential. The trees may be used opportunistically by individual bats.

Plate 4-1 Ash treeline to the north of T08

Plate 4-2 Broken branch offering roosting potential for bats

Plate 4-3 Dense Ivy cover around trunk of tree

Plate 4-4 Ivy cover obscuring view of crown of tree

4.3.3 Manual Transects

Manual transects were undertaken in Spring, Summer and Autumn of 2023. Bat activity was recorded on all surveys. A total of 253 bat passes were recorded (Table 4-8). In general, Leisler's bat (n=155) was recorded most frequently, followed by common pipistrelle (n=51) and soprano pipistrelle (n=46). *Myotis spp.* was rare (n= 1). Species composition across all manual surveys is presented in **Error! Reference source not found.**5.

Table 4-8 Species composition of Manual Transects in 2023.

	Spring	Summer	Autumn
Total Bat Passes	**253**		
Myotis spp.	0	1	0
Leisler's bat	16	139	0
Common pipistrelle	14	31	6
Soprano pipistrelle	20	10	16

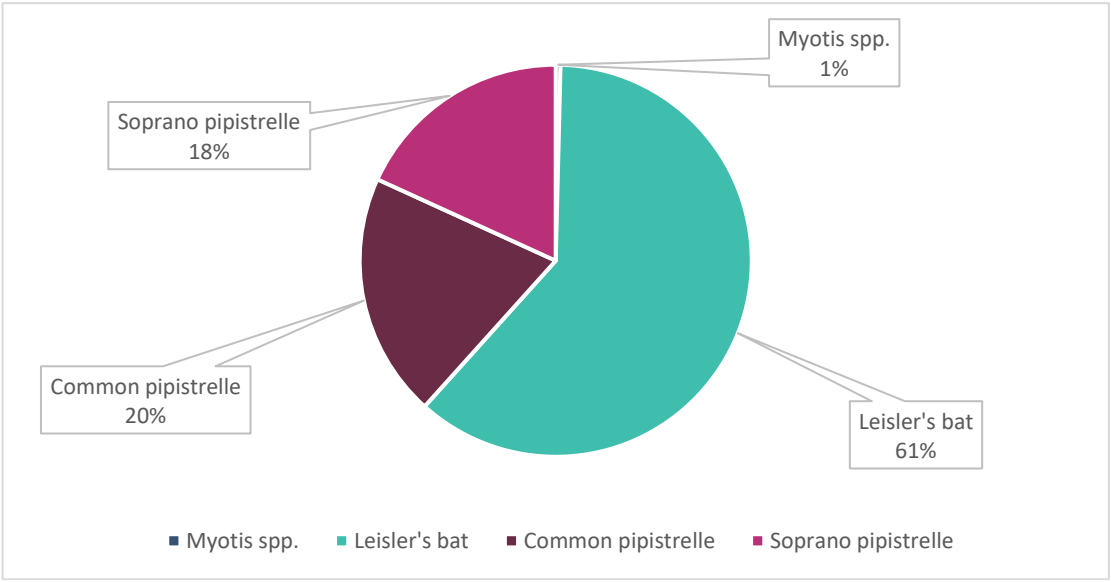

Plate 4-5 2023 Manual Activity Surveys (Total Species Composition)

Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). **Error! Reference source not found.**6 presents results for individual species per survey period. Bat activity was concentrated along hedgerows, stone walls and linear (road/track) habitats. Figures 4-1 to 4-3 present the spatial distribution of bat activity across the 2023 surveys.

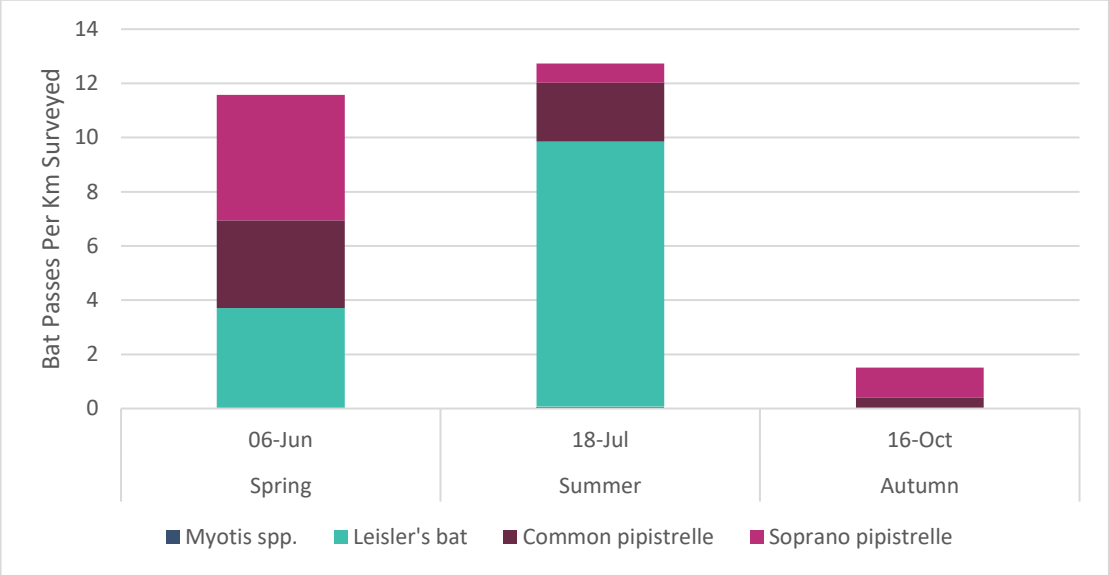

Plate 4-6 2023 Transect Results – Species Composition Per Survey Period

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Spring Dusk Transect Route 6th June 2023

Spring Dusk Manual Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title
2023 Spring Manual Results

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 4-1
Scale	Date
1:25,000	2024-02-19

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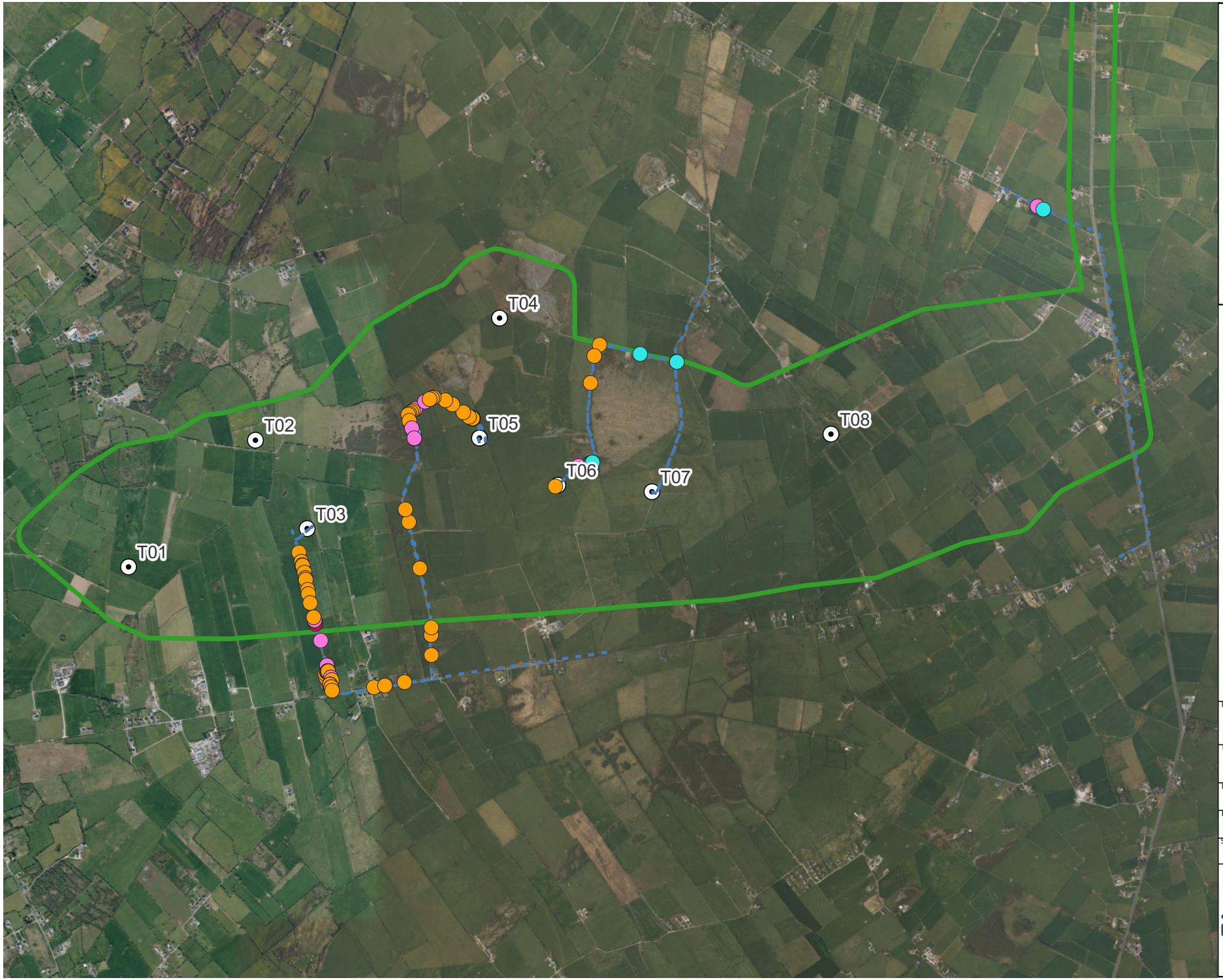

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Summer Transect Route 18th July 2023

Summer Transect Results

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

N

Drawing Title
2023 Summer Manual Results

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 4-2
Scale	Date
1:25,000	2024-02-19

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Autumn Transect Route 16th October 2023

Autumn Transect Results

- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title
2023 Autumn Manual Results

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 4-3
Scale	Date
1:25,000	2024-02-19

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4.3.4 Ground-level Static Surveys

In total, 62,368 bat passes were recorded in 2023. In general, Common pipistrelle (n= 23,601) occurred most frequently, followed by Leisler's bat (n= 22,925) and Soprano pipistrelle (n=14,655). Instances of Brown long-eared bat (n=848), *Myotis spp.* (n=267), Nathusius' pipistrelle (n=57) and Lesser horseshoe bat (n=15) were significantly less. Plate 4-7 presents species composition across all ground-level static detectors.

