Appendix 7.2 – Bat Survey Report

Lyrenacarriga Wind Farm

DOCUMENT DETAILS

Client:	**RWE Ltd.**
Project Title:	**Lyrenacarriga Wind Farm**
Project Number:	**170749**
Document Title:	**Bat Survey Report**
Document File Name:	**BR F - 06.01.2021 - 170749**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	06/01/2021	LD	PR

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1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats of the proposed Lyrenacarriga Wind Farm, Co. Waterford and Co. Cork. This assessment is based on the results of bat surveys and data collected and provided by Pat Doherty of Doherty Environmental Ltd.

This report provides details of the bat surveys undertaken by Doherty Environmental Ltd., including methods and results. It then provides an assessment of potential effects of the proposed development on bats. Where necessary, mitigation is prescribed to minimise the potential for likely significant effects. Bat surveys undertaken in 2019 form the core dataset for the assessment of effects on bats. It is supplemented by additional data derived from surveys undertaken on the site in 2017 and 2018. The bat surveys undertaken employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level.

The impact assessment and mitigation provided in this report are in accordance with Scottish Natural Heritage (SNH) 2019 Guidance.

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. Why bats fly in the vicinity of wind turbines has been attributed to several different behavioural and environmental factors, e.g. habitat associations, weather conditions and, species ecology.

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

1.2 Bat Assessment Guidance

The impact assessment and mitigation provided in this report are in accordance with SNH 2019 Guidance.

In 2019, Scottish Natural Heritage published *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH 2019). 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.

1.3 Statement of Authority

Bat surveys, survey design and all other data collection were designed and conducted by Pat Doherty MSc, MCIEEM. Scope development and project management was undertaken by Pat Doherty of Doherty Environmental Ltd.

Data analysis was undertaken, and results were compiled by Luke Dodebier (BSc.). Impact assessment, the design of mitigation and final reporting was completed by Luke Dodebier and Aoife Joyce (BSc., MSc.) under the supervision of Pat Roberts (BSc., MCIEEM). Pat has over 10 years' experience in management and ecological assessment. He has supervised the majority of ecological assessments (300+) completed by the company, including more recently, over 200 assessments required in accordance with Article 6(3) of the Habitats Directive.

1.4 Irish Bats: Legislation, Policy and Status

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

All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat *(Rhinolophus hipposideros*) is further listed under Annex II of the Directive, requiring the designation of conservation areas for the species. Under this Directive, Ireland is obliged to maintain the favourable conservation status of Annex-listed species. This Directive has been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) and the Planning and Development Act 2000, as amended.

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2019). Under this legislation, it is an offence to intentionally disturb, injure or kill a bat, or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

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

2. PROJECT DESCRIPTION

The proposed development comprises the construction of a wind farm comprising 17 wind turbines and all associated works. The proposed turbines will have a maximum blade tip height of up to 150 metres. The full description of the proposed development, as per the public planning notices, is as follows:

i. *Construction of up to 17 No. wind turbines with a maximum overall blade tip height of up to 150 metres;*
ii. *1 no. Meteorological Mast with a maximum height of up to 112 metres;*
iii. *Construction of 1 no. staff welfare and storage facility including waste water holding tank;*
iv. *1 no. permanent 110 kV electrical substation with 2 no. control buildings with welfare facilities, 10 no. battery containers, battery switchgear building, all associated electrical plant and equipment, security fencing, all associated underground cabling, waste water holding tank and all ancillary works;*
v. *Underground cabling connecting the turbines to the proposed substation and connection from the proposed substation to the national grid via a 110 kV loop in connection.*
vi. *Upgrade of existing tracks, roads and provision of new site access roads and hardstand areas;*
vii. *Construction of an access track in the townlands of Breeda and Rearour South to facilitate turbine delivery;*
viii. *Junction improvement works in the townland of Killea to facilitate turbine delivery;*
ix. *3 no. borrow pits;*
x. *2 no. temporary construction compounds;*
xi. *Site Drainage;*
xii. *Forestry Felling;*
xiii. *Signage; and*
xiv. *All associated site development works.*

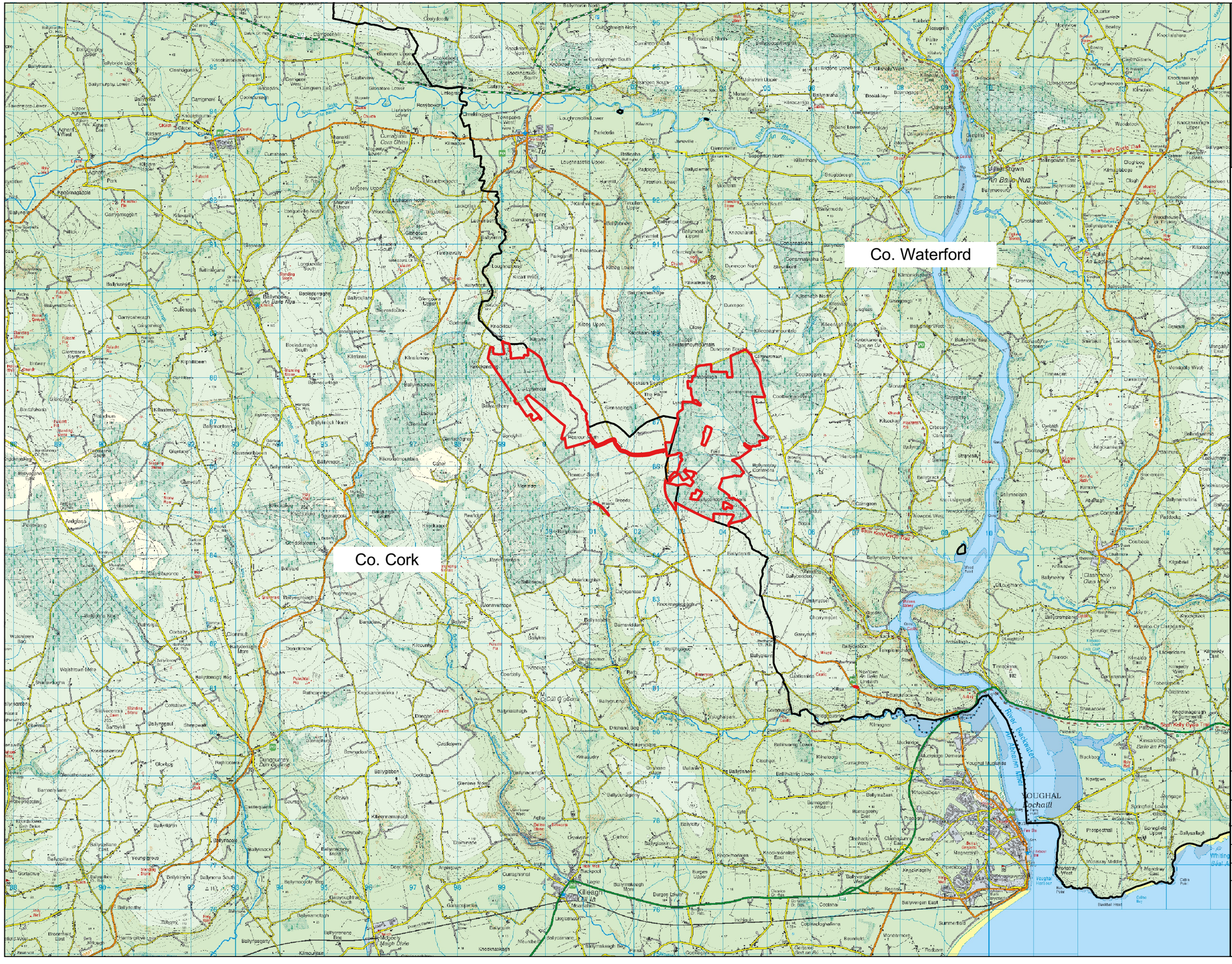
A full description of the proposed development is provided in Chapter 4 of this EIAR.

For the purpose of this report, the term 'Study Area' refers to the site red line boundary, comprising the entire wind farm site (including onsite grid connection) as shown in Figure 2-1.

The layout of the Proposed Development has been designed to minimise the potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource passing through the site. A constraints study, as described in Section 3.6.1 of this EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site. The Proposed Development layout makes maximum possible use of the existing access roads and tracks within the site.

The proposed development site is located approximately 5 kilometres (km) southeast of Tallow, Co. Waterford and approximately 9 kilometres northwest of Youghal, Co. Cork. The site is accessed via local roads from the R634 Regional Road, which travels in a northwest-southeast direction between Tallow and Youghal, and the R627 Regional Road, which travels in northeast-southwest direction between Tallow and Midleton. The site itself is served by a number of existing forestry roads, access points and grid infrastructure. The proposed development site encompasses two clusters of turbines located in eastern and western sections.

The EIAR site boundary of the proposed development encompasses a total area of approximately 733 hectares, the majority of which comprises commercial forestry plantation. The proposed permanent footprint of the development measures approximately 23.3 hectares, which represents approximately 3% of the primary study area. The site location is shown on Figure 2-1.



Map Legend

- County Boundary
- Site Boundary

Drawing Title

Site Location

Project Title	Lyrenacarriga Wind Farm
Drawn By: H. Witter	Checked By: D. McNicholas
Project No.: 170749	Drawing No.: Figure 2-1
Scale: 1:75000	Date: 2021-01-05

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3. METHODS

3.1 Consultation

A scoping exercise was undertaken as part of the EIAR for the proposed development. A Scoping Document, providing details of the application site and the proposed development, was prepared by MKO and circulated to consultees in May 2018. 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 development to affect bats.

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

3.2 Desk Study

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

3.2.1 Bat Records

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. A search of the National Bat Database of Ireland was last carried out on the 21st July 2020 and examined bat presence and roost records within a 10 km radius of a central point in the Study Area (IG E201738 N086395) (BCI 2012, Hundt 2012, SNH 2019).

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

3.2.2 Bat Species' Range

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

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

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 10 km radius of the Study Area (BCI 2012, Hundt, 2012, SNH 2019). 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 Study Area 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 Spelaeological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the Study Area (BCI, 2012) (last searched on the 14th February 2020). 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 1th July 2020).

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 development was reviewed in relation to bat habitat suitability indices. The aim of this was to assess habitat suitability for all bat species within the Study Area. It should be noted 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 site.

3.2.4.4 Additional Wind Energy Projects in the Wider Landscape

A search for existing, permitted and proposed wind energy developments within 10km of the proposed site was undertaken (SNH, 2019). Information on the location and scale of these developments was gathered to inform cumulative effects. Further details on other infrastructure developments can be found in Section 2.5.1 and Figure 2-2, Chapter 2 of the main EIAR.

3.3 Field Surveys

Bat surveys were undertaken in 2019 and form the core dataset for the assessment of effects on bats. This information is supplemented by additional data derived from surveys undertaken on the site in 2017 and 2018.

3.3.1 2019 Surveys

3.3.1.1 Bat Habitat Suitability Appraisal

Bat Habitat Suitability Appraisal was based on habitat description from the EIAR Biodiversity chapter and ecological site visits conducted by MKO. During these MKO surveys, habitats within the Study Area 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 to this report**.

3.3.1.2 Roost Surveys (2019)

A search for bat roosts was undertaken within the boundary of the proposed development. The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in June, July and October 2019. A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats. Any potential roost sites were subject to a roost assessment. This comprised a detailed inspection of the exterior and interior (if accessible) to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

One structure, (IG Ref: W 99673 87430) first identified in 2017, was assessed as having potential to support roosting bats and was subject to subsequent roost assessment (Plate 3-1). Emergence surveys were carried out at this dilapidated farm shed in July 2018 and 2019. A roost survey was completed on the 29th of July 2019. The emergence survey commenced at 21:15 approximately 15 minutes before sunset and continued for 45 minutes after sunset. The surveyor was equipped with a Petersson D230 handheld bat detector, LED head torch and handheld maglite torch were used during the roost emergence survey. 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).

Plate 3-1 Dilapidated Farm Shed

3.3.1.3 Manual Transects (2019)

Manual bat activity surveys were completed during the 2017 and 2019 bat activity season. The manual bat activity surveys were undertaken by walking line transects throughout the site in the vicinity of potential turbine locations.

During the 2019 surveys longer transects were completed by walking the transect at a slow steady pace, continuously recording for bat activity. The bat detector was set in the heterodyne mode and rapid sweeps were made with the frequency dial between 15 – 120kHz to maximise the chance of detecting different bat species. Where bat activity was registered the location was recorded using a handheld GPS.

All manual activity surveys were undertaken using a Peterson's D230 (heterodyne and frequency division). Other equipment used during the survey included a high-powered torch, an inspection camera and binoculars. Table 3-1 shows conditions for the manual transects in 2019.

Table 3-1 2019 Survey Effort - Manual Transects

Date	Surveyor	Transect	Start/Finish Time	Duration	Weather
06/05/2019	Pat Doherty	1	21:30 – 1:15	3h 45min	8-10˚; dry; calm
21/05/2019	Pat Doherty	3	21:30 – 1:15	3h 45min	9-13˚; dry; light air
21/05/2019	Pat Doherty	2	01:35 – 2:10	45min	9˚; dry; calm
14/07/2019	Pat Doherty	1	21:45 – 01:20	3h 35min	8-9˚; dry; calm-light air
14/07/2019	Pat Doherty	2	1:30 – 02:00	30min	12˚; dry; calm
29/07/2019	Pat Doherty	3	23:10 – 02:00	2h 50min	13˚; dry; calm
29/09/2019	Pat Doherty	1	20:10 – 23:40	3h 30min	7-10˚; dry; light air
30/09/2019	Pat Doherty	3	19:20 – 23:40	3h 30min	12; dry; light air
30/09/2019	Pat Doherty	2	23:10 – 23:45	35min	12˚; dry; light air

3.3.1.4 Ground-level Static Surveys (2019)

The 2019 bat monitoring surveys commenced in early May 2019. A proposed wind farm layout with turbine positions was made available in April 2019 prior to the commencement of the 2019 bat activity surveys. A total of 18 turbines were included at that time in the proposed wind farm layout. Thirteen monitoring points were erected within the site in spring and 15 monitoring points were erected within the site during summer and autumn (see Figures 3-1 and 3-2).

The monitoring point locations were chosen for being close to proposed turbine locations or to habitat features of interest. During each of the surveys a minimum of ten monitoring points were located in close proximity to turbine positions. Some separation from turbine positions occurred due to the presence of dense forestry at the proposed turbine location. Monitoring points were also established at habitat locations considered to be of high foraging value for bats. Given that the turbine locations are located in similar habitat types, namely conifer plantation, improved agricultural grassland or arable land with hedgerow field boundaries, it was considered that the sampling of locations of high bat foraging potential within the wind farm would provide a better understanding of bat activity patterns across all habitat types occurring adjacent to and in the wider vicinity surrounding turbine locations. Hence “control” points were identified in locations that were considered to be representative of higher value bat foraging habitat.

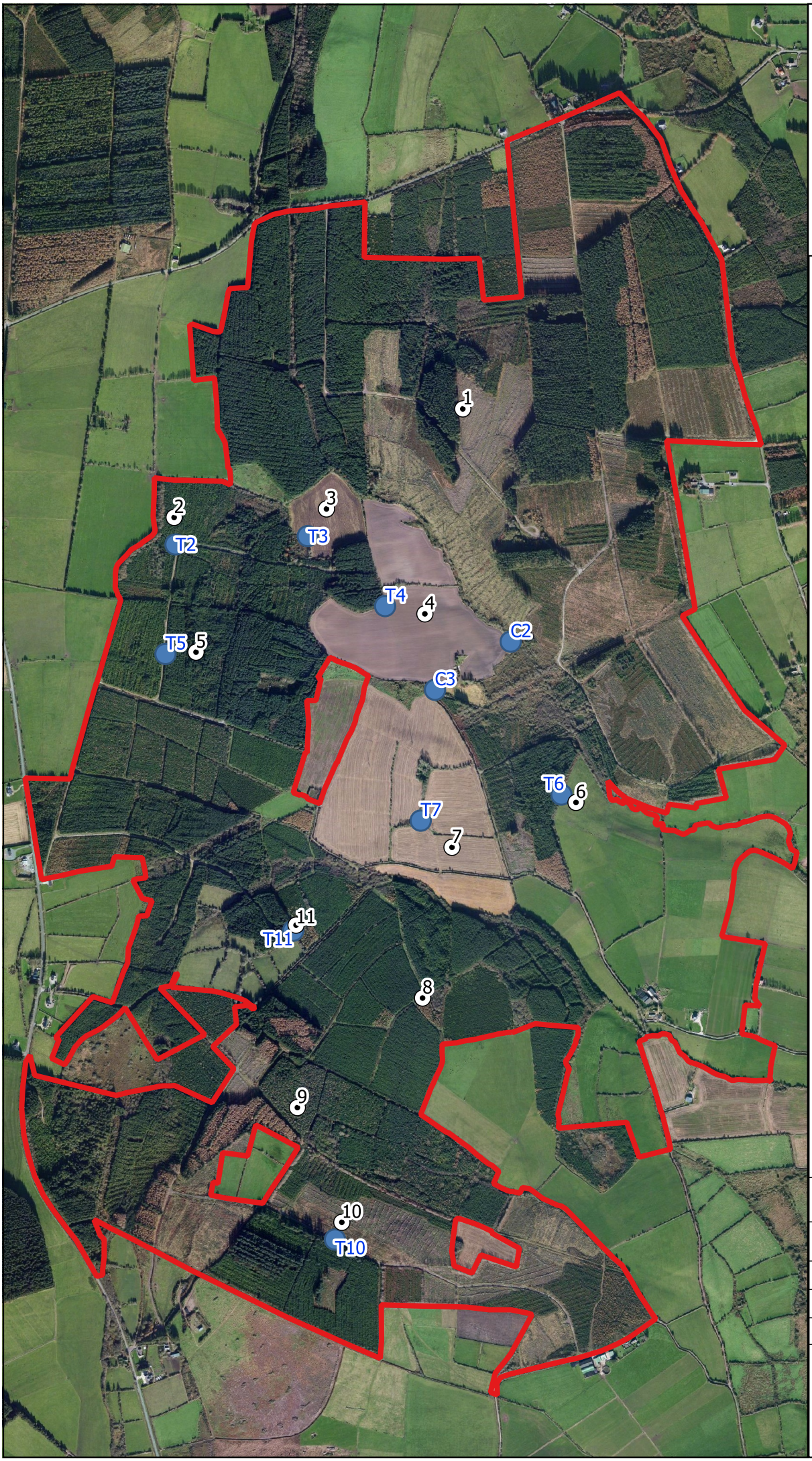
Table 3-2 provides information on the monitoring completed during the 2019 activity season. A total of 934 nights of monitoring were completed across all detectors during the 2019 season.

Monitoring was completed using Wildlife Acoustics SM2BAT+ and SM4BAT FS and SM4BAT ZC bioacoustic recorders. All SM4BAT FS and SM2BAT+ detectors recorded bat activity in full spectrum (at 192 kHz Stereo) while the SM4BAT-ZC recorded bat activity in zero-crossing. SMX-US ultrasonic omni-directional microphones were used with the SM2BAT+ while SMX U1 and U2 microphones were used with the SM4BAT FS and SM4BAT-ZC recorders. Fresh branded batteries (e.g. Duracell; Panasonic) were used at the start of each monitoring session. 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.

