Appendix 6-3

Bat Report (2020)

Malachy Walsh and Partners
Engineering and Environmental Consultants

Bat Survey Report 2020

Shronowen Wind Farm

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1 SUMMARY

- Passive automated bat surveys were conducted at the site of a proposed wind farm development near Ballylongford, County Kerry, during the spring, summer, and autumn of 2020.

- The surveys, which were designed to passively sample and record bat activity at 10 pre-selected sampling points (SP), were carried out on 10 consecutive nights during each season. The surveys were conducted to supplement surveys conducted in 2019 and to increase the data set upon which bat impact assessments would be based.

- The following species were recorded within the proposed wind farm site:

    - Brown long-eared bat (*Plecotus auritus*) (0.2%).[1]
    - Common pipistrelle (*Pipistrellus pipistrellus*) (47.3%).
    - Leisler's bat (*Nyctalus leisleri*) (7.5%).
    - Soprano pipistrelle (*Pipistrellus pygmaeus*) (28.9%)
    - Species from the genus *Myotis* were also recorded (0.5%).

- As had been the case in 2019 lesser horseshoe bat (*Rhinolophus hipposideros*) and Nathusius' pipistrelle (*Pipistrellus nathusii*) were not recorded.

- The number of bat calls recorded in spring comprises 58.89% of the total; summer comprises 10.91% and autumn 30.20%.

- Notwithstanding that bats were recorded at all SPs during each season[2], due to the relatively homogeneous topographical and ecological characteristics of the site, the wind farm site is not considered to have any value as roosting habitat and is of low/moderate value as foraging habitat.

- The levels of activity recorded, even at the highest recorded levels, were extremely low and it is concluded that the activity levels recorded are reflective of the normal patterns that pertain at the location.

- The levels of activity recorded were consistent with the Bat Habitat Suitability Index[3] ratings for the site and its surrounds.

- Considering the habitat and development related features of the proposed wind farm and the levels of activity recorded it is concluded that the site is assessed as being intrinsically 'Low' risk and the proposed development should not pose a significant risk to any species of bat.

- The conclusions of this report are consistent with those presented in the report on the 2019 bat surveys.

[1] % of total number of bat calls recorded.

[2] See **Section 8.1** for detail on non-activation of unit at SP3 during spring survey.

[3] See **Section 8.2.1.2**

2 INTRODUCTION

Malachy Walsh and Partners were commissioned by Shronowen Wind Farm Limited Ltd., to conduct seasonal bat surveys during the spring, summer, and autumn of 2020, at the location of a proposed wind farm development at Shronowen Bog near Ballylongford, County Kerry. (Irish Grid Co-ordinates: R 00498 40715). The proposed wind farm development site is illustrated in **Figure 1**, below.

Figure 1: Site Location with Development Area boundary in red.

3 COMPETENCY OF ASSESSOR

This report was prepared by Patrick Ryan (BSc Hons, Wildlife Biology), staff ecologist with Malachy Walsh and Partners. He has 10 years' experience in designing, managing and analysing bat activity surveys and has a particular expertise in sonogram analysis. During 2020 he designed and carried out SNH (2019) compliant bat surveys at 10 proposed wind farm development sites which comprised a combined total of 64 sampling points and carried out sonogram and data analysis for each. He has completed numerous ecological assessments for a variety of projects, including wind farm proposals, and is an experienced ecologist with a diverse professional profile spanning the required skills, knowledge, competencies and areas of expertise.

The report has been reviewed by Muiréad Kelly (MSc. BSc.), Senior Ecologist, with Malachy Walsh and Partners. Muiréad has 9 years' experience in ecological surveys and impact assessment for EIA and AA and has authored and contributed to numerous Natura Impact Statements and Ecological Impact Assessments for renewable energy projects.

4 SCIENTIFIC NOMENCLATURE: CONVENTIONS

Species nomenclature follows the standard form of common name, followed by the binomial, on first instance of usage in the text or first instance of usage in a table. Thereafter, for any subsequent usage, common names only are used.

5 BRIEF DESCRIPTION OF THE DEVELOPMENT SITE

The site largely comprises cut over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 2** for Corine Landcover)[4]. The topography of the site is essentially flat, albeit, with the slight peat dome that is a characteristic of the lowland bog type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition. The southern boundary of the proposed development site is situated in close proximity to a 1st order tributary of the Galey River[5] which drains to the River Feale; the Ballyline River drains from the northern part of the site to the inner reaches of Ballylongford Bay[6] and the Coolkeragh, a tributary of the Ballyline, drains northward adjacent to the development boundary in the western part of the site.

Turbary rights pertain and much of the original peat mass has been removed. While a large central area remains relatively uncut, an extensive network of drains intersects the site. The effect of these has been the progressive lowering of the water table across the site over time and the resulting sustained drying out of the peat mass. Because the water table is the key determinant of aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog. A significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked.

While the dominant current practice is removal of peat by excavator to a hopper, from which the peat is then extruded (see **Drone Flown Image 1**, below), there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 2**, below). **Aerial Image 1**, below, illustrates the extent to which, over time, the peat mass has been removed progressively, and incrementally, from the edge of the bog to the interior area of the peat mass.

[4] Areas of bog are shown in purple, forestry in green and pastureland is shown in yellow.

[5] Part of the Lower River Shannon SAC (002165)

[6] Within the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077)

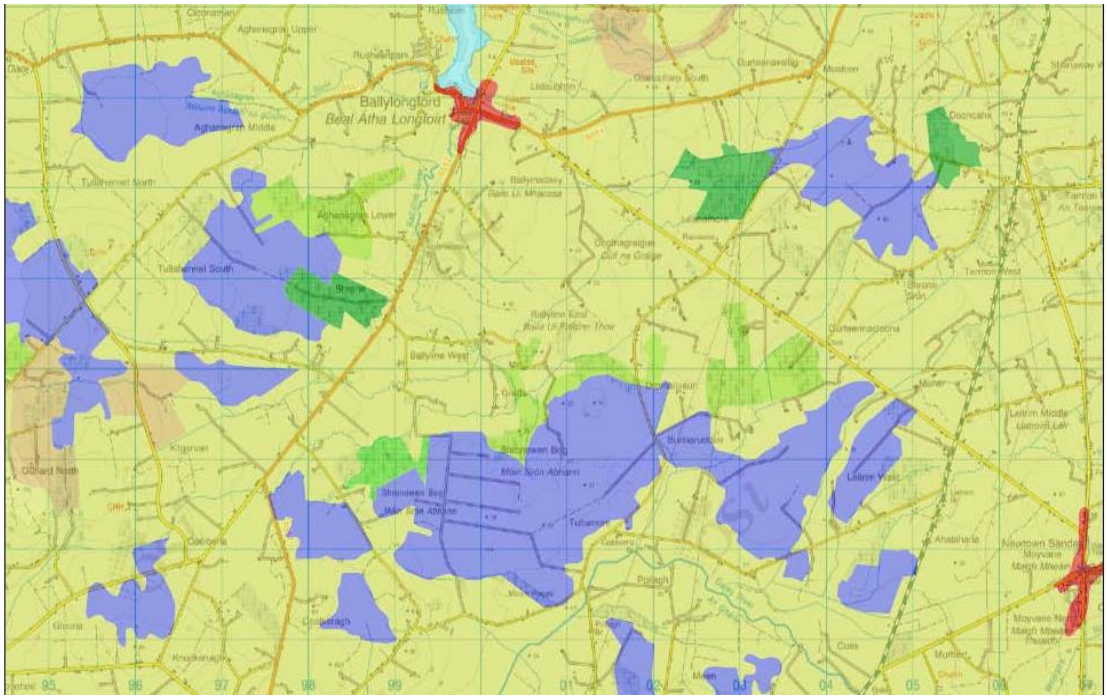
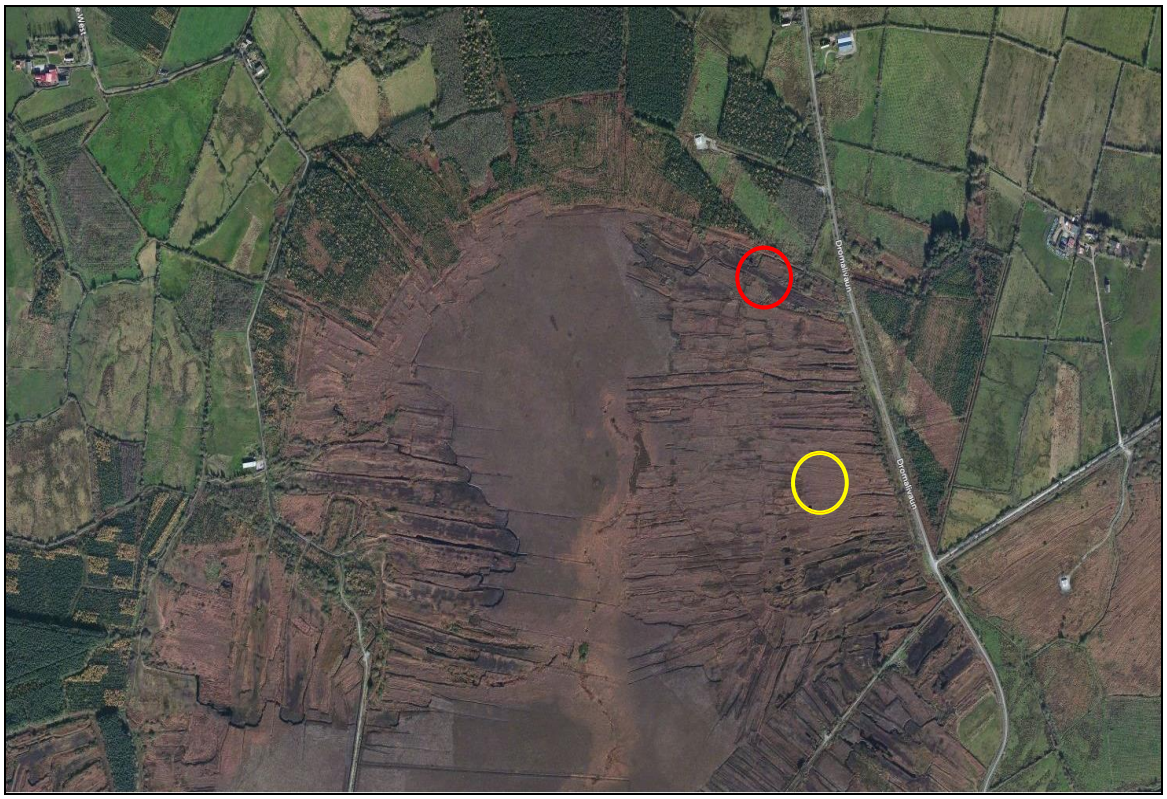


Figure 2: Corine Landcover (2006) [from http://maps.biodiversityireland.ie/#/Map]



Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (parallel 'scars' aligned left to right)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of purple moor-grass (*Molinia caerulea*). While ling heather (*Erica cinerea*) and bell heather (*Calluna vulgaris*) are present, surveys determined that heather is not a significant component in the overall plant cover. A few isolated tree lines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog and in the interface areas between the agricultural and

commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

Apart from some localised ponding of water, in some of the lower lying peat banks, no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[7].However, those that are present are likely to support amphibians; frog spawn was noted at several locations along roadside drains and in small pools. While stands of bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse. Gorse (*Ulex* spp.) is present and locally abundant along track sides.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities but also in the variety of insect species. The plant communities present comprise low-growing, open vegetation with low plant species richness that lacks the variety and complexity required for high macro-invertebrate productivity and the site lacks the characteristics synonymous with high value foraging, roosting, or breeding habitats for any bat species.