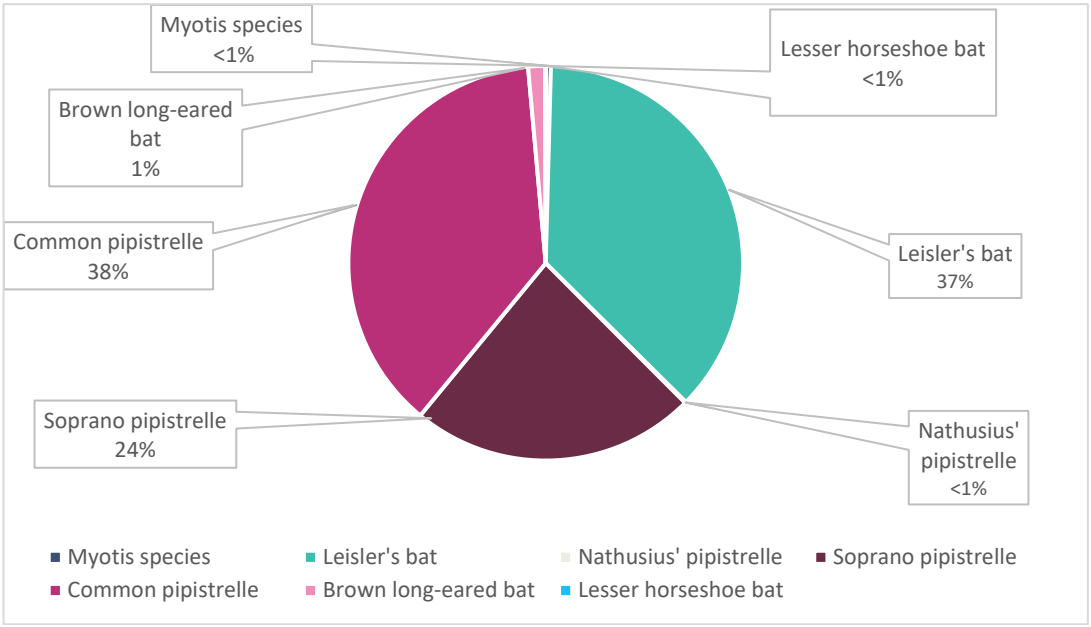

Plate 4-7 2023 Static Detector Surveys: Species Composition (Total Bat Passes)

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 4-8 and Table 4-9 presents these results for each species.

In general, Leisler's bat activity was recorded most frequently in spring, Common pipistrelle in summer and Soprano pipistrelle in autumn. There was no clearly predominant species in any of the seasons surveyed. *Myotis spp.* and brown long-eared bat were relatively rare throughout each season. Nathusius' pipistrelle and Lesser horseshoe bat was detected in low numbers in each season.

The redeployed detectors D02 (R) & D05 (R) exhibited species composition that was relatively similar to other seasons with Leisler's bat, Common and Soprano pipistrelle dominating most of the bat activity across the deployment. D05 (R) recorded significantly higher activity levels with a greater percentage of Leisler's bat present through the season while D02 (R) had a higher prevalence of Common and Soprano pipistrelle.

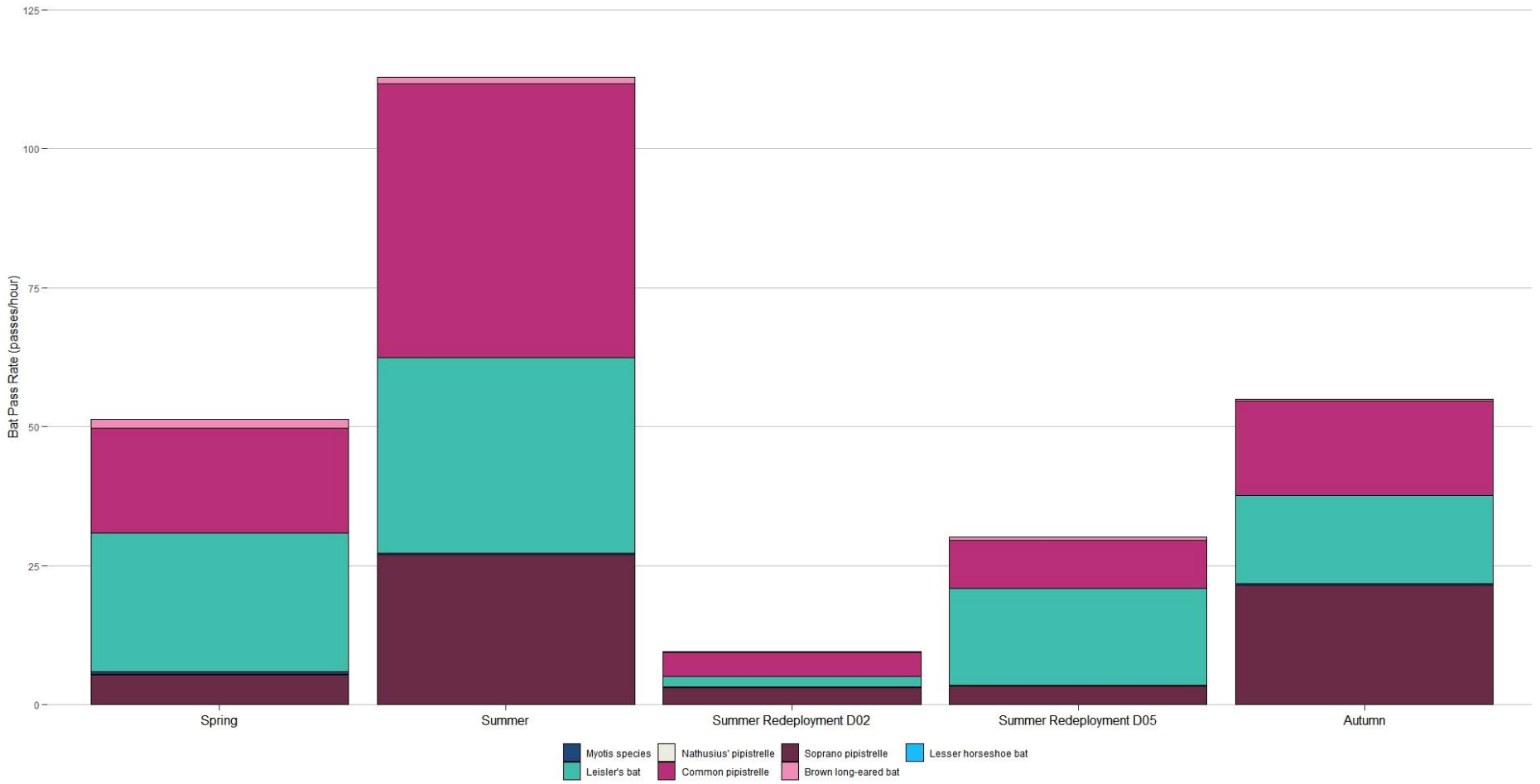

Plate 4-8 Static Detector Surveys in 2023: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights).

Table 4-9 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

	Spring	Summer	Summer D02 Redeployment	Summer D05 Redeployment	Autumn
Total Survey Hours	**168**	**242**	**424**	**380**	**242**
Myotis spp.	0.38	0.33	0.03	0.17	0.19
Leisler's bat	24.97	35.05	1.61	16.91	15.88
Nathusius' pipistrelle	0.23	0.01	0.01	0.01	0.05
Common pipistrelle	18.86	49.35	3.82	8.35	17
Soprano pipistrelle	5.3	26.97	2.69	3.22	21.46
Brown long-eared bat	1.62	1.1	0.17	0.54	0.35
Lesser horseshoe bat	0.01	0	0.01	0	0.04

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. 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).

The Median Bat Pass Rate, Per Detector, Per Survey period is shown in Plates 4-9 and 4-10 (varied axis scale). Bat activity varied across seasons and detector locations. Activity in spring was similar across the Proposed Wind Farm site, with D07 having the most activity, primarily consisting of Leisler's bat. Detector D08 had the highest activity in summer with D03 not far behind. Both were dominated by Common pipistrelle. D04 and D07 had similar bat pass rates, however D07 activity was made up of predominantly Leisler's bat while D04 had a more equal spread of Leisler and Soprano pipistrelle.

The Median 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 (Plate 4-11). Activity was often variable between survey nights, with activity peaking in late spring and early summer. Plates 4-12 to 4-14 (varied axis scales) illustrates the median Nightly Pass Rate per species per deployment. Therefore, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). Zero data, when a species was not detected on a night, was also included. Environmental factors play a significant role in influencing bat activity. Plate 4-15 provides a comprehensive illustration of nightly weather data throughout the 2023 survey period.