Table 3-2 Static detector locations

Monitoring Point	Deployment period	No. Monitoring Nights	Detector Type	Grid Reference	Habitat
Spring Season					
C1	06/05/19 – 16/05/19	10	SM4BAT-ZC	E600691 N587539	Riparian scrub woodland and minor stream in a sheltered, swallow valley
C2	06/05/19 – 16/05/19	10	SM2BAT+	E604138 N587006	Riparian treeline
C3	06/05/19 - Recording failed	0	SM2BAT+	E603907 N586858	Riparian treeline
T2	06/05/19 – 20/05/19	15	SM4BAT-ZC	E603113 N587303	Conifer plantation access road
T3	06/05/19 – 15/05/19	9	SM4BAT-FS	E603517 N587328	Hedgerow field boundary; improved agricultural grassland; dense bracken and scrub
T4	06/05/19 – 20/05/19	15	SM4BAT-FS	E603754 N587114	Conifer plantation edge and arable land
T5	06/05/19 – 18/05/19	13	SM4BAT-FS	E603082 N586968	Conifer plantation access road
T7	06/05/19 – 31/05/19	25	SM4BAT-FS	E603863 N586458	Hedgerow, drainage ditch and arable fields
T10	06/05/19 – 31/05/19	25	SM4BAT-FS	E603601 N585177	Conifer plantation edge and forestry access road
T12	06/05/19 – 31/05/19	25	SM4BAT-ZC	E599737 N588360	Conifer plantation and improved agricultural grassland edge; hedgerow
T14	06/05/19 - Recording failed	0	SM4BAT-FS	E599457 N588101	Conifer plantation fire break
T15	06/05/19 – 31/05/19	25	SM4BAT-ZC	E599656 N587780	Open clear-fell conifer plantation
T16	06/05/19 – 13/05/19	7	SM4BAT-FS	E600063 N587587	Farm shed and improved agricultural grassland
Summer Season					
C1	29/07/19 - 20/08/19	23	SM4BAT-ZC	E600691 N587539	Riparian scrub woodland and minor stream in a sheltered, swallow valley
C2	30/07/19 - 22/08/19	24	SM4BAT-ZC	E604138 N587006	Riparian treeline
C3	30/07/19 - 06/08/19	8	SM2BAT+	E603907 N586858	Riparian treeline
T2	30/07/19 - 23/08/19	25	SM4BAT-ZC	E603113 N587303	Conifer plantation access road
T3	29/07/19 - 15/08/19	18	SM4BAT-FS	E603517 N587328	Hedgerow field boundary; improved agricultural grassland; dense bracken and scrub
T4	30/07/19 - 26/08/19	28	SM4BAT-ZC	E603754 N587114	Conifer plantation edge and arable land
T5	30/07/19 - 22/08/19	24	SM4BAT-FS	E603082 N586968	Conifer plantation access road

Monitoring Point	Deployment period	No. Monitoring Nights	Detector Type	Grid Reference	Habitat
T6	14/07/19 - 19/07/19	5	SM4BAT-FS	E604293 N586538	Conifer plantation edge, scrub and improved agricultural grassland edge
T7	01/08/19 - 18/08/19	18	SM4BAT-FS	E603863 N586458	Hedgerow, drainage ditch and arable fields
T10	14/07/19 - 31/08/19	48	SM4BAT-FS	E603601 N585177	Conifer plantation edge and forestry access road
T11	06/08/19 - 25/08/19	19	SM4BAT-FS	E603473 N586121	Conifer plantation and improved agricultural grassland edge; hedgerow
T12	15/07/19 - 23/08/19	39	SM4BAT-ZC	E599737 N588360	Conifer plantation fire break
T14	15/07/19 - 20/08/19	36	SM4BAT-ZC	E599457 N588101	Open clear-fell conifer plantation
T15	29/07/19 - 07/08/19	10	SM4BAT-FS	E599656 N587780	Farm shed and improved agricultural grassland
T16	19/07/19 - 31/08/19	45	SM4BAT-FS	E600063 N587587	Clearfell conifer plantation and immature conifer plantation edge
Autumn Season					
C1	28/09/19 Recording failed	0	SM4BAT-FS	E600691 N587539	Riparian scrub woodland and minor stream in a sheltered, swallow valley
C2	28/09/19 Recording failed	0	SM4BAT-FS	E604138 N587006	Riparian treeline
C3	28/09/19 - 03/10/19	6	SM2BAT+	E603907 N586858	Riparian treeline
T2	28/09/19 - 10/10/19	13	SM4BAT-ZC	E603113 N587303	Conifer plantation access road
T3	28/09/19 - 31/10/19	34	SM4BAT-ZC	E603517 N587328	Hedgerow field boundary; improved agricultural grassland; dense bracken & scrub
T4	28/09/19 - 31/10/19	34	SM4BAT-ZC	E603754 N587114	Conifer plantation edge and arable land
T5	28/09/19 - 31/10/19	34	SM4BAT-FS	E603082 N586968	Conifer plantation access road
T7	27/09/19 - 22/10/19	26	SM4BAT-ZC	E604293 N586538	Hedgerow, drainage ditch and arable fields
T10	26/09/19 - 31/10/19	48	SM4BAT-FS	E603863 N586458	Conifer plantation edge and forestry access road
T11	27/09/19 - 31/10/19	19	SM4BAT-FS	E603601 N585177	Conifer plantation and improved agricultural grassland edge; hedgerow
T12	27/09/19 - 31/10/19	39	SM4BAT-FS	E603473 N586121	Conifer plantation fire break
T14	27/09/19 - 11/10/19	36	SM4BAT-FS	E599737 N588360	Open clear-fell conifer plantation
T15	27/09/19 - 25/10/19	29	SM4BAT-FS	E599457 N588101	Farm shed and improved agricultural grassland
T16	27/09/19 - 18/10/19	22	SM4BAT-FS	E599656 N587780	Clearfell conifer plantation and immature conifer plantation edge
T17	27/09/19 - 31/10/19	45	SM4BAT-ZC	E599623 N587230	Farm shed and improved agricultural grassland



Map Legend

- Turbine Locations
- Static Detector Locations
- Site Boundary

Drawing Title	Static Locations Eastern Envelope
Project Title	Lyrenacarriga Windfarm
Drawn By: LD	Checked By: JH
Project No.: 170749	Drawing No.: Figure 3-1
Scale: 1:15,500	Date: 30/10/2020

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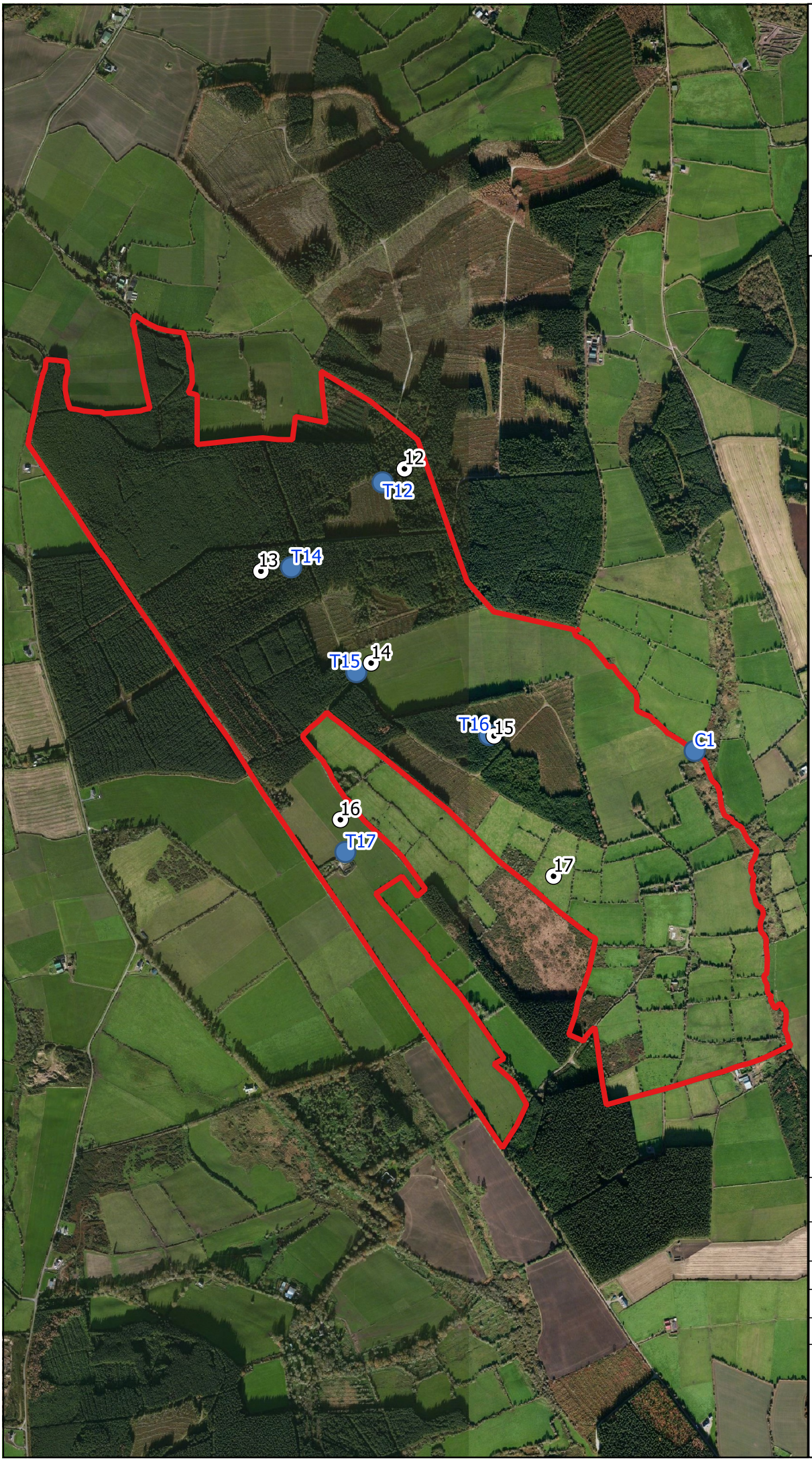

Map Legend

- Turbine Locations
- Static Detector Locations
- Site Boundary

N

Drawing Title	Static Locations Western Envelope
Project Title	Lyrenacarriga Windfarm
Drawn By: LD	Checked By: JH
Project No.: 170749	Drawing No.: Figure 3-2
Scale: 1:15,500	Date: 30/10/2020

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3.3.1.4.1 Weather Data

A Davis Vantage Vue remote weather station was erected on site for the duration of the 2019 bat activity season. The weather station was installed in May 2019 in an area of open Clear-fell ground in the vicinity of the proposed turbine T14. The weather station was erected at this location so that weather data from an unsheltered and exposed location was gathered. Data recorded from the Davis weather station included barometric pressure, temperature (°C), wind speed (m/s) and rainfall (mm). Data was recorded at 30-minute intervals.

In the event of a weather station equipment failure a back-up Sodar station was also installed on site for the duration of the 2019 bat activity season. The Sodar station recorded wind speeds at a height of 40m and temperature (°C). Data was recorded at 10-minute intervals.

Data was recorded by the Davis weather station for the spring and summer/early autumn monitoring sessions. There was a failure of the Davis weather station during the late autumn monitoring session and as such wind speed and temperature data gathered on site from the Sodar station has been used to inform the analysis of bat activity and weather conditions. As no rainfall data was collected by the Sodar station an average of the 1 hour rainfall data taken from Roches Point and Moore Park Met Eireann weather stations has been used to inform an analysis of the influence (if any) of rainfall and bat activity during the late autumn monitoring session. Roches Point and Moore Park are the nearest Met Eireann weather stations to the wind farm site (c. 30 and 20km respectively) that record hourly rainfall data. The suitability of the Met Eireann rainfall data from Roches Point and Moore Park with the respect to the wind farm site was investigated by comparing the total daily rainfall from Moore Park, Roches Point against the daily rainfall data recorded by Met Eireann's rainfall station at Tallow Kilmore, which is located approximately 3km to the north of the nearest proposed turbine. Given the proximity of the Tallow Kilmore rainfall station to the wind farm it is considered that the daily rainfall recorded at this location is representative of the daily rainfall occurring at the wind farm site.

Plate 3-2 provides a comparison of the daily rainfall recorded at Tallow Kilmore and the average daily rainfall recorded at both Roches Point and Moore Park. As can be seen on Plate 3-2 there is a similar trend for daily rainfall from all locations. Given the similarity in daily rainfall records between each of these locations, the average hourly rainfall data recorded at Roches Point and Moore Park has been used to inform the relationship between the late autumn bat monitoring session and rainfall.

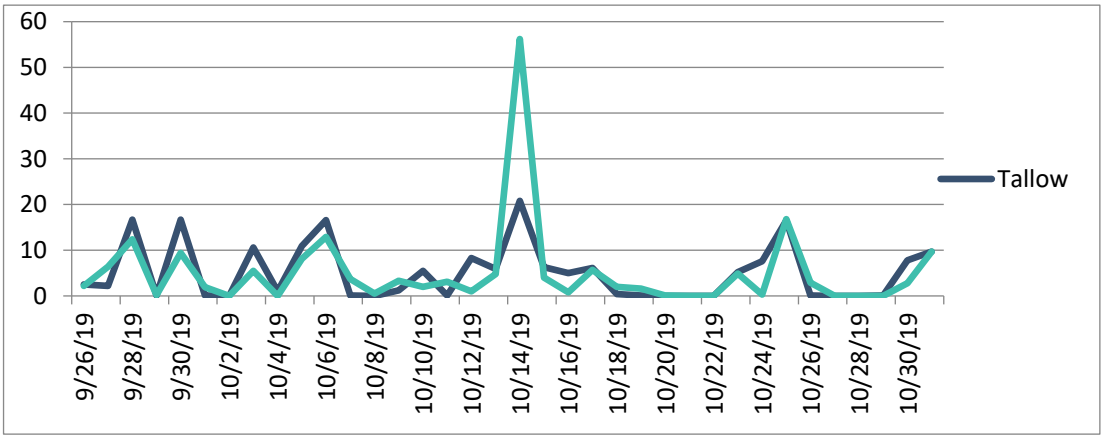


Plate 3-2 2019 Survey Effort - Ground-level Static Surveys

3.3.2 2018 Surveys

Monitoring was completed at four locations during the summer of 2018. This data does not form the core data set for assessment but is supplementary to the assessment of the proposed development. The locations were selected based on a preliminary wind farm turbine layout provide in July 2018. These locations are shown on Figures 3-1 and 3-2. The monitoring points used during the 2018 monitoring relate to the positions of turbines T4, T6, T17 and T18 of the final wind farm turbine layout. These locations were selected to provide bat activity data at locations, near the position of turbines selected for the preliminary layout, where no monitoring was completed during the 2017 survey. Table 3-3 provides information for these surveys. A total of 43 nights of monitoring was completed during the summer of 2018. Table 3-4 provides a brief description of the habitats surveyed.

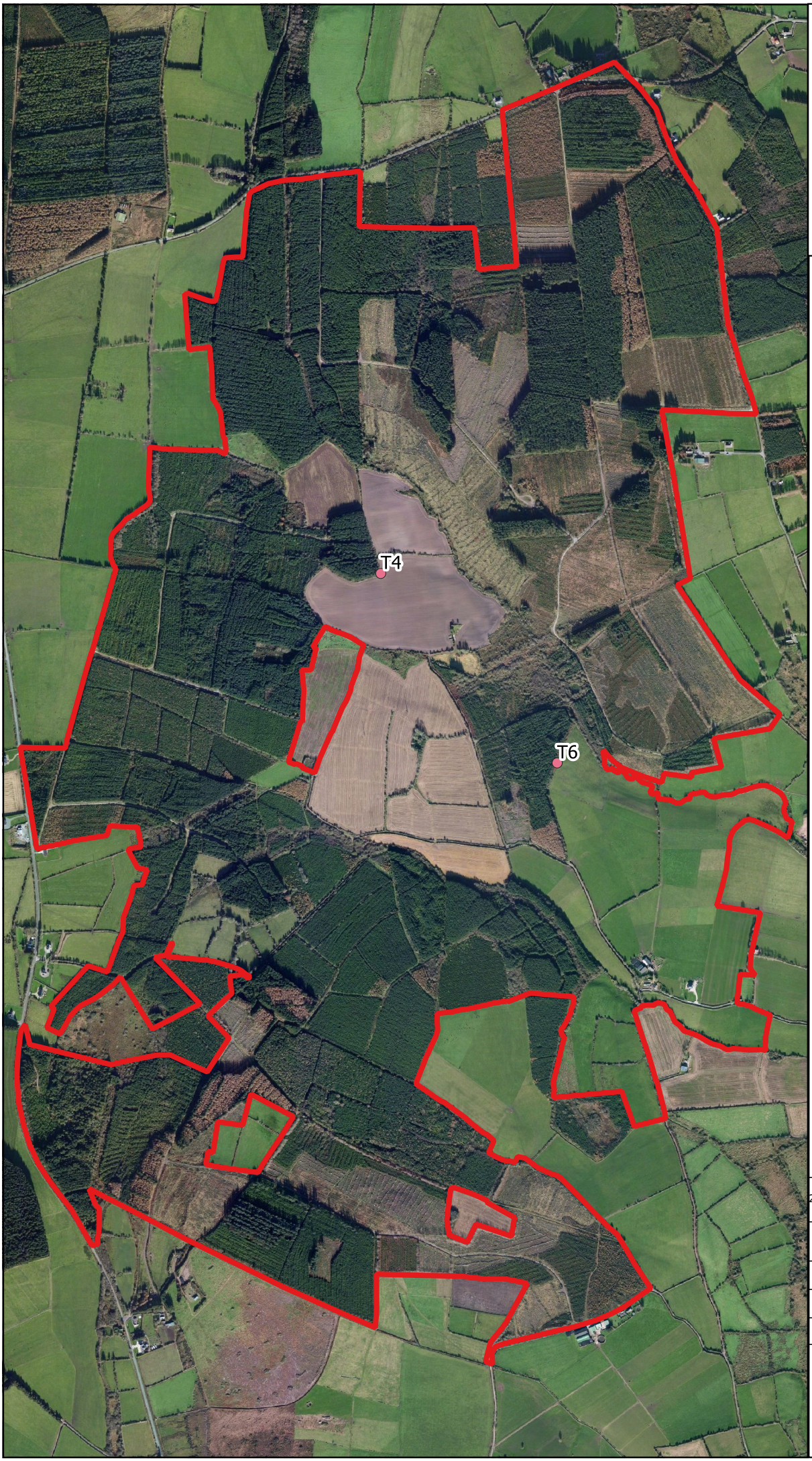
Monitoring was completed using SM4BAT FS and SM4BAT ZC bioacoustic recorders. All SM4BAT FS detectors recorded bat activity in full spectrum while the SM4BAT-ZC recorded bat activity in zero-crossing. SMX U1 and U2 microphones were used with the SM4BAT FS and SM4BAT-ZC recorders. Fresh branded batteries (e.g. Duracell; Panasonic) were used at the start of each monitoring session.

Table 3-3 Details of 2018 Automatic Bat Monitoring

Monitoring Point	Start Date	Finish Date	No. Monitoring Nights	Season	Detector Type
T4	27/07/18	01/08/18	5	Summer	SM4BAT-FS
T6	27/07/18	05/08/18	10	Summer	SM4BAT-FS
T17	27/07/18	09/08/18	14	Summer	SM4BAT-ZC
T18	27/07/18	09/08/18	14	Summer	SM4BAT-ZC
Total No. Monitoring Nights			**43**		

Table 3-4 Description of Habitats at 2018 Monitoring Locations

Monitoring Point	Habitat Type	Habitat Category	Description
T4	Conifer plantation access road	Enclosed	Microphone mounted onto the end of a conifer tree branch and approximately 3.5m overhanging the existing access road.
T6	Conifer plantation	Enclosed	The microphone was mounted at the end of a 2m pole that was attached horizontally to a mature conifer tree at the edge of a mature section of plantation.
T17	On bund adjacent to farmyard	Open	The microphone was mounted at the end of a 2m pole that attached to a hawthorn tree growing on a vegetated berm surrounding the farmyard to the east of the proposed turbine location T17.
T18	Hedgerow	Edge	The microphone was mounted at the end of a 2m pole that was attached to a fence post along a field boundary.