The proposed turbine layout comprises 12 turbines that are distributed in an area that is largely homogenous in terms of its habitat composition and undifferentiated in terms of its potential value to bats. With the exception of SP6 and SP9 (see **Figure 3**, and **Table 12**, **Section 8.4.2**) there is little in the way of variation in terms of topography, exposure or proximity to, or availability of, biodiversity rich areas capable of supporting high levels of insect prey biomass and, as outlined, previously, the site generally lacks the ecological and landscape characteristics synonymous with high levels of bat activity.

6 PURPOSE OF THE SURVEYS

The surveys were undertaken to establish the extent of bat activity at the proposed wind farm site during 2020 and the results of the survey, outlined in this report, will, in conjunction with the results of the 2019 survey, form the basis for the assessments of the potential impacts on bat species when the proposed wind farm is submitted for assessment under the planning consent process.

6.1 SCOPE OF THE SURVEYS

The surveys were carried out in compliance with SNH (2019)[8] which stipulates that pre application surveys should take place over a full season of bat activity.

Further details on the survey design are provided in **Section 8.4**, below and the results are presented in **Section 9**, below.

[7] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

[8] The publication replaces the previous guidance on the subject: Mitchell-Jones *et al.* (2014) and Hundt (2012) and tailors the generic Eurobats guidance (Rodrigues *et al.*, 2014) to the UK.

6.1.1 Static Surveys

10 bioacoustic recorders were deployed as follows:

- Spring: 1/5/2020 to 10/5/2020
- Summer: 16/7/2020 to 25/7/2020
- Autumn: 20/8/2020 to 29/8/2020

The locations where the bioacoustic units were deployed are illustrated in **Figure 3**, below, and are described in **Table 12**, **Section 8.4.2**, below.

6.1.2 Transect Surveys

Regarding transect surveys SNH (2019) notes that, while they

> *"can be used to complement the information gained from static detectors and other sources…* [t]*heir applicability is discretionary and site-specific."*

Transect surveys were not conducted.

7 BAT SPECIES IN IRELAND

7.1 RESIDENT SPECIES

There are 9 resident bat species on the island of Ireland. These species are:

- Brown long-eared bat
- Common pipistrelle
- Daubenton's bat (*Myotis daubentoni*)
- Leisler's bat
- Lesser horseshoe bat
- Nathusius' pipistrelle
- Natterer's bat (*Myotis nattereri*)
- Soprano pipistrelle
- Whiskered bat (*Myotis mystacinus*)

All are insectivores that feed on insects and use a seasonal feeding strategy to help build fat reserves during the summer and autumn, prior to their hibernation during winter - a time, generally, when insects are not available. Most hunt flying prey, but some species, e.g., lesser horseshoe bat or Daubenton's bat, glean their prey from surfaces of leaves or water on which the prey have alighted.

All hibernate during winter and typically become active in late spring and early summer. As the days and nights warm up each species flies out to forage for insects for progressively longer periods at night. Around late June or early July pregnant females give birth to a single young which feeds on its mother's milk for 6-7 weeks at which point it is able to fly and learns to echolocate and to catch its own prey. Mating takes place from August onwards; the female retains the sperm throughout the winter but does not ovulate and become pregnant until spring the following year. The onset of hibernation, which takes place from October/November onwards, begins once temperatures drop and insect prey abundance drops.

7.2 LEGAL AND CONSERVATION STATUS OF BAT SPECIES IN IRELAND

All Irish bat species are protected under the Wildlife Acts (1976 to 2018)[9] and by the Habitats Directive[10] which protects rare species, including bats, and their habitats. All bat species are listed in Annex IV of the Habitats Directive as species protected across their entire natural range and the lesser horseshoe bat is further listed, under Annex II, as a species for which core areas of their habitat must be protected within the Natura 2000 network of protected sites.

Across Europe bats are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Under Article 11 of the Habitats Directive, each member state is obliged to undertake surveillance of the conservation status of the natural habitats and species in the Annexes and, under Article 17, to report to the European Commission every six years on their status and on the implementation of the measures taken under the Directive. In April 2019, Ireland submitted the third assessment of conservation statuses for 59 habitats and 60 species. The current Conservation Status assessments for bat species resident in Ireland are listed in **Table 1**, below; the trend in the Conservation Status for each is included.

Table 1: Overall Assessment of Conservation Status for bat species resident in Ireland (NPWS, 2019)

Species	Overall assessment of Conservation Status	Overall trend in Conservation Status
Brown long-eared bat	Favourable (FV)	Improving
Common pipistrelle	Favourable (FV)	Improving
Daubenton's bat	Favourable (FV)	Improving
Leisler's bat	Favourable (FV)	Improving
Lesser horseshoe bat	Unfavourable-Inadequate (U1)	Deteriorating
Nathusius' pipistrelle	Unknown (X)	N/A
Natterer's bat	Favourable (FV)	Stable
Soprano pipistrelle	Favourable (FV)	Improving
Whiskered bat	Favourable (FV)	Stable

7.3 HABITAT ASSOCIATIONS

Bats in Ireland feed exclusively on insects and, in the summer, they generally emerge from their roosts at dusk to feed. While the distances covered while foraging varies considerably between individual species, all are known to use several different foraging sites in the same night and to move between them to locate areas of high insect density (in this regard see **Section 7.3.1**).

The interplay between habitat mix, environmental conditions, topography, elevation, and availability of prey is a key determinant of whether a location is suitable for bats as is the distance between

[9] Collective citation for the following: Wildlife Act 1976 (no. 39 of 1976); Wildlife (Amendment) Act 2000 (no. 38 of 2000); Wildlife (Amendment) Act 2010 (no. 19 of 2010); Wildlife (Amendment) Act 2012 (no. 29 of 2012) and Heritage Act 2018 (no. 15 of 2018), Part 3.

[10] Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora enacted in Ireland as European Communities (Birds and Natural Habitats) Regulations 2011-2015 (Collective citation for the following: S.I. No. 477 of 2011, S.I. No. 499 of 2013, S.I. No. 355/2015)

roosts and the location in question. Because bats preferentially select certain habitats and avoid others, each species has a strong association with different habitat types to which they exhibit a high level of site loyalty and will frequently return to the same foraging sites night after night (Entwhistle *et al.*, 2001). Because bats are colonial mammals, intergenerational learning is a fundamental characteristic of their biology and one that tends to reinforce site loyalty such that foraging grounds are frequented for periods of years or even decades. As was noted in **Section 7.1** juvenile bats hunt independently within weeks of birth and, therefore, acquire knowledge of foraging sites before their first hibernation period. Reliability of supply of prey biomass is foundational to each species' capacity to maintain populations at viable levels (in this regard see content on metabolic constraints in **Section 7.4**).

Table 2, below, lists and ranks, in order of precedence, the relative importance to bat species of certain landscape features that bats use as they roost, commute and hunt. They use hunting grounds - foraging habitats - to find food and commuting habitats to travel. Bog habitat of the type, which is dominant at the proposed development site, while used by foraging bats, is less favoured than other habitat types and is, generally, avoided by all Irish species (Lundy *et al.*, 2011).

Table 2: Landscape features of importance to bat species

Features of high importance	Features of medium importance	Features of low importance
Underground sites	Improved pasture	Intensive arable
Buildings with high bat roost potential	Drainage ditches	Dense urban, particularly lit areas
Broadleaved woodland and scrub	Walls and fences	
River valleys	Minor roads (no hedges)	
Small field systems with low intensity pasture	Exposed upland sites	
Tree lines and hedgerows	Coniferous woodland	
Bridges and structures with high bat roost potential		

(Adapted from the UK Department of Transport's Interim Advice Note 116/08 Nature Conservation Advice in Relation to Bats)[11]

7.3.1 Distribution of Prey

At any location the abundance of flying insects is heavily influenced by, *inter alia*, wind speed (Møller, 2013). Small insects generally tend to settle in areas with low wind speeds as control and manoeuvrability of flight is optimised where wind speeds are lower than the insect's flight speed (Pasek, 1988). Therefore, within any established foraging ground, existing windbreaks such as tree lines, vegetated field or roadside boundaries, and woodland edges create sheltered corridors where concentrations of insects accumulate leeward of these windbreaks particularly in comparison with adjacent unsheltered areas. Within these sheltered corridors the patterns of distribution will be affected by wind speed, angle of incidence of the wind, permeability of the windbreak, turbulence, vegetative composition, and source of insects (windbreak, local fields, upwind sites) (Pasek, 1988).

[11] Available at http://www.dft.gov.uk/ha/standards/ians/pdfs/ian116.pdf

7.4 METABOLIC CONSTRAINTS

Two fundamental behavioural characteristics impose a high metabolic cost on all bat species – flight and the use of acoustic signalling to navigate, hunt and communicate. As true fliers, rather than gliders, bats use flapping flight which is one of the most expensive activities in terms of metabolic cost (Winter *et al*., 1998); the metabolic costs of acoustic signalling are about eight times that of the silent animal (Ophir *et al.*, 2010), and the cost of echolocation can be even higher. As a group, therefore, bats have evolved to favour minimal mass because of the energetic demands of flight, hunting and communication.

The wing of a bat resembles a modified human hand with a flexible skin membrane that extends between each long finger bone and it is the many movable joints that make bats agile fliers. Because of the thin wing membrane, flying during the heat of the day could be hazardous causing excessive absorption of heat and resulting in dehydration and possible heat prostration. Nocturnality offers protection from the heat and helps bats maintain body temperature and moisture. It also affords protection from aerial predators most of which hunt during the day.

Even though they share the characteristics of all mammals - hair, regulated body temperature, the ability to bear their young alive, and to nurse them; bats are the only mammals to truly fly. Flying consumes so much energy that each female bat is only able to produce a single off-spring each year and a bat typically will need to consume about 1/3 of its own body weight in food per night; a common pipistrelle, for example, can eat over 3,000 insects in a single night. As insectivores, bats in Ireland feed on arthropods which contain the energy-rich carbohydrate chitin, which is indigestible for the typical mammalian gastrointestinal tract. However, European vespertilionid bat species have evolved an enzymatic adaptation (acidic mammalian chitinase) which enables them to digest the chitin present in their primary source of food to optimize resource use and energy intake (Strobel *et al.* 2013[12]).