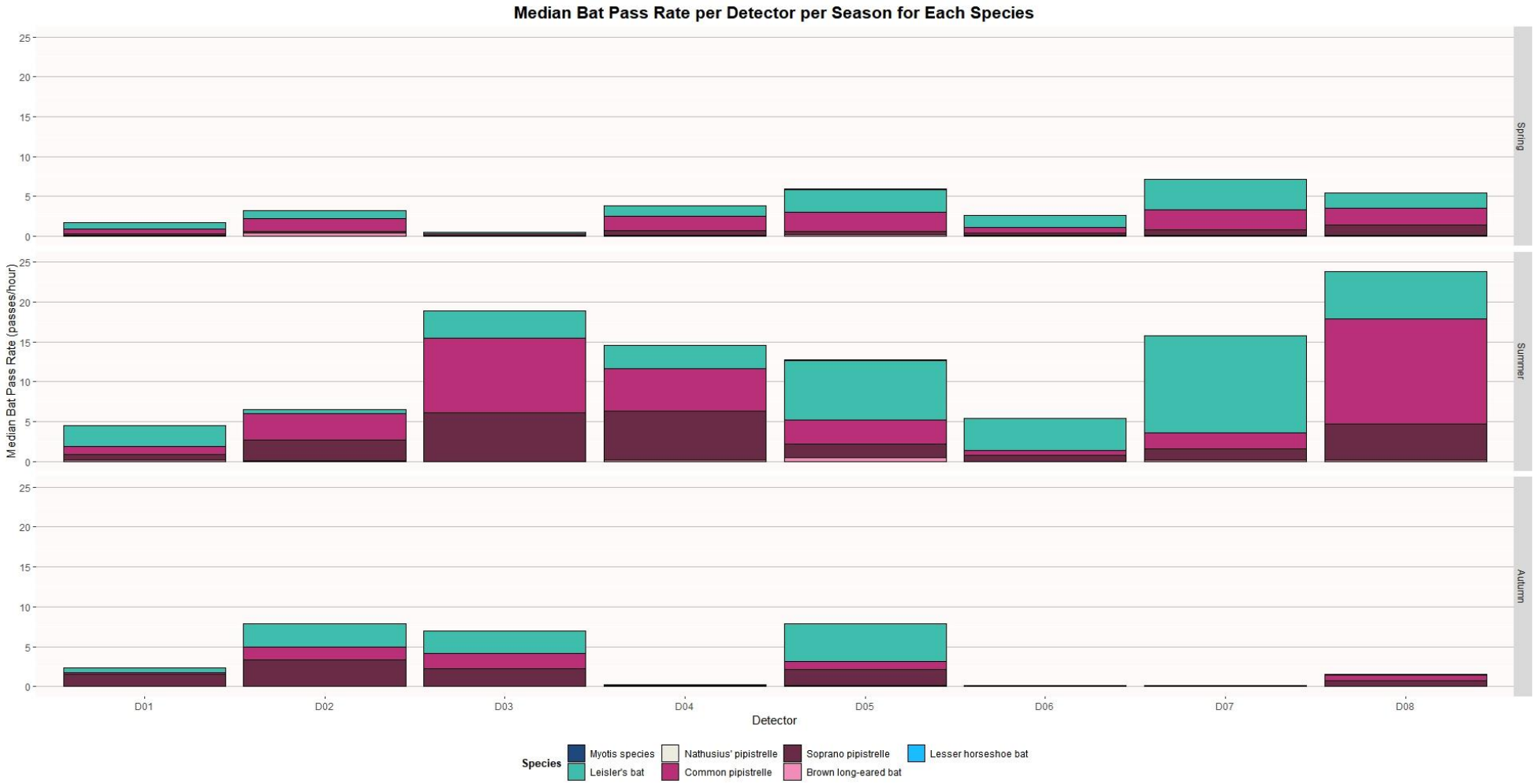

Plate 4-9 Static Detector Surveys: Median Bat Pass Rate (bpph) Including Absences, Per Location Per Survey Period (incl. Summer Redeployments D02 & D05).

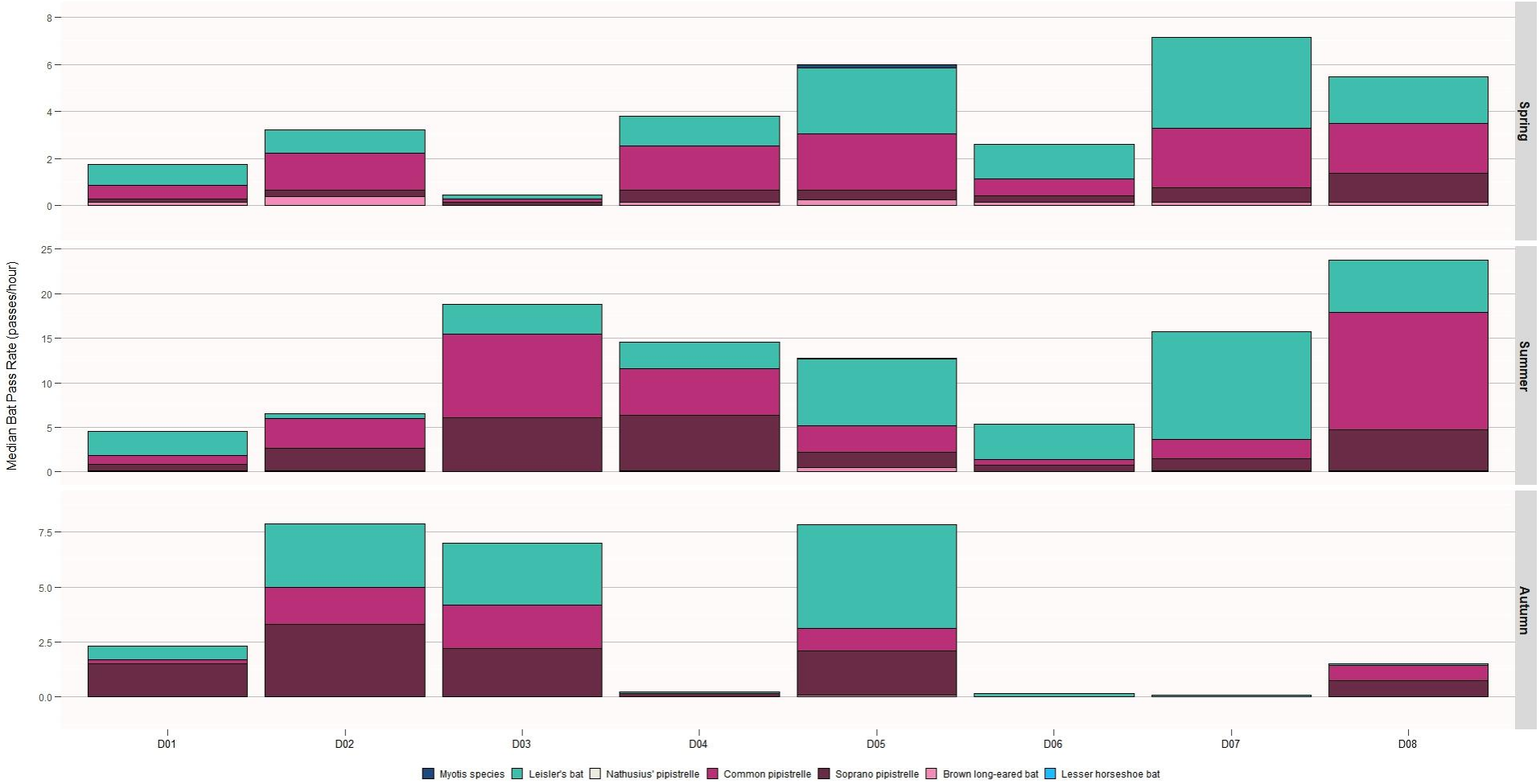

Plate 4-10 Static Detector Surveys: Median Bat Pass Rate (bpph) Including Absences, Per Location Per Survey Period (Varied Axis Scale) (incl. Summer Redeployments D02 & D05).