Map Legend

- Site Boundary
- Static Detector Locations

Drawing Title
2018 Static Bat Activity Monitoring Points in the Eastern envelope

Project Title
Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 3-3
Scale	Date
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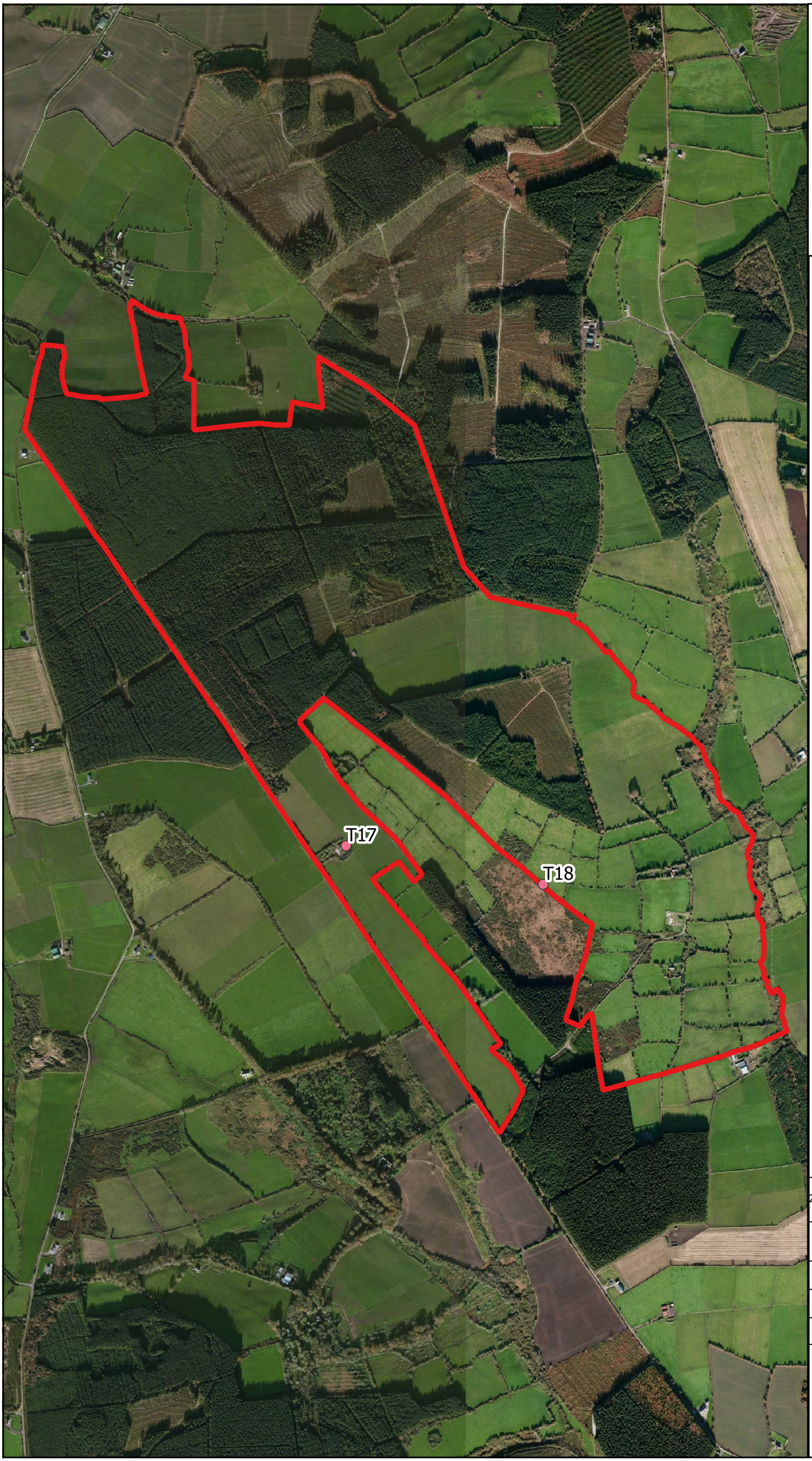

Map Legend

- Site Boundary
- Static Detector Locations

Drawing Title
2018 Static Bat Activity Monitoring Points in the Western envelope

Project Title
Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 3-4
Scale	Date
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3.3.3 2017 Surveys

This data does not form the core data set for assessment but is supplementary to the assessment of the proposed development.

3.3.3.1 Manual Transects (2017)

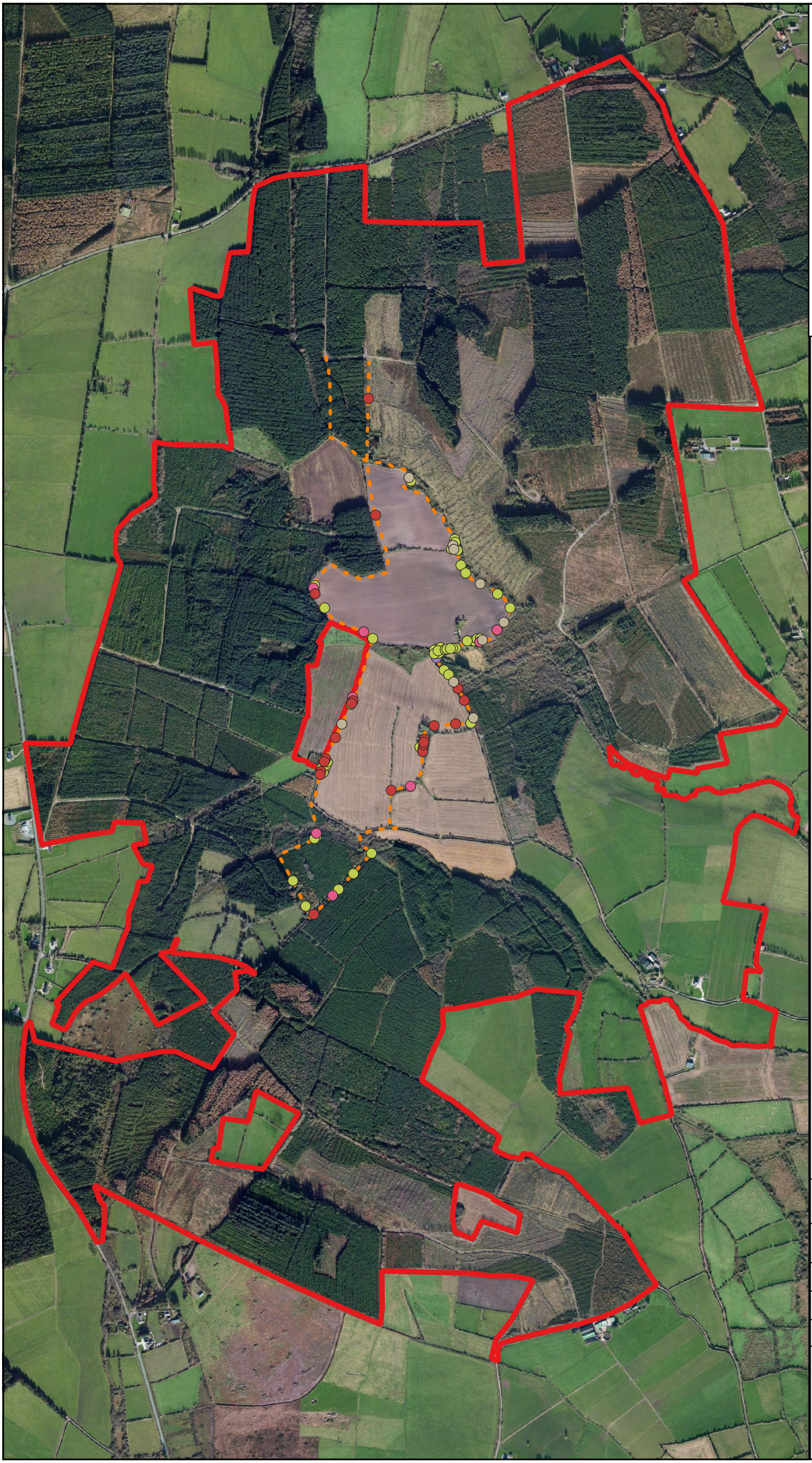
The manual bat activity surveys were undertaken by walking line transects throughout the site.

During the 2017 transect surveys 2-minute spot surveys (SS) were taken at approximate 400m intervals along transects or at points where the transect route intersected habitats of high bat foraging potential such as woodland and treelines. The bat detector was set in the heterodyne mode and rapid sweeps were made with the frequency dial between 15 – 120kHz to maximise the chance of detecting different bat species. Where bat activity was registered the location was recorded using a handheld GPS.

All manual activity surveys were undertaken using a Petersson D230 (heterodyne and frequency division). Other equipment used during the survey included a high-powered torch, an inspection camera and binoculars. Manual transect survey effort is displayed Table 3-5).

Table 3-5 2017 Survey Effort - Manual Transects

Date	Surveyor	Type	Transect	Start/end	Duration	Weather
06/05/2017	Pat Doherty	Dusk	1	21:30 – 01:15	3h 45min	9-10˚; dry; gentle breeze – light air
22/05/2017	Pat Doherty	Dusk	2	21:20 – 22:45	1h 25min	12˚; dry; Gentle breeze to light air
15/06/2017	Pat Doherty	Dawn	1	21:40 – 00:00	2h 20min	12-13˚; dry; Gentle breeze to light air
22/06/2017	Pat Doherty	Dusk	2	22:10 – 23:30	1h 20min	14˚; dry; Gentle breeze
07/07/2017	Pat Doherty	Dawn	2	21:50 – 23:20	1h 30min	14˚; dry; Gentle breeze
28/07/2017	Pat Doherty	Dusk	1	21:20 – 23:30	2h 10min	12-13˚; dry; Gentle breeze
15/08/2017	Pat Doherty	Dusk	1	20:40 – 23:00	2h 20min	13˚; dry; Gentle breeze
19/08/2017	Pat Doherty	Dusk	2	20:40 – 22:05	1h 25min	10-11˚; dry; Gentle breeze to light air
12/09/2017	Pat Doherty	Dusk	2	19:50 – 21:20	1h 30min	10-11˚; dry; strong breeze
15/09/2017	Pat Doherty	Dusk	1	19:30 – 21:30	2 hours	9˚; dry; Gentle breeze



Map Legend

- Site Boundary
- Transect
- Unidentified pipistrelle
- Myotis sp.
- Leislers
- Common pipistrelle
- Brown Long Eared
- Soprano pipistrelle

N

Drawing Title

2017 Manual Transect Results Eastern Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 3-5
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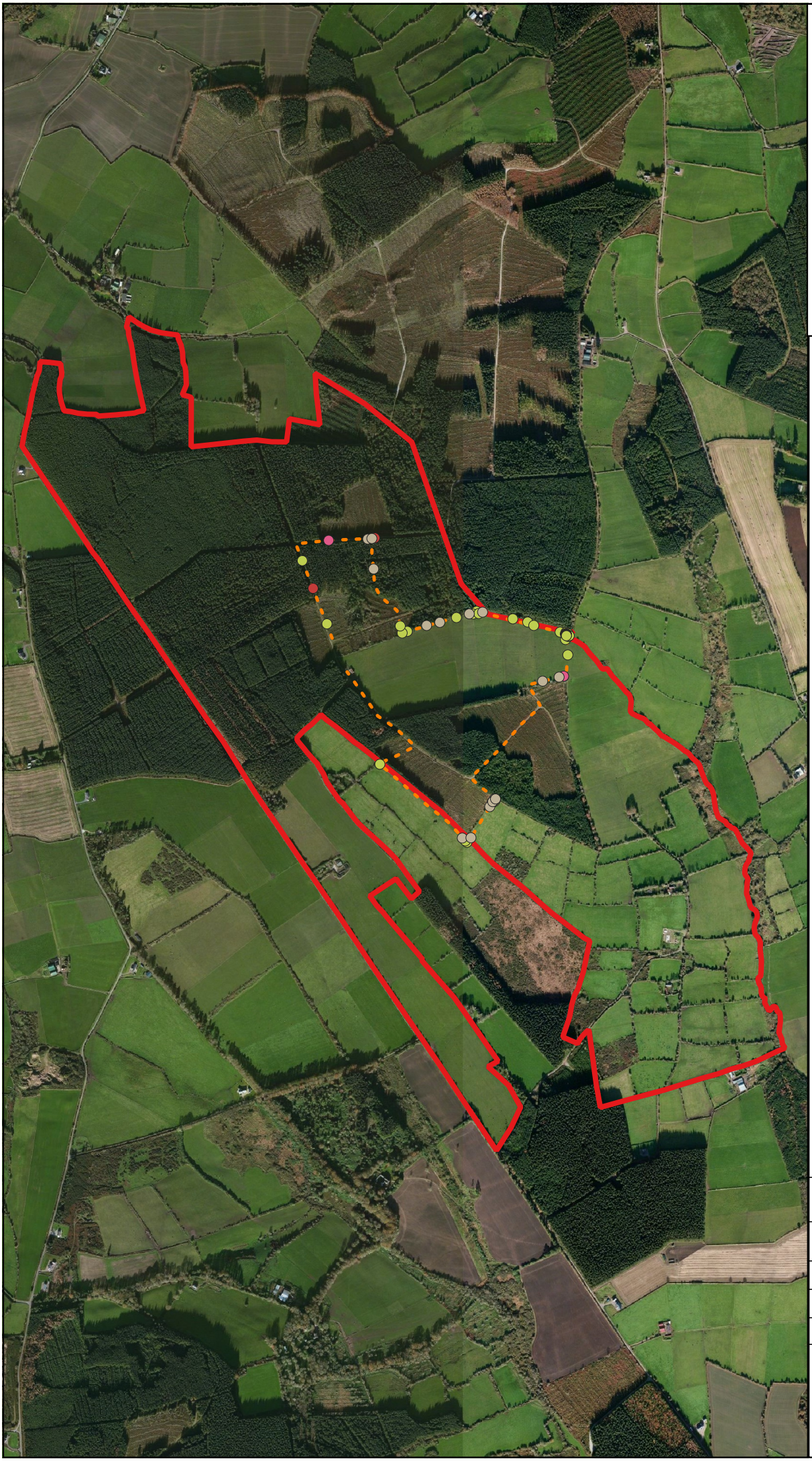

Map Legend

- Site Boundary
- Transect
- Unidentified pipistrelle
- Myotis sp.
- Leislers
- Common pipistrelle
- Brown Long Eared
- Soprano pipistrelle

N

Drawing Title
2017 Manual Transect Results Western Envelope

Project Title
Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 3-6
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3.3.3.2 Ground-level Static Surveys (2017)

Bat monitoring commenced at the proposed Lyrenacarriga Wind Farm site during the spring of 2017 (Figures 3-7 and 3-8). At this time the project site boundary and layout for the proposed wind farm was not finalised. A broad land envelope was delineated on maps and was provided in advance of the commencement of the activity surveys in April 2017. The aim of the 2017 automatic surveys was to collect detailed baseline data of bat activity within the wind farm site.

A review of satellite imagery was completed in the spring of 2017 prior to the commencement of bat activity surveys. A walkover of the site was completed on the 27th and 28th April 2017 and locations for monitoring of bat activity were selected. The rationale underpinning the selection of monitoring locations for the 2017 monitoring was based on: The presence of habitat features typical of bat foraging habitat. Habitats were categorised into edge, enclosed and open habitats. Given that the surveys aimed to identify bat activity within and adjacent to the land envelope a greater number of monitoring points were situated within habitat categories that are known to be preferred by bats for foraging (i.e. edge and enclosed habitats); and the provision of a spread of locations that would provide broad spatial coverage within both areas.

All automatic bat detectors were mounted at least 2m above ground level. Table 3-6 provides information on the monitoring completed during the 2017 activity season. A total of 226 nights of monitoring were completed during the 2017 season, with 146 nights being completed in the eastern land envelope (Area 1) and 80 nights being completed in western envelope (Area 2).

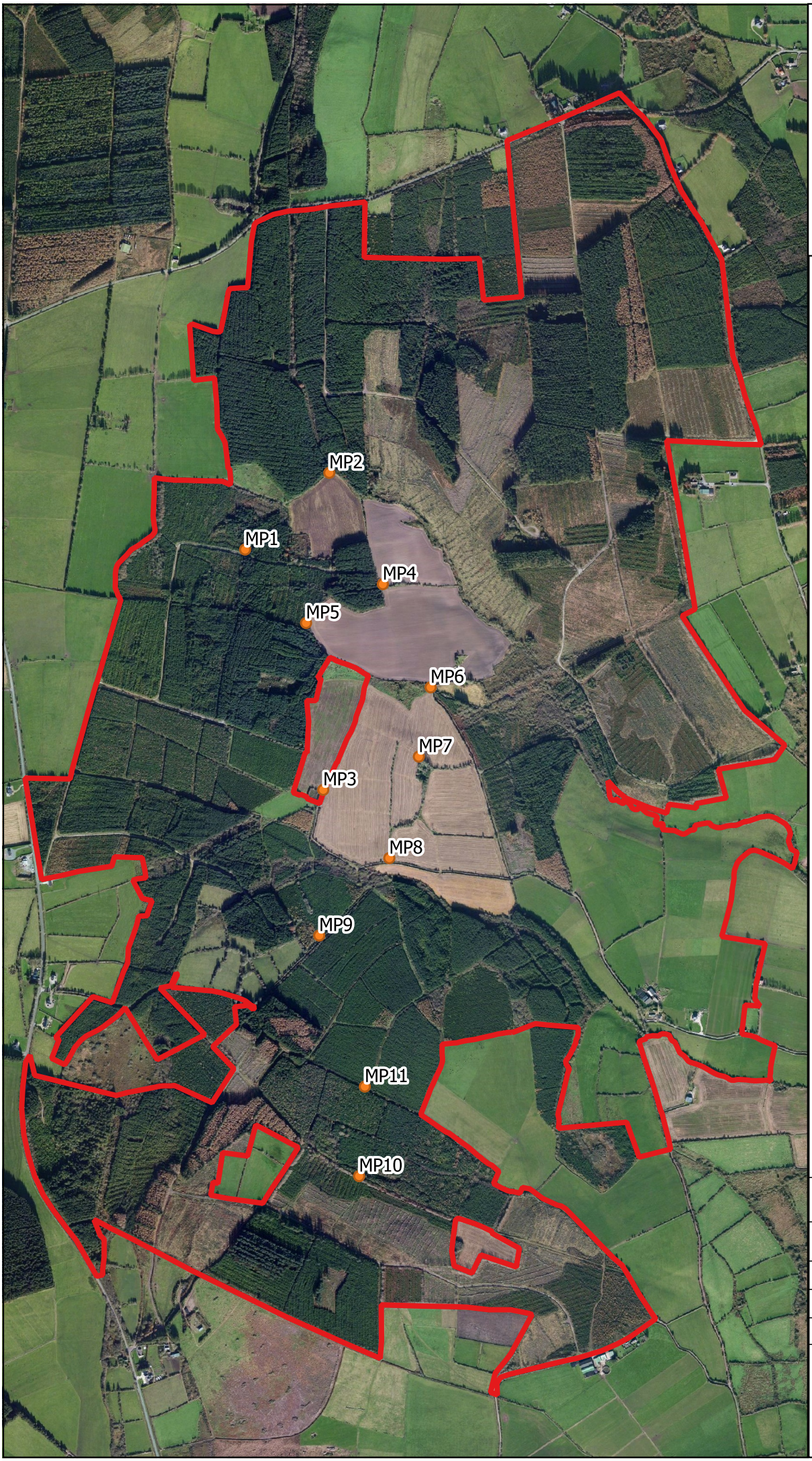
Table 3-6 Details of 2017 Automatic Bat Monitoring