This aspect of their ecology, this high metabolic demand, is a key determinant in the foraging strategies of all bat species. Speculative foraging carries too low a risk/reward ratio in that the metabolic cost of flight, and echolocation, are so high that bats will seek out locations that have previously rewarded energy cost inputs. This aspect of their behaviours is demonstrated by the previously mentioned high level of site loyalty exhibited by bat species and the repeated return to the same foraging sites night after night (Entwhistle *et al*., 2001). In addition, because the cost of flight increases with decreasing body size, de Jong (1994 cited in Erickson *et al*., 2003) hypothesized that smaller bats with slower flight could be restricted from using habitats where insect abundance was low and long-distance foraging flights were required. Strong winds can increase the cost of flight and can affect the net energy gain for foraging adults (Weimerskirch *et al*., 2012; cited in Møller, 2013).

Differences in activity on different nights could be the result of climatic conditions, insect availability or morphological differences between species. Cooler and windier nights tend to suppress flight activity of bats (Anthony *et al.*, 1981; O'Farrell, 1967; Stebbings, 1968; cited in Erickson *et al*., 2003) by imposing thermoregulatory stress and by reducing the activity of their insect prey.

[12]Strobel *et al.* (2013) included analyses of, *inter alia*: common pipistrelle, brown long-eared, Natterer's, Daubenton's and Leisler's bats all of which are vespertilionid bat species resident in Ireland.

7.5 AUDIO SIGNATURE

Because they have evolved to be active in the dark, bats use echolocation, a form of acoustic signalling for sensing the environment and to orientate and forage at night. It is these signals that were detected and recorded during the surveys described in this report. Echolocation involves the production of pulses of high frequency sound, usually in the ultrasound range above 20 kHz and the detection of the returning echoes with acutely sensitive ears. By comparing the outgoing pulse with the returning echoes — which are modified versions of the outgoing pulse — their brains can assemble dynamic images of the surroundings including the size, shape, distance, and motion of their prey the location of which can be determined, in three dimensions, from its range and direction (Jones, 2005).

Each species uses echolocation in an individualised manner adapted to its preferred habitat and flight behaviour. Species that fly high emit signals over a long range, i.e., long signals that sweep through a narrow spectrum, which enable them to retrieve information from long way ahead. Conversely species that hunt where obstacles are likely to be quite near do not need to emit intense pulses because of proximity.

7.6 SPECIES DETECTABILITY

The detectability of a species depends mainly on 2 factors:

- the abundance of the species and its ubiquity in the area surveyed;
- the intensity of its echolocation signals.

As a result, the probability of acoustic detection varies from species to species and this probability is also influenced by the acuity of the microphones in the units used for detection. Each species' Intensity of emission is characterised in **Table 3**, below; the detection range is included.

Table 3: Intensity of emission and detection range (open to semi-open environment)

Intensity of emission	Species	Detection range (m)
Very weak	Daubenton's bat	15
	Natterer's bat	15
	Lesser horseshoe bat	5
	Whiskered bat	10
Medium	Brown long-eared bat	20
	Common pipistrelle	25
	Nathusius' pipistrelle	25
	Soprano pipistrelle	25
Strong	No species in this category are resident in Ireland	N/A
Very strong	**Leisler's bat**	**80**

[Adapted from Barataud (2020)]

8 SURVEY METHODOLOGY

8.1 CONSTRAINTS

- Surveyors did not have permission to access any lands outside the client's control. However, this did not impose a significant constraint on sampling as these lands comprise, almost exclusively, agricultural grassland habitats and it is expected, in light of the methodologies

that were used, that the typical species associated with the proposed development site and its surrounds will be detected during the surveys.

- At the survey design stage the proposed development comprised 11 turbines and it was decided that 10 bioacoustic units would be deployed. The current proposal is for a development with 12 turbines. Notwithstanding the SNH (2019) recommendation that, in circumstances where more than 10 turbines are proposed:

  > *detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites*[,]

  it is concluded, based on professional judgement and expertise, that the deviation from a *sensu stricto* compliance with SNH (2019) does not compromise the robustness of the survey design or the representative character of the survey data.

- There are three species of the genus *Myotis* resident in Ireland namely, Daubenton's bat, whiskered bat, and Natterer's bat. Because the sonograms generated by recordings of the calls of these species cannot reliably be identified to species level based on sonogram analysis alone, any calls attributed to the genus are specified as *Myotis* spp. in this report.

- During the spring surveys the unit deployed at SP3 did not activate. It is assumed that this was due to unit malfunction rather than an indication of no activity at the SP. As the levels of activity recorded at this SP during the summer and autumn were quite low (see **Table 19** and **Table 20**) and because the SP location is similar to the majority of the other SPs it is considered that the non-activation of the unit does not compromise the assessments carried out in **Section 9** or the conclusions in **Section 10**.

8.2 DESK STUDY

A desk study was carried out to collate available information on the bat species likely to be present. This comprised a review of the following publications, datasets and on-line resources:

- OSI Aerial photography and 1:50000 mapping
- National Parks and Wildlife Service (NPWS)
- Bat Conservation Ireland publications and website
- National Biodiversity Centre (NBDC) (on-line map-viewer)
- Aerial imagery available at Google Earth and Bing Maps
- Other information sources and reports footnoted in the report

8.2.1 Data Base Search

8.2.1.1 Data Request

Following a data request for all data within a 10 km radius of the proposed development site all available records were provided by Bat Conservation Ireland on 16th of July 2020. The records received include roost locations **(Table 4**), results from transect surveys (**Table 5**) and Ad-hoc observations (**Table 6**). Grid references for all these data were provided by BCI, however, due to the sensitivity of the data, and in order to blur the resolution of the locations, the specific locations are not identified in the tables below and the locations shown are indicative. As the key issue is the

distribution of these records relative to the location of the proposed development site it is considered that this level of detail is sufficient for the purposes of the assessments carried out in this report.

No records for lesser horseshoe bat or Nathusius' pipistrelle are retained by BCI for the 10 km search radius specified.

Table 4: Roost location

Location	Species
Tarbert area	Soprano pipistrelle & whiskered bat

Table 5: Transect surveys

Location	Species
Listowel area	Brown long-eared bat, common pipistrelle, soprano pipistrelle, Daubenton's bat, unidentified bat.
Finuge area	Daubenton's bat, unidentified bat.

Table 6: Ad-hoc records

Location	Species
< 2 km south east	Common pipistrelle, soprano pipistrelle, Daubenton's bat, unidentified bat.
< 2 km south west	Soprano pipistrelle.
< 2 km north	Leisler's bat, common pipistrelle, soprano pipistrelle.
< 3 km north east	Leisler's bat, common pipistrelle, soprano pipistrelle.
< 5 km north east	Leisler's bat, common pipistrelle, soprano pipistrelle.
Newtownsandes/Knocanure	Leisler's bat, common pipistrelle, soprano pipistrelle, *Myotis* spp.
Newtownsandes area	Daubenton's bat, Leisler's bat, common pipistrelle.
Tarbert area	Common pipistrelle, soprano pipistrelle, Daubenton's bat.
Listowel area (a)	Daubenton's bat, Natterer's bat, Leisler's bat, common pipistrelle, soprano pipistrelle.
Listowel area (b)	Common pipistrelle, soprano pipistrelle.
Listowel area (c)	Brown long-eared bat, Daubenton's bat, Leisler's bat, common pipistrelle.

8.2.1.2 Bat Habitat Suitability Index

The National Biodiversity Data Centre's online mapper[13] includes a Bat Habitat Suitability Index (BHSI) layer derived from an analysis of the habitat and landscape associations of Irish bats compiled in Lundy *et al.* (2011). The index evaluation ratings range from 0 to 100 with 0 being the least favourable, and 100 the most favourable, for bats. Index evaluations are available for each individual species and an overall rating is also available for all species in combination. As the ratings are mapped to a 2 km grid square resolution, multiple ratings are available for any search area that extends beyond this 2 km scope. In order to ensure that the BHSI ratings for the proposed development site and its surrounds are fully described, the reference area, to which the ratings listed in **Table 7** and **Table 8**, below, relate, comprise the proposed wind farm development site, lands immediately adjacent and the wider geographical area[14]. With regard to the area within the proposed wind farm development site, as can be seen from the ratings listed in **Table 7**, below, not

[13] https://maps.biodiversityireland.ie/Map

[14] The 40 km^2 area encompassed within hectads Q93, Q94, R03 and R04.

only is the overall BHSI rating for all bat species very low, only soprano pipistrelle and brown long-eared bat have a rating above 30, and, while Daubenton's bat, Leisler's bat and common pipistrelle have a rating above 20, the remainder of the species have ratings below this level - a clear indication that the site is evaluated, by the BHSI criteria, as, in effect, having little or no potential value for these species namely, Nathusius' pipistrelle, whiskered bat and lesser horseshoe bat.

Table 7: BHSI Ratings

Species	Rating
All bats	20.44
Nathusius' pipistrelle	9
Whiskered bat	9
Daubenton's bat	22
Natterer's bat	18
Common pipistrelle	29
Leisler's bat	26
Soprano pipistrelle	34
Brown long-eared bat	31
Lesser horseshoe bat	6

The BHSI ratings for hectads Q93, Q94, R03 and R04 are listed in **Table 8**, below. The ratings from said table that fall within different data classes are listed in **Table 9**, below, and the percentages of the total that fall within different data classes are included. As can be seen from these tables, while there is a degree of variation in the ratings listed, the area encompassed within the 4 hectads is, quite consistently, of relatively low value to bats of all species. Only 37.8% of the ratings across this considerable expanse of the landscape, that surrounds the proposed wind farm development site, are above 30 and 62.3% have a rating below 30. These ratings, while not predictive, provide meaningful metrics that characterise the probable value of the area within and surrounding the proposed wind farm site to bat species and are an indicator as to the likelihood that different bat species are, or are not, likely to, typically, be a significant presence in the area within and around the site. This likelihood then, in turn, indicates the probability that bats may use the proposed development area. In this regard see **Section 7.3**, above.