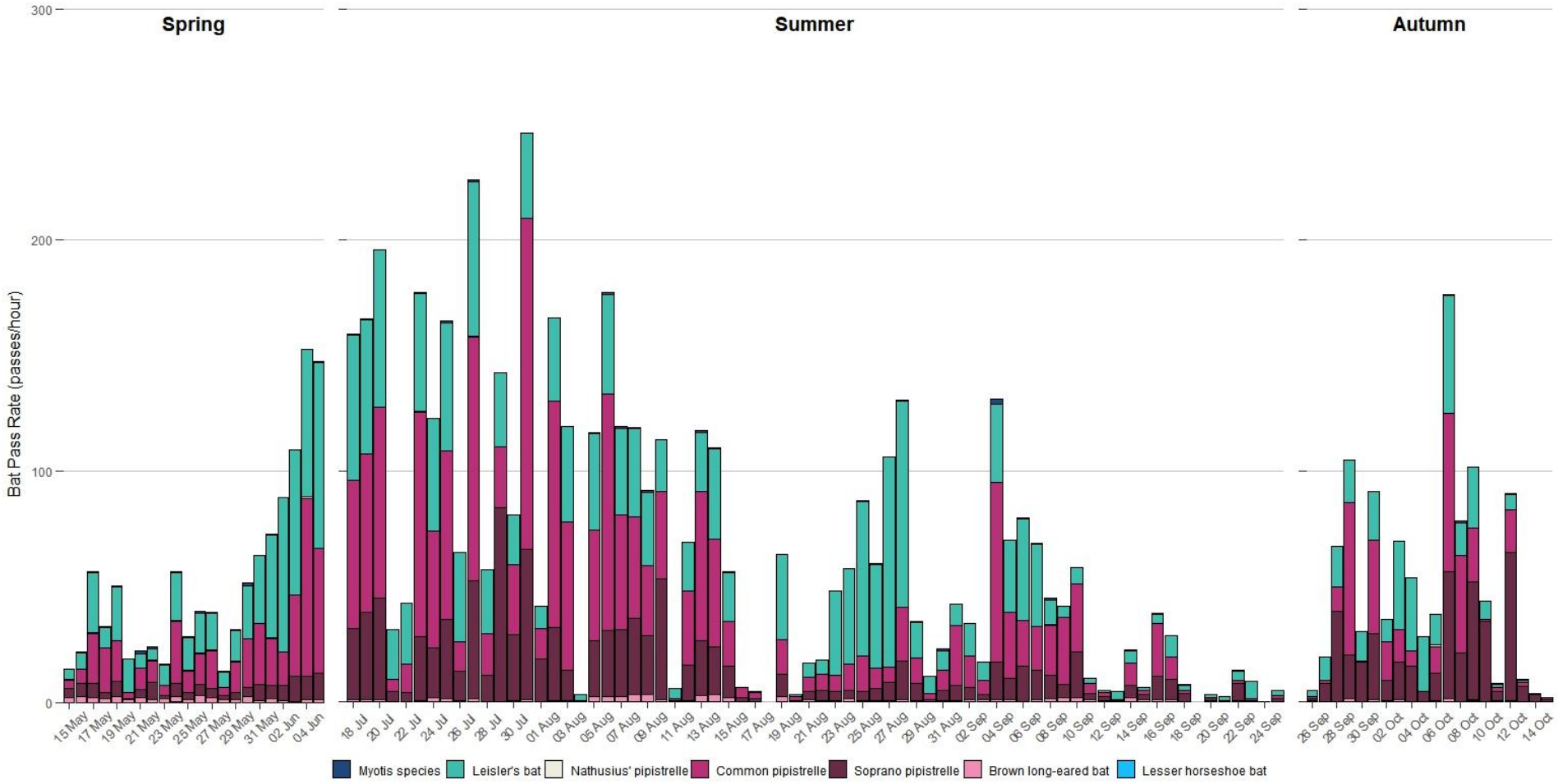

Plate 4-11 2023 Static Detector Surveys: Median Nightly Pass Rate (bpph) Including Absences, Per Location Per Survey Period (incl Summer Redeployment D02 & D05).

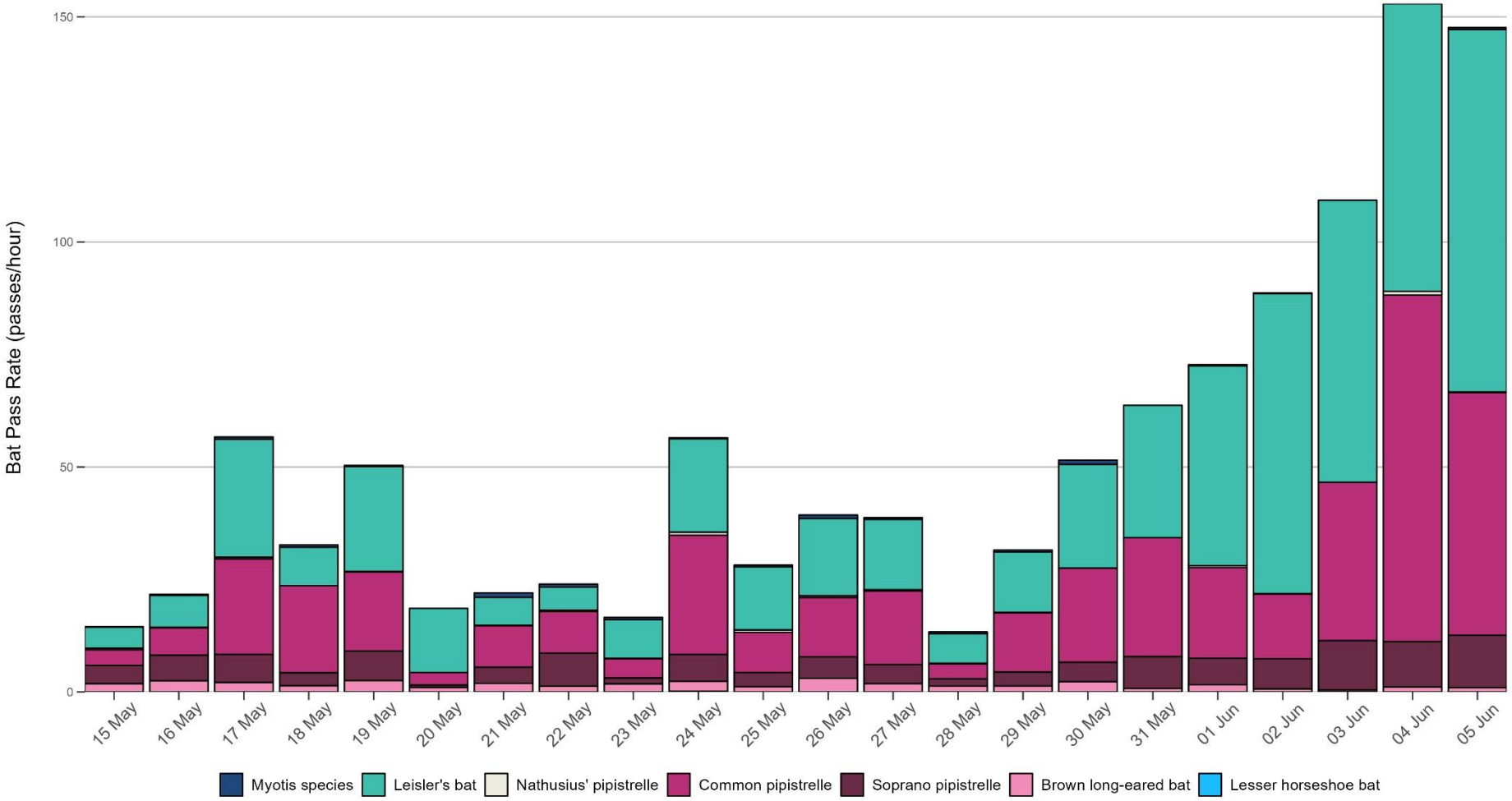

Plate 4-12 Static Detector Surveys: Spring Median Bat Pass Rate (bpph) Including Absences, Per Night.

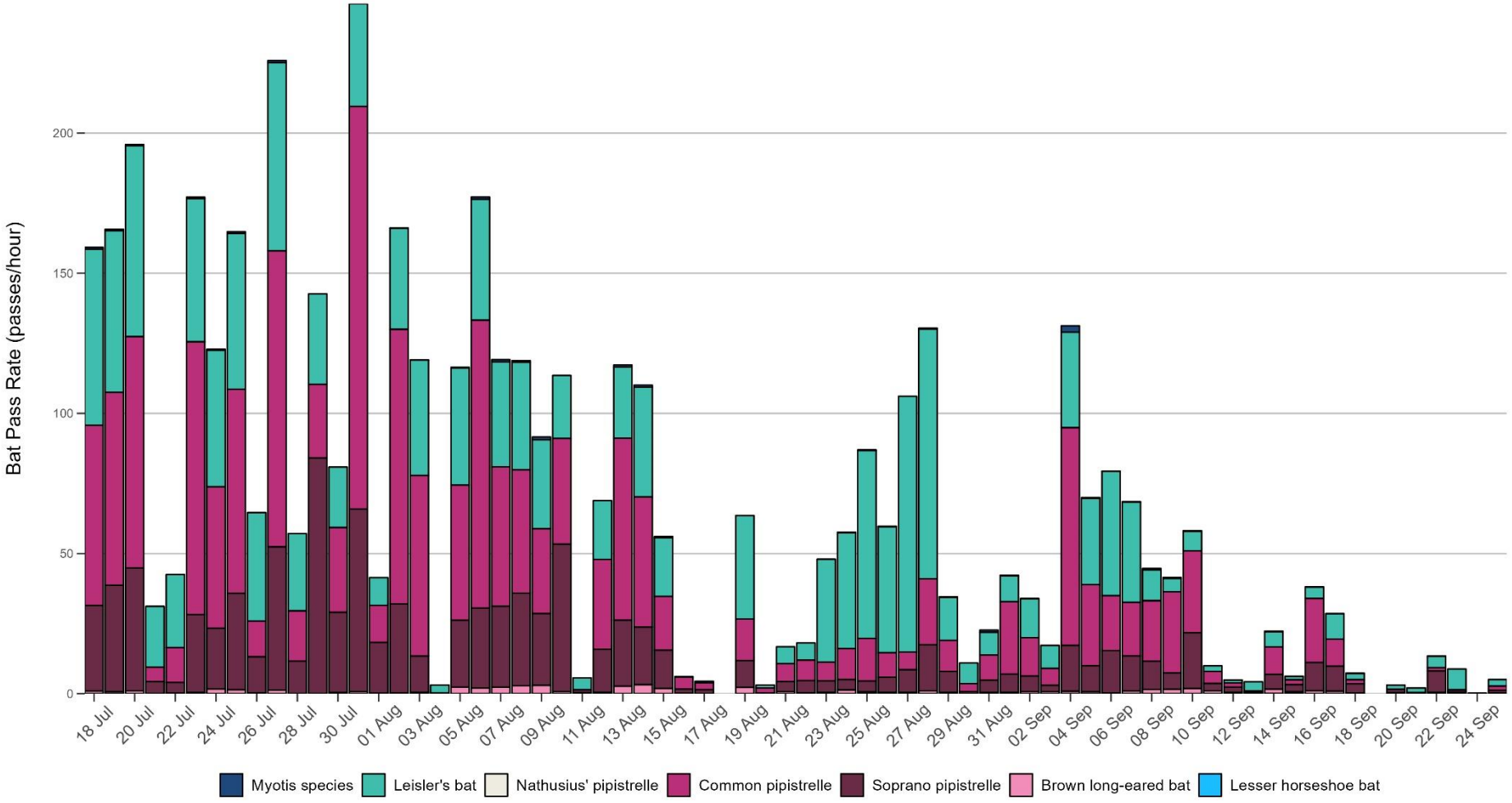

Plate 4-13 Static Detector Surveys: Summer Median Bat Pass Rate (bpph) Including Absences, Per Night (incl. redeployments)