Area	Monitoring Point	Start Date	Finish Date	No. Monitoring Nights	Season	Detector Type
1	1	28/04/17	07/05/17	11	Spring	SM2BAT+
	2	11/06/17	17/06/17	7	Summer	SM2BAT+
	3	15/06/17	21/06/17	7	Summer	SM2BAT+
	4	18/06/17	22/06/17	5	Summer	SM4-ZC
	5	22/06/17	25/06/17	4	Summer	SM2BAT+
	6	27/07/17	15/08/17	20	Summer	SM4-ZC
	7	27/07/17	15/08/17	20	Summer	SM2BAT+
	8	16/08/17	26/08/17	10	Autumn	SM4-ZC
	9	16/08/17	26/08/17	10	Autumn	SM2BAT+
	10	15/09/17	28/09/17	14	Autumn	SM2BAT+
	11	28/09/17	04/11/17	38	Autumn	SM4-ZC
Total No. Monitoring Nights				**146**		
2	1	28/04/17	07/05/17	11	Spring	SM2BAT+
	2	13/05/17	22/05/17	10	Spring	SM2BAT+
	3	13/05/17	-	Detector Failed	-	SM2BAT+
	4	22/06/17	28/06/17	7	Summer	SM2BAT+
	5	22/06/17	28/06/17	7	Summer	SM4-ZC
	6	30/06/17	06/07/17	7	Summer	SM4-ZC
	7	07/07/17	11/07/17	5	Summer	SM4-ZC
	8	30/06/17	08/07/17	9	Summer	SM4-ZC
	9	15/08/17	03/09/17	19	Autumn	SM4-ZC
	10	15/08/17	19/08/17	5	Autumn	SM2BAT+
Total No. Monitoring Nights				**80**		

Table 3-7 Description of habitats at 2017 monitoring locations

Site Location	Monitoring Point	Habitat Type	Habitat Category	Description
East Envelope	1	Conifer plantation access road	Edge	Microphone mounted onto the end of a conifer tree branch and approximately 3.5m overhanging the existing access road.
	2	Conifer plantation/improved agricultural grassland edge	Edge	Microphone mounted onto the end of a pole and attached to a small rowan tree at the edge of a conifer plantation and improved agricultural grassland field. The microphone was mounted approximately 3m above the ground level within the field to the south.
	3	Hedgerow and Tree line	Edge	Microphone was mounted onto a 2m pole that was attached to a farm gate post at the end of a farm access road. The microphone was installed at a height of approximately 3m. Adjacent habitats include hedgerows and tree lines along the farm access road, scrub, conifer plantation and improved agricultural grassland.
	4	Conifer plantation edge, hedgerow, minor stream and arable land	Edge	The microphone was mounted onto a 2m pole that was attached to small tree at the edge of conifer plantation. A minor stream and arable land occur at the monitoring location.
	5	Conifer plantation and arable land edge	Edge	The microphone was mounted onto a 2m pole attached to the edge of the woodland
	6	Eroding Stream and Scrub edge	Edge	The microphone was mounted onto a 2m pole that was attached to a farm gate post so that it was positioned 2.5m above ground.
	7	Mature broadleaved woodland edge	Edge	The microphone was attached to the end of a 2m pole which was mounted horizontally onto a mature tree at a height of approximately 3m above ground.
	8	Hedgerow	Edge	The microphone was mounted onto a 2.5m pole that was place along the hedgerow. The microphone was positioned approximately 2m above ground and clear of the surrounding hedgerow vegetation.
	9	Conifer plantation, scrub and woodland path.	Enclosed	The microphone was positioned approximately 3m above ground at the end of a 2m pole that was attached to a small hawthorn tree at the start of a woodland path.
	10	Conifer plantation, forest path	Enclosed	The microphone was attached to the end of a 1m pole that was then attached to an immature spruce tree at the edge of the plantation along the path.
	11	Conifer plantation, forest path	Enclosed	The microphone was attached to the end of a 1m pole that was then attached to an immature spruce tree at the edge of the plantation along the path.

Site Location	Monitoring Point	Habitat Type	Habitat Category	Description
West Envelope	1	Conifer plantation	Enclosed	The microphone was placed on a 2m pole that was positioned along a break in conifer plantation.
	2	Conifer plantation break	Enclosed	The microphone was mounted at the end of a 2m pole that was attached horizontally to a mature conifer tree at the edge of a mature section of plantation.
	3	Scrub	Enclosed	The microphone was mounted at the end of a 2m pole that was attached to an immature willow tree, so that it stood 3.5m above ground and proud of surrounding vegetation.
	4	Hedgerow and grassland edge	Edge	The microphone was mounted on the end of a pole that was attached to a fence post so that it stood approximately 2.5m above ground.
	5	Scrub and grassland edge	Edge	The microphone was mounted to a 2m pole that was attached to fence post, so that it stood approximately 2.5m above ground.
	6	Clear-fell	Open	The microphone was mounted at the end of a 2m pole on placed on brash so that it was approximately 2.5m above ground.
	7	Grassland and conifer plantation edge	Edge	The microphone was mounted on a 2m pole that was attached to a post at the edge of the field so that it stood approximately 2.5m above ground.
	8	Recently planted conifer plantation in grassland	Open	The microphone was mounted to the end of a 2m pole that was attached to a conifer seedling.
	9	Clear-fell	Open	The microphone was mounted on a 2m pole that was attached to a tree stump so that it stood approximately 3m from ground.
	10	Eucalyptus plantation	Enclosed	The microphone was mounted onto a 2m pole that was attached horizontally to a eucalyptus tree so that it stood 3m from ground.



Map Legend

- Site Boundary
- Static Detector Locations

N

Drawing Title
2017 static survey locations Eastern Envelope

Project Title
Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
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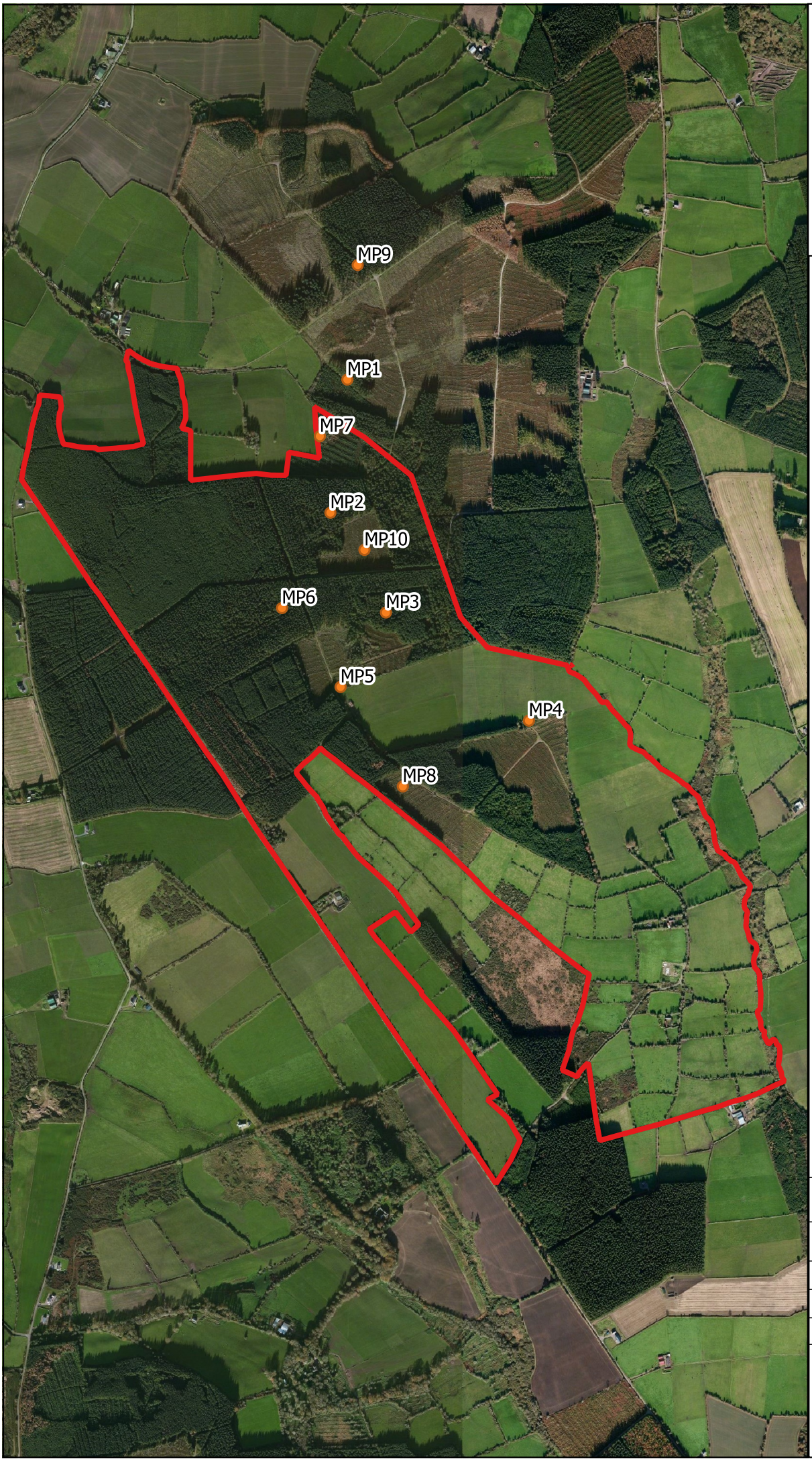

Map Legend

- Site Boundary
- Static Detector Locations

Drawing Title
2017 static survey locations Western Envelope

Project Title
Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
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3.4 Bat Call Analysis

All recordings from 2019 were later analysed using bat call analysis software Kaleidoscope Pro v.5.1.9 (Wildlife Acoustics, MA, USA). The aim of this was to identify, to a species or genus level, what bats were present at the proposed development 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 (peak frequency of maximum energy in search flight) frequency of ~55 kHz and ~ 46 kHz respectively (Jones & van Parijs, 1993).

Plate 3-3 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.

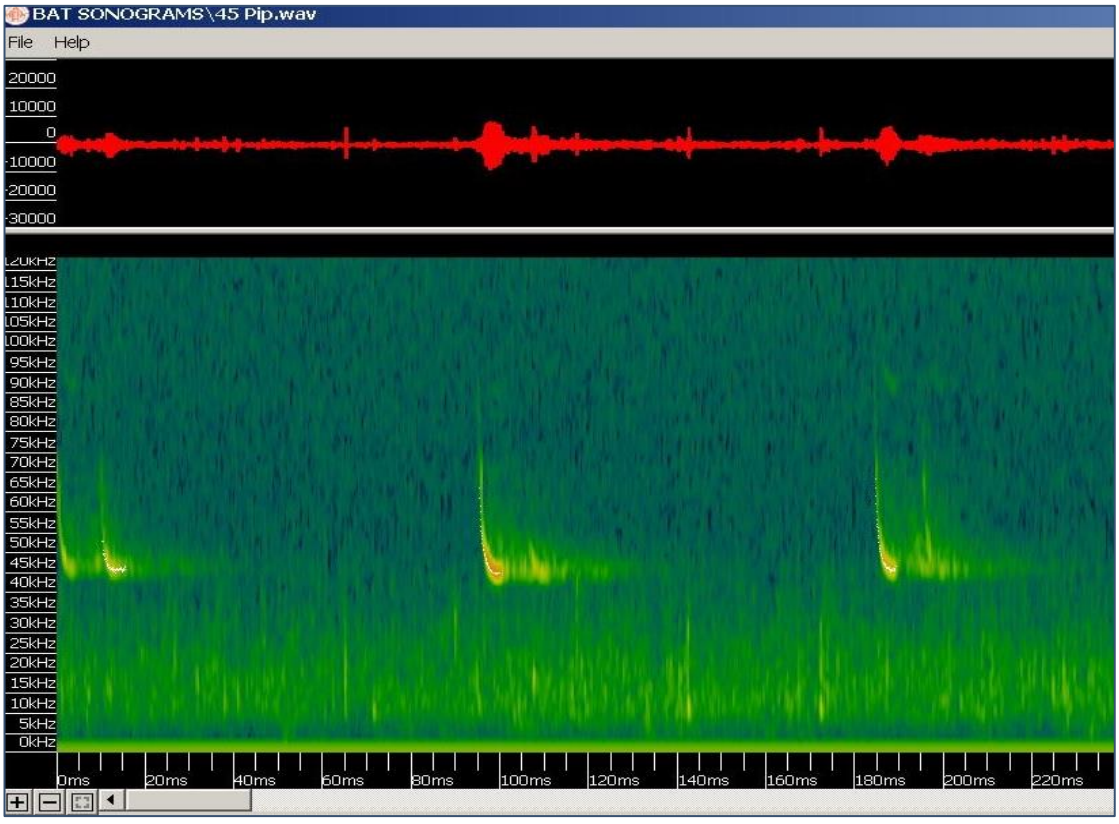


Plate 3-3 Sonogram of Echolocation Pulses of Common Pipistrelle (Peak Frequency 45kHz)Sonogram of Echolocation Pulses of Common Pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

Static detector monitoring results were uploaded to the online database tool Ecobat (ecobat.org.uk). 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 Ecobat 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 3.8 defines bat activity levels as they relate to Ecobat percentile values (SNH, 2019).

2019 static detector at ground level results for the proposed development were uploaded in 2019. Database records used in analyses were limited to those within a similar time of year (within 30 days of recording) and a within a similar geographic region (within 200 km).

Guidelines in the use of Ecobat recommend a Reference Range of 2000+ to be confident in the relative activity level. The reference range is the stratified dataset of bat results recorded in the same region, at the same time of year, by which percentile outputs can be generated. This comprises all records of nightly bat activity across Ireland.

Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 2000. As Ecobat continues to be utilised in Ireland the accuracy of data outputs and results will improve over time. Results of Ecobat analysis for the proposed development site can be found in Table 3-8 in the results section below.

Table 3-8 Ecobat Percentile Score and Categorised Level of Activity (SNH, 2019)

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

3.6 Assessment of Collision Risk

3.6.1 Population Risk

SNH (2019) 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 3-4, an adapted assessment of vulnerability for Irish bat populations is provided. This adaptation of the SNH Guidance Table 2 is based on collision risk and species abundance of Irish bat populations. Species' collision risk follows those described in SNH (2019). 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 3-4 Population Vulnerability of Irish Bat Species (Adapted from SNH, 2019)

3.6.2 Site Risk

The likely impact of a proposed development 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 3-5) i.e. Table 3a (SNH, 2019). Table 5-1 in the results section describes the criteria and site-specific characteristics used to determine an indicative risk level for the proposed site. All site assessment levels, as per SNH (2019) 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 3-5 Site-risk Level Assessment Matrix (Table 3a, SNH, 2019)

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. Ecobat bat activity outputs), as shown in the overall risk assessment matrix table (Plate 3-6) i.e. Table 3b (SNH, 2019). The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values).

Site Risk Level	Ecobat Activity Category					
	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 3-6 Overall Risk Assessment Matrix (Table 3b, SNH, 2019)

This exercise was carried out for each high collision risk species, i.e. Common, Soprano and Nathusius' pipistrelles, and Leisler's bat. 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 3-4).

3.7 Limitations

A suite of bat surveys was undertaken at the Proposed Development site in 2017, 2018 and 2019. The surveys undertaken in 2019, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the proposed development on bats receptors. It is supplemented by additional data derived from surveys undertaken on the site in 2017 and 2018.

The information provided in this report accurately and comprehensively describes the baseline environment; provides an accurate prediction of the likely effects of the Proposed Development; prescribes mitigation as necessary; and describes the predicted residual impacts.

Static detector surveys conducted in spring 2019 had two malfunctioning detectors that failed to record any data. Two extra detectors were deployed during the summer season as a corrective action and provided sufficient detector coverage. Two detectors failed during the autumn 2019 survey season. However, 13 detectors recorded data for the autumn season which provides sufficient data to provide a comprehensive assessment of the site.

The data provided between 2017-2019 is sufficient to provide an accurate, robust and comprehensive assessment of the bat populations and activity at the proposed development site. The SNH Guidelines have been followed in the approach taken for impact assessment and the application of mitigation where appropriate.

4. SURVEY RESULTS

4.1 Consultation

A detailed scoping exercise was undertaken for the proposed wind farm. This is described fully in Chapter 2 of the EIAR. No scoping response was received from Bat Conservation Ireland (BCI). A scoping response was received from the National Parks and Wildlife Service via the Department of Culture, Heritage and Gaeltacht (DCHG) on 18th July 2018. In relation to bats, the DCHG response stated that *"A thorough baseline survey of bats using the wind farm area'* should be carried out as part of the assessment. Copies of all scoping responses are provided in Appendix 2-2 of the EIAR.

4.2 Desk Study

4.2.1 Bat Records

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of a central point within the proposed site boundary (Grid Ref: E201738 N086395) last search 21/07/2020). At least seven of Ireland's nine resident bat species were recorded including Soprano pipistrelle and Brown long eared bat. The results of the database search are provided in Table 4-1.

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

Record Type	Species	Location / Grid Reference	Date	Dataset
Roost	*Plecotus auritus*	X0983 Near Youghal Bridge and Clashmore; Co. Waterford	Unknown	Unknown
Roost	*Pipistrellus pipistrellus (45kHz); Plecotus auritus*	X1078 Youghal; Co. Waterford	Unknown	Unknown
Transects	*Myotis daubentonii;Myotis natterreri;Pipistrellus nathusii;Unidentified bat*	Start point W9980094400	Unknown	Unknown
Ad-hoc observations	*Pipistrellus pygmaeus*	X0474185121	09/07/2008	BATLAS 2010
Ad-hoc observations	*Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*	X0474876992	09/07/2008	BATLAS 2010
Ad-hoc observations	*Myotis daubentonii*	X0859595172	09/07/2008	BATLAS 2010
Ad-hoc observations	*Myotis daubentonii*	X0495579991	09/07/2008	BATLAS 2010

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 (SNH, 2019). Therefore, range maps presented in the 2019 Article 17 Reports (NWPS, 2019) were reviewed in relation to the location of the proposed development.

The proposed development site is located outside the current range for Lesser horseshoe bat and, partially outside and on the edge of the range for Nathusius' pipistrelle, Whiskered bat and Brown L-long-eared bat within range but not at the edge 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 development site is situated outside the known range of this species. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs within a 10 km radius of the Study Area found no sites designated for the conservation of bats. One pNHA containing a bat roost was identified within 10km of the site boundary (Table 4-2).

Table 4-2 pNHAs with Known Bat Roosts

Site Code	Site Name	Results	Year	Distance from site boundary
000670	Bracken's Dwelling, near Whiteford	Nursery roost for Leisler's bat colony - located outside of the required survey distance from the proposed development site.	Unknown	4.5km

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 development site. In summary, the primary recent land use within the proposed development site is Commercial Forestry and Agriculture. A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the study area and a search of the National Monuments Database did not reveal the presence of any manmade subterranean sites within the study area. A search of the University of Bristol Speleological Society (UBSS) Cave Database for the Republic of Ireland found three caves within 10km of the site boundary (Table 4-3). A review of the NBDC bat landscape map provided a habitat suitability index of 22.67 (yellow) for the eastern envelope and 21 (green) for the western envelope. This indicates that the proposed development area has moderate and low respective habitat suitability for bat species.