Table 8: BHSI Ratings for 4 hectads encompassing proposal site and surrounds

Species	Suitability Index Rating								
	Q94		RO4		Q93			R03	
All bats	17.67	31	21.11	30.33	20.56	28.56	25.44	21.11	23.33
Nathusius' pipistrelle	11	26	12	31	3	3	2	3	2
Whiskered bat	4	14	8	19	9	20	11	7	12
Daubenton's bat	17	28	23	24	30	30	34	23	25
Natterer's bat	16	31	18	29	20	28	26	19	22
Common pipistrelle	27	36	31	34	30	40	35	32	35
Leisler's bat	23	36	27	34	28	39	34	29	32
Soprano pipistrelle	31	41	35	40	35	44	40	37	38
Brown long-eared bat	25	42	31	43	33	45	39	33	36
Lesser horseshoe bat	5	25	5	19	7	8	8	7	8

Table 9: BHSI Ratings from Table 4 within data classes

Data Class (1)	Number	%	Data Class (2)	Number	%
0 - 1	0	0	**0 - 10**	16	17.8
2 - 5	8	8.9			
6 - 10	8	8.9			
11 - 15	5	5.6	**10 - 20**	14	15.6
16 - 20	9	10.0			
21 - 25	12	13.3	**20 - 30**	26	28.9
26 - 30	14	15.6			
31 - 35	19	21.1	**30 - 40**	29	32.2
36 - 40	10	11.1			
41 - 45	5	5.6	**> 40**	5	5.6

8.2.2 Initial Site Risk Assessment

In order to characterise potential risks that may exist at the site SNH (2019) recommends that an Initial Site Risk Assessment (ISRA) of site-based risk factors be carried out. This ISRA, which comprises an evaluation of the site's risk level, is based on a consideration of the habitat and development related features of the proposed wind farm site. Using the risk criteria outlined in **Table 10**, below, the proposed wind farm site is evaluated as 'Low' risk.

Table 10: Initial Site Risk Assessment

Habitat Risk	Project Size		
	Small	Medium	Large
	Site Risk Level		
Low	1[15]	2	3
Moderate	2	3	4
High	3	4	5

Habitat Risk Level	
Habitat Risk	**Description**
Low	• Small number of potential roost features, of low quality. NO ROOST FEATURES • Low quality foraging habitat that could be used by small numbers of foraging bats. YES • Isolated site not connected to the wider landscape by prominent linear features. YES
Moderate	• Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. NO • Habitat could be used extensively by foraging bats. NO • Site is connected to the wider landscape by linear features such as scrub, tree lines and streams. YES
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. NO • Extensive and diverse habitat mosaic of high quality for foraging bats. NO • Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. NO • At/near edge of range and/or on an important flyway. NO • Close to key roost and/or swarming site. NO
Project Size Risk Level	
Project Size	**Description**
Small	• Small scale development (≤10 turbines). NO • No other wind energy developments within 10 km. NO • Comprising turbines <50 m in height. NO
Medium	• Larger developments (between 10 and 40 turbines). YES • May have some other wind developments within 5 km. YES • Comprising turbines 50-100 m in height. NO
Large	• Largest developments (>40 turbines) with other wind energy developments within 5 km. NO • Comprising turbines >100 m in height.). YES

[15] Key: (1-2) - low/lowest site risk; (3) - medium site risk; (4-5) - high/highest site risk.

8.3 SITE INVESTIGATION

The desktop included a preliminary assessment of the availability of landscape features of importance to bats within the proposed development site and/or that connect it to the geographical area extending away from it.

This initial assessment was supplemented by a ground truthing daytime survey conducted when the remote survey bioacoustic units were deployed an exercise which was also conducted in 2019. During the ground truthing surveys an assessment of the potential value to foraging bats of the existing habitats and features was made. Given the generally open and flat character of the site and surrounding landscape, particular attention was paid to the presence of linear features within the site that connected the site to the surrounding hinterland. The habitat mix present within the proposed development's agricultural hinterland, the presence of linear landscape features and the types of land use was noted. The purpose of this daytime survey was to ensure that, as far as was possible within the strictures of SNH (2019), the locations of the bioacoustic units would intersect with a habitat mix that was representative of the proposed wind farm site and would, therefore, accurately sample the activity of any bat populations present. When determining which landscape features were of importance to bat species, cognisance was taken, during both the desk top and ground truthing assessments, of the criteria listed in **Table 2**, above, of NRA (2006a and 2006b), Collins (2016) and of the UK Department of Transport's Interim Advice Note 116/08[16].

This initial assessment was also informed by knowledge of the site and its surrounds accumulated over repeated visits to the site during ecological and bird surveys, previous bat surveys and assessments conducted previously by MWP in areas adjacent to the proposed wind farm site and by a range of ecological surveys and assessments completed by MWP in the locality.

8.3.1 Preliminary Bat Roost Survey (Visual Daytime Search)

The preliminary bat roost survey was conducted per Aughney *et al.* (2008) and Collins (2016) and was cognisant of criteria include in Kelleher *et al.* (2006) (see **Table 11**, below). Routes were driven in daylight hours to determine if suitable roost habitat sites such as old farmyard buildings or derelict houses were available or present within/adjacent to the site. The proposed development site comprises open habitats and is devoid of dwellings or suitable mature broadleaf trees such as beech, willow, oak or ash. While bats will use suitable conifer trees for roosting, the tree species within the adjacent commercial conifer plantations do not typically form cavities that would be suitable for bats. This is very much the case at Shronowen where the uniform growth form of the relatively young trees that dominate the conifer blocks, and the lack of damage to them, militate against any likelihood that bats can use them as roost sites.

Table 11: Species associations with roost types

Species	Trees		Buildings		Underground	
	Maternity	Hibernation	Maternity	Hibernation	Maternity	Hibernation
Lesser horseshoe bat	L	L	H	M	L	H
Daubenton's bat	M?	L?	M	L	M?	H
Whiskered bat	M?	M?	H	L	N	H
Natterer's bat	M?	M?	H	L	L	H

[16] 'Nature Conservation Advice In Relation To Bats'(Available at http://www.dft.gov.uk/ha/standards/ians/pdfs/ian116.pdf

Species	Trees		Buildings		Underground	
Nathusius' pipistrelle			H?			
Common pipistrelle	M	M	H	H	N	L
Soprano pipistrelle	M	M	H	H	N	L
Leisler's bat	M	M	H	L	N	N
Brown long-eared bat	H	H	H	H	N	M

Trees- includes all types of crevice and hollow as well as bat-boxes attached to trees.
Buildings – above-ground areas, with an emphasis on roof voids and other areas warmed by the sun.
Underground – anywhere that provides cool humid conditions buffered against rapid temperature change. Includes caves, mines, tunnels, souterrains, fortifications, cellars, ice-houses, lime-kilns etc.

N – not recorded in recent times
L- low dependence; unusual, but has been recorded
M – some usage recorded, though perhaps not the most important type of site
H – the most frequently recorded type of site for this species/activity

Species associations with roost types [adapted from Kelleher *et al.* (2006)]

8.4 FIELD SURVEY DESIGN

8.4.1 Passive Automated Bat Surveys (PABS)

In compliance with SNH (2019) PABS, designed to passively sample and record bat activity at 10 pre-selected sampling points (SP), were conducted during spring, summer, and autumn, 2020.

Three key criteria from SNH (2019) informed the survey design. These are, as follows:

1. **Minimum survey effort for ground-based surveys**:

   *The minimum level of pre-application survey required using static detectors is 10 nights in each of: spring (April-May), summer (June-mid-August) and autumn (mid-August-October)***.**

2. **Number of detectors required*:***

   Detectors should be placed at all known turbine locations at wind farms containing less than ten proposed turbines. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites.

3. **Location of detector units:**

   At sites where the proposed turbine locations are known, ***static detectors should be placed*** *[....]* ***at or close to these points****.* [Emphasis added]

   The selection of locations at which to place detectors should be based on professional judgement, but at large sites, it is recommended that beyond the initial ten detectors placed at proposed turbine sites (if known), the remainder should be distributed based on the availability of different habitats and topographical features on the site.

Because a proposed layout for 11 turbines was available at the outset of the surveys the units were located in compliance with SNH (2019) as it pertains to sites where turbine locations are known and were situated at or close to the proposed turbine locations (see point 3 above). The SP locations are

shown in **Figure 3**, below. Subsequently, after the surveys were completed, the turbine layout was altered and is illustrated in **Figure 3**.

To the extent possible within the constraints of the SNH (2019) methodology, the locations of the bioacoustic units were chosen in the expectation that, should bats be present, detectable levels of activity were reasonably foreseeable at the selected SP locations, particularly because bats are known to exhibit a high level of site loyalty and will frequently return to the same foraging sites night after night (Entwhistle *et al*., 2001). This characteristic of the sampling locations also increased the probability that any species with a habitual presence in the survey area would, at some point, be encountered at the sampling locations. Details of the characteristics of the SP locations are summarised in **Table 12**, below.

Because an individual bat can be the source of more than one, or even many, calls, the numbers of calls recorded by the bioacoustic units are not a direct measure of numbers of any bat species. In fact, the number of calls recorded is likely to be greater than the numbers of bats that generated them. Bats will frequently fly over and back along short sections of habitat if prey is readily available while foraging and they use linear features to navigate through the landscape, to and from roosts and within foraging sites. However, the numbers recorded are a reliable proxy for the levels of bat activity at the proposed wind farm site, particularly in light of the relatively homogenous habitat and ecological characteristics of the site.

8.4.1.1 Detectors Deployed

2 different models of Song Meter[17] Full Spectrum bioacoustic recording units were deployed within the proposed wind farm site for 10 nights during each season. Full Spectrum (FS) detectors continuously record all frequencies and retain details of the call structure. The sound recordings from these detectors are typically very high quality[18] and are stored on the units for later analysis. Because FS detectors record sounds at the full frequency, i.e., ultrasonic sounds are not converted to a lower frequency in order to make them audible, they are able to capture sound in a high level of detail which they record in real time. The resulting sound files are very large, so these detectors use a triggering system so that recordings are made only when sounds detected are above certain frequency and amplitude thresholds.

The units were programmed to begin recording half an hour before sunset each evening and to continue until half an hour after dawn the next morning. Prior to deployment the latitude, longitude and time zone for each survey location was inputted to each unit and each then automatically determined the times of dawn and dusk, thereby, reducing the likelihood of operator error. Calls emitted by bats that passed within the detecting range of the units, during the period of activation, were recorded and their calls stored for later analysis. Each unit has an omnidirectional microphone that detects bat ultrasonic calls and each unit records and stores data on internal SD cards.

The results are presented in **Section 9**, below.

[17] Song Meter SM4BAT-FS and Song Meter Mini Bat manufactured by Wildlife Acoustics Ltd.