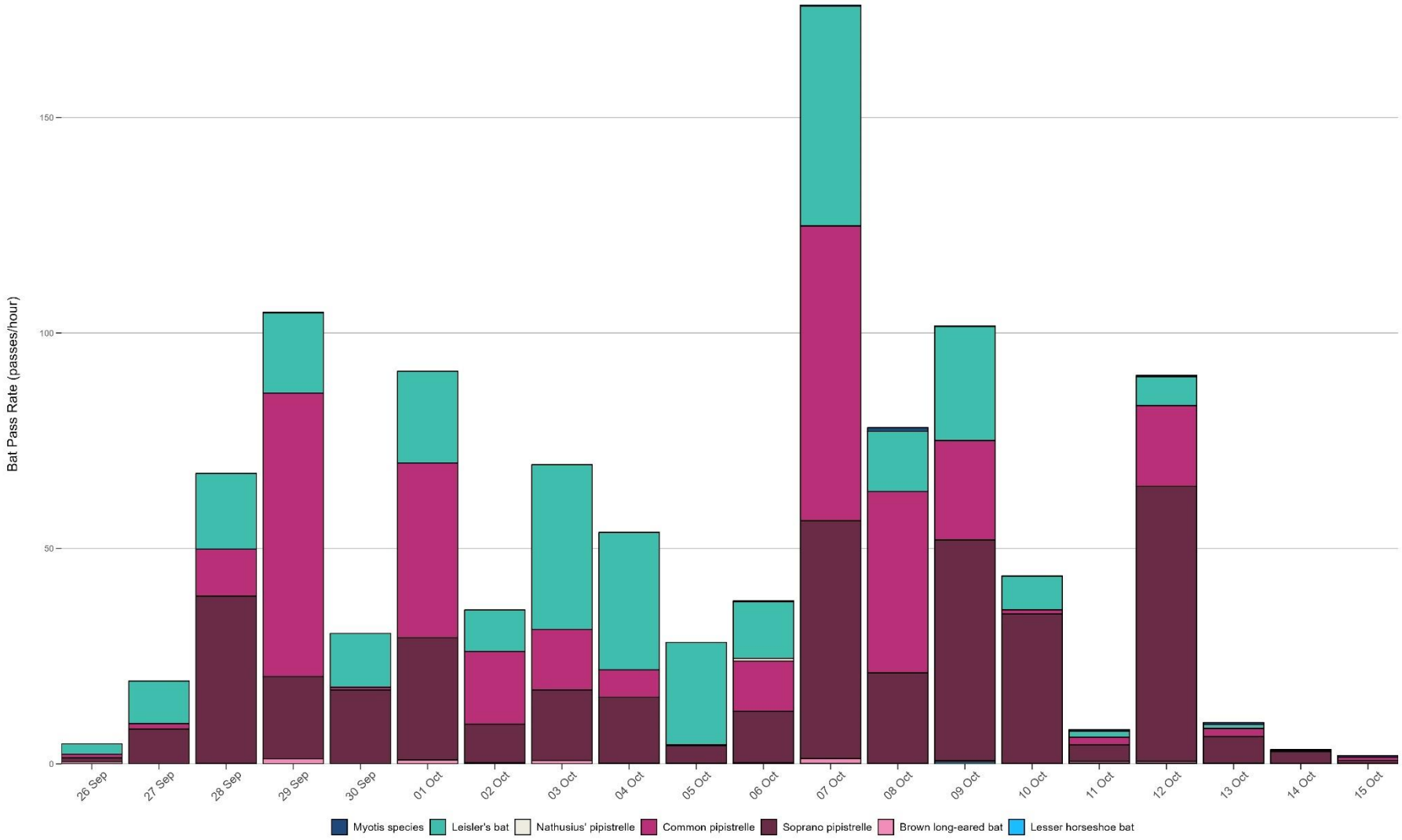

Plate 4-14 Static Detector Surveys: Autumn Median Bat Pass Rate (bpph) Including Absences, Per Night

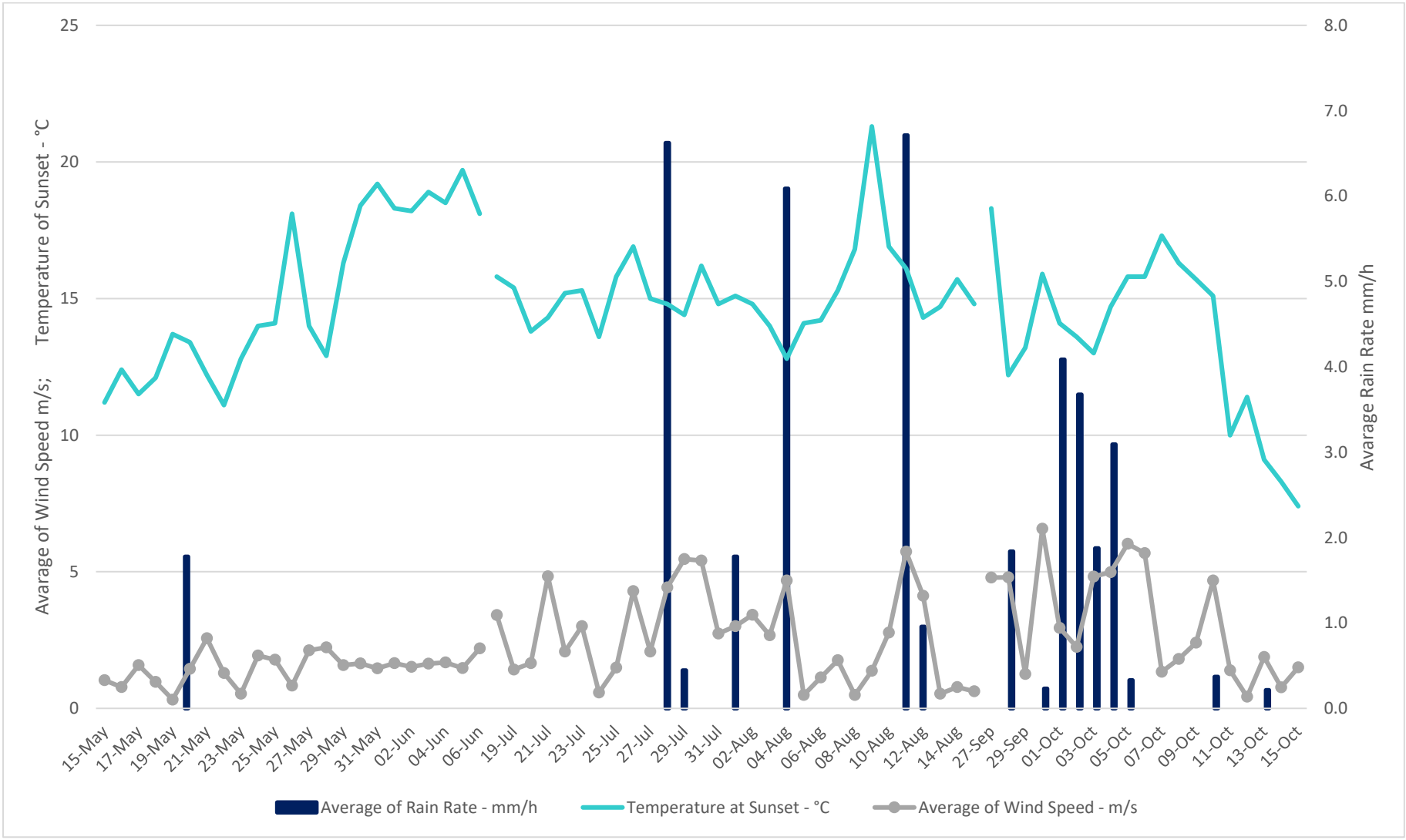

Plate 4-15 Night weather data collected across survey period (2023)

4.4 Assessment of Bat Activity Levels

4.4.1.1 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 Proposed Wind Farm site, as adapted from Mathews *et al.* (2016). Table 4-10 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.

Leisler's bat Median Bat Activity was recorded as Low in Spring at all detectors. In Summer Moderate Median Activity was recorded at D05 (Redeployment) and D08 with High Median Activity occurring at D07. The Median Activity was Moderate at D05 in the Autumn. Max Activity peaked at D05 (R) in Summer 2023.

Common pipistrelle Median Activity was recorded as Low in Spring at all detectors Moderate Median Activity was observed at D03 in Summer with High Activity at D08. Median Activity was Low for all detectors in Autumn. Max Bat Activity was observed at D03 in Summer.

Soprano pipistrelle Median Bat Activity was generally Low, being Moderate only at D04 in Summer. Max Bat Activity was recorded at D03 in Summer.

Myotis spp. recorded Low Median Activity at all detectors in in all seasons of 2023. The Max Bat Activity occurred at D05 during the Summer Redeployment.

Nathusius' pipistrelle and Lesser horseshoe bat recorded relatively Low Median Activity in comparison to other species. High Max Activity Nathusius' pipistrelle occurred at D02 and D07 in the Spring while it was also high at D08 in the Autumn. Lesser horseshoe bat Max Activity was Moderate at D01 in Autumn.

Brown long-eared Median Bat Activity was Moderate at D05 and High at D02 in Spring. D05 (R) also recorded High Activity during the Summer. Max Bat Activity was recorded at D02 (R) during the Summer redeployment.

D02, D05 and D08 were located in close proximity to favourable linear features such as treelines, hedgerows and stone walls which provide more suitable habitat for foraging and commuting bats and are likely conducive to the higher activity levels recorded. Detectors in open habitats, far from similar features, such as D01 and D06, recorded less activity overall.