Table 4-3 UBSS database results

Subterranean Site name and Location	Distance from Boundary	Location	Description
Poulnaharka Rising Co. Cork	4.4km	52.13930932, -8.030084866	40m to Sump
Dronana Cave	7.7km	52.10355394, -7.861939541	5m crawl to pool
Glenbeg Cave	9.8km	52.13930932, -8.030084866	30m Long

4.2.5 Other Wind Energy Developments

A review of the Irish Wind Energy Association (IWEA) map viewer found no wind developments within 10km of the site boundary. A search was also conducted of planning applications for wind farm developments (comprising two or more turbines) lodged within a 10km radius of the EIAR study area. These wind farms applications are based on a review of the Waterford County Council and Cork County Council Planning Register. Further details on other infrastructure developments can be found in Section 2.5.1 and Figure 2-2, Chapter 2 of the main EIAR.

4.3 Overview of Study Area and Bat Habitat Appraisal

The majority of the study area is dominated by plantation forestry, comprising mainly of Sitka spruce (*Picea sitchenis*) and Lodgepole pine (*Pinus contorta*) as well as large plantations of Eucalyptus (*Eucalyptus sp.*). The site is accessible via a network of existing forestry access tracks and forestry rides. The remainder of the wind farm infrastructure site is dominated by ***Improved agricultural grassland (GA1)*** and ***Arable crops (BC1)***. The grid connection route is also predominantly located within Improved agricultural grassland (GA1) and existing roads.

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 closed canopy forestry as well as exposed areas of agricultural land habitats were considered *Negligible* suitability, i.e. negligible habitat features on site likely to be used by commuting or foraging bats (Collins, 2016). Forestry edge, scrub and hedgerow/treeline habitats may provide greater foraging and commuting opportunities. These habitats within the study area are connected to the wider landscape by further adjacent forestry. As such, these habitats were classified as *Moderate* suitability, i.e. habitat connected to the wider landscape that could be used by bats for foraging and commuting (Collins, 2016).

Trees present within the proposed site are commercial coniferous species with *Negligible – Low* roosting potential.

4.4 Roost Surveys 2017, 2018 and 2019

Three built structures occur within the wind farm site. These are located within 200m of turbines T15 and T17. No trees with potential to support roosting bats were identified in the immediate vicinity of turbine locations.

All three structures were subject to internal inspections in April 2017, July 2018 and July 2019. The structure adjacent to T15 is a corrugated iron cattle shed. The two structures occurring in the vicinity of T17 comprise a dilapidated brick shed with a collapsed slate roof and a corrugated iron cattle shed. The two corrugated cattle sheds in the vicinity of T15 and T17 were not deemed to have any potential to support roosting bats and no roost emergence surveys were completed at these sheds. A roost emergence survey was completed at the dilapidated farm shed adjacent to T17 in July 2018 and again in July 2019. No evidence of bat use was recorded during the roost assessment.

4.5 Manual Transect Results 2017

A total of 144 bat registrations were recorded during the 2017 manual transect surveys. Of these 90 registrations (or 62% of all registrations) were assigned to Soprano pipistrelle; 24 registrations (or 17% of all registrations) were assigned to Common pipistrelle; 26 registrations (or 18% of all registrations) were assigned to Leisler's bat; and 4 registrations (or 3% of all registrations) were assigned to Myotis species. No Brown long-eared bat activity was recorded during the 2017 manual transects. Figure 3-5 and 3-6 show all registrations recorded during the 2017 manual transects (see 2017 surveys Methodology).

4.6 Static Detector Results 2017 and 2018

For 2017, the total bat passes came to 2,181 across the 226 nights of deployment. In general, Soprano pipistrelle (n= 931), Common pipistrelle (n=449) and Leisler's bat (n= 724) occurred most frequently,

while instances of *Myotis* spp. (n=51) and Brown long-eared bat (n=26) were significantly less. Plate 4-1 presents relative species composition across all ground-level static detector surveys in 2017.

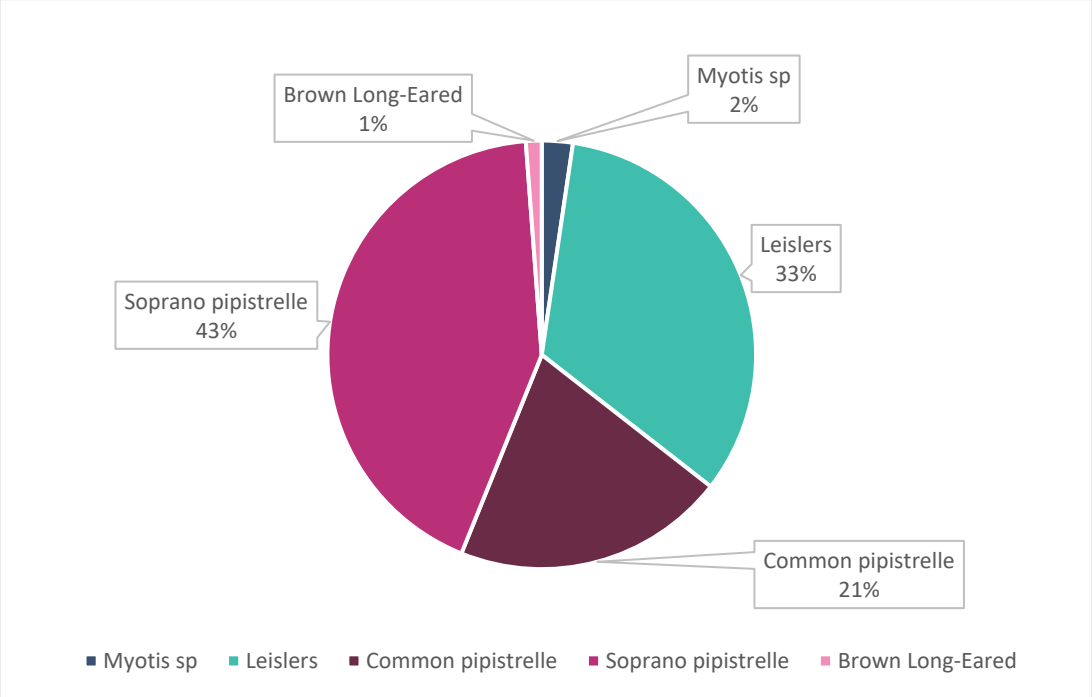


Plate 4-1 2017 species composition across the site

For 2018, the total bat passes came to 3,814 across the 43 nights deployment. In general, Soprano pipistrelle (n= 2,036), Common pipistrelle (n=839) and Leisler's bat (n= 594) occurred most frequently, while instances of *Myotis* spp. (n=268), Brown long-eared bat (n=77) were significantly less. Plate 4-2 presents relative species composition across all ground-level static detector surveys in 2018.

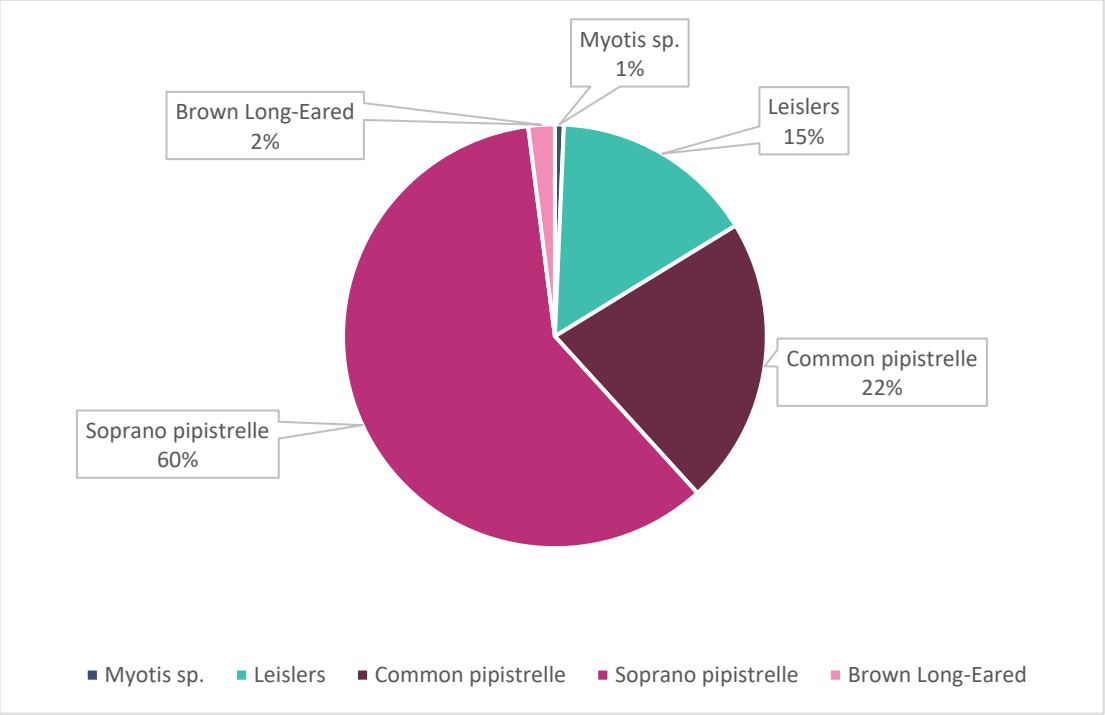


Plate 4-2 2018 species composition across the site

4.7 Manual Transects 2019

Manual transects were undertaken in Spring, Summer and Autumn 2019. Bat activity was recorded on all surveys.

A total of 141 bat registrations were recorded during the 2019 manual transect surveys. Of these 78 registrations (or 55% of all registrations) were assigned to Soprano pipistrelle; 32 registrations (or 24% of all registrations) were assigned to Common pipistrelle; 23 registrations (or 16% of all registrations) were assigned to Leisler's bat; 5 registrations (or 3% of all registrations) were assigned to Myotis species; and 3 registrations (or 2% of all registrations) were assigned to Brown long-eared (Plate 4-3). The results of the 2019 manual transect are presented in Figure 4-1 to 4-6.

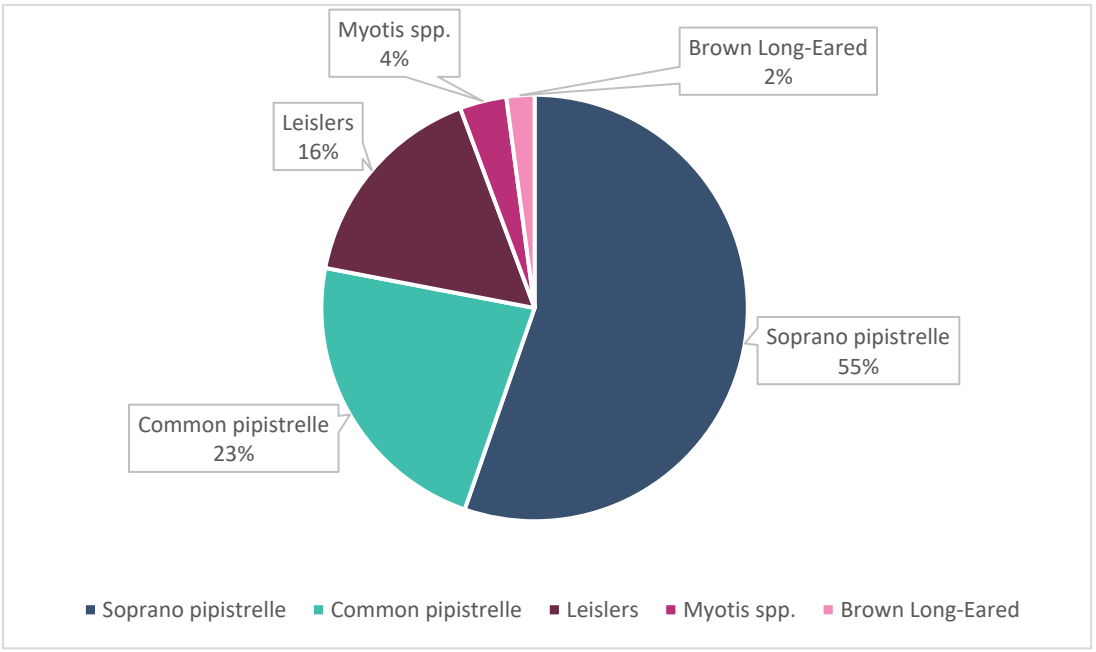
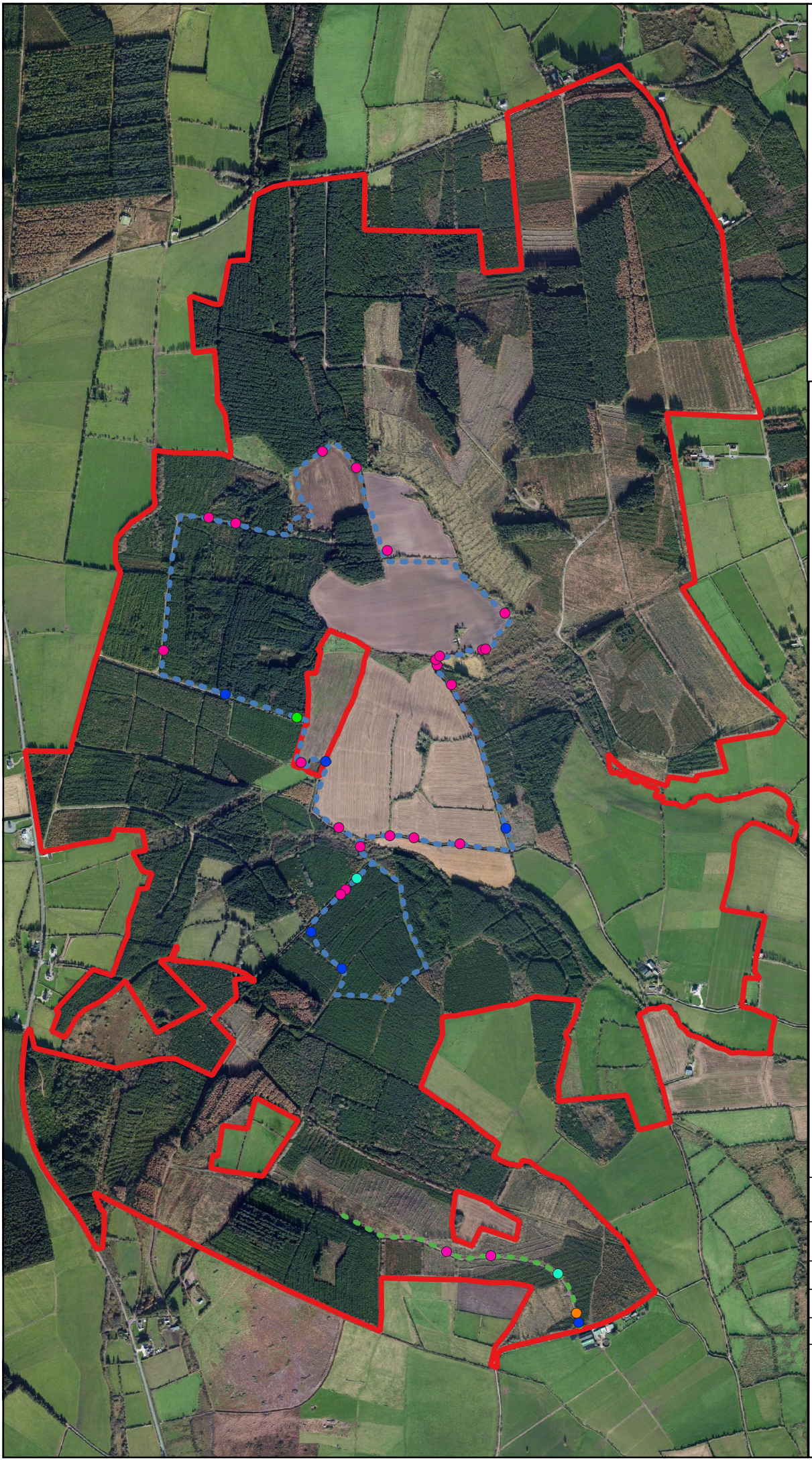


Plate 4-3 Species composition across 2019 manual transects



Map Legend

- Site Boundary
- 2019 Transect 1
- 2019 Transect 2
- 2019 Transect 3
- Brown long-eared
- Common pipistrelle
- Leislers
- Myotis Sp.
- Soprano pipistrelle

Drawing Title

Spring Manual transect survey 2019
Eastern Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 4-1
Scale	Date
1:15,500	30/10/2020

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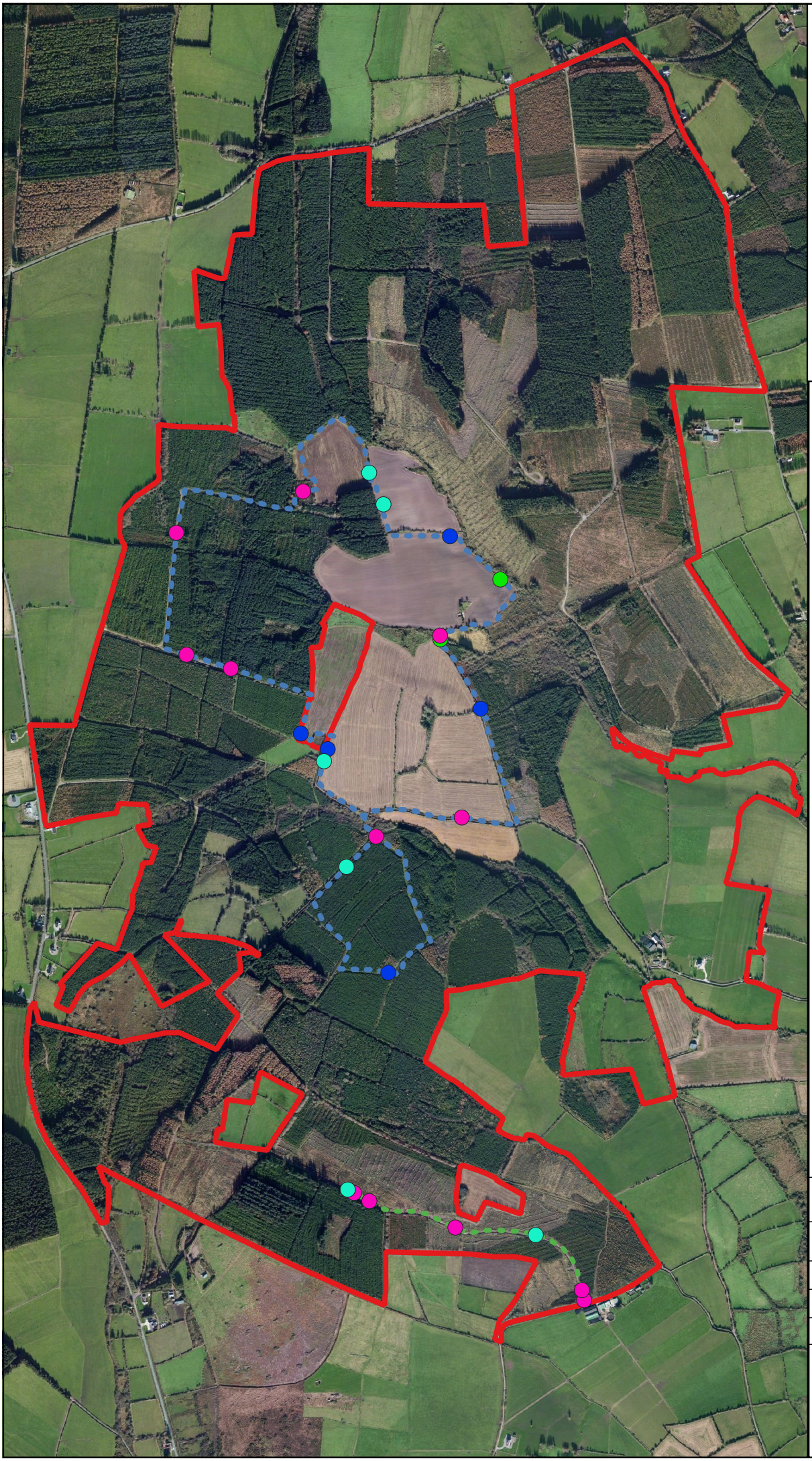