[18] https://www.batconservationireland.org/get-involved/bat-detectors-getting-using

8.4.2 Characteristics of Sampling Points (SP)

The SP locations are shown in **Figure 3** and their habitat characteristics are summarised in **Table 12**, below. Due to the relatively homogeneous topographical and ecological characteristics of the site (described in **Section 5**), there is very little in the way of habitat variation between the locations. This is also due, in part, to the strictures of the SNH (2019) guidance which recommends that units be placed at or near turbine location. SP6 and SP9 are the only locations where the habitat mix and structure varies to any significant extent from the open, exposed bog habitats at the other SP locations. SP6 is located adjacent to a forest block and is, therefore, the SP best positioned in terms of the availability of sheltered corridors within the proposed development site, along which insects can accumulate. SP9 also benefits from the availability of shelter from adjacent woodland albeit not to the same extent as SP6. It does, however, have the benefit of a more complex structure as it is situated at a location adjacent to several small blocks of relatively young broadleaf woodland in an area of rough grazing with a willow scrub element and a more diverse ground flora than any other SP.

Because it was not possible to gain access to the location of T1 in-house expertise was used when selecting the location of SP6.

Table 12: Characteristics of SP locations

SP	Characteristics	Structure	Diversity of ground flora
1	At T12. Cut-over bog (in use) with numerous turf banks nearby. Turf cutting occurred in several locations during 2020. SP adjacent to bog access track. Some bare ground due to turf cutting.	Generally open and exposed but some shelter provided by turf bank edges which are shallow (< 2 m) excisions into the peat mass. No connectivity via linear features.	Poor.
2	Adjacent to T10, Cut-over bog (not currently in use (NCIU) at SP but areas adjacent are in use). Numerous abandoned turf banks with pooled water in areas adjacent to SP.	Generally open and exposed but some shelter provided by turf bank edges which are shallow (< 2 m) excisions into the peat mass. No connectivity via linear features.	Poor.
3	On a track through cutover bog (NCIU). T8 and T9 adjacent	Open but some degree of shelter and connectivity from trackside gorse and willow scrub.	Poor/ Moderate.
4	Adjacent to T5.Cutover bog (NCIU).	Open.	Poor.
5	At T4. Rough gazing with wet grassland influences.	Open and exposed. Some connectivity via poor quality linear features along track side.	Moderate.
6	150m from T1. Woodland edge with cut-over bog in area adjacent. Active turf cutting extensive in this area in 2019 & 2020.	Shelter belt extends northwards for approximately 400 m along adjacent woodland edge and continues for approximately 1 km west from SP (see **Figure 4**).	Moderate/Good.
7	At T3. Turf bank in cut- over bog. Active turf cutting extensive in area around SP in 2019 & 2020 but not at bank where SP located	Open and exposed. Some connectivity via poor quality linear features along track side.	Poor.
8	At T11.Area of bog where turf cutting has not encroached but where network of drains is present and maintained.	Open and exposed. No connectivity via linear features.	Poor.
9	At T7. Heavily poached rough grazing. Mixed woodland to south and west. Area not intensively grazed in 2020 resulting in full	Sheltered by woodland adjacent to south and west. Some connectivity via woodland	Good.

SP	Characteristics	Structure	Diversity of ground flora
	growth forms of all grasses and forbs.	edge and farm track	
10	At T6. Cutover bog (NCIU). Area of bog where turf cutting has not encroached but within area where network of drains is present and maintained.	Open and exposed. No connectivity via linear features.	Poor.

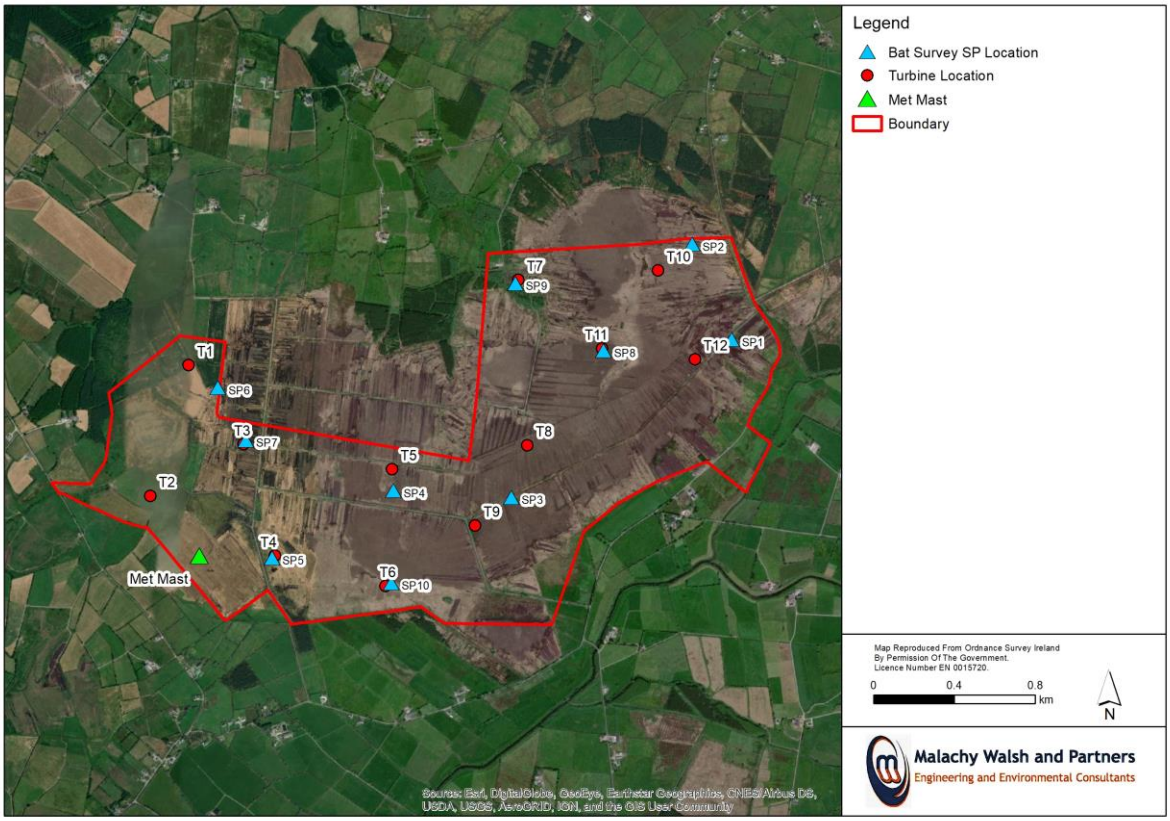


Figure 3: SP locations

8.4.3 Transect Surveys

Limitations pertain to transect surveys in that, while they *"can be used to complement the information gained from static detectors and other sources. Their applicability is discretionary and site-specific."* (SNH, 2019).

In light of these limitations on the value of transect survey data, and having due cognisance of the characteristics of the site and surrounds (**Sections 5** and **8.2.1.2**, above), and because, during lengthy transects carried out previously, by the surveyor, in areas adjacent to the proposed wind farm development site, very few bats were encountered, transect surveys were not conducted.

8.5 SONOGRAM ANALYSIS

Post survey, the sound files were converted, using a proprietary software[19], to produce sonograms (graphs of the sound recorded). As each species has a unique audio signature, the sonograms, or graphs, can be used to distinguish between one species and another. Using training and experience of sonogram analysis a staff ecologist, with extensive experience of and expertise in sonogram

[19] Kaleidoscope Pro Software (Manufactured by Wildlife Acoustics Ltd.)

analysis, used the software to eliminate all data files that were not generated by bats. Once an individual call is identified the recording is labelled using tools available in the software.

Not every call emitted by a bat is the echolocation call that is characteristic of the species in question. Many bat species use differently structured echolocation calls, adapted to their habitat structure or foraging situation (Miller & Degn, 1981; Fenton, 1987; Rydell, 1990; Kalko, Schnitzler & Schnitzler, 1993; Jones, 1995 cited in Pfalzer *et al.,* 2003). In addition to echolocation calls bats use 'social' calls which are differentiated from echolocation calls by their solely communicational function. Pfalzer *et al.* (2003) categorise these into 4 types, as follows, squawk, trill (repeated), cheep (curved) and song (complex). While these can readily be attributed to bats they cannot be used to differentiate between species. In this report any calls that match the parameters outlined in the preceding sentences are designated as unidentified. Sonograms of this category are shown in the various tables under the column heading 'NoID'.

9 RESULTS

- A summary of the results is provided in **Section 9.1**.
- The total numbers of calls of each species recorded at each SP, over the course of the survey period, are provided in tables, and are discussed, in **Section 9.2**.
- The seasonal and annual totals of all calls that were recorded at each SP are provided in tables, and are discussed, in **Section 9.4**.
- The seasonal totals of bat calls that were recorded of each species at each SP are provided in tables, and are discussed, in **Section 9.5**.
- Information on nightly averages is provided in tables, and is discussed, in **Section 9.6**.
- Information on hourly averages is provided in tables, and is discussed, in **Section 9.7**.

9.1 SPECIES RECORDED

A total of 25,961 calls generated by bats, including calls to which a species or genus could not be attributed[20], were recorded during the 30 nights of the deployment of 10 detectors during the survey. The species recorded are listed below and in **Table 13**, with the percentage of calls[21] each comprises and with their BHSI rating (see **Section 8.2.1.2**).

With the exception of brown long-eared bat which the BHSI rating 'forecast' a level of activity equivalent to both pipistrelle species, the BHSI ratings are broadly reflected in the percentage of the total that each species comprises.

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

As had been the case in 2019, lesser horseshoe bat and Nathusius' pipistrelle were not recorded.

[20] See **Section 8.5**.

[21] % of the total number recorded.

Table 13: Species Recorded with % and BHSI Rating

Species	%	BHSI Rating
Common pipistrelle	47.3	29
Soprano pipistrelle	28.9	34
Leisler's bat	7.5	26
Whiskered bat[22]	0.5	9
Daubenton's bat		22
Natterer's bat		18
Brown long-eared bat	0.2	31

9.2 NUMBERS OF CALLS RECORDED AT INDIVIDUAL SAMPLING POINTS

The numbers of calls of each species recorded at each SP during the survey are provided in **Table 14**; in each case the percentage of the total number recorded, that each represents, is included. Cells highlighted in yellow indicate the largest number of calls recorded[23]; the cell highlighted in green is the largest total number of calls recorded at any SP.

With 12,290 calls, common pipistrelle was the most frequently recorded species; soprano pipistrelle was the next most frequently recorded species (7,516) calls and while Leisler's bat (1,941 calls), bats from the genus *Myotis*[24] (140 calls) and brown long-eared bat (62 calls) were also recorded, these species were recorded in very low numbers, particularly the latter two species. These figures equate, respectively, to 47.3%, 28.9%, 7.5%, 0.5% and 0.2% of the total number recorded (see **Table 14**). Calls generated by bats to which a species or genus could not be attributed comprised 15.5% of the total. The equivalent percentages from the 2019 surveys are 34.6%, 19.8%, 12.0%, 0.6% and 0.4% (see **Table 15**). As can be seen from these data, the general pattern in relative proportions of the different species is quite similar in both years.