Table 4-10 Assessment of Activity Levels. Low Moderate High

2023 Season	Detector	Brown long-eared bat		Common Pipistrelle		Leisler's bat		*Myotis spp.*		Nathusius' Pipistrelle		Soprano Pipistrelle		Lesser horseshoe bat	
		Median Bat Activity	Max Bat Activity	Median Bat Activity	Max Bat Activity	Median Bat Activity	Max Bat Activity	Median Bat Activity	Max Bat Activity	Median Bat Activity	Max Bat Activity	Median Bat Activity	Max Bat Activity	Median Bat Activity	Max Bat Activity
Spring	*D01*	0.14	1.01	0.6	1.66	0.87	4.05	0	0.39	0	0.14	0.14	0.74	0	0.13
	D02	0.38	0.99	1.58	10.49	0.99	2.72	0	0.13	0	0.55	0.27	3.33		
	D03	0	0.79	0.13	2.12	0.2	1	0	0.38	0	0.13	0.13	1.87		
	D04	0.13	0.37	1.87	7.01	1.27	3.56	0	0.14	0	0.13	0.53	3.47		
	D05	0.25	0.78	2.39	54.53	2.81	15.39	0.13	0.54	0	0.26	0.4	2.12		
	D06	0.13	0.53	0.73	3	1.48	4.02	0	0.14	0	0.14	0.27	0.51		
	D07	0.13	1.09	2.51	6.65	3.89	48.38	0	0.26	0	0.39	0.63	1.64		
	D08	0.13	0.62	2.13	15.21	1.97	15.46	0	0.13	0	0.13	1.23	5.03		
Summer	*D01*	0.12	0.88	1.02	8.02	2.69	8.71	0	0.22			0.7	1.83		
	D02 (R)	0.09	2.23	3.33	14.85	0.49	36.92	0	0.3	0	0.11	2.59	9.55	0	0.18
	D03	0	1.1	9.34	104.26	3.41	16.26	0	0.46	0	0.12	6.08	62.48		
	D04	0.13	1.03	5.27	19.86	2.95	10.66	0	0.26			6.21	20.66		
	D05 (R)	0.47	1.83	3	73.19	7.47	89.85	0.09	2.19	0	0.1	1.7	15.47		
	D06	0	0.69	0.65	2.05	4.01	15.12	0	0.34	0	0.13	0.73	2.86		
	D07	0.12	0.88	2.1	6.15	12.14	29.85	0	0.26			1.4	5.67		
	D08	0.13	0.51	13.18	75.68	5.87	16.92	0	0.23			4.61	21.97		
Autumn	*D01*	0	0.08	0.16	17.4	0.63	2.89	0	0.08	0	0.08	1.53	35.5	0	0.23
	D02	0	0.48	1.69	7.59	2.87	5.93	0	0.23			3.3	20.86	0	0.15
	D03	0	0.33	1.98	17.57	2.83	18.49	0	0.16			2.19	16.32		
	D04	0	0.16	0	1.85	0.08	0.86	0	0.23			0.16	1.05	0	0.08
	D05	0.08	0.62	1.03	13.27	4.71	31.23	0	0.16			2.02	12.59		
	D06	0	0.08	0	0.94	0.16	1.28	0	0.15	0	0.08	0	0.62		
	D07	0	0.16	0	2.34	0.08	0.55	0	0.16		0	0	0.78		
	D08	0	0.23	0.71	36.74	0.08	0.78	0	0.08	0	0.63	0.73	13.04		

4.5 Importance of Bat Population Recorded at the Proposed Wind Farm 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, as amended. No 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.

No roosting bats were identified during the surveys and no roosting site of National Importance (i.e. site greater than 100 individuals) was recorded within the Site. It is suspected that some PRFs within the Site may provide potential roosting habitat for small numbers of roosting bats. However, none of these PRF's reside within the bat felling buffers. The Site was not found to host a roosting site of ecological significance.

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 site has been utilized to predict the potential effects of the Proposed Wind Farm on bats.

5.1 Collision Mortality

5.1.1 Assessment of Site-Risk

The likely impact of a Proposed Project 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 Proposed Project (Adapted from NatureScot 2021)

Criteria	Site-specific Evaluation	Site Assessment
Habitat Risk	No roosting sites were discovered within the Proposed Wind Farm site. However, there are a small number of trees with *Low* potential as roosting habitat on or near the Proposed Wind Farm site. The habitats within the Proposed Wind Farm site provide low quality commuting and foraging habitat that could be used by small numbers of bats. It is an isolated site, not connected to the wider landscape by prominent linear features. Despite the presence of some sparse linear features such as hedgerows, treelines and stone walls, it does not provide a habitat that could be used extensively by foraging bats or meet any of the criteria of a Moderate or High risk site as set out in Table 3a of NatureScot, 2021.	Low
Project Size	Following the criteria set out in NatureScot, 2021 the project is of Medium scale as it consists of 8 no. turbines. Whilst those turbines are over 100m in height, it is not a strategic infrastructural development and is well below the number of turbines that would constitute a Large development (NatureScot, 2021). There are no other wind energy developments within 5km. However, there are 3 within 10km.	Medium
Site Risk Assessment (from criteria in Plate 3-3)		**Low Site Risk (2)**

The Proposed Wind Farm site is located in an area of predominantly agricultural grassland. As per table 3a of the NatureScot Guidance (2021), it has a *Low* habitat risk score. As per Table 3a, the

Proposed Wind Farm is a *Medium* project size (8 turbines). The cross tabulation of a Medium project on a Low risk site results in an overall risk score of **Low** (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 3**), by a cross-tablature of the site risk level (i.e. Low) bat activity outputs for each species. The assessment was carried out for both median and maximum 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 that 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 the following low risk species were recorded:

- *Myotis* spp.,
- 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 Proposed Wind Farm 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 vulnerability which have a high collision risk (Plate 3-4). 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 was found to be ***Medium*** for Summer and ***Low*** for Spring and Autumn at typical activity levels and ***High*** for all seasons at peak activity levels (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, which is open agricultural grassland, calcareous grassland, dry meadows and grassy verges 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 Leisler's Bat in Summer and *Low* collision risk level in Spring and Autumn.

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	Low (2)	Low (1)	Typical Risk is Low (2)	High (4)	Peak Risk is Medium (8)

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)
Summer		Moderate (3)	Typical Risk is Medium (6)	High (4)	Peak Risk is Medium (8)
Autumn		Low (1)	Typical Risk is Low (2)	High (4)	Peak Risk is Medium (8)

5.1.2.2 Soprano pipistrelle

This Proposed Wind Farm site is within the current range of the soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelle bats are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-4). Soprano pipistrelle was 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 was found to be ***Low*** for Spring, Summer and Autumn at typical activity levels. At peak activity levels, risk was as assessed as ***Low*** for Spring and Autumn and ***High*** for Summer (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 open agricultural grassland, calcareous grassland, dry meadows and grassy verges 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 bat in Spring, Summer and Autumn.

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	Low (2)	Low (1)	Typical Risk is Low (2)	Low (1)	Peak Risk is Low (2)
Summer		Low (1)	Typical Risk is Low (2)	High (4)	Peak Risk is Medium (8)
Autumn		Low (1)	Typical Risk is Low (2)	Low (1)	Peak Risk is Low (2)

5.1.2.3 Common pipistrelle

This Proposed Wind Farm site is within the current range of the common pipistrelle bat (NPWS, 2019). Common pipistrelle bats are classed as a common species of a medium population risk which have a high collision risk (Plate 3-4). 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 was found to be ***Low*** at typical activity levels in Spring, Summer and Autumn. The risk for peak activity levels were assessed as ***High*** for Spring and Summer and ***Medium*** for Autumn. (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 open agricultural grassland, calcareous grassland, dry meadows and grassy verges 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 in Summer and *Low* in Spring and Autumn.

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	Low (2)	Low (1)	Typical Risk is Low (2)	High (4)	Peak Risk is Medium (8)
Summer		Low (1)	Typical Risk is Low (2)	High (4)	Peak Risk is Medium (8)
Autumn		Low (1)	Typical Risk is Low (2)	Moderate (3)	Peak Risk is Medium (6)

5.1.2.4 Nathusius' pipistrelle

This Proposed Wind Farm 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 (Plate 3-4). 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, which is open agricultural grassland, calcareous grassland, dry meadows and grassy verges 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 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	Low (2)	Nil (0)	Typical Risk is Low (0)	Moderate (3)	Peak Risk is Medium (6)
Summer		Nil (0)	Typical Risk is Low (0)	Low (1)	Peak Risk is Low (2)
Autumn		Nil (0)	Typical Risk is Low (0)	Low (1)	Peak Risk is Low (2)

5.1.3 Collision Risk Summary

Site-level collision risk for high collision risk bat species was typically *Low* to *Medium,* with the exception of Nathusius' pipistrelle and Soprano pipistrelle which had a *Low* risk level. Overall bat activity levels were typical of the nature of the site, which is predominantly open grassland habitats with low levels of bat activity recorded during the static detector surveys as well as the walked and driven transects undertaken.

However, following per detector R-analysis, Detectors D07 and D08 recorded *High* median activity levels of high-risk species in spring and summer (Table 5-6).

While *High* median activity was recorded at two locations, it is noted that habitats at these locations will change during the construction phase of the Proposed Wind Farm with the required implementation of the bat buffers. A 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. After year 1 monitoring, if a curtailment requirement is identified (i.e. significant bat fatalities encountered), a curtailment programme, in line with relevant guidelines, will be devised around key activity periods and weather parameters, as well as a potential increase in buffers.

Table 5-6 Detector Locations Recording High Median Bat Activity Per Detector For High Risk Species in 2023

Detector ID	Turbine	Species	High Median Activity Survey Period
2023			
D07	T07	Leisler's bat	Summer 2023
D08	T08	Common pipistrelle	Summer 2023

5.2 Loss or Damage to Commuting and Foraging Habitat

In the absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Wind Farm site is predominantly located on agricultural grassland. This environment provides relatively poor-quality commuting and foraging habitat for bats. While certain elements, such as immature treelines, hedgerows, and stone walls exist on the Proposed Wind Farm site, and have the potential to serve as commuting and foraging grounds for bats, their distribution is sporadic, and they are often isolated from the broader landscape.