Map Legend

- Site Boundary
- 2019 Transect 1
- 2019 Transect 2
- 2019 Transect 3
- Brown long-eared
- Common pipistrelle
- Leislers
- Myotis Sp.
- Soprano pipistrelle

Drawing Title

Summer Manual transect survey 2019
Eastern Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 4-2
Scale	Date
1:15,500	30/10/2020

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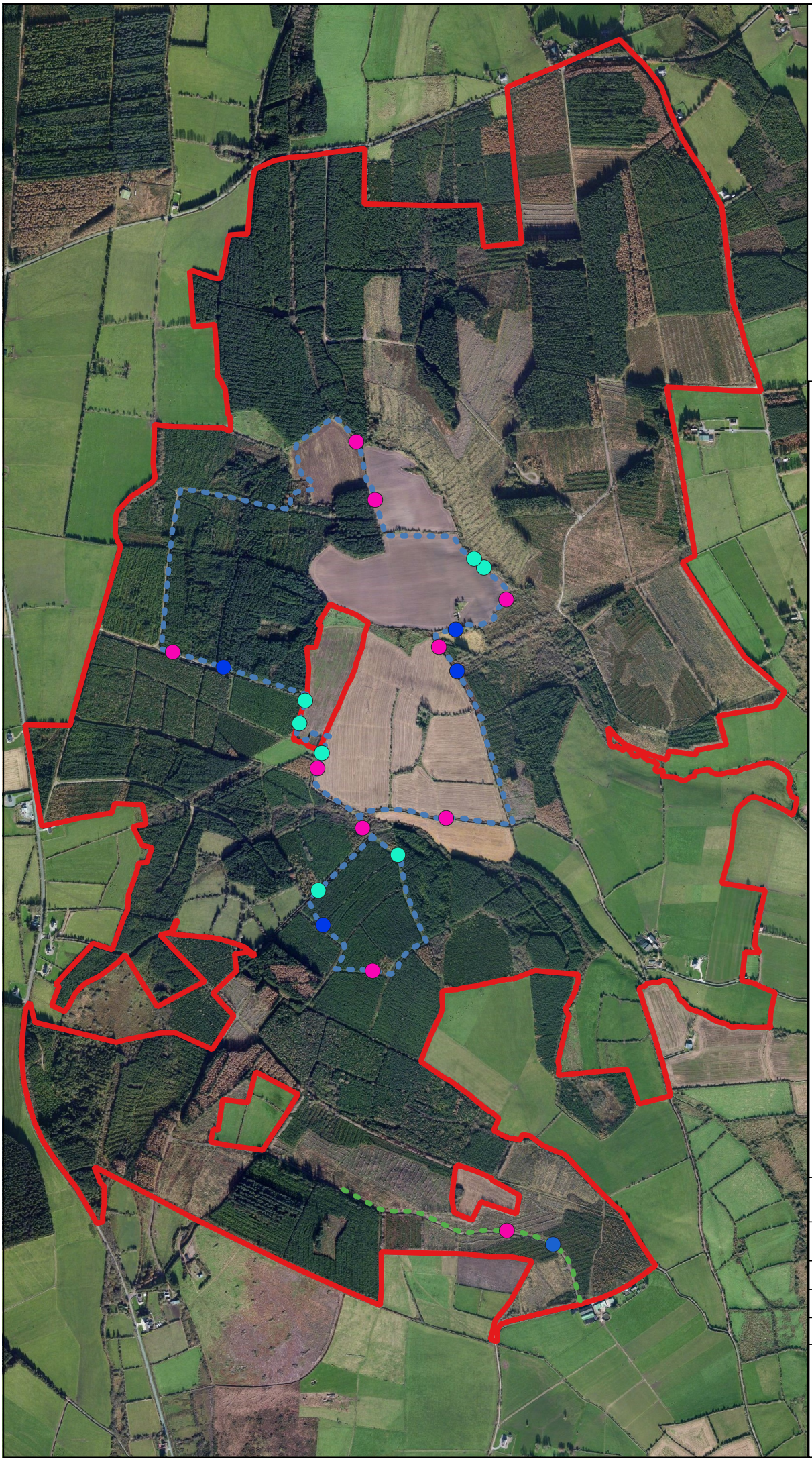

Map Legend

- Site Boundary
- 2019 Transect 1
- 2019 Transect 2
- 2019 Transect 3
- Brown long-eared
- Common pipistrelle
- Leislers
- Myotis Sp.
- Soprano pipistrelle

N

Drawing Title

Autumn Manual transect survey 2019
Eastern Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 4-3
Scale	Date
1:15,500	30/10/2020

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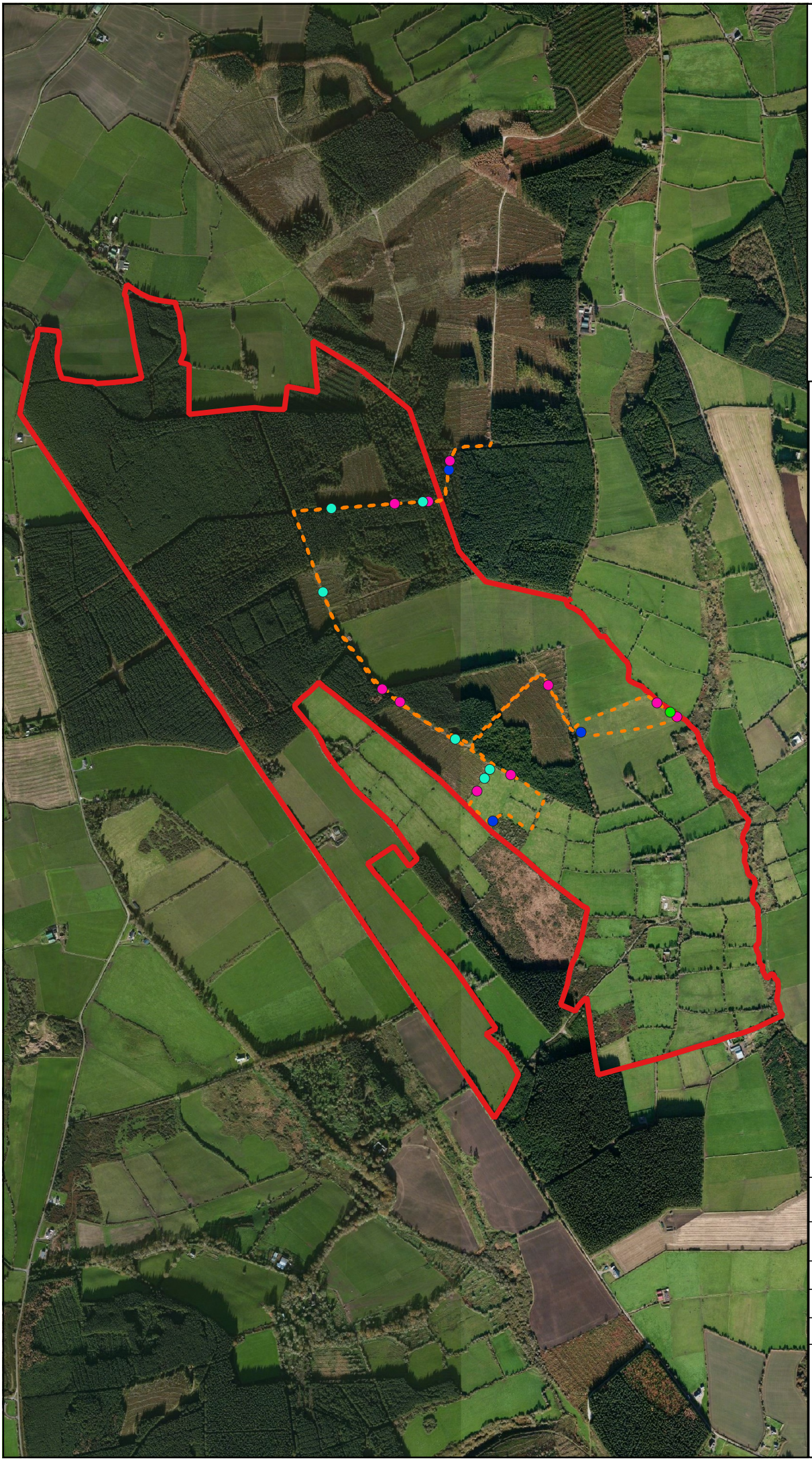

Map Legend

- Site Boundary
- 2019 Transect 1
- 2019 Transect 2
- 2019 Transect 3
- Brown long-eared
- Common pipistrelle
- Leislers
- Myotis Sp.
- Soprano pipistrelle

Drawing Title

Spring Manual transect survey 2019
Western Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 4-4
Scale	Date
1:15,500	30/10/2020

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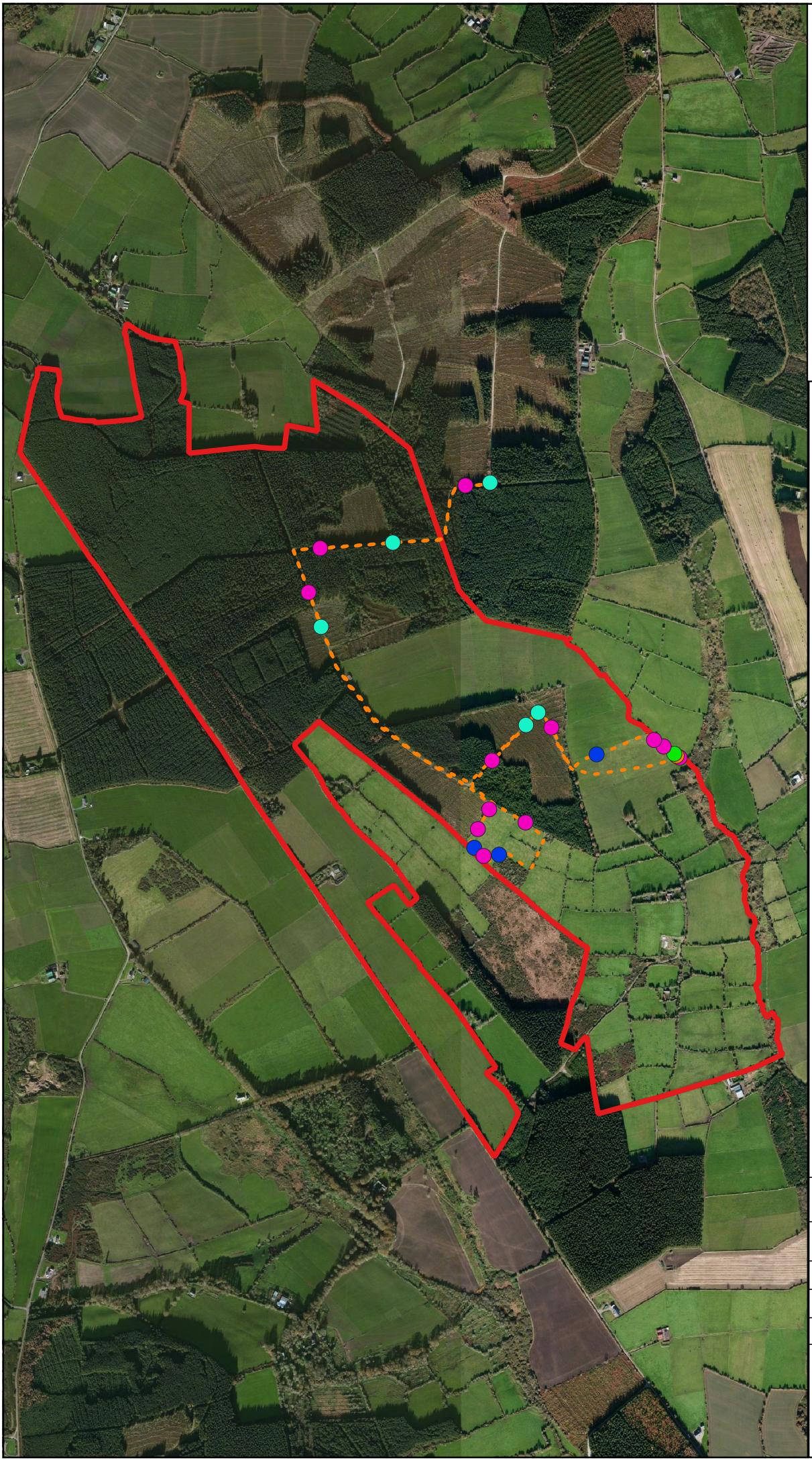

Map Legend

- Site Boundary
- 2019 Transect 1
- 2019 Transect 2
- 2019 Transect 3
- Brown long-eared
- Common pipistrelle
- Leislers
- Myotis Sp.
- Soprano pipistrelle

N

Drawing Title

Summer Manual transect survey 2019
Western Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 4-5
Scale	Date
1:15,500	30/10/2020

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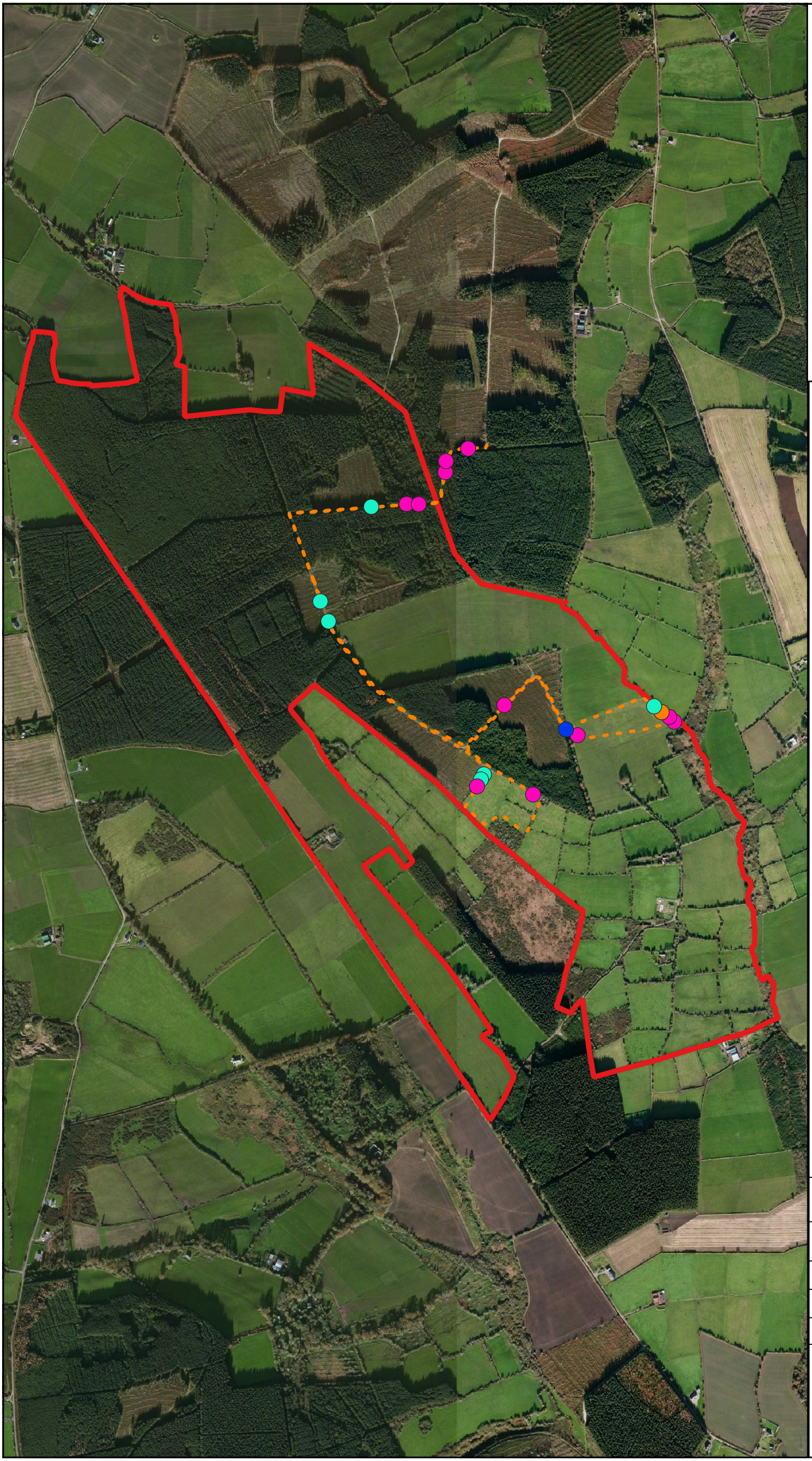

Map Legend

- Site Boundary
- 2019 Transect 1
- 2019 Transect 2
- 2019 Transect 3
- Brown long-eared
- Common pipistrelle
- Leislers
- Myotis Sp.
- Soprano pipistrelle

Drawing Title

Autumn Manual transect survey 2019
Western Envelope

Project Title

Lyrenacarriga Windfarm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 4-6
Scale	Date
1:15,500	30/10/2020

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4.8 Ground-level Static Surveys 2019

In total, 104,823 bat passes were recorded across all deployments. In general, Soprano pipistrelle (n= 49,598), Common pipistrelle and (n=32,378) Leisler's bat (n= 18,242) occurred most frequently, while instances of *Myotis* spp. (n=4188), Brown long-eared bat (n=408) and Nathusius' pipistrelle (n=9) were significantly less. Plate 4-4 presents relative species composition across all ground-level static detector surveys.

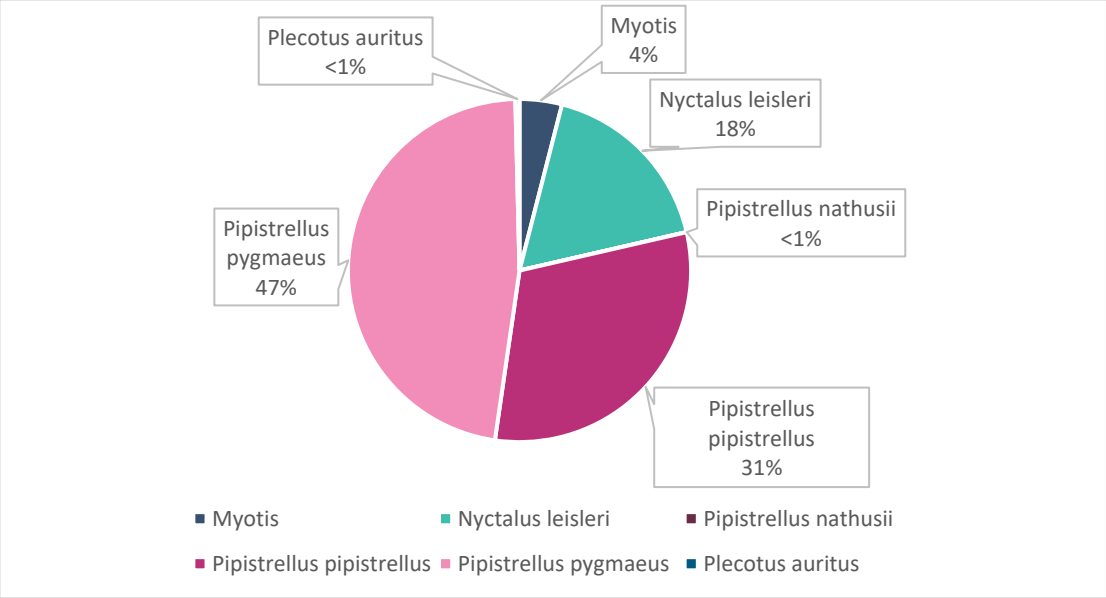

Plate 4-4 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

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 4-5 and Table 4-4 presents these results for each species. Bat activity was dominated by Soprano pipistrelle, Common pipistrelle, and Leisler's bat through all seasons. Instances of *Myotis* spp. were less frequent and Brown long-eared bat and Nathusius' pipistrelle were relatively rare.