The increase in the percent of the total calls attributed to common or soprano pipistrelle in 2020 (21.8%) is similar to the decrease in the percent to which NoID is attributed in the same year (17%). It is probable that this change is a result of the improved detection capacity of the newer, full spectrum, recorders which provide sound recordings which are very high quality.[25] Because the detectors used in 2020 record the calls in full spectrum format, each sound file has more data points from which the software can generate sonograms of higher quality which can, then, more reliably be attributed to individual species during sonogram analysis.

Table 14: Number of calls of each species recorded at each SP (spring, summer, and autumn)

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	6	139	2,752	1,033	14	776	4,720
2	5	156	1,482	334	7	321	2,305
3	1	93	1,032	664	3	53	1,846
4	4	222	268	73	1	177	745
5	69	136	311	146	15	175	852
6	46	253	3,212	4,005	3	931	8,450
7	2	305	1,157	472	2	395	2,333
8	3	180	225	76	3	68	555

[22] Whiskered bat, Daubenton's bat and Natterer's bat are the members of genus *Myotis* resident in Ireland.

[23] Of the category in the column header.

[24] See **Section 8.1** for notes on identifying bats of genus *Myotis* to species level on the basis of sonograms.

[25] https://www.batconservationireland.org/get-involved/bat-detectors-getting-using

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
9	2	300	1,615	619	11	1,009	3,556
10	2	157	236	94	3	107	599
Total	140	1,941	12,290	7,516	62	4,012	25,961
%	0.5	7.5	47.3	28.9	0.2	15.5	

Table 15: Comparison between % 2019 and % 2020

Year	*Myotis* spp.		Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
2019	0.6		12.0	34.6	19.8	0.4	32.5
2020	0.5		7.5	47.3	28.9	0.2	15.5
Change	-0.1		-4.5	+12.7	+9.1	-0.2	-17.0
				+21.8			-17.0

9.3 SEASONAL AND ANNUAL TOTALS OF ALL CALLS RECORDED AT EACH SP

The seasonal and annual totals of all calls that were recorded at each SP are provided in **Table 16** and the SPs are ranked by levels of activity in **Table 17 (**the percentages of the total number recorded are included).

The highest level of seasonal activity was recorded in spring and the total number of calls recorded - 15,288 – was approximately double the total recorded in autumn and 5.5 times the number of calls recorded in summer. The number recorded in spring comprises 58.89%; summer comprises 10.91% and autumn 30.20%, of the total. The SP with the highest level of activity is SP6 where 8,450 calls were recorded during the full annual period of activity.

Within this seasonal variation there are also significant differences between the numbers recorded at individual SPs. SP6, the SP with the highest number of recorded calls, has almost the same number of calls recorded (8,450 calls) as the cumulative total of the seven lowest SPs (9,235 calls); as are the combined totals of the 2nd and 3rd highest SPs, namely SP1 and SP9, albeit that the combined total of these two SPs is slightly lower – by 959 calls - than the cumulative total of the, aforementioned, seven lowest SPs.

Table 16: Seasonal & annual totals all SPs

SP No.	1	2	3	4	5	6	7	8	9	10	Total
Spring	4,161	2,005	0	433	495	3,954	1,842	355	1,746	297	15,288
Summer	305	179	789	66	172	490	144	118	462	108	2,833
Autumn	254	121	1057	246	185	4006	347	82	1348	194	7,840
Total	4,720	2305	1846	745	852	8450	2333	555	3556	599	25,961
Average[26]	157	77	62	25	28	282	78	19	119	20	865

[26] Per night over 30 nights (rounded value).

Table 17: SP ranked - lowest to highest - by total numbers recorded

	SP	Total	%	%
	8	555	2.14	7.32
	10	599	2.31	
	4	745	2.87	
	5	852	3,28	
	3	1846	7.11	24.98
	2	2305	8.88	
	7	2333	8.99	
	9	3556	13.70	31.88
	1	4720	18.18	
	6	8450	32.55	32.55

9.4 SEASONAL TOTALS

The seasonal totals of bat calls that were recorded of each species at each SP are provided in **Table 18** to **Table 20**, inclusive. The 5 occasions when the total number of calls exceeded 1,000, over a 10-night survey period, are highlighted in yellow.

180 of the data points listed in these 3 tables relate to counts of bat calls attributed to individual species, to bats from the genus *Myotis* or to species to which NoID is attributed. **T**hese data points are categorised, in **Table 21,** in data-classes based on the number of bat calls recorded over a 10-night period. These data are summarised below:

- 13% of the data points relate to occasions when no calls were recorded.
- 65% relate to values between 1 – 100 bat calls.
- 19% relate to values between 100 and 1,000 bat calls.
- 3% relate to values greater than 1,000.

On only 22% of the survey nights did recorded activity exceed 100 bat calls, over a 10-night period, at any SP.

Table 18: Number of bat passes of each species recorded at each SP during spring surveys.

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	2	52	2,632	761	5	709	4,161
2	1	75	1,348	288	1	292	2,005
3	0	0	0	0	0	0	0
4	0	95	223	46	0	69	433
5	59	40	187	89	8	112	495
6	2	140	2,467	798	3	544	3,954
7	0	166	1,027	332	1	316	1,842
8	0	79	176	46	0	54	355
9	1	186	856	318	1	384	1,746
10	0	56	124	44	2	71	297
Total	**65**	**889**	**9,040**	**2,722**	**21**	**2,551**	**15,288**

Table 19: Number of bat passes of each species recorded at each SP during summer surveys.

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	3	44	68	161	1	28	305
2	2	61	81	17	0	18	179
3	1	36	265	458	0	29	789
4	2	40	10	9	0	5	66
5	8	22	79	32	3	28	172
6	25	37	77	251	0	100	490
7	0	41	42	48	0	13	144
8	1	54	41	12	1	9	118
9	1	47	240	45	0	129	462
10	0	23	65	12	0	8	108
Total	43	405	968	1,045	5	367	2,833

Table 20: Number of bat passes of each species recorded at each SP during autumn surveys.

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	1	43	52	111	8	39	254
2	2	20	53	29	6	11	121
3	0	57	767	206	3	24	1,057
4	2	87	35	18	1	103	246
5	2	74	45	25	4	35	185
6	19	76	668	2,956	0	287	4,006
7	2	98	88	92	1	66	347
8	2	47	8	18	2	5	82
9	0	67	519	256	10	496	1,348
10	2	78	47	38	1	28	194
Total	32	647	2,282	3,749	36	1,094	7,840

Table 21: Number of values within data classes

Data Class	No of values	%
0	24	13
1-10	44	24
11-50	43	24
51-100	30	17
101-200	11	19
201-300	9	
301-400	4	
401-500	2	
501-600	2	
601-700	1	
701-800	4	
801-900	1	
901-1,000	0	
>1,000	5	3

9.5 INDIVIDUAL SPECIES: CALLS RECORDED BY SP AND BY SEASON

The seasonal and annual totals of calls that were recorded of each species at each SP are provided, in **Table 22** to **Table 26**, inclusive. The totals from 30 nights of surveys and the averages over 30 nights are included.

Table 22: *Myotis* spp.: Calls recorded by SP and season

	1	2	3	4	5	6	7	8	9	10	Total
Spring	2	1	0	0	59	2	0	0	1	0	65
Summer	3	2	1	2	8	25	0	1	1	0	43
Autumn	1	2	0	2	2	19	2	2	0	2	32
Total[27]	6	5	1	4	69	46	2	3	2	2	140
Average[28]	0.20	0.17	0.03	0.13	2.30	1.53	0.07	0.10	0.07	0.07	

Table 23: Leisler's bat: Calls recorded by SP and season

	1	2	3	4	5	6	7	8	9	10	Total
Spring	52	75	0	95	40	140	166	79	186	56	889
Summer	44	61	36	40	22	37	41	54	47	23	405
Autumn	43	20	57	87	74	76	98	47	67	78	647
Total	139	156	93	222	136	253	305	180	300	157	1,941
Average	4.63	5.20	3.10	7.40	4.53	8.43	10.17	6.00	10.00	5.23	

Table 24: Common pipistrelle: Calls recorded by SP and season

SP	1	2	3	4	5	6	7	8	9	10	Total
Spring	2,632	1348	0	223	187	2,467	1,027	176	856	124	9,040
Summer	68	81	265	10	79	77	42	41	240	65	968
Autumn	52	53	767	35	45	668	88	8	519	47	2,282
Total	2,752	1482	1,032	268	311	3,212	1,157	225	1,615	236	12,290
Average	91.73	49.40	34.40	8.93	10.37	107.07	38.57	7.50	53.83	7.87	

Table 25: Soprano pipistrelle: Calls recorded by SP and season

	1	2	3	4	5	6	7	8	9	10	Total
Spring	761	288	0	46	89	798	332	46	318	44	2,722
Summer	161	17	458	9	32	251	48	12	45	12	1,045
Autumn	111	29	206	18	25	2,956	92	18	256	38	3,749
Total	1,033	334	664	73	146	4,005	472	76	619	94	7,516
Average	34.43	11.13	22.13	2.43	4.87	133.50	15.73	2.53	20.63	3.13	

Table 26: Brown long-eared bat: Calls recorded by SP and season

	1	2	3	4	5	6	7	8	9	10	Total
Spring	5	1	0	0	8	3	1	0	1	2	21
Summer	1	0	0	0	3	0	0	1	0	0	5
Autumn	8	6	3	1	4	0	1	2	10	1	36
Total	14	7	3	1	15	3	2	3	11	3	62
Average	0.47	0.23	0.10	0.03	0.50	0.10	0.07	0.10	0.37	0.10	

[27] **Table 22** to **Table 26**: Total from 30 nights of surveys.

[28] **Table 22** to **Table 26**: Average of 30 nights.

9.6 SEASONAL NIGHTLY AVERAGES OF CALLS RECORDED AT INDIVIDUAL SPS

The average nightly numbers of calls recorded of each species at each SP are listed in **Table 28** to **Table 37**, below. The peak average values for each SP are highlighted in yellow in each table; any other instance of the average number exceeding 100 calls is highlighted in green. These data are summarised in **Table 27**. The nightly average rate exceeded 100 calls on only five occasions during the 30 nights of surveys. Four of these occurred during the spring surveys and the other during autumn surveys. On all occasions, bar one - when the species in question was soprano pipistrelle, common pipistrelle was the species with the highest nightly average value.