The majority of turbines will be located in agricultural grassland resulting in minimal loss of linear habitat features. However, approximately 1.8 km of linear vegetation removal will be required within and around the Proposed Project infrastructure footprint to allow for the construction of the turbine bases, access roads, and the other ancillary infrastructure. This also includes vegetation removal in accordance with the proposed bat buffers detailed in Section 6.1.3. Further details on vegetation removal required within and around development footprint is detailed in Chapter 6 of this EIAR. A replanting plan has been developed to mitigate the loss of bat foraging/commuting habitat associated with the Proposed Project and is presented in Section 6.1.4. The replanting design will ensure habitat connectivity is maintained and enhanced around the Proposed Wind Farm site.

An additional 3.6km of linear hedgerow planting is proposed along select field boundaries within the Site, which will result in a net gain in linear habitat features within the Proposed Wind Farm site. Linear vegetation removal will result in a short-term effect, with connectivity re-established within approximately 2-5 years. No permanent loss of, or damage to, commuting or foraging habitats is anticipated as a result of the Proposed Wind Farm or associated infrastructure. The proposed replanting area is shown and discussed in Appendix 6-4, Biodiversity Management and Enhancement Plan (BMEP). Following the implementation of the replanting plan within the Proposed Wind Farm site, no significant effects in relation to habitat fragmentation or loss of foraging habitat for bats is anticipated.

The habitat within the proposed 110kV substation and adjacent temporary construction compound consists entirely of Improved agricultural grassland (GA1). Therefore, no loss of significant commuting/foraging habitat are anticipated.

Works are sometimes required along proposed turbine transport routes to accommodate the large vehicles used to transport turbine components to wind farm sites. However, the accommodation works for the Proposed Project are limited to temporary measures including temporary relocation of some

signs and street furniture (See Chapter 4, Section 4.2.2). These works will not negatively impact commuting and foraging habitat for bats.

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

5.3 Loss of, or Damage to, Roosts

The Proposed Project is predominantly located within areas of improved agricultural grassland with stone walls, hedgerows and treelines delineating field boundaries. Habitats within the Proposed Wind Farm site are largely unsuitable for roosting bats.

There will be some requirement to remove trees to facilitate the proposed bat felling buffers, as detailed in section 6.1.3 below. Trees within the bat buffers all presented *Negligible* suitability for roosting bats A small number of ash trees (5no.), identified during the roost surveys as having potential to host roosting bats, were located outside the bat buffers and proposed infrastructure footprint. No evidence of bat use was identified during daytime inspection of the trees. However, the trees are being retained and avoided as part of the Proposed Project.

Throughout the 2023 survey period, no roosts were identified within the Proposed Wind Farm site or at any of the watercourse or motorway crossings along the Proposed Grid Connection underground cabling route. Given the nature of the works associated with these crossings, no loss of roosting habitat associated with Proposed Grid Connection is anticipated.

The turbine delivery route (TDR) accommodation works are limited to temporary measures including temporary relocation of some signs and street furniture. Therefore, no loss of roosting habitat associated with the TDR is anticipated.

No potential for significant effect regarding the loss or disturbance of roosting habitat within the Proposed Wind Farm site, Proposed Grid Connection or along the TDR accommodation route is anticipated.

5.4 Displacement of Individuals or Populations

The Proposed Project is predominantly located within agricultural grassland with treelines/hedgerows delineating field boundaries. 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 Proposed Wind Farm 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 Wind Farm site, and consequently on bats i.e. Lighting will be directed away from mature trees/treelines around the periphery of the site boundary 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.

The proposed lighting around the Proposed Wind Farm site shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/23 Bats and artificial lighting in the UK (ILP, 2023).

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 limited illumination of the turbines in the form of aviation lighting. Post construction monitoring will be carried out (as outlined below) to assess any potential changes in bat activity patterns and collision risk. Significant effects as a result of lighting are not anticipated; however, if in the course of this monitoring, any potential for significant effects on bats is identified, the site-specific mitigation measures will be reviewed and any changes necessary will be implemented to avoid any such impacts.

6.1.3 Bat Felling Buffers

In accordance with NatureScot and NIEA Guidance, a minimum 50m buffer to all habitat features used by bats (e.g., hedgerows, tree lines etc.) should be applied to the siting of all wind turbines (See example provided in Plate 6-1 below). However, Eurobats No. 6 guidance and NIEA recommends increased buffers of 100m and 200m around woodland/forestry areas, however, there is no scientific evidence to support these increased buffer distances in the UK.

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 (outlined in Section 6.2 below) and updated where necessary.

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 turbine model to be installed on the Proposed Wind Farm site will have an overall ground-to-blade tip height of 185m, rotor diameter of 163m, and hub height of 103.5m.

This mitigation measure has been applied and no felling is required within the Proposed Wind Farm site. There will be a requirement to remove some linear vegetation i.e. treelines/hedgerows, to facilitate the required bat buffers. This is outlined in further detail in Section 6.1.4 below. These vegetation-free areas will be maintained during the operational life of the Proposed Project.

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. E.g. (below) b = 69.3m (Plate 6-1)

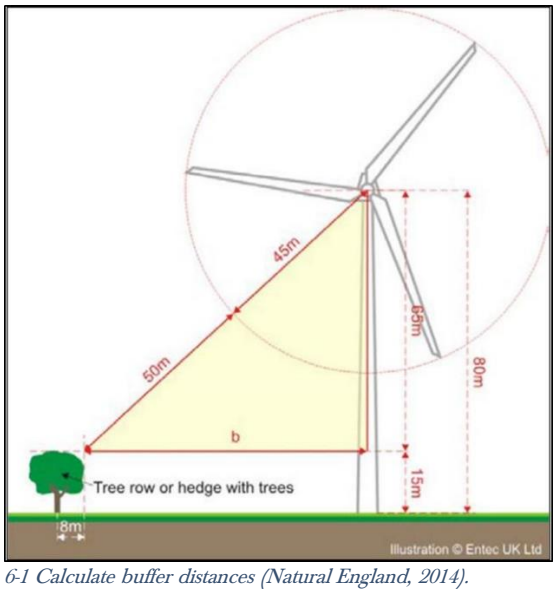

Plate 6-1 Calculate buffer distances (Natural England, 2014).

6.1.4 Proposed Linear Vegetation Removal

A number of trees and hedgerows will be subject to removal to facilitate the Proposed Wind Farm infrastructure footprint and required bat buffers, as shown in Figure 6-1. Trees within the designated bat buffers are not deemed to provide significant potential roosting opportunities; therefore, no impacts on roosting bats are anticipated. Furthermore, no removal of linear vegetation is proposed for the Proposed Grid Connection or the TDR and as such, no impacts on roosting bats are anticipated.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Linear Habitat Loss
- Proposed Bat Buffer
- Proposed Hardstands
- Proposed Roads
- Existing Roads For Upgrade

N

Drawing Title
Linear Habitat Loss Within the Site

Project Title
Laurclavagh Renewable Energy Development

Drawn By	Checked By
RC	AJ
Project No.	Drawing No.
210627	Figure 6-1
Scale	Date
1:25,000	2024-02-22

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6.1.5 Proposed Habitat Replacement

In the absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Project is predominantly located within agricultural grasslands and linear landscape features such as stone walls, hedgerows and trees which will be largely retained or avoided.

Linear vegetation within the required turbine bat buffers will be removed (Chapter 6, Appendix 6-4, Figure 1-1). A replanting design has been curated to provide alternative commuting corridors within the Site. To comply with NatureScot recommendations in relation to habitat buffering to avoid bat fatalities, a total of 1.8km of treeline/hedgerow habitat will be lost as a result of the Proposed Wind Farm, including the recommended buffers applied for bats. Further details are outlined in Appendix 6-4 BMEP.

Linear landscape features in the wider area that will be retained, and the loss of gappy hedgerow/treelines is not anticipated to have a significant effect on local bat populations. However, it is proposed to plant new linear features and bolster existing habitat features to offset any potential loss in linear habitat features and to provide additional new opportunities for commuting and foraging bats. A total of 3.6km of linear habitat will be added, which will result in a net gain in linear habitat features within the Proposed Wind Farm site.

The locations in which the proposed linear hedgerow planting will take place will be carried out along selected boundaries of fields within the Site. Refer to the BMEP outlined in Appendix 6-4 of the EIAR for hedgerow planting details.

Overall, the proposed replanting will result in a 100% net gain in the linear landscape features within the Proposed Wind Farm site. Species planted in these locations will be of a similar composition to those occurring on site, namely, hawthorn and hazel. Further details with regard to species, planting location, and management is contained within the BMEP.

6.1.6 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.

6.2 Bat Monitoring Plan

Overall risk levels for high collision risk bat species were typically *Low* or *Medium.* This risk level is reflective of the nature of the sites predominately open grassland habitats. Furthermore, the walked transects revealed consistently low levels of bat activity in the area.

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 Project, in line with the case study example provided in Appendix 5 of the NatureScot, (2021) and based on the site-specific data.

6.2.1 Operational Monitoring

To assess the effects of the Proposed Project 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. At the end of Year 1, and if a curtailment requirement is identified (i.e. significant bat fatalities encountered), a curtailment programme, in line with relevant guidelines, will 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 site, 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.

6.2.1.1 Monitoring Year 1

Bat activity surveys

The post-construction surveys will be carried out as per the pre-construction survey effort. Static monitoring will take place at each turbine during the bat activity season (between April and October) (NatureScot, 2021, NIEA, 2021). Full spectrum recording detectors will be utilised for the same duration as during pre-application surveys and at the same density (NatureScot, 2021). As described in Section 3.5 above, the assessment of bat activity levels will include the use of "Ecobat" (or similar alternative), a web-based interface, allowing uploaded activity data to be contrasted with a comparable reference range, allowing objective and robust interpretation. Walked survey transects will also be conducted.