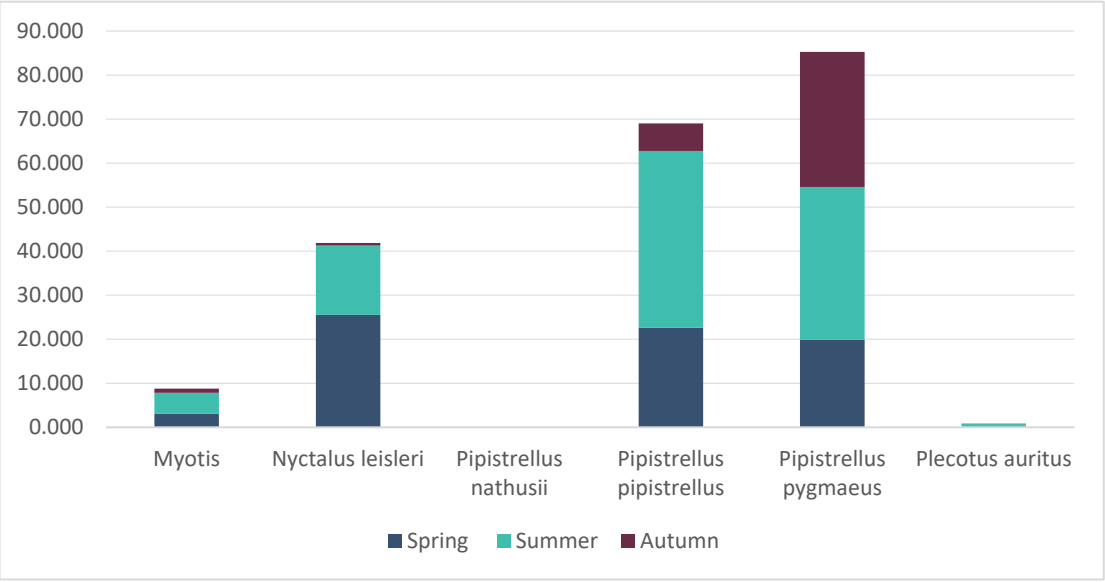

Plate 4-5 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

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

	Spring	Summer	Autumn
Total survey hours	427.5	433.7	849.2
Myotis spp.	3.111	4.724	0.953
Leisler's bat	25.558	15.727	0.583
Nathusius' pipistrelle	0.005	0.005	0.006
Common pipistrelle	22.648	40.118	6.238
Soprano pipistrelle	19.904	34.674	30.677
Brown long-eared bat	0.105	0.627	0.107

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the proposed site. Activity was variable between survey nights. Therefore, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). Plate 4-6 illustrates the median Nightly Pass Rate per species per deployment. Zero data, when a species was not detected on a night, was also included.

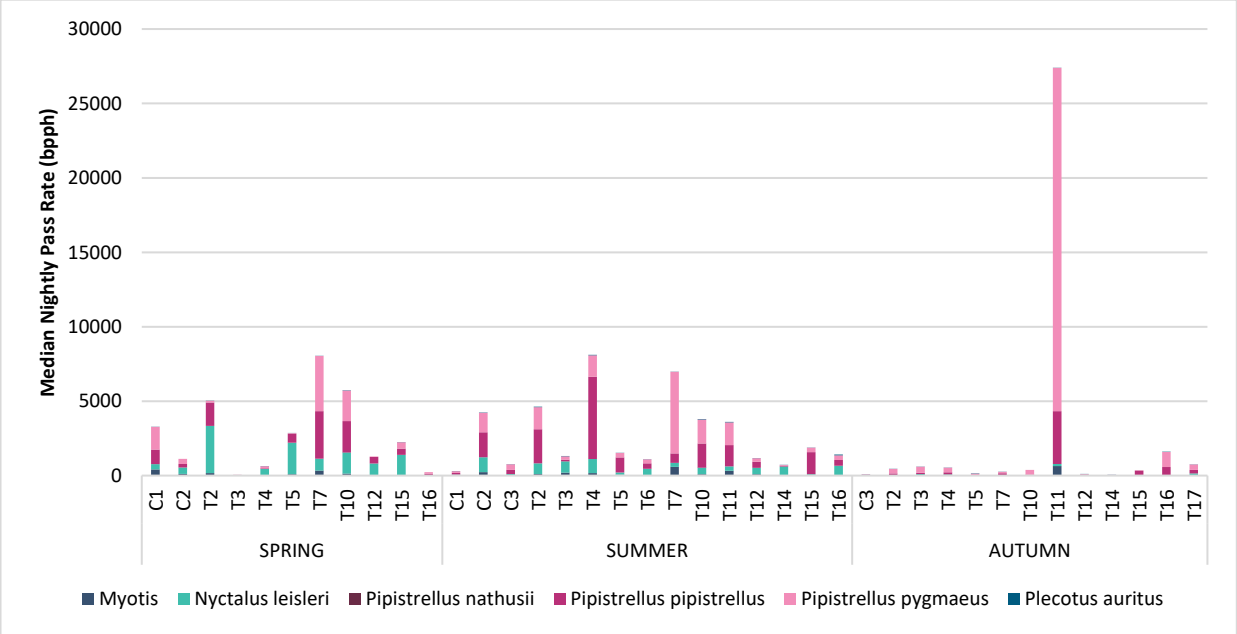

Plate 4-6 Static Detector Surveys: Median Nightly Pass Rate (Bat Passes Per Hour) Including Absences, Per Location Per Survey Period.

Leisler's bat was the most recorded bat during the spring period. Common pipistrelle was the most recorded during the summer. Overall highest activity was during the summer period over all other deployments; however, the soprano pipistrelle was the most recorded species in spring and most recorded species overall. Leisler's bat activity decreased significantly from spring (10,926 passes) to summer (6,821 passes) to autumn (495 passes). Whereas Soprano pipistrelles significantly increased from spring (8,509 passes) to summer (17,399 passes) to autumn (26,051 passes). Common pipistrelle, Myotis spp. and Brown long-eared bat had the highest proportion of bat passes during the summer period when compared to the spring and autumn periods for these species.

Bat detector T11 had a very high amount of bat passes during the autumn season. This may be due to a variety of reasons. For example, a small number of bats may be frequently using the area surrounding T11. The detectors were deployed for long periods of time and this may have caused an apparent spike in activity when compared to other detectors across the site.

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 4-5 presents the results of Ecobat analysis for each species per season on a site-level. **Appendix 3** provides these results per detector. Median activity levels for Common pipistrelle, Soprano pipistrelle and Leisler's bat peaked with ***Moderate to High*** during all seasons, except autumn for Leisler's bat which was Moderate. Median activity for *Myotis* spp. peaked at ***Moderate*** activity during spring and summer which, decrease to ***Low to Moderate*** for autumn. Brown long-eared bat and Nathusius' pipistrelle median activity peaked at ***Low-Moderate*** during nearly all seasons.

Peak activity was ***High*** for Common pipistrelle, Soprano pipistrelle, Leisler's bat and Myotis spp. across all seasons. Brown long-eared bat peaked at ***Moderate to High*** activity during summer and autumn. Nathusius' pipistrelle peaked at ***Moderate*** activity during the autumn period.

Table 4-5 Static Detector Surveys: Site-level Ecobat Analysis

Survey Period	Median Percentile	Median Bat Activity	Max Percentile	Max Bat Activity	Nights Recorded	Ref Range
Common pipistrelle						
Spring	75	Moderate - High	99	High	215	4062
Summer	77	Moderate - High	100	High	298	5159
Autumn	66	Moderate - High	100	High	210	2346
Soprano pipistrelle						
Spring	72	Moderate - High	99	High	198	3843
Summer	79	Moderate - High	100	High	286	4917
Autumn	73	Moderate - High	100	High	246	2399
Nathusius pipistrelle						
Spring	33	Low - Moderate	33	Low - Moderate	1	1146
Summer	23	Low - Moderate	23	Low - Moderate	2	1737
Autumn	32	Low - Moderate	52	Moderate	4	720
Leisler's bat						
Spring	74	Moderate - High	99	High	215	3350
Summer	70	Moderate - High	99	High	308	4004
Autumn	52	Moderate	88	High	145	1586
***Myotis* sp.**						
Spring	42	Moderate	93	High	138	3014
Summer	57	Moderate	93	High	232	3984
Autumn	32	Low - Moderate	98	High	116	2054
Brown long-eared bat						
Spring	18	Low	48	Moderate	30	1842
Summer	38	Low - Moderate	75	Moderate - High	117	2968
Autumn	32	Low - Moderate	66	Moderate - High	63	1512

4.9 Significance of Bat Population Recorded at the Site

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

All bat species in Ireland are protected under the Bonn Convention (1992), Bern Convention (1982) and the EU Habitats Directive (92/43/EEC). Additionally, in Ireland bat species are afforded further protection under the Birds and Natural Habitats Regulations (2011) and the Wildlife Acts 1976-2017. No bat roosts were identified within the footprint of the proposed development. Following the surveys undertaken and reported above, bats as an Ecological Receptor have been assigned ***Local Importance (Higher value)*** on the basis that the habitats within the study area are utilized by a regularly occurring bat population of Local Importance.

5. RISK AND IMPACT ASSESSMENT

As per SNH 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; and
- Displacement of individuals or populations.

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

5.1 Collision Mortality

5.1.1 Assessment of Site Risk

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

Table 5-1 Site-risk Level Determination for the Proposed Development Site (Adapted From SNH, 2019)

Criteria	Site-specific Evaluation	Site Assessment
Habitat Risk	A small number of potential roost features were identified within the site with no roosts identified during the surveys undertaken. However, the habitat has the potential to be used by foraging bats and is connected to the wider landscape by linear features such as scrub, tree lines and streams. The site does not provide an extensive and diverse habitat mosaic of high quality for foraging bats or meet any of the criteria of a high-risk site as set out in Table 3a of SNH 2019	Moderate
Project Size	Following the criteria set out in SNH 2019 the project is of Medium scale as it consists of 17 no. turbines. Whilst those turbines are over 100m in height, it is well below the number of turbines that would constitute a Large development (in the context of the SNH guidance) and there are no existing wind developments within 5km. (SNH 2019)	Medium
Site Risk Assessment (from criteria in Plate 3-5)		**Medium Site Risk (3)**

The site of the proposed development is in an area of commercial coniferous forestry Agricultural land. As per table 3a of the SNH Guidance (2019), it has been assigned a Medium habitat risk score. The proposed development includes 17 turbines of 150m in height. As per Table 3a, it is a medium project (17 turbines) but the turbines are greater than 100m in height and thus for the purposes of the assessment, it is considered to be a large project.

The cross tabulation of a large project on a medium risk site results in an overall risk score of **Medium** (SNH 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 SNH guidance (**Appendix 4** of this report), by a cross-tablature of the site risk level (i.e. Medium) and Ecobat bat activity outputs for each species. The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values). SNH recommends that the most appropriate activity level (i.e. median or maximum) be utilised to determine the overall risk assessment for a species.

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

- *Myotis* spp.
- Brown long-eared bat

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

5.1.2.1 Leisler's Bat

This site is within the current range of the Leisler's bat (NPWS, 2019). Leisler's bats are classed as a rarer species of a high population risk which have a high collision risk (Plate 3-6). Leisler's bats were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019) overall activity risk for Leisler's bat was found to be ***Medium*** at typical activity levels in Spring, Summer and Autumn. Peak activity levels were ***High*** in Spring, Summer and Autumn (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 a commercial forestry and agricultural land 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.

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

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Autumn		Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)

5.1.2.2 Soprano pipistrelle

This site is within the current range of the Soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelle are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-6). Soprano pipistrelle were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (SNH 2019) overall activity risk for Soprano pipistrelle was found to be ***Medium*** at typical activity levels and ***High*** at peak activity levels across all three seasons (See Table 5-3 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is a commercial forestry and agricultural land 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 Soprano pipistrelle.

Table 5-3 Soprano pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Autumn		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

5.1.2.3 Common pipistrelle

This site is within the current range of the Common pipistrelle bat (NPWS, 2019). Common pipistrelle are classed as a common species of a medium population risk which have a high collision risk (Plate 3-6). Common pipistrelle were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (SNH 2019); overall activity risk for Common pipistrelle at typical activity levels was found to be ***Medium*** *at typical activity levels and* ***High***. (See Table 5.6 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 a commercial forestry and agricultural land with low levels of bat activity recorded during the walked transects undertaken.

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

Table 5-4 Common pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Autumn		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

5.1.2.4 Nathusius' pipistrelle

This site is within the current range of the Nathusius' pipistrelle bat (NPWS, 2019). Nathusius' pipistrelle are classed as a rarest species of a High population risk which have a high collision risk (Plate 3-6). Nathusius' pipistrelle were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (SNH 2019); overall activity risk for Nathusius' pipistrelle at typical and peak activity levels was found to be ***Medium*** across all seasons. (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 a commercial forestry and agricultural land 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 Nathusius' pipistrelle.

Table 5-5 Nathusius' pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Low to Moderate (2)	Typical Risk is Medium (6)	Low to Moderate (2)	Typical Risk is Medium (6)
Summer		Low to Moderate (2)	Typical Risk is Medium (6)	Low to Moderate (2)	Typical Risk is Medium (6)
Autumn		Low to Moderate (2)	Typical Risk is Medium (6)	Moderate (3)	Typical Risk is Medium (9)

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 development is predominantly located within a commercial forestry, agricultural grasslands and linear landscape features such as hedgerows and treelines have been largely avoided.

To comply with SNH recommendations in relation to habitat buffering to avoid bat fatalities, there is a requirement to remove approximately 236m of hedgerow in proximity to Turbine 7 (Figure 5-1). While this loss is not significant as there is an extensive network of linear landscape features in the general area that will be fully retained, additional hedgerow/tree planting is proposed (See section 6.1.3). Consequently, there will be no significant habitat fragmentation, loss of commuting habitat or loss of foraging habitat associated with the buffering requirement.

In addition, the opening up of conifer forestry plantations to facilitate turbine construction will also result in a net gain in linear landscape features available for foraging and commuting bats.

No significant effects with regard to loss of commuting and foraging habitat are anticipated.

5.3 Loss of, or Damage to, Roosts

The development is predominantly located within commercial forestry and agricultural land. No bat roosts were recorded on site.

No roosting sites suitable for maternity colonies, swarming or hibernation will be impacted by the proposed development.

No significant effects with regard to loss of, or damage to, roosts are anticipated.

5.4 Displacement of Individuals or Populations

The development is predominantly located within a commercial forestry and agricultural land. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no significant displacement of individuals or populations is anticipated.

5.5 Habitats Along the Proposed Turbine Delivery Route

A short section of proposed site access track occurs to the south of the proposed wind farm development. This proposed access track is required to facilitate turbine delivery and is located within an agricultural grassland (GA1). Impacts are therefore restricted to improved agricultural grassland and an individual immature ash tree.

Map Legend

- Site Boundary
- Proposed Turbine Location
- Linear feature within felling buffer
- Felling Buffer

N

Drawing Title
Linear features to be felled at T7

Project Title
Lyrenacarriga Wind Farm

Drawn By	Checked By
LD	JH
Project No.	Drawing No.
170749	Figure 5-1
Scale	Date
1:50,000	29/10/2020

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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 and machinery will be turned off when not in use and all plant and equipment for use will comply with S.I. No. 632/2001 - European Communities (Noise Emission by Equipment For Use Outdoors) Regulations, 2001.

6.1.2 Lighting Restrictions

Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. This will be achieved using lighting accessories, such as hoods, cowls, louvers and shields, to direct the light to the intended area only.

6.1.3 Hedgerow Replanting

The proposed development will result in the loss of approximately 236 metres of hedgerow as a result of the proposed development. This is predominantly associated with the incorporation of mitigation for bats around each turbine in order to reduce or their occurrence in close proximity to the turbines, and ultimately avoid mortality.

In order to offset for the loss of hedgerow and treeline habitat to the proposed development (predominantly associated with bat mitigation measures), it is also proposed to plant 236 linear metres of new hedgerow within large areas of agricultural/arable lands to increase connectivity locally. The locations in which the proposed planting will be located will be subject to final landowner agreement. However, indicative areas for planting are proposed in Figure 7-13, Chapter 7 of the EIAR. The species composition will be similar to that in the surrounding landscape i.e. hawthorn, blackthorn and semi-mature native tree species. There will therefore be no net loss in hedgerow or treeline habitat. In addition, connectivity to the wider landscape will be maintained around turbines where hedgerows and treelines are retained.

6.1.4 Buffering

A 50m buffer from the blade tip to the nearest woodland, as recommended by the Natural England (2014) and SNH (2019) guidelines, shall be implemented at each turbine location with exception to T16. These vegetation-free areas will be maintained during the operational life of the development.

Turbine 16 is located in the Western envelope (Figure 6-1). There is approximately 80.2m of hedgerow located to the east of this turbine that falls within the felling buffer. This hedgerow is not proposed to be felled as it runs along the site boundary. In order to counter this potential risk, the turbine will be monitored post construction. monitoring will be completed in line with the post construction monitoring proposal for the site, as detailed in section 6.2.1 below.

Monitoring will be conducted in line with SNH guidelines and comprise of static monitoring at turbine bases and at nacelle level. Carcass searches, to monitor and record bat fatalities shall take place at each

turbine, see section 6.2 below. If the impact on the bat populations are deemed significant, a bespoke curtailment program will be implemented for this turbine.

The correct buffer distance must be measured from the blade tip sweep to the canopy of the nearest habitat feature. Measuring 50m from the base of the turbine to the habitat feature is inadequate as tall tree canopies may put bat populations at risk. 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)

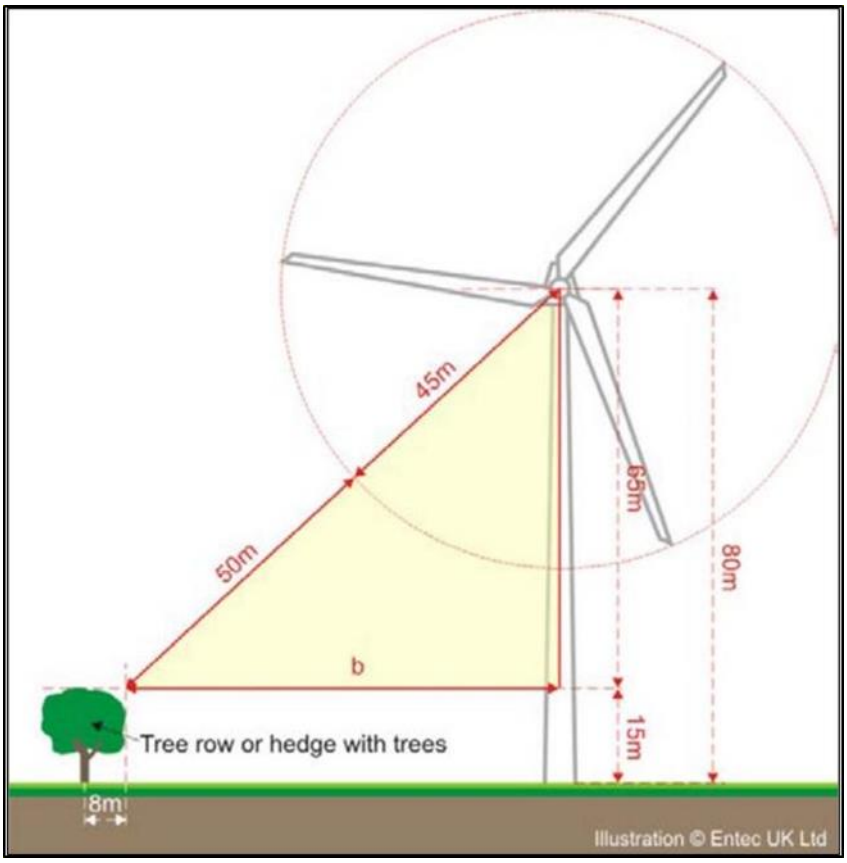

Plate 6-1 Calculate Buffer Distances (Natural England, 2014).