Table 27: Peak Average Value by SP

Season	SP	Species	Nightly Average	Data Class	Number in Data Class
Spring	1	Common pipistrelle	263.20	> 100	5
Spring	2	Common pipistrelle	134.80		
Spring	6	Common pipistrelle	246.70		
Spring	7	Common pipistrelle	102.70		
Autumn	6	Soprano pipistrelle	295.60		
Spring	9	Common pipistrelle	85.60	50 -100	2
Autumn	3	Common pipistrelle	76.70		
Spring	4	Common pipistrelle	22.30	0 - 50	4
Spring	5	Common pipistrelle	18.70		
Spring	8	Common pipistrelle	17.60		
Spring	10	Common pipistrelle	12.40		

Table 28: SP1: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.20	5.20	263.20	76.10	0.50	70.90
Summer	0.30	4.40	6.80	16.10	0.10	2.80
Autumn	0.10	4.30	5.20	11.10	0.80	3.90

Table 29: SP2: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.10	7.50	134.80	28.80	0.10	29.20
Summer	0.20	6.10	8.10	1.70	0.00	1.80
Autumn	0.20	2.00	5.30	2.90	0.60	11.00

Table 30: SP3: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.00	0.00	0.00	0.00	0.00	0.00
Summer	0.10	3.60	26.50	45.80	0.00	2.90
Autumn	0.00	5.70	76.70	20.60	0.30	2.40

Table 31: SP4: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.00	9.50	22.30	4.60	0.00	6.90
Summer	0.20	4.00	1.00	0.90	0.00	0.50
Autumn	0.20	8.70	3.50	1.80	0.10	10.30

Table 32: SP5: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	5.90	4.00	18.70	8.90	0.80	11.20
Summer	0.80	2.20	7.90	3.20	0.30	2.80
Autumn	0.20	7.40	4.50	2.50	0.40	3.50

Table 33: SP6: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.20	14.00	246.70	79.80	0.30	54.40
Summer	2.50	3.70	7.70	25.10	0.00	10.00
Autumn	1.90	7.60	66.80	295.60	0.00	28.70

Table 34: SP7: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.00	16.60	102.70	33.20	0.10	31.60
Summer	0.00	4.10	4.20	4.80	0.00	1.30
Autumn	0.20	9.80	8.80	9.20	0.10	6.60

Table 35: SP8: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.00	7.90	17.60	4.60	0.00	5.40
Summer	0.10	5.40	4.10	1.20	0.10	0.90
Autumn	0.20	4.70	0.80	1.80	0.20	0.50

Table 36: SP9: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.10	18.60	85.60	31.80	0.10	38.40
Summer	0.10	4.70	24.00	4.50	0.00	12.90
Autumn	0.00	6.70	51.90	25.60	1.00	49.60

Table 37: SP10: Average nightly rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
Spring	0.00	5.60	12.40	4.40	0.20	7.10
Summer	0.00	2.30	6.50	1.20	0.00	0.80
Autumn	0.20	7.80	4.70	3.80	0.10	2.80

9.7 SEASONAL HOURLY AVERAGE NUMBERS OF CALLS RECORDED AT INDIVIDUAL SPS

The average hourly numbers of calls recorded of each species at each SP are listed in **Tables 40** to **49**, inclusive; the peak average values for each SP are highlighted in green in each table. 150 of the data points listed in these tables relate to average values of bat calls attributed to individual species or to bats from the genus *Myotis*. **T**hese data points are categorised, in **Table 38,** into data-classes based on the number of bat calls. 92% of the average hourly rates were 5 per hour or less and the rate exceeded 5 on only 12 occasions (8%).

Table 38: Average hourly rates: Numbers of data points within each class

Average Hourly Rate	Number of Data Points	%	%
0	22	15	92
0-1	92	61	
1-2	12	8	
2-3	6	4	
3-4	3	2	
4-5	3	2	
>5	12	8	8

The twelve occasions when the average hourly rate exceeded 5 are listed in **Table 39.** Three were occasions when the average rate exceeded 20, two when the average was between 10 and 20 calls and the remainder were between 5 and 10. The exceedance occurred once at SP2 and SP7, twice at SP1, SP3 and SP9 and on 4 occasions at SP4 and SP6. Seven of the exceedances took place during the spring surveys, one during the summer surveys and three during the autumn surveys. On all occasions when the rate exceed 5 calls the species in question were either common (8) or soprano (4) pipistrelle bats.

Table 39: Average hourly rates exceeding 5/hour

Species	Season	SP	Average hourly rate	
Common pipistrelle	Spring	1	29.24	> 20
		6	27.41	> 20
		2	14.98	10 -20
		7	11.41	10 - 20
		9	9.51	5 - 10
	Autumn	3	7.67	5 - 10
		6	6.68	5 - 10
		9	5.19	5 - 10
Soprano pipistrelle	Autumn	6	29.56	> 20
	Spring	1	8.46	5 - 10
		6	8.87	5 - 10
	Summer	3	7.63	5 - 10

Table 40: SP1: Average hourly species' rates by season[29]

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.02	0.58	29.24	8.46	0.06	7.88
Summer	0.05	0.73	1.13	2.68	0.02	0.47
Autumn	0.01	0.43	0.52	1.11	0.08	0.39

Table 41: SP2: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.01	0.83	14.98	3.20	0.01	3.24
Summer	0.03	1.02	1.35	0.28	0.00	0.30
Autumn	0.02	0.20	0.53	0.29	0.06	0.11

Table 42: SP3: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	0.00	0.00	0.00	0.00	0.00
Summer	0.02	0.60	4.42	7.63	0.00	0.48
Autumn	0.00	0.57	7.67	2.06	0.03	0.24

Table 43: SP4: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	1.06	2.48	0.51	0.00	0.77
Summer	0.03	0.67	0.17	0.15	0.00	0.08
Autumn	0.02	0.87	0.35	0.18	0.01	1.03

Table 44: SP5: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.66	0.44	2.08	0.99	0.09	1.24
Summer	0.13	0.37	1.32	0.53	0.05	0.47
Autumn	0.02	0.74	0.45	0.25	0.04	0.35

Table 45: SP6: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.02	1.56	27.41	8.87	0.03	6.04
Summer	0.42	0.62	1.28	4.18	0.00	1.67
Autumn	0.19	0.76	6.68	29.56	0.00	2.87

[29] In calculating the averages, nightly durations of 9, 6 and 10 hours were used, respectively, for spring summer and autumn. [Using sunset to sunrise as per: https://www.timeanddate.com/sun/@2961574?month=9&year=2019]

Table 46: SP7: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	1.84	11.41	3.69	0.01	3.51
Summer	0.00	0.68	0.70	0.80	0.00	0.22
Autumn	0.02	0.98	0.88	0.92	0.01	0.66

Table 47: SP8: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	0.88	1.96	0.51	0.00	0.60
Summer	0.02	0.90	0.68	0.20	0.02	0.15
Autumn	0.02	0.47	0.08	0.18	0.02	0.05

Table 48: SP9: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.01	2.07	9.51	3.53	0.01	4.27
Summer	0.02	0.78	4.00	0.75	0.00	2.15
Autumn	0.00	0.67	5.19	2.56	0.10	4.96

Table 49: SP10: Average hourly species' rates by season

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	0.62	1.38	0.49	0.02	0.79
Summer	0.00	0.38	1.08	0.20	0.00	0.13
Autumn	0.02	0.78	0.47	0.38	0.01	0.28

10 DISCUSSION

10.1 BAT ACTIVITY SURVEYS

10.1.1 Species recorded

The following species were recorded during the surveys.

- Brown long-eared bat (0.2%).[30]
- Common pipistrelle (47.3%).
- Leisler's bat (7.5%).
- Soprano pipistrelle (28.9%).

In addition, species from the genus *Myotis* were also recorded (0.5%).

As evidenced by the data summarised, analysed, and provided in detail in tables, in **Sections 9.1** to **Section 9.7** inclusive, above, the level of bat activity recorded during the 2020 surveys was low with low levels at activity at all SPs and with significant variation between those SPs located within the central peat mass of the bog and those SPs situated at the edge of the peat mass (SP1) or at locations with more habitat diversity (SP6 and SP9).[31] Common and soprano pipistrelle bats

[30] Of the total number recorded.

[31] Details of the habitat characteristics of the SP locations is provided in **Table 12**, **Section 8.4.2**.

constitute the most frequently recorded and the combined total of their calls comprises 76.2% of the total. Activity levels ranged from 555 calls, at SP8, to 8,450 calls, at SP6. When expressed as a percentage, the level of activity recorded at SP8 equates to 6.6% of that recorded at SP6 (the seasonal and annual totals of all calls that were recorded at each SP are provided in **Table 16** and the SPs are ranked by levels of activity in **Table 17**). As was noted, previously, in **Section 9.2**, SP6, the SP with the highest number of recorded calls, has almost the same number of calls recorded (8,450 calls) as the cumulative total of the seven lowest SPs (9,235 calls).

Even at the highest levels recorded, the nightly and hourly averages are low (see specifically **Sections 9.6** and **9.7**). The nightly average rate exceeded 100 calls on only five occasions during the 30 nights of surveys. Four of these occurred during the spring surveys and the other during autumn surveys. 92% of the average hourly rates were 5 per hour or less and the rate exceeded 5 on only 12 occasions (8%). 3 were occasions when the average rate exceeded 20, 2 when the average was between 10 and 20 calls and the remainder were between 5 and 10. The highest average hourly rate of any species was 30[32] soprano pipistrelle calls per hour at SP6 during the autumn surveys. It is considered that this number is indicative of a very low level of activity particularly in light of the behavioural characteristic, outlined, previously, in **Section 8.4.1**, that individual bats can be the source of more than one, or even many, calls. As a result, the 30 calls per hour are likely to have been greater than the numbers of soprano pipistrelle bats that generated them. Throughout the 30 nights of surveys the average hourly rate exceed 20 bat calls on only 3 occasions (in this regard see tables in **Section 9.7** - in particular **Table 38** and **Table 39**).

While SP1, SP6, and SP9 are clear outliers in terms of the level of activity recorded, no clear pattern in the levels of activity recorded at the other SPs emerges and no differentiation between individual SPs that can be attributed to the locations of individual SPs or to habitat type is evident. However, clear differentiation across all these criteria is evident if each of the outliers is contrasted with the other 6 SPs which are all situated in open and exposed areas, most are in open bog a habitat type that is avoided by bats (in this regard see paragraph 3, **Section 7.3**), with lower diversity in terms of ground flora structure or species mix (for detail on the effect of ground flora on insect abundance see **Section 7.3.1**). This contrast is exemplified by a comparison of the habitats at SP6 (8,450 calls) and SP7 (2,333). Less than 300 metres separates these SPs but the difference in the levels of activity is marked. If the movement of bats through and around the proposed development site was random then it would be expected that 2 SPs in such close proximity would have, even if only broadly, similar levels of activity. This is clearly not the case and the contrast between the levels of activity at these 2 SPs demonstrates the overriding influence that habitat, shelter and availability of prey exert on bat activity.