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

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

Carcass searches

Carcass searches, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with NIEA Guidance. 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.

6.2.1.2 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-consent monitoring will also be considered. Should no bat fatalities be recorded in Year 1, curtailment (where applicable) in Year 2 and Year 3 could be reduced/re-evaluated or removed with monitoring continuing to inform this strategy. A monitoring programme will be submitted to, and agreed with, the Planning Authority. Any subsequent changes will be agreed with the Planning Authority.

6.3 Residual Impacts

Not Significant Effect

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.

6.4 Cumulative Effects

The Proposed Project was considered in combination with other projects and/or plans (existing approved and pending 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 projects and/or plans considered are detailed in Section 2.8 in Chapter 2 of the EIAR.

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 no other wind farm sites located within 5km of the Proposed Wind Farm site; however, three existing, permitted or proposed wind farm sites are located within 10km of the Proposed Project. There are four further EIA projects and three extractive industries within 10km. No potential for the Proposed Project to contribute to any cumulative adverse effects on any bat populations is anticipated 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 Proposed Project, 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 Wind Farm site. The surveys provided in this report are in accordance with NatureScot guidance and assessment/mitigation 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.

8. BIBLIOGRAPHY

Abbott, I., Aughney, T., Langton, S. and Roche, N. (2015) BATLAS 2020 Pilot Project Report. Bat Conservation Ireland, Virginia, Cavan.

Amorim, F., Rebelo, H., & Rodrigues, L. (2012). Factors influencing bat activity and mortality at a wind farm in the Mediterranean region. Acta Chiropterologica, 14(2), 439-457.

Andrews, H. (2013) Bat Tree Habitat Key. AEcol, Bridgewater.

Arnett, E. B. (2006). A preliminary evaluation on the use of dogs to recover bat fatalities at wind energy facilities. Wildlife Society Bulletin, 34(5), 1440-1445.

Arnett, E. B., Baerwald, E. F., Mathews, F., Rodrigues, L., Rodríguez-Durán, A., Rydell, J., ... & Voigt, C. C. (2016). Impacts of wind energy development on bats: a global perspective. In Bats in the Anthropocene: Conservation of Bats in a Changing World (pp. 295-323). Springer International Publishing.

Aughney, T. (2008) An investigation of the impact of development projects on bat populations: Comparing pre- and post-development bat faunas. Irish Bat Monitoring Programme. Bat Conservation Ireland, Virginia, Cavan.

Aughney, T., Langton, S. and Roche, N. (2011) Brown long-eared bat roost monitoring scheme for the Republic of Ireland: synthesis report 2007-2010. Irish Wildlife Manuals, No.56. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Aughney, T., Langton, S. and Roche, N. (2012) All Ireland Daubenton's Bat Waterway Monitoring Scheme 2006-2011. Irish Wildlife Manuals, No. 61. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Barataud, M. and Tupinier, Y. Écologie acoustique des chiroptères d'Europe: identification des espèces, étude de leurs habitats et comportements de chasse. Biotope, 2012.

Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. Current biology, 18(16), R695-R696.

Baerwald, E. F., & Barclay, R. M. (2009). Geographic variation in activity and fatality of migratory bats at wind energy facilities. Journal of Mammalogy, 90(6), 1341-1349.

BCI (2012a). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. Bat Conservation Ireland, Virginia, Co. Cavan

BCI (2012b) Bats and Appropriate Assessment Guidelines, Version 1, December 2012. Bat Conservation Ireland, Virginia, Co. Cavan Berthinussen, A., Richardson. O.C. and Altringham, J.D. (2014) Bat Conservation: Global evidence for the effects of interventions. Exeter: Pelagic Publishing.

Carden, R., Aughney T., Kelleher C. and Roche, N. (2010) Irish Bat Monitoring Schemes. BATLAS Republic of Ireland Report for 2008-2009.

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

Collins, J., and Jones, G. (2009). Differences in bat activity in relation to bat detector height: implications for bat surveys at proposed windfarm sites. Acta Chiropterologica, 11(2), 343-350.

Cryan, Paul M., et al. (2014) Behavior of bats at wind turbines. Proceedings of the National Academy of Sciences 111.42: 15126-15131.

EUROBATS (2016) Report of the Intersessional Working Group on Wind Turbines and Bat Populations at 21st Meeting of the Advisory Committee, Zandvoort, the Netherlands, 18 – 20 April 2016.

Hein, C.D., Gruver, J. and Arnett, E.B. (2013). Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International, Austin, TX, USA.

Hill D., Fasham, M., Tucker P., Shewry, M. and Shaw, P (eds) (2005) Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring, 433-449. Cambridge University Press, Cambridge.

Horn, J.W., Arnett, E.B. and Kunz, T.H. (2008). Behavioral responses of bats to operating wind turbines. Journal of wildlife management, 72(1), 123-132.

Hundt L. (2012) Bat Surveys: Good Practice Guidelines, 2nd edition. Bat Conservation Trust ISBN-13: 9781872745985.

ILP (2023) Guidance Note 08/23: Bats and Artificial Lighting at Night.

Korner-Nievergelt, F., Brinkmann, R., Niermann, I., & Behr, O. (2013). Estimating bat and bird mortality occurring at wind energy turbines from covariates and carcass searches using mixture models. PloS one, 8(7), e67997.

Kunz, Thomas H., Edward B. Arnett, Brian M. Cooper, Wallace P. Erickson, Ronald P. Larkin, Todd Mabee, Michael L. Morrison, M. Dale Strickland, and Joseph M. Szewczak. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71, no. 8 (2007): 2449-2486.

Kunz, T.H. and Parsons, S. (2009). Ecological and Behavioral Methods for the Study of Bats, 2nd Edition. The Johns Hopkins University Press, USA.

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

Mathews, F., Swindells, M., Goodhead, R., August, T. A., Hardman, P., Linton, D. M., and Hosken, D. J. (2013). Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: A blinded randomized trial. Wildlife Society Bulletin, 37(1), 34-40.

Mathews, F., Richardson, S., Lintott, P. and Hosken, D. (2016) Understanding the risk to European protected species (bats) at onshore wind turbine sites to inform risk management. Final Report. University of Exeter.

Mitchell-Jones, A. J. and McLeish, A. P. (2004). The Bat Worker's Manual, 3rd Edition. JNCC, Peterborough.

Mitchell-Jones, A.J. (2004). Bat Mitigation Guidelines. English Nature.

Montgomery, W. I., Provan, J., McCabe, A. M., and Yalden, D. W. (2014). Origin of British and Irish mammals: disparate post-glacial colonisation and species introductions. Quaternary Science Reviews, 98, 144-165.

NatureScot (2021). Bats and onshore wind turbines: survey, assessment and mitigation. Version: August 2021 (updated with minor revisions).

NRA (2006a) Best practice guidelines for the conservation of bats in the planning of national road schemes. National Roads Authority, Dublin, Ireland.

NRA (2006b) Guidelines for the treatment of bats during the construction of national road schemes. National Roads Authority, Dublin, Ireland.

Natural England (2014). Bats and Onshore Wind Turbines: Interim Guidance. Third Edition TIN051. English Nature.

NatureScot (2021). Bats and onshore wind turbines: survey, assessment and mitigation. August 2021.

Nealon, Ú.C. (2016) Bats and wind farms in Ireland: An assessment of current practices in surveying and monitoring. Oral presentation at the 1st Ecology and Evolution Ireland conference, Sligo.

Northern Ireland Environment Agency (2011) Bat Survey – Specific Requirements for Wind Farm Proposals.

NIEA, Natural Environment Division (2021). Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments.

Perrow, M. (Ed.). (2017). Wildlife and Wind Farms-Conflicts and Solutions, Pelagic Publishing Ltd.

Regini, K. (2000) Guidelines for ecological evaluation and impact assessment, In Practice: Bulletin of the Institute of Ecology and Environmental Management, 29, 1-7.

Roche, N., Langton, S. & Aughney T. (2012) Car-based bat monitoring in Ireland 2003-2011. Irish Wildlife Manuals, No. 60. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

Roche, N., T. Aughney, F. Marnell, and M. Lundy (2014). Irish Bats in the 21st Century. Bat Conservation Ireland, Virginia, Co. Cavan, Ireland.

Roche, N., Aughney T. & Langton S. (2015) Lesser Horseshoe bat: population trends and status of its roosting resource. Irish Wildlife Manuals, No 85. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Rodrigues, L., L. Bach, M. J. Dubourg-Savage, B. Karapandža, D. Kovač, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, and J. Minderman (2015). Guidelines for consideration of bats in wind farm projects - Revision 2014. UNEP/EUROBATS Secretariat Bonn, Germany.

Russ, J. (2012). British bat calls: a guide to species identification. Pelagic publishing.

Rydell, J., Bach, L. Dubourg-Savage, M.-J., Green, M., Rodrigues, L. and Hedenström, A. (2010). Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12. 2: 261 – 274.

Schofield H. (2008). The Lesser Horseshoe Bat: Conservation Handbook. The Vincent Wildlife Trust, Ledbury, UK.

Schuster, E., L. Bulling, and J. Köppel (2015). Consolidating the State of Knowledge: A Synoptical Review of Wind Energy's Wildlife Effects. Environmental Management 56:300-331.

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

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

APPENDIX 1

BAT HABITAT SUITABILITY APPRAISAL

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Appendix 1 – 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)

Suitability	Roosting Habitats	Commuting 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 conditions1 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 hibernation2. A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential3.	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 habitats. 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 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	A structure or tree 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 and surrounding habitat.	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, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

[1] For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.
[2] 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).
[3] Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

APPENDIX 2

SITE RISK ASSESSMENT

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Appendix 2 – Site Risk Assessment (Table 3a, SNH)

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

OVERALL SITE RISK ASSESSMENT

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Appendix 3 – Overall Risk Assessment (Table 3b, SNH)

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).