Map Legend

- Site Boundary
- Proposed Turbine Location
- Hedgerow to be monitored
- Felling Buffer

N

Drawing Title

Montoring hedgerow at T16

Project Title

Lyrenacarriga Wind Farm

Drawn By	Checked By
LD	PR
Project No.	Drawing No.
170749	Figure 6-1
Scale	Date
1:50,000	29/10/2020

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6.2 Site Specific Mitigation and Monitoring Programme

The site does not provide an extensive and diverse habitat mosaic of high quality for foraging bats or meet any of the criteria of a high-risk site as set out in Table 3a of SNH 2019. Overall risk levels for high collision risk bat species were typically found to be ***Medium***. This risk level is reflective of the nature of the site, which is a commercial forestry and agricultural land with low levels of bat activity recorded during the walked transects undertaken. Post-construction monitoring is normally only required at developments where the mitigation involves turbine curtailment (SNH, 2019). However, taking a precautionary approach and given that a high collision risk was determined at peak activity levels, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the SNH Guidance. The proposed monitoring strategy, coupled with the buffering and replanting outlined above, more than ensures compliance with SNH Guidelines.

6.2.1 Post Construction Monitoring Proposal and Assessment of Adaptive Mitigation Requirement

As per SNH Guidance, at least 3 years of post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity. For example, it may be that the construction of wind turbines significantly reduces bat activity at the site relative to that recorded pre-construction and to a level at which there is no longer potential for significant effects on bats (SNH 2019). It may also be concluded that the construction of the proposed development does not have an impact on bat activity patterns. Therefore, the results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements where deemed necessary, including curtailment, to ensure that there are no significant residual effects on bat species.

6.2.1.1 Operational Year 1

Static monitoring at turbine bases shall take place at each turbine during the bat activity season (between April and October). Full spectrum recording detectors shall be utilised for the same duration as during pre-application surveys and at the same density (SNH, 2019).

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, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with SNH 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. Calculating casualty rates across the site shall be done in accordance with the methods and formulas provided in Appendix 4 of the SNH Guidance.

At the end of Year 1, should a curtailment requirement be identified (i.e. significant bat fatalities encountered), a curtailment programme shall be deployed for identified key activity periods and weather parameters.

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

sophisticated form of curtailment, “blanket” curtailment, involves feathering the blades between dusk and dawn over the entire bat active period (April to October). A more sophisticated and efficient solution is to focus on certain times and dates, corresponding with those periods when the highest level of bat activity is expected to occur. Further efficiency can be achieved by programming the SCADA operating system to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

In order to minimise down time, the threshold values at which turbines are feathered should be site specific and informed by identified bat activity peaks at that location, but as an indication, they are likely to be in the range of wind speeds between 5.0 and 6.5m/s and at temperatures above approximately 10 or 11ºC measured at the nacelle. Significant savings can be achieved by so-called “smart“ curtailment over the other less sophisticated alternatives.

The effectiveness of 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.

6.2.1.2 Operational Years 2 and 3

Where a curtailment requirement is identified, monitoring surveys shall continue in Year 2 and 3, and the success of the curtailment strategy shall be assessed in line with the baseline data collected in the subsequent 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 curtailment programme shall be reviewed, and any identified efficiencies incorporated into the curtailment programme.

6.3 Residual Impacts

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

7. CONCLUSION

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

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

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APPENDIX 1

HABITAT SUITABILITY ASSESSMENT

Planning and Environmental Consultants

Bat Survey Report

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

Planning and Environmental Consultants

Bat Survey Report

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

ECOBAT PER DETECTOR RESULTS

Planning and Environmental Consultants

Bat Survey Report

Appendix 3 – Ecobat Per Detector Results 2019

Table of Contents

Summary tables are provided for each species recorded showing key metrics per detector per survey period.

LEISLER'S BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	10	3350	C1	82	High	91	High
Spring	11	3350	C2	82	High	93	High
Spring	15	3350	T2	93	High	99	High
Spring	42	3350	T3	42	Moderate	71	Moderate - High
Spring	7	3350	T4	63	Moderate - High	95	High
Spring	13	3350	T5	95	High	98	High
Spring	47	3350	T7	71	Moderate - High	86	High
Spring	48	3350	T10	70	Moderate - High	96	High
Spring	17	3350	T12	82	Moderate - High	96	High
Spring	27	3350	T15	72	Moderate - High	98	High
Spring	5	3350	T16	48	Moderate	73	Moderate - High
Summer	2	4004	C1	53	Moderate	67	Moderate - High
Summer	24	4004	C2	77	Moderate - High	99	High
Summer	5	4004	C3	63	Moderate - High	87	High
Summer	24	4004	T2	79	Moderate - High	97	High
Summer	177	4004	T3	79	Moderate - High	95	High
Summer	19	4004	T4	87	High	95	High
Summer	20	4004	T5	60	Moderate	80	Moderate - High
Summer	5	4004	T6	92	High	96	High
Summer	29	4004	T7	63	Moderate - High	86	High
Summer	26	4004	T10	74	Moderate - High	89	High
Summer	19	4004	T11	75	Moderate - High	87	High
Summer	36	4004	T12	65	Moderate - High	88	High
Summer	35	4004	T14	67	Moderate - High	94	High
Summer	9	4004	T15	52	Moderate	78	Moderate - High
Summer	38	4004	T16	64	Moderate - High	96	High
Autumn	1	1586	C3	32	Low - Moderate	32	Low - Moderate
Autumn	7	1586	T2	32	Low - Moderate	61	Moderate - High
Autumn	17	1586	T3	52	Moderate	86	High
Autumn	17	1586	T4	32	Low - Moderate	82	High
Autumn	2	1586	T5	42	Moderate	52	Moderate
Autumn	9	1586	T7	52	Moderate	61	Moderate - High
Autumn	2	1586	T10	66	Moderate - High	70	Moderate - High
Autumn	34	1586	T11	52	Moderate	88	High

LEISLER'S BAT							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Autumn	12	1586	T12	42	Moderate	66	Moderate - High
Autumn	9	1586	T14	52	Moderate	66	Moderate - High
Autumn	-	1586	T15	-	Nil	-	Nil
Autumn	8	1586	T16	32	Low - Moderate	84	High
Autumn	27	1586	T17	70	Moderate - High	84	High

SOPRANO PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	10	3843	C1	94	High	98	High
Spring	11	3843	C2	70	Moderate - High	93	High
Spring	11	3843	T2	61	Moderate - High	78	Moderate - High
Spring	-	3843	T3	-	Nil	-	Nil
Spring	11	3843	T4	65	Moderate - High	85	High
Spring	9	3843	T5	42	Moderate	70	Moderate - High
Spring	49	3843	T7	84	High	99	High
Spring	79	3843	T10	79	Moderate - High	95	High
Spring	8	3843	T12	38	Low Moderate	77	Moderate - High
Spring	28	3843	T15	50	Moderate	95	High
Spring	6	3843	T16	67	Moderate - High	89	High
Summer	2	4917	C1	87	High	93	High
Summer	24	4917	C2	85	High	96	High
Summer	7	4917	C3	57	Moderate	97	High
Summer	24	4917	T2	87	High	98	High
Summer	16	4917	T3	66	Moderate - High	90	High
Summer	18	4917	T4	87	High	98	High
Summer	21	4917	T5	71	Moderate - High	86	High
Summer	5	4917	T6	89	High	94	High
Summer	32	4917	T7	90	High	100	High
Summer	26	4917	T10	86	High	98	High
Summer	20	4917	T11	91	High	95	High
Summer	28	4917	T12	46	Moderate	92	High
Summer	17	4917	T14	23	Low Moderate	57	Moderate
Summer	10	4917	T15	81	High	93	High
Summer	36	4917	T16	57	Moderate	87	High
Autumn	3	2399	C3	80	Moderate - High	89	High
Autumn	13	2399	T2	84	High	95	High
Autumn	27	2399	T3	52	Moderate	97	High
Autumn	34	2399	T4	70	Moderate - High	90	High
Autumn	21	2399	T5	61	Moderate - High	81	High
Autumn	20	2399	T7	61	Moderate - High	89	High
Autumn	13	2399	T10	66	Moderate - High	97	High
Autumn	52	2399	T11	95	High	100	High
Autumn	12	2399	T12	52	Moderate	66	Moderate - High

SOPRANO PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Autumn	5	2399	T14	32	Low Moderate	52	Moderate
Autumn	3	2399	T15	52	Moderate	77	Moderate - High
Autumn	18	2399	T16	75	Moderate - High	98	High
Autumn	25	2399	T17	75	Moderate - High	94	High

COMMON PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	10	4062	C1	91	High	98	High
Spring	10	4062	C2	74	Moderate - High	89	High
Spring	14	4062	T2	89	High	97	High
Spring	1	4062	T3	18	Low	18	Low
Spring	12	4062	T4	38	Low -Moderate	68	Moderate - High
Spring	11	4062	T5	74	Moderate - High	98	High
Spring	49	4062	T7	76	Moderate - High	99	High
Spring	55	4062	T10	83	High	95	High
Spring	16	4062	T12	69	Moderate - High	91	High
Spring	30	4062	T15	62	Moderate - High	92	High
Spring	7	4062	T16	61	Moderate - High	82	High
Summer	2	5159	C1	77	Moderate - High	93	High
Summer	24	5159	C2	88	High	97	High
Summer	7	5159	C3	69	Moderate - High	95	High
Summer	24	5159	T2	88	High	99	High
Summer	14	5159	T3	66	Moderate - High	78	Moderate - High
Summer	19	5159	T4	96	High	100	High
Summer	24	5159	T5	75	Moderate - High	97	High
Summer	5	5159	T6	87	High	95	High
Summer	30	5159	T7	65	Moderate - High	94	High
Summer	26	5159	T10	87	High	97	High
Summer	20	5159	T11	87	High	99	High
Summer	32	5159	T12	65	Moderate - High	92	High
Summer	24	5159	T14	38	Low -Moderate	60	Moderate
Summer	10	5159	T15	95	High	98	High
Summer	37	5159	T16	67	Moderate - High	87	High
Autumn	3	2346	C3	81	High	88	High
Autumn	11	2346	T2	77	Moderate - High	91	High
Autumn	17	2346	T3	61	Moderate - High	90	High
Autumn	31	2346	T4	52	Moderate	90	High
Autumn	11	2346	T5	52	Moderate	80	High
Autumn	21	2346	T7	70	Moderate - High	91	High
Autumn	9	2346	T10	70	Moderate - High	82	High
Autumn	49	2346	T11	86	High	100	High
Autumn	8	2346	T12	52	Moderate	82	High

COMMON PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Autumn	5	2346	T14	61	Moderate - High	73	Moderate - High
Autumn	8	2346	T15	83	High	97	High
Autumn	16	2346	T16	74	Moderate - High	96	High
Autumn	21	2346	T17	66	Moderate - High	94	High

NATHUSIUS PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	-	-	C1	-	Nil	-	Nil
Spring	-	-	C2	-	Nil	-	Nil
Spring	-	-	T2	-	Nil	-	Nil
Spring	-	-	T3	-	Nil	-	Nil
Spring	-	-	T4	-	Nil	-	Nil
Spring	-	-	T5	-	Nil	-	Nil
Spring	-	-	T7	-	Nil	-	Nil
Spring	1	1146	T10	33	Low -Moderate	33	Low -Moderate
Spring	-	-	T12	-	Nil	-	Nil
Spring	-	-	T15	-	Nil	-	Nil
Spring	-	-	T16	-	Nil	-	Nil
Summer	-	-	C1	-	Nil	-	Nil
Summer	-	-	C2	-	Nil	-	Nil
Summer	-	-	C3	-	Nil	-	Nil
Summer	-	-	T2	-	Nil	-	Nil
Summer	1	1737	T3	23	Low -Moderate	23	Low -Moderate
Summer	-	-	T4	-	Nil	-	Nil
Summer	-	-	T5	-	Nil	-	Nil
Summer	-	-	T6	-	Nil	-	Nil
Summer	-	-	T7	-	Nil	-	Nil
Summer	1	1737	T10	23	Low -Moderate	23	Low -Moderate
Summer	-	-	T11	-	Nil	-	Nil
Summer	-	-	T12	-	Nil	-	Nil
Summer	-	-	T14	-	Nil	-	Nil
Summer	-	-	T15	-	Nil	-	Nil
Summer	-	-	T16	-	Nil	-	Nil
Autumn	-	-	C3	-	Nil	-	Nil
Autumn	-	-	T2	-	Nil	-	Nil
Autumn	1	720	T3	52	Moderate	52	Moderate
Autumn	3	720	T4	32	Low -Moderate	32	Low -Moderate
Autumn	-	-	T5	-	Nil	-	Nil
Autumn	-	-	T7	-	Nil	-	Nil
Autumn	-	-	T10	-	Nil	-	Nil
Autumn	-	-	T11	-	Nil	-	Nil
Autumn	-	-	T12	-	Nil	-	Nil

NATHUSIUS PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Autumn	-	-	T14	-	Nil	-	Nil
Autumn	-	-	T15	-	Nil	-	Nil
Autumn	-	-	T16	-	Nil	-	Nil
Autumn	-	-	T17	-	Nil	-	Nil

MYOTIS SPP.

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	10	3014	C1	82	High	93	High
Spring	10	3014	C2	67	Moderate - High	79	Moderate - High
Spring	14	3014	T2	61	Moderate - High	83	High
Spring	13	3014	T3	33	Low - Moderate	56	Moderate
Spring	-	3014	T4	-	Nil	-	Nil
Spring	7	3014	T5	52	Moderate	83	High
Spring	8	3014	T7	52	Moderate	83	High
Spring	34	3014	T10	33	Low - Moderate	80	Moderate - High
Spring	-	3014	T12	-	Nil	-	Nil
Spring	11	3014	T15	33	Low - Moderate	42	Moderate
Spring	2	3014	T16	18	Low	18	Low
Summer	2	3984	C1	90	High	91	High
Summer	2	3984	C2	78	Moderate - High	88	High
Summer	4	3984	C3	70	Moderate - High	74	Moderate - High
Summer	23	3984	T2	52	Moderate	75	Moderate - High
Summer	14	3984	T3	55	Moderate	90	High
Summer	18	3984	T4	65	Moderate - High	83	High
Summer	18	3984	T5	46	Moderate	67	Moderate - High
Summer	5	3984	T6	60	Moderate	70	Moderate - High
Summer	28	3984	T7	62	Moderate - High	93	High
Summer	20	3984	T10	65	Moderate - High	83	High
Summer	20	3984	T11	72	Moderate - High	91	High
Summer	22	3984	T12	38	Low - Moderate	82	High
Summer	7	3984	T14	23	Low - Moderate	23	Low - Moderate
Summer	8	3984	T15	49	Moderate	52	Moderate
Summer	21	3984	T16	23	Low - Moderate	57	Moderate
Autumn	2	2054	C3	49	Moderate	66	Moderate - High
Autumn	7	2054	T2	52	Moderate	73	Moderate - High
Autumn	17	2054	T3	32	Low - Moderate	61	Moderate - High
Autumn	19	2054	T4	52	Moderate	70	Moderate - High
Autumn	6	2054	T5	32	Low - Moderate	61	Moderate - High
Autumn	6	2054	T7	32	Low - Moderate	61	Moderate - High
Autumn	8	2054	T10	32	Low - Moderate	32	Low - Moderate
Autumn	24	2054	T11	66	Moderate - High	98	High
Autumn	10	2054	T12	32	Low - Moderate	85	High

MYOTIS SPP.							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Autumn	2	2054	T14	32	Low - Moderate	32	Low - Moderate
Autumn	-	2054	T15	-	Nil	-	Nil
Autumn	7	2054	T16	32	Low - Moderate	66	Moderate - High
Autumn	8	2054	T17	32	Low - Moderate	70	Moderate - High

BROWN LONG-EARED BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	6	1842	C1	26	Low - Moderate	48	Moderate
Spring	-	1842	C2	-	Nil	-	Nil
Spring	2	1842	T2	18	Low	18	Low
Spring	-	1842	T3	-	Nil	-	Nil
Spring	1	1842	T4	18	Low	18	Low
Spring	1	1842	T5	18	Low	18	Low
Spring	1	1842	T7	33	Low - Moderate	33	Low - Moderate
Spring	17	1842	T10	18	Low	33	Low - Moderate
Spring	-	1842	T12	-	Nil	-	Nil
Spring	2	1842	T15	18	Low	18	Low
Spring	-	1842	T16	-	Nil	-	Nil
Summer	1	2968	C1	23	Low - Moderate	23	Low - Moderate
Summer	7	2968	C2	38	Low - Moderate	60	Moderate
Summer	1	2968	C3	23	Low - Moderate	23	Low - Moderate
Summer	13	2968	T2	38	Low - Moderate	65	Moderate - High
Summer	10	2968	T3	38	Low - Moderate	60	Moderate
Summer	11	2968	T4	38	Low - Moderate	75	Moderate - High
Summer	4	2968	T5	23	Low - Moderate	38	Low - Moderate
Summer	3	2968	T6	23	Low - Moderate	23	Low - Moderate
Summer	8	2968	T7	23	Low - Moderate	52	Moderate
Summer	14	2968	T10	42	Moderate	65	
Summer	15	2968	T11	23	Low - Moderate	57	Moderate
Summer	5	2968	T12	23	Low - Moderate	52	Moderate
Summer	3	2968	T14	38	Low - Moderate	46	Moderate
Summer	5	2968	T15	38	Low - Moderate	52	Moderate
Summer	17	2968	T16	38	Low - Moderate	63	Moderate - High
Autumn	1	1512	C3	32	Low - Moderate	32	Low - Moderate
Autumn	9	1512	T2	52	Moderate	61	Moderate - High
Autumn	8	1512	T3	32	Low - Moderate	66	Moderate - High
Autumn	4	1512	T4	32	Low - Moderate	52	Moderate
Autumn	8	1512	T5	42	Moderate	61	Moderate - High
Autumn	1	1512	T7	32	Low - Moderate	32	Low - Moderate
Autumn	-	1512	T10	-	Nil	-	Nil
Autumn	5	1512	T11	32	Low - Moderate	52	Moderate
Autumn	7	1512	T12	32	Low - Moderate	52	Moderate

BROWN LONG-EARED BAT							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Autumn	5	1512	T14	32	Low - Moderate	52	Moderate
Autumn	-	1512	T15	-	Nil	-	Nil
Autumn	10	1512	T16	32	Low - Moderate	61	Moderate - High
Autumn	5	1512	T17	32	Low - Moderate	52	Moderate

APPENDIX 4

OVERALL RISK ASSESSMENT

Planning and Environmental Consultants

Bat Survey Report

Appendix 4 – 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).