It is notable that SP6, the SP with the highest level of activity (see, *inter alia*, **Table 14** and **Table 16**, **Section 9**), is located adjacent to a forest block and is, therefore, the SP best positioned in terms of the availability of sheltered corridors within the proposed development site, along which insects can accumulate. The sketch, in **Figure 4**, provides a stylised view of potential sheltered corridors (represented by white lines) at the woodland edges. As can be seen from the aerial image in the figure the interior of the woodland that extends westward is intersected by a network of additional shelter belts and the woodland has numerous points of contact with the field boundaries that

[32] Rounded value.

extend into the area of agricultural grassland that comprises the area surrounding the proposed wind farm development site.

Figure 4: SP6: Network of shelter belts [adapted from https://www.google.ie]

The levels of activity recorded, described in **Section 9**, above, strongly suggest that, while the proposed development site is within the extended foraging range of local populations of common and soprano pipistrelle bat the levels of activity, even of these, the most frequently recorded, species are very low.

With regard to Leisler's bats, brown long-eared bats, and bats from genus *Myotis* it is considered, in light of the fact that the numbers recorded comprise such low total numbers of calls recorded that the level of activity of these species is extremely low. It is concluded that use of the proposed wind farm site by these species is sporadic and not sustained and the site is not within the core, or extended, foraging range of the local populations of the species recorded. Specifically, with regard to brown long-eared bat and species from genus *Myotis* it is concluded that the individuals recorded are considered to be vagrants commuting through the site using the site sporadically rather than regularly and in low numbers only.

It is concluded, therefore, that the levels of activity recorded are indicative of an area at the least used limit of the foraging ranges of the species recorded and the proposed development site is not, therefore, within the core foraging range of these species. It is probable that any increase in the use of the site, should it occur, would be opportunistic and would occur in response to the onset of stable mild weather conditions when winds are abated, and air temperatures elevated above the norm and when the thermoregulatory cost is minimised, and accumulations of insect prey are increased.

In summary, the survey data indicate that common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and species from the genus *Myotis* were present at the site during the 2020 surveys. However, there was a marked contrast between the levels of activity recorded for individual species and even the species most frequently recorded, namely common pipistrelle, was recorded at

very low average hourly rates: On the basis of the numbers of calls recorded it is concluded that none of these species were present to any significant extent during the 2020 surveys.

10.1.2 Species not recorded

As had been the case in 2019 lesser horseshoe bat and Nathusius' pipistrelle were not recorded, an outcome that is consistent with, in the case of the former, the ecological resources available at the proposed development site, and, in the case of the latter, with the restricted distribution of the species in Ireland. That neither species was recorded is also consistent with the fact that no records for lesser horseshoe bat or Nathusius' pipistrelle are retained by BCI for the 10 km search radius specified (see **Section 8.2.1.1**) and with the BHSI values for the area of the proposed development site, presented in **Table 7**, which for lesser horseshoe bat is 6 and for Nathusius' pipistrelle is 9.

10.1.2.1 Habitat requirements of lesser horseshoe bat

In Ireland the lesser horseshoe bat's distribution is strongly linked with broadleaved and mixed woodland and it usually forages in woodland and scrub[33] where it feeds on craneflies, caddis flies, lacewings, midges and moths[34] gleaning prey from branches and stones. Tall hedgerows or woodland edges delimiting pastures grazed by cattle tend to be favoured core foraging areas (Ransome *et al.*, 2000) and the species actively avoids bog habitats (Lundy *et al.*, 2011) of the type that is dominant at the proposed development site. It is the only Irish bat species capable of exploiting Doppler-shifted echoes, and it emits calls at between 105 kHz and 115 kHz, higher than the other bats.[34] However, one disadvantage of such high frequency calls is that they do not travel far from the bat, so this species cannot detect distant objects. As a result, it must commute between roosts and foraging habitats by closely following linear features, such as hedgerows, stone walls, earth banks and tree lines landscape features which are largely absent from the proposed development site The majority of studies indicate that lesser horseshoe bats range within 3-4 km of maternity roosts, and, in two extensive studies, the mean adult range was about 2.2 km (Schofield, 2008 cited in NPWS, 2017; Knight, 2006 and Bontadina *et al.*, 2002, cited in Burrows, 2017). They are, therefore, quite restricted in their ranging behaviours even within landscapes where they are present and any night roosts, which are typically in buildings, are found in close proximity to core foraging areas (Knight *et al.,* 2009).

The fact that this species was not recorded is consistent with the absence of the habitat requirements of this species at the proposed development site.

10.1.2.2 Distribution of Nathusius' pipistrelle

While Nathusius' pipistrelle is now considered resident on the island, its current known distribution is restricted. It had, in the past, been considered a vagrant (Stebbings, 1988 cited in Boston *et al*., 2016) until the first evidence of an Irish breeding colony was discovered in 1997 near Lough Neagh.[35] Since then it has been found across Northern Ireland, mainly close to Loughs Neagh and Erne and one hypothesis is that this species is expanding its range in response to changing climatic conditions in Europe (Roche *et al*., 2012) (Lundy *et al.*, 2010; cited in Boston *et al*., 2016). However, no roost records, or evidence of breeding in the Republic of Ireland have been documented (Boston *et al*., 2016).

[33] http://www.batconservationireland.org/irish-bats/species/lesser-horseshoe-bat

[34] http://www.mammals-in-ireland.ie/species/lesser-horseshoe-bat

[35] https://www.batconservationireland.org/irish-bats/species/nathusius-pipistrelle

The fact that this species was not recorded is consistent with the restricted distribution of the species described in paragraph 1, **Section 10.1.2**.

10.2 SUITABILITY OF THE SITE AS BAT FORAGING HABITAT

While common pipistrelle, soprano pipistrelle, Leisler's bat, species from the genus *Myotis* and brown long-eared bat were recorded, it is concluded that the site is unlikely to provide significant foraging, roosting or breeding habitats for any bat species (with regard to roost sites see **Section 8.3.1**) .

The site, described in **Section 5**, above, lacks the characteristics that would render it of high potential value as bat foraging habitat and there is little in the way of variation within the habitat structure of the site and, relative to its surroundings, it is less ecologically and structurally diverse than is the case in the geographical area extending away from it. As a result, the site will provide less insect prey biomass than in the agricultural grassland areas that dominate the area extending away from the proposed wind farm site which, in any event, bats are more likely to preferentially select. In addition, because the proposed development site comprises an open and relatively featureless terrain, it is quite exposed and, particularly in the open area of cut-over bog where most of the proposed turbines are located, lacks the types of landscape features that would provide habitat connectivity for bats, within the site, and between the site and the surrounding landscape, which bats could use for commuting between roosts and foraging grounds. While forest edges are present that do provide sheltered corridors along which insect prey may accumulate and bats forage, the open and unsheltered character of the majority of the proposal site is entirely lacking in equivalent shelter belts (with regard to the influence of sheltered corridors on insect distribution see **Section 7.3.1**).

With regard to the area within the proposed wind farm site, as can be seen from the BHSI ratings listed in **Table 7**, above, not only is the overall habitat suitability rating for all bat species very low, only soprano pipistrelle and brown long-eared bat have a rating above 30, and, while Daubenton's bat, Leisler's bat and common pipistrelle have a rating above 20, the remainder of the species have ratings below this level - a clear indication that the site is evaluated, by the BHSI criteria, as, in effect, having little or no potential value for these species.

Of the 90 individual BHSI ratings listed in **Table 8**, above, that pertain to the 40 km^2 area[36] that encompasses the proposed wind farm site and the extended geographical area surrounding it, only 60 (37.8%) have a rating above 30 of which only 5 (5.6%) are above 40[37]. This characteristic of the location and its extended surrounds is significant in light of the known strong correlation between bat activity and the habitat mix of an area. While preferential habitat selection and the tendency towards site loyalty, which are characteristic of bat foraging behaviours (described in **Section 7.3**, above), do not preclude the occasional use of sub-optimal habitats, they are key determinants in the level of activity at any location and of the frequency or regularity of its occurrence. It is self evident, if the wider geographical area is of uniformly low value to bats, then the likelihood that the proposed wind farm is within the core or extended foraging ranges of any bat species is significantly

[36] The proposed development site and surrounds are encompassed within the following hectads: Q93, Q94, R03 and R04.

[37] See **Table 9**

reduced as, in all cases, individual species forage over relatively limited ranges that do not exceed kilometres in the single digit range. For detail on metabolic constraints on bat activity see **Section 7.4**, above.

Therefore, in light of the low BHSI ratings for the site and the bog habitat that dominates (see **Section 5**, above) it is concluded that the site is of relatively low value for bat species particularly by comparison with the characteristics of the surrounding area which is characterised by a more ecologically and structurally diverse habitat mix than is the case within the proposed wind farm site. It is also evident from the 'All species' ratings for the wider geographical area, comprising the 4 hectads that are listed in **Table 8**, above, that the proposed development site is not adjacent to any locations rated as being of high ecological value to bats.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that influences species diversity not only in terms of the floristic communities but also in the variety and biomass of insect species. The proposed development site is largely exposed and unsheltered and the plant communities present comprise low-growing, open vegetation with low plant species richness that lacks the variety and complexity required for high macro-invertebrate productivity. It is concluded that the site is unlikely to provide significant foraging, roosting or breeding habitats for any bat species.

Therefore, while bat activity by certain species was recorded and is reasonably foreseeable as occurring in future, the levels of activity are unlikely to be significant at any point and it is concluded that the level of activity and the patterns in site usage, described in **Section 9**, above, are consistent with this assessment of the proposed wind farm site's suitability as bat foraging habitat. It is concluded, therefore, that the levels of activity recorded during 2020 are reflective of the normal patterns that pertain at the site. In this regard the data on percentages presented in **Table 15** (replicated here, for ease of reference, in **Table 50**) are germane.

Table 50: Comparison between % 2019 and % 2020

Year	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
2019	0.6	12.0	34.6	19.8	0.4	32.5
2020	0.5	7.5	47.3	28.9	0.2	15.5
Change	-0.1	-4.5	+12.7	+9.1	-0.2	-17.0
			+21.8			-17.0

10.3 CONCLUSION

The site and much of its hinterland are generally lacking the habitat, environmental, landscape and topographic characteristics that are conducive to high and sustained levels of bat activity. By contrast these characteristics are abundantly available in the areas that are present in the wider geographical area that encompasses the site and its surrounds. As a result, the site is of less significance to foraging bats than the habitats of higher ecological value that surround it and which bats will preferentially select. While the species listed above were recorded, the levels of site usage were, even at the highest recorded levels, extremely low. The levels of usage, as reflected in the average hourly rates in recorded calls across all the species are consistent with the BHSI ratings for the site and its surrounds, as outlined in **Section 8.2.1.2**.

Section 10.1, above, concluded that the levels of activity recorded during 2020 are low and reflective of the normal patterns that pertain at the site. This conclusion, when viewed in conjunction with the assessment in **Section 10.2** above, that the habitat and development related features of the proposed wind farm site render the site as intrinsically 'Low' risk to bat species, indicates that the proposed development should not pose a significant risk to bat species.